Contribution to the Global Assessment Report on Disaster Risk Reduction (2009)

URBAN DEVELOPMENT AND INTENSIVE AND EXTENSIVE RISK

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Introduction

All successful urban centres transform their physical sites and wider regional environments as they adapt to changing economic and political circumstances – and do so through the choices and investments of their populations and enterprises as well as their governments. For instance, all large successful cities have had to invest heavily in ensuring adequate supplies of fresh water and in building the systems that can manage the disposal of waste water, as well as storm and surface run-off. Their built form and infrastructure have also adapted over time to cope with physical circumstances including risks from flooding, extreme weather, fires and seismic events. In one sense, most urban areas already have adaptation processes underway to reduce the risk of disasters, and it is in urban areas with competent, well-resourced, accountable urban governments that these adaptations work best. Most are 'preventive' in the sense that the buildings and infrastructure prevent any extreme weather or seismic event causing a disaster. In addition, a web of regulations and controls limits the potential for technological disasters (including industrial and ship accidents and airplane, rail and road transport crashes).

This does not mean that all disaster risk is removed for prosperous cities, as can be seen by the devastation caused in many such cities – for instance the earthquake in Kobe in 1994 and the flooding in New Orleans during and after Hurricane Katrina (although in this latter case, local governance limitations contributed considerably to the scale of the disaster's impact). But it does mean that the scale of deaths and serious injuries from disasters relative to the urban population has been cut in high-income nations, even as they have become predominantly urban. As described in detail later, in high-income nations, a web of institutions, infrastructure, services and regulations protect urban populations from extreme weather and limit risks for other potential disasters. This also means that there is infrastructure, services, regulations and institutions that can be adjusted and enhanced to cope with the new or increased risks that will be generated through the effects of climate change –at least for the next few decades.[1] This is not the case for most of the urban population in low- and middle-income nations.[2]

The need to address disaster risk in urban areas is much increased by the concentration of most of the world's production in urban areas, the increasing proportion of the world's population in urban areas and by the rapid growth in the deaths and devastations caused by disasters in urban areas. Nearly three quarters of the world's urban population and most of its largest cities are now in low- and middle-income nations.[3] Since 1950, there has been a sevenfold increase in the urban population of low- and middle-income nations (see Table 1) and a much-increased concentration of people and economic activities in low-lying coastal zones or other areas at risk from flooding and extreme weather events (as described in a later section on the additionality of climate change). The United Nations Population Division suggests that almost all of the world's population growth up to 2025 and beyond will be in urban areas in low- and middle-income nations.[4] How this very large and rapidly growing urban population is served and governed has major implications for development and for reducing disaster risk.

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[1] With longer time horizons, the scale and nature of the risks become less certain although clearly much larger if anthropogenic greenhouse gas emissions are not cut.

[2] Satterthwaite, David, Saleemul Huq, Mark Pelling, Hannah Reid and Patricia Lankao Romero (2007), *Adapting to Climate Change in Urban Areas; The possibilities and constraints in low- and middle-income countries*, IIED Working Paper, IIED, London, 107 pages; see also case studies in *Environment and Urbanization* Vol 19, No 1, 2007.

[3] Satterthwaite, David (2007), *The Transition to a Predominantly Urban World and its Underpinnings*, Human Settlements Discussion Paper, IIED, London, 86 pages.

[4] United Nations, Department of Economic and Social Affairs, Population Division (2008). *World Urbanization Prospects: The 2007 Revision*. CD-ROM Edition, data in digital form (POP/DB/WUP/Rev.2007), United Nations, New York.

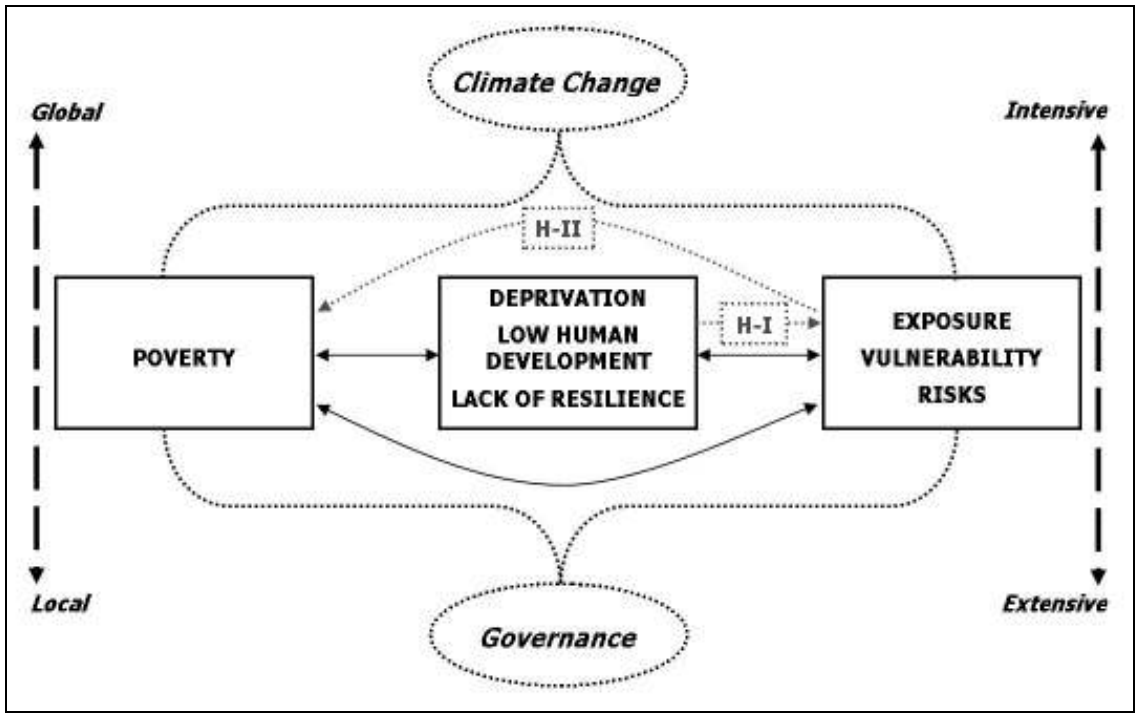
Table 1: The distribution of the world's urban population by region, 1950–2010

Region or country	1950	1970	1990	2000	Projected for 2010	Projected for 2020
Urban populations (millions of inhabitants)						
WORLD	737	1,332	2,275	2,854	3,495	4,210
High-income nations	427	652	818	873	925	972
Low- and middle-income nations	310	680	1,456	1,981	2,570	3,237
"Least developed nations"	15	41	110	169	254	376
Africa	33	86	204	295	412	566
Asia	237	485	1,015	1,373	1,770	2,212
Europe	281	412	509	520	530	540
Latin America and the Caribbean	69	164	314	394	471	543
Northern America	110	171	214	250	286	321
Oceania	8	14	19	22	25	28
Urbanization level (percentage of population living in urban areas)						
WORLD	29.1	36.0	43.0	46.6	50.6	54.9
High-income nations	52.5	64.6	71.2	73.1	75.0	77.5
Low- and middle-income nations	18.0	25.3	35.1	40.2	45.3	50.5
"Least developed nations"	7.3	13.1	21.0	24.8	29.4	35.0
Africa	14.5	23.6	32.0	35.9	39.9	44.6
Asia	16.8	22.7	31.9	37.1	42.5	48.1
Europe	51.2	62.8	70.5	71.4	72.6	74.8
Latin America and the Caribbean	41.4	57.0	70.6	75.3	79.4	82.3
Northern America	63.9	73.8	75.4	79.1	82.1	84.6
Oceania	62.0	70.8	70.6	70.4	70.6	71.4
Percentage of the world's urban population living in:						
WORLD	100.0	100.0	100.0	100.0	100.0	100.0
High-income nations	58.0	49.0	36.0	30.6	26.5	23.1
Low- and middle-income nations	42.0	51.0	64.0	69.4	73.5	76.9
"Least developed nations"	2.0	3.1	4.9	5.9	7.3	8.9
Africa	4.4	6.5	9.0	10.3	11.8	13.5
Asia	32.1	36.4	44.6	48.1	50.6	52.5
Europe	38.1	30.9	22.4	18.2	15.2	12.8
Latin America and the Caribbean	9.4	12.3	13.8	13.8	13.5	12.9
Northern America	14.9	12.9	9.4	8.8	8.2	7.6
Oceania	1.1	1.0	0.8	0.8	0.7	0.7
Nations with largest urban populations in 2000						
China	9.8	10.9	13.8	15.9	17.4	18.0
India	8.6	8.2	9.7	10.1	10.5	11.2
USA	13.7	11.6	8.5	7.9	7.4	6.9
Brazil	2.6	4.0	4.9	5.0	4.9	4.7
Russian Federation	6.2	6.1	4.8	3.8	2.9	2.3

SOURCE: Derived from statistics in United Nations, Department of Economic and Social Affairs, Population Division (2008). *World Urbanization Prospects: The 2007 Revision*. CD-ROM Edition, data in digital form (POP/DB/WUP/Rev.2007), United Nations, New York.

The last few decades have also brought a very large increase in the number of urban dwellers living in poverty, lacking provision for the basic infrastructure and services that should protect them from environmental health hazards and from disasters. As described in more detail in the later section on urban poverty, over 800 million urban dwellers live in poor-quality, overcrowded housing in 'slums' or informal settlements. These are locations where poverty and disaster risk are often closely intertwined, and that are likely to become increasingly threatened as a consequence of climate change. Tens of millions face or will soon face life-threatening risks from the increased intensity of storms, flooding and heat waves that climate change is bringing, with associated threats to livelihoods, asset bases (including property), environmental quality and future prosperity. The uneven nature of the distribution of risk and vulnerability among the world's three billion urban dwellers is a key issue of social justice, particularly in the context of climate change. Climate change is perhaps the greatest global outcome of environmental inequity, since it is driven by the emissions that have brought benefits to affluent individuals and societies yet most of the burdens fall on poorer individuals and societies. However, to focus only on the current and likely impact of climate change is to miss a very large preventable disaster burden that has long occurred in urban areas and continues to occur, independent of climate change.

Figure 1: Conceptual Framework: Poverty, Vulnerability and Risk



Although it is generally recognised that poverty and risk in urban areas are linked, the precise nature of this relationship is often taken for granted rather than rigorously examined. The framework presented in Figure 1 proposes several aspects of the direction of the poverty-vulnerability relationship, the ways in which this is mediated through broader concepts of deprivation and low human development, and the ways in which it is influenced by over-arching themes of governance and climate change. These relationships take place at a variety of spatial scales (from global to local) and levels of intensity (from intensive to extensive risk), and may assume particular characteristics as these features vary.

A more detailed understanding of the precise nature of these poverty-risk relationships will provide a more effective basis for preventing poverty from leading to greater risk; and for preventing disasters from causing greater poverty. This will require action at different scales (the household, the community, the district, the city and the nation), political interventions to ensure that the voices of urban residents are heard and heeded, financial changes to enable small-scale and locally appropriate preparations for and recovery from disaster events, and – perhaps most importantly – the formation of deeper partnerships with urban poor organizations by governments and international agencies.

One of the main challenges related to the understanding of the poverty-vulnerability nexus (and one of the main interests of this report) is understanding the relative contributions of intensive and extensive risk to premature death, injury/illness and impoverishment – and the relationships between intensive and extensive risk. Intensive risk is the risk from major disasters. Extensive risk is the risk of premature death, injury and impoverishment from all events whose impact is too small to be classified as major disasters. Ideally, an analysis of the events that caused premature death, illness/injury and impoverishment should be disaggregated into the categories noted below, to get an idea of the relative contribution of everyday risks (for instance a child drowning in a drainage canal or being killed by a road vehicle), 'small' disasters (for instance several people being killed during a storm from a mudslide down a hill) and disasters of different scales. International disaster databases provide only a small part of this – what is listed below as 'disasters' but even here, the coverage is limited because the event has to produce a call for international assistance to be registered. So many disasters that killed 10 or more people or caused 100 or more people to be seriously injured are also not covered in these databases. However, the limitations of available data mean that the division between intensive and extensive risk in this report is 50 deaths and/or 500 houses destroyed or seriously damaged in one municipality/local government area.

Table 2: Intensive and extensive risk

Nature of event	Disasters	Small disasters	Everyday risks
Frequency	INFREQUENT (perhaps return periods of 50-100 years)	FREQUENT (often seasonal)	EVERYDAY
Scale	LARGE or potential to be large: 10+ killed, 100+ seriously injured	3-9 persons killed, 10 or more injured	1-2 persons killed, 1-9 injured
Impact on all premature death and serious injury/illness	Can be catastrophic for specific places & times but low overall	Probably significant and under-estimated contribution	Main cause of premature death and serious injury
Intensive or extensive	INTENSIVE RISK	EXTENSIVE RISK	

SOURCE: Developed from Bull-Kamanga, Liseli, Khady Diagne, Allan Lavell, Fred Lerise, Helen MacGregor, Andrew Maskrey, Manoris Meshack, Mark Pelling, Hannah Reid, David Satterthwaite, Jacob Songsore, Ken Westgate and Andre Yitambe (2003), "Urban development and the accumulation of disaster risk and other life-threatening risks in Africa", *Environment and Urbanization*, Vol. 15, No. 1, pages 193-204

Both intensive and extensive risk comes from hazards in the home, workplace or wider city environment. These hazards are generally divided into biological pathogens (disease causing agents), chemical pollutants and physical hazards. Most premature death in relation to everyday risks comes from biological pathogens – the diseases spread through air (eg TB and acute respiratory infections), water and food (eg most diarrhoeal diseases) or disease vectors (eg malaria and dengue fever). Most premature death from disasters (and thus from intensive risk) comes from physical hazards. But this is not always the case. For instance, epidemics can cause sufficient deaths to be classified within intensive risk events;

so too can some technological disasters caused by chemical pollutants (for instance the catastrophic industrial accident in Bhopal[5]). In addition, a large part of the extensive risk in most urban contexts in low- and middle-income nations comes from physical hazards such as floods and storms. Deaths and serious injuries from transport accidents figure prominently in intensive and extensive risk (and within extensive risk between disasters, small disasters, and everyday risks).

Although there is inadequate documentation of the scale and depth of these hazards and the environmental health burdens they bring in many urban areas in low- and middle-income nations, there is plenty of evidence of high levels of extensive risk to life, health, income and assets from very poor quality living and working environments affecting large sections of the urban population.[6] A considerable part of this environmental health burden comes from physical traumas triggered by, for instance, floods, collapsing buildings, fires and traffic collisions. It is difficult to know where to draw a line between disaster risk (intensive risk) and everyday risks (extensive risk); indeed, just one person seriously injured within a low-income household can be a disaster for that household if this cuts their incomes or imposed medical expenses that cut needed food consumption. Any premature death and most serious injuries are disasters for particular individuals or families – and their economic consequences are usually far greater for low-income households. A house damaged by a storm can be disastrous for households that have no savings and are not covered by insurance. Thus, events which cause serious injury or death can be classified within a continuum of risk in relation to frequency and scale of impact (Table 2).

Obviously, there is a need for a strong information base on what causes premature death, serious illness or injury and impoverishment to highlight what measures can be taken to reduce these. But in most nations or cities in low- and middle-income nations, there are not the data available for this – and so there is no possibility of assessing the relative contributions of intensive and extensive risk to premature death, serious illness/injury or impoverishment. For instance, in most urban centres, the data on causes of death are both inadequate (as many deaths are misdiagnosed) or incomplete (as many deaths are not registered) so it is not possible to assess the scale of premature death and its causes. The data on morbidity (i.e. on injuries or serious illnesses) and their causes is even more lacking, except where records are kept of certain identified ('notifiable') diseases. In many nations, it is possible to collect data from the records of hospitals and health centres or from health insurance institutions or from fire services or organizations that manage emergency services but these have different reporting systems – for instance in how events are registered – which make their use and their aggregation difficult. In addition, most of these have limited coverage – as large sections of the urban population do not having health insurance or access to health care or served by emergency vehicles. So there is very little hard data on the impact of extensive risk. **As discussed in detail later, we know far more about the environment of extensive risk than its impacts.**

Disaster specialists rightly complain about the lack of data on the impacts of disasters. But actually, for most nations, there are more data on the impact of disasters than on the impacts of small disasters and everyday risk, even if these causes a far larger impact each year. There may only be statistics on deaths and economic costs and with a focus only on large disasters (with many 'large disasters' also not registered). But however inadequate, there is an idea of the total impact of 'large' disasters for each nation in terms of deaths and economic costs and an idea of which kinds of large disasters cause the largest impacts.

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[5] Dinham, Barbara and Satinath Sarangi (2002), "The Bhopal gas tragedy 1984-? The evasion of corporate responsibility", *Environment and Urbanization*, Vol. 14, No. 1, pages 89-100.

[6] Hardoy, Jorge E., Diana Mitlin and David Satterthwaite (2001), *Environmental Problems in an Urbanizing World: Finding Solutions for Cities in Africa, Asia and Latin America*, Earthscan, London, 448 pages; UN-Habitat (2003) *Water and Sanitation in the World's Cities: Local Action for Global Goals*, Earthscan, London; UNCHS (Habitat) (1996), *An Urbanizing World: Global Report on Human Settlements, 1996*, Oxford University Press, Oxford and New York, 593 pages.

The impacts of 'large' disasters are often measured simply by estimates of mortality and the effect on economies often being measured by damage to buildings and infrastructure. As discussed in more detail later, we know that the number of deaths from events that are classified as disasters in international databases in urban areas in low- and middle-income nations has grown rapidly over the last 30 years. But we do not know how significant these disaster-related deaths are in comparison to premature death from 'large' disasters that were not recorded and from small disasters and everyday hazards. We also do not know what relationship there is between intensive and extensive risk. We also do not know how climate change will affect the distribution of risk between intensive risk and extensive risk (and within extensive risk between disasters and everyday risk).

In addition, the linkages between poverty and intensive and extensive risk are far broader and more complex than that recorded by premature death. Urban poor groups' vulnerability to intensive and extensive risk can be seen as involving a variety of assets, livelihood strategies and social relationships at the level of the individual, household and community.

Even if it proves possible to get basic data on the impacts of intensive and extensive risk on premature deaths, this would miss the substantial impacts on the livelihoods of poor urban residents, for example through effects on health and well-being that may prevent productive work, through damage to small-scale productive enterprises, or through generating new challenges that take precedence over longer-term and more sustainable livelihood activities. Data collection at a higher resolution from a wide range of cities would help to illuminate these relationships and provide more effective recommendations for actions to remove or reduce the risks.

The next section of this chapter examines the global context of urbanization, and is followed by a more detailed description of the particular disaster risks facing urban areas. The scale and nature of urban poverty is then outlined, before the specific relationships between urban poverty and intensive and extensive risk are assessed. This information is then brought together with recommendations for measures to support risk reduction in urban areas that take into account both technical necessity and institutional frameworks, with a particular focus on the role of good urban governance in addressing this challenge. Indeed, appropriate interventions to break the bi-directional linkages between poverty and disaster risk in urban areas will bring corresponding benefits in improving the overall quality of life for poor urban residents and enhancing the sustainability of the cities they inhabit.

The Risk Context: An Urbanizing World

Much has been made of the fact that in 2008, for the first time, more than half the world's population was living in urban areas. There were two milestones that happened much earlier that are in effect the economic underpinning of this: around 1940 when more than half the world's GDP came to be generated by industry and services (now 97 percent); and around 1980 when more than half the labour force was working in industry and services (now around 65 percent).[7] Urbanization[8] (and the rapid growth of particular cities within nations' urban systems) has been driven by the increasing proportions of GDP generated by industries and service enterprises (most of which are in urban centres) and increasing proportions of the labour force working in industry and services. There are a few contemporary exceptions to this and many historic exceptions (for instance where political changes such as decolonisation drove urbanization). But in almost all nations in Asia, Latin America and the Caribbean and North Africa and most in sub-Saharan Africa, it is an economic logic that drives urbanization. The nations with the wealthiest economies are all heavily urbanized. The nations with the fastest growing

[7] Satterthwaite 2007, op. cit.

[8] Urbanization, understood as an increasing proportion of a nation's population living in urban centres, is strongly associated with economic growth; rapid population growth within a city or a nation's urban population from natural increase may not be.

economies are generally those that are urbanizing most rapidly; the nations with stagnant economies generally those that are urbanizing least. There is also an economic logic to where large cities are located and where rapid city growth takes place; globally and within each continent, the largest cities are heavily concentrated in the largest economies.[9]

At the core of much of the urban population's vulnerability to disasters (and other environmental hazards) is the mismatch between the economic drivers of urban expansion (the concentration of profit-seeking enterprises and investments in particular cities) and the institutional mechanisms to manage or govern the direct and indirect implications of this concentration (and of the people attracted to it). The concentration of private capital and economic opportunity in a city does not of itself produce the institutional means to ensure that the supply of land for housing, infrastructure and services keeps up with population growth; it also does not, of itself, produce the regulatory framework to ensure environmental and occupational health and safety, including needed systems for managing solid and liquid wastes. All these are, in effect, the means by which both extensive and intensive risks that are linked to a high spatial concentration of people, enterprises, motor vehicles and their wastes are reduced.

The 'solution' to this institutional incapacity has been for much urban expansion to be outside the official, legal framework of building codes and land-use regulations and of officially recorded and legally sanctioned land transactions. Much of the housing stock is created and modified informally and illegally (usually on land that is occupied, sub-divided or developed illegally). Much service provision is also private and informal (for water, often for sanitation, health care and solid waste management, sometimes even for schools) and of poor quality or providing inadequate coverage. And a high proportion of urban economic activity and of livelihoods derived from this is outside the formal, regulated economy. The creation and expansion of these informal settlements and unregulated enterprises means that the urbanized area expands haphazardly, with little or no official control.[10] Inevitably, those with the least purchasing power and least political influence have to occupy land or housing that no-one else wants which often means land at risk from extreme weather or other hazards.

This mismatch between cities' rapid urban expansion and their institutional (or governance) capacity was evident in all rapidly expanding cities in Europe and North America during the industrial revolution; indeed, in the late 19th century, most cities in Europe had infant mortality rates that were over 100 per 1000 live births.[11] Many booming cities were so unhealthy that rates of natural increase were negative and it was only through net in-migration that their populations grew. Building the institutional means to reduce urban poverty (and address for instance the inadequacies in provision for water, sanitation, drainage, solid waste removal, schools and health care) was a long, slow, often conflictive process. However, the extent of this mismatch between cities' rapid expansion and their governance capacity is often greater today in low- and middle-income nations, in part because of the greater speed with which successful cities grow, in part because the lack of support from middle and upper income groups for building a governance system that would mean universal provision of infrastructure and services (they know how to protect themselves from the diseases associated with a lack of infrastructure and health services poverty whereas their Victorian predecessors did not).[12] It has also not been helped by the disinterest among so many international agencies in addressing urban poverty.

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[9] Satterthwaite 2007, op. cit. .

[10] This does not mean with no official influence since there may be widespread government collusion in informal land developments.

[11] Bairoch, Paul (1988), *Cities and Economic Development: From the Dawn of History to the Present*, Mansell, London, 574 pages.

[12] In cities in Europe and North America, in the second half of the 19th century, the deaths and economic disruptions brought by cholera were a major factor in persuading middle and upper income groups to accept very substantial public investments in improving provision for water, sanitation, drainage and garbage collection that served the whole city population. But as the understanding of how diseases are transmitted improved, so middle and upper income groups learned how to protect themselves without having to support such city-wide improvements. See Chaplin, Susan E. (1999), "Cities, sewers and poverty: India's politics of sanitation", *Environment and Urbanization*, Vol.11, No.1, April, pages 145-158.

Part of this mismatch is also caused by the attitudes of politicians and civil servants towards 'the poor' and their settlements: the 'poor' are seen not as people making logical economic choices to where livelihood and education opportunities are concentrated but as encroachers, squatters and 'ignorant migrants who should have stayed in rural areas' (even when most of those living in many informal settlements are city-born). Cities such as Mumbai and Bangalore with a high proportion of their population living in 'slums' / informal settlements lacking provision for basic infrastructure and services certainly have the prosperity to allow them to address these issues. There have also been constitutional reforms in India to support more competent accountable local governments[13] and now a central government that has allocated a very large capital sum to support city governments doing so.[14] There have also been examples of cities and nations in Africa, Asia and Latin America that have made great progress in developing 'good local governance' and where economic success is not accompanied by much of the population living in illegal settlements lacking basic services. There are some examples of higher levels of government seeking to develop a legal, institutional and financial framework to address urban poverty more effectively.[15] There are also tens of thousands of urban centres that are smaller and less prosperous where there are far more financial and institutional constraints to risk reduction but here too, it is often as much the political constraints that limit needed actions. There are also examples of innovative local governments in smaller and less prosperous urban centres that work with and support their population in addressing such vulnerability.

Assessing government performance in regard to addressing extensive risk in urban areas

All urban centres can be assessed according to the levels of risk for premature death and ill-health and injury. At one extreme are urban centres with average life expectancies below 50 years (some have below 40 years); at the other are urban centres with average life expectancies above 80 years.[16] Table 3 illustrates this. Although data is lacking for so many urban centres on the indicators listed in Table 3, or available data are not comparable (for instance differences in how 'slums' are defined), available data including detailed city-studies permits some classification of urban centres according to risk levels. For instance, many cities and most urban centres in sub-Saharan Africa and many in low-income nations in Asia would have the characteristics listed under Highest Risk. Some major cities and many smaller urban centres in Latin America are also likely to fall into this category – especially in the poorer nations or poorer regions of richer nations or in new urban centres growing on agricultural or forest frontiers.[17]

As will be discussed in more detail later, any analysis of the events that caused loss of life and serious injury would show these including events that affected one person to those that affected larger groups. Those events that impact a large enough group are considered to be disasters (and those where 50 or more persons are killed and/or 500 or more houses seriously damaged and destroyed are considered intensive risks). This section focuses on extensive risk.

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[13] Pinto, Marina R (2000), *Metropolitan Governance in India*, Sage Publications, Thousand Oaks, London, New Delhi, 242 pages; Prakash Mathur, Om (editor) (1999), *India: The Challenge of Urban Governance*, National Institute of Public Finance and Policy, New Delhi, 290 pages; Sivaramakrishnan, K.C. (2000), *Power to the People? The Politics and Progress of Decentralization*, Published for the Centre for Policy Research by Konark Publishers, Delhi, 249 pages.

[14] The Jawaharlal Nehru National Urban Renewal Mission (JNNURM)

[15] See for instance Fernandes, Edesio (2007), "Implementing the urban reform agenda in Brazil", *Environment and Urbanization*, Vol. 19, No. 1, pages 177–189.

[16] UN Habitat publishes figures for female and male life expectancies at birth for a considerable number of cities although some demographers I have talked to worry at their accuracy and the basis by which they were calculated

[17] See for instance Browder, John D. and Brian J. Godfrey (1997), *Rainforest Cities: Urbanization, Development and Globalization of the Brazilian Amazon*, Columbia University Press, New York and Chichester, 429 pages.

Almost all urban centres in high-income nations would have the characteristics listed under Lowest Risk. If complete and comparable data were available for the indicators listed, many well-governed urban centres in many middle-income nations are likely to be in this category or close to it. For instance, in terms of provision for water and sanitation, most cities in Chile and many of the larger and more prosperous Brazilian and Mexican cities have coverage reaching well above 90 percent of their population.[18] Porto Alegre, Montevideo, Rosario and Tunis are all reported to have female life expectancy at birth of 74 or more years; these are also all cities with much of their population served with good provision for water and sanitation. It is also likely that they have good performance in the other indicators listed below, relative to their average per capita income.

Table 3: Ranking cities in regard to the levels of risk for premature death and ill-health for their population

Indicators relevant to scale of extensive risk	HIGHEST RISK	LOWEST RISK
Life expectancy at birth	Average life expectancy of 40-55 years; much lower for low-income groups within the city	Average life expectancy 75-85 years
Under five mortality rates	Average for city of 100-200 per 1000 live births; much higher for low-income groups within the city	Average for city of under 10 per 1000 live births
Proportion of children stunted	25-50%+ of all children under-weight	Very small proportion of children underweight
Proportion of the population in 'slums and informal settlements'	40-70%	0
Provision for water for residential areas	Small percentage with regular, good quality piped supplies to home	100 percent with good quality piped supplies to home 24 hours a day
Provision for sanitation for residential areas	No sewers or sewers for only a small proportion of the population; much of the population with difficult or no access to sanitary toilets and washing facilities	100 percent with good quality toilets and washing facilities within the home served by sewers
Provision for good access to high quality health care and medicines they can afford	Most of the population lacking this	Close to 100 percent coverage
Provision for emergency services (fire, ambulance and rapid treatment)	Most of the population lacking this	100 percent

Note how the above table could be applied to each city to compare the people at highest risk and the people at lowest risk. For well-governed cities, these differentials would not be so large; for poorly governed cities, they can be very large – for instance with under five mortality rates in 'informal settlements' ten to fifteen times those in middle and upper income residential areas.[19]

Most of the urban problems described above reflect not the inherent characteristics of cities but the limitations in their governance structures. However, there are many examples of innovation and

[18] UN-Habitat (2003), *Water and Sanitation in the World's Cities: Local Action for Global Goals*, Earthscan, London.
[19] APHRC (2002), *Population and Health Dynamics in Nairobi's Informal Settlements*, African Population and Health Research Center, Nairobi, 256 pages.

better practice from low- and middle-income nations where the need for improved governance is most evident, which give clues on how current problems can be tackled. Many come from local initiatives that arise from more competent and democratic urban governments in nations where decentralization programmes have given more power and resources to such governments.[20] Many others come from innovative local civil-society groups – usually a combination of grassroots organizations and local NGOs – and increasingly from partnerships that these groups form with local governments, which in turn contributes to more competent and democratic local governments.[21]

Some cities that have grown rapidly in the last 50 years have avoided most of the problems noted above. For instance, Curitiba and Porto Alegre in Brazil have both grown very rapidly in recent decades: Porto Alegre from under half a million inhabitants in 1950 to around 3.5 million in its metropolitan area today; Curitiba from around 150,000 in 1950 to 2.5 million in its metropolitan area. Both have high-quality living environments and innovative environmental policies (including Curitiba's much-admired public transport system, based on express busways and feeder buses,[22] which has encouraged comparable systems in other cities). Citizens in Porto Alegre enjoy an average life expectancy and many indicators of environmental quality that are comparable to cities in West Europe and North America – and also a city government that during the 1990s was well known for its commitment to supporting citizen participation, greater government accountability and good public health and environmental management.[23]

Two kinds of innovation need highlighting. The first is a local government programme of action and support for community initiatives within a plan that has been developed involving all groups within the city. Porto Alegre helped to pioneer participatory budgeting through which residents in each district of the city had the right to influence public investment priorities; the development of this was much helped by the strength of grassroots organizations within the city.[24] Participatory budgeting has come to be implemented in many other cities both within Brazil and elsewhere;[25] this show how measures can be taken to make local governments and businesses develop the habit of responding to the local needs identified in participatory consultations – no easy task for any large institution.[26] Case studies below from Malawi, Namibia and India illustrate local government-civil society partnerships. Local governments can also demonstrate an independence to innovate when national government provides no lead (see case study below of Ilo).

The second kind of innovation that needs highlighting is the sustained city programmes to tackle the backlog in investment in infrastructure and services in the poorer and worst-served areas of cities and to support ways in which lower-income households can get better-quality housing. This comes under many names and many forms, including regeneration, upgrading and community development. Many cities in

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[20] Campbell, Tim (2003), *The Quiet Revolution: Decentralization and the Rise of Political Participation in Latin American Cities*, University of Pittsburgh Press, Pittsburgh, 208 pages.

[21] D'Cruz, Celine and David Satterthwaite (2005), *Building Homes, changing official approaches: The work of Urban Poor Federations and their contributions to meeting the Millennium Development Goals in urban areas*, Poverty Reduction in Urban Areas Series, Working Paper 16, IIED, London, 80 pages; Mitlin, Diana (2008), "With and beyond the state – co-production as a route to political influence, power and transformation for grassroots organizations", *Environment and Urbanization*, Vol. 20, No. 2.

[22] Rabinovitch, Jonas (1992), "Curitiba: towards sustainable urban development", *Environment and Urbanization*, Vol. 4, No. 2, pages 62–77

[23] Menegat, Rualdo (2002), "Environmental management in Porto Alegre", *Environment and Urbanization*, Vol. 14, No. 2, October, pages 181–206.

[24] Abers, Rebecca (1998), "Learning democratic practice: distributing government resources through popular participation in Porto Alegre, Brazil", In Mike Douglass and John Friedmann (editors), *Cities for Citizens*, John Wiley and Sons, West Sussex, pages 39-65; Menegat, 2002, op. cit.

[25] Cabannes, Yves (2004), "Participatory budgeting: a significant contribution to participatory democracy", *Environment and Urbanization*, Vol. 16, No. 1, pages 27-46.

[26] Roberts, Ian (2000), "Leicester environment city: learning how to make Local Agenda 21, partnerships and participation deliver", *Environment and Urbanization*, Vol. 12, No. 2, October, pages 9–26; also Lafferty, William M and Katarina Eckerberg (editors) (1998), *From the Earth Summit to Local Agenda 21: Working Towards Sustainable Development*, Earthscan, London, 280 pages.

low- and middle-income nations where the backlog is largest have had major "upgrading" programmes to improve provision for water, sanitation, drainage and garbage collection in inner-city tenement districts and in squatter settlements – often with programmes to improve schools and health care too. Initially, these were seen as one-off projects in particular "targeted" neighbourhoods; now there is a recognition that city and municipal governments need the capacity and competence to support continuous upgrading programmes throughout the city, working in partnership with their inhabitants.[27] This recognition can extend up to central government – see the case studies below of CODI in Thailand and of Tunisia. The case study of Orangi Pilot Project-Research and Training Institute below is interesting for what started as a community-driven initiative which developed to the point where it helped changed city-wide and national policy.

It is difficult to generalize about innovations that stretch from something as large as Sao Paulo's slum upgrading programme or CODI's national programme to support for neighbourhood improvement programmes by the municipality of Ilo (in part because of its very small budget),[28] except to say that there are core principles of "good governance" underpinning them. This often includes an eye for new opportunities that an increasingly globalized world economy can bring to a particular city. Many of the more successful regeneration programmes have also recognized that they must support and celebrate their own city's culture. But this eye for international investment also needs to be tempered with realism; many city authorities have invested heavily in the infrastructure and facilities that were meant to attract international investment, but with few results.[29]

Most of the case studies below are underpinned by stronger local democracy, as the introduction of elected mayors and councillors over the last 10–20 years has helped make many city governments more accountable and responsive to their citizens. Several nations have had new constitutions or important constitutional amendments that make explicit the new powers and responsibilities of local governments – including Brazil, Colombia and India. Brazil has probably gone further than any other nation in developing new national institutions to support more effective urban programmes.[30]

But the innovations powered by more effective local democracies are not only the result of elected mayors and councillors. Indeed, they are often far more the result of citizen groups being able to organize, make demands and undertake their own programmes (see case studies below from India, Namibia, Malawi and Pakistan). In a growing number of countries, federations formed by groups of the urban poor are demonstrating new ways of developing programmes that are transforming the lives of thousands of their member households – for instance, through negotiating upgrading, or developing new urban neighbourhoods. They have done so at unit costs that are far lower than those of government or international agency programmes. Many of their initiatives also recover some of their costs, with the money returned to fund further community-level programmes. Such federations of the urban poor are active in 15 nations and are emerging in many more.[31] They have even formed their own international umbrella organization to increase their capacity to change the policies of international agencies and support each other's efforts[32] and have attracted significant funding from some foundations (including the Sigrid Rausing Trust and the Bill and Melinda Gates Foundation).

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[27] See, for instance, Budds, Jessica with Paulo Teixeira and SEHAB (2005), "Ensuring the right to the city: pro-poor housing, urban development and land tenure legalization in São Paulo, Brazil", *Environment and Urbanization*, Vol. 17, No. 1, pages 89-114.

[28] López Follegatti, Jose Luis (1999), "Ilo: a city in transformation", *Environment and Urbanization*, Vol. 11, No. 2, October, pages 181–202.

[29] See Douglass, Mike (2002), "From global intercity competition to cooperation for livable cities and economic resilience in Pacific Asia", *Environment and Urbanization*, Vol. 14, No. 1, April, pages 53–68.

[30] Fernandes 2007, op. cit.

[31] D'Cruz and Satterthwaite 2005 and Mitlin 2008, op. cit.

[32] Slum/Shack Dwellers International; see www.sdinet.org.

Case Studies Of National Policies that Have Addressed Issues Of Extensive Risk In Urban Areas

The Community Organizations Development Institute (CODI) in Thailand: The Thai government is implementing one of the most ambitious 'slum' and squatter upgrading initiatives currently underway.[33] Managed by the Thai Government's Community Organizations Development Institute (CODI), this channels government funds in the form of infrastructure subsidies and housing loans direct to community organizations formed by low-income inhabitants in informal settlements. Each community organization develops the solution that works best for them in regard to land. Within this national programme, there are a variety of means by which those in illegal settlements can get legal land tenure – for instance by the inhabitants purchasing the land from the landowner (supported by a government loan), negotiating a community lease, agreeing to move to another location provided by the government agency on whose land they are squatting, or agreeing with the landowner to move to part of the site they are occupying in return for tenure of that site (land sharing). The CODI also provides loans to community organizations to on-lend to their members to help build or improve their homes. It also supports city governments in taking the initiative in collaboration with urban poor organizations – for instance providing a site on which those living in various 'mini' squatter settlements in their jurisdiction could relocate, with the land provided on a 30 year lease. These are the kinds of solutions that can develop when there is a city-wide process in which urban poor communities are involved.

From 2003 to September 2007, within the *Baan Mankong* (secure housing) programme, CODI approved 495 projects in 957 communities in over 200 urban centres covering 52,776 households and it plans a considerable expansion in the programme within the next few years. Overall, CODI (and the organization out of which it developed, the Urban Community Development Office) has provided loans and grants to community organizations that reached 2.4 million households between 1992 and 2007. The *Baan Mankong* initiative has particular significance in three aspects: the scale; the extent of community-involvement; and the extent to which it seeks to institutionalize community-driven solutions within local governments so this addresses needs in all informal settlements in each urban centre in which it is implemented. It is also significant in that it draws almost entirely from domestic resources – a combination of national government, local government and community contributions. Low-income communities living in informal settlements know that CODI has resources they can draw on – so they can plan for what they need, look at the different possibilities, organize and develop their own savings groups. If they cannot negotiate tenure for the land they currently occupy, they can search for land, start land negotiations and draw in people from other urban poor communities to help them plan and develop solutions. They can also visit other places where community-driven development has worked well. Support is provided not only to community organizations formed by the urban poor for projects but also to their networks, to allow them to work with municipal authorities and other local actors and with national agencies on city-wide upgrading programmes. Its strategy for 'going to scale' is to provide the support for hundreds of community-driven initiatives within programmes designed and managed by urban poor networks working in partnership with local governments and other local actors.

Tunisia and slum prevention: 'Slum' prevention can be construed in many ways. Large scale bulldozing of 'slums' and controls which prevent new informal settlements forming might be seen as 'prevention' in that it reduces the number of 'slum' housing – but it does not reduce the number of households living in 'slums' as those who are displaced by this bulldozing generally double up with other low-income households or create new 'slums' as a result. Very few cities have managed to 'prevent' slums – although some have managed to greatly reduce the proportion of people living in them. Tunisia has managed to greatly reduce the proportion of its urban population living in poor quality housing in illegal or informal settlements. In part, this is because of a large-scale and consistent policy of

[33] Boonyabancha, Somsook (2005), "Baan Mankong; going to scale with 'slum' and squatter upgrading in Thailand", *Environment and Urbanization*, Vol.17, No.1, pp. 21–46; *Codi News*, November 2007.

'slum'/squatter upgrading that has been implemented since 1978.[34] This ended the previous policy of slum/squatter demolition and with the creation of the Urban Rehabilitation and Renewal Agency (Agence de Rehabilitation et de Renovation Urbaine ARRU) upgrading came within the policy mainstream and resulted in regularization of tenure status in districts selected for rehabilitation. From 1978 to 1992, the key features were tenure regularization, provision of infrastructure and public amenities and support for housing improvement. Plots were also provided to households whose homes were demolished to make way for infrastructure and plots sold to households to reduce densities. New owners could get credit. Tenure regularization triggered a dynamic process of housing improvement in the rehabilitated settlements and an evaluation concluded that the rehabilitation projects undertaken between 1978 and 1984 represented a turning point in access to urban land by low-income groups. Since then, the commitment to providing or improving infrastructure and public amenities has remained (and implemented on a very large scale) but without the support for tenure regularization and less support for housing improvements. In part, tenure regularization became less pressing with the growing role of clandestine land-developers that offered cheap lots of unserviced land, often on the agricultural outskirts of urban areas and these enabled households with modest income levels to get land for housing. These land developments have regular lay-outs and generally with housing built on them using permanent materials.

The government of Tunisia also has a long-term policy of supporting the development of land for housing but serving middle and upper income groups. From the early 1970s to the mid 1980s, the Agence Fonciere d'Habitation (AFH) developed land sites for housing, installed infrastructure and services and sold them – on a considerable scale. For instance, in the Fourth Urban Project, 20 estates with 8,500 plots were to be developed. From the mid 1980s, AFH serviced large plots that were sold to public and private developers to build social housing – and 10,200 100 square metre plots were sold by AFH. These plots could be afforded by households with modest means but were still too expensive for low-income groups. The same is true for the social housing units marketed by private developers, building housing on land developed by AFH – as this reached the lower-end of middle-income groups. From 1978 to 1990, there had been urban land components for the urban poor in the upgrading programmes but not a systematic policy – and in the (large scale) national slum rehabilitation programmes during the 1990s and after, the focus was infrastructure and public amenities and not on tenure or on land-for-housing for low-income groups.

However, increasing numbers of municipalities have increased their role in producing serviced land plots for housing. A pilot project in Sousse in the mid 1990s in which the municipal government took the lead role (with support from ARRU) included rehabilitation of spontaneous settlements and the production of serviced plots for housing. The serviced plots were too expensive for low-income groups. Between 1994 and 1998, 53 municipalities in 16 governorates undertook the servicing of land – making lots available to 3682 households. But again, these primarily benefited middle-income group.
This combination of a large, long-term commitment by the government to upgrading combined with a large, long term programme to acquire land in and around urban centres, install infrastructure and sell it (always seeking full cost-recovery) helps explain the low proportion of Tunisia's urban population living in 'slums'. This land acquisition and development programme did not provide housing sites for low-income groups but it did greatly increase the supply and reduce the cost of legal land-for-housing plots for lower-middle and middle-income groups. So these groups were no longer competing with poorer groups for rental accommodation and for land in informal settlements. The ways in which city and national governments in Tunisia shifted from 'slum' clearance to 'slum' upgrading (which received significant and consistent support from 1978 to the present) and implemented measures to greatly increase the supply of land for housing (unusual for its scale and consistency over a thirty year period; also for its boosting of land for housing for non-poor groups which acted to increase overall supplies and reduce costs).

[34] This draws from a detailed case study in French by Morched Chabbi on access to urban land for low-income groups.

Case Studies Of City Policies that Have Addressed Issues Of Extensive Risk In Urban Areas

Changing standards for land-for-housing in Namibia: The example from Namibia is interesting in that it shows how a change in approach by the city government greatly increased the possibilities for low-income households to be able to get their own housing. The city authorities in Windhoek recognized that to reach low-income households, they had to cut unit costs in their government-funded serviced-site programme. This programme had to recover the costs of developing the land for housing and developing land with infrastructure to official standards made it too expensive for low-income groups.[35] A new government policy, developed with the Shack Dwellers Federation of Namibia (a federation of savings groups formed mostly by low-income women) shows a willingness to overturn conventional approaches to standards and regulations, for instance in plot sizes and in infrastructure standards, to make their serviced sites more affordable to low-income households. Two new options were developed: a plot of 180 square metres serviced with communal water points and gravel roads which could be rented with the rental charge covering the financing costs for the land investment, water services and refuse collection; and group purchase or lease of land with communal services and with minimum plot sizes allowed below the official national minimum plot standard of 300 square metres. Families living in areas with communal services have to establish their own neighbourhood committee to manage their toilet block. As significantly, families are allowed to upgrade services as they can afford to make the investments, extending sewerage and water lines from mains provision into their homes. Groups that belong to the Shack Dwellers Federation have access to their own loan fund from which they can borrow for such service improvements and around 1,000 have taken such loans at an average household cost of US $150. However, this underestimates the number of improvements because once households have a system they can respond to, many can afford to make the improvements using their own resources without a need to use loan finance.

Case study of changed relationship between the government and the urban poor

Land and housing development by the Malawi Homeless People's Federation: [36]A partnership has developed in Malawi between the Malawi Homeless People's Federation and government agencies to access land for housing and build good quality housing units. The Federation is formed by savings groups; most savers are women who currently rent accommodation in existing slums. There are more than 100 savings groups with a member of more than 30,000. The Federation manages savings and credit schemes for income generation, bereavement, sanitation and housing. The federation manages their own housing fund (Mchenga) which provides loans to savings groups to finance house construction.
The Federation and its small support NGO CCODE lobbied the government for land and when it demonstrated to government the capacity of its members to build good quality housing at low unit costs, government support in the form of land increased considerably. There has long been a government policy of developing serviced sites but it was rare for low-income groups to get such sites.
Since 2003, around 760 plots have been provided by national government and city authorities and houses built (222 in Lilongwe, 465 in Blantyre, 83 in Mzuzu); more land has been earmarked in Lilongwe and other urban centres and the target is to provide 3,600-10,000 more plots.

Changing official standards was an important part of keeping down costs and making better use of land. The Federation's negotiation with the Department of Physical Planning in Lilongwe allowed agreement on plots of 150 to 200 square metres (well below the official standard) and this meant that land originally allocated to 95 plots could produce 222 plots. This was also helped by reducing road size from the standard 12 metres to 9 metres. The Federation has also established a new lime company with a local company to keep down building costs. Various new schemes are under discussion, including a

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[35] Mitlin, Diana and Anna Muller (2004), "Windhoek, Namibia: towards progressive urban land policies in Southern Africa", *International Development Planning Review*, Vol. 26, No. 2, pages 167-186.
[36] Drawn from Manda, Mtafu A Zeleza (2007), "Mchenga - urban poor housing fund in Malawi", *Environment and Urbanization*, Vol. 19, No. 2, pages 337-359.

partnership with the Ministry of Lands for housing development for lower ranked civil servants such as drivers and messengers who cannot access government home ownership schemes.
Case study of a small municipality where from 1982, elected mayors changed the approach of the municipal authority to one that worked with residents and resident organizations and transformed the city between 1982 and 2003. Note too the land for housing development that allowed low-income households access to legal land for housing at very low cost.

Municipal support for upgrading and land-for-housing in Ilo, Peru[37]: Ilo is a port city in Southern Peru with around 70,000 inhabitants. Over the last 25 years, housing and living conditions have been much improved, despite being an industrial town with rapid population growth and very little external support. Provision for water, sanitation and solid waste collection have improved greatly (most of the population now have home connections for drinking water and regular solid waste collection), over 5,000 houses have been improved and there has been a large expansion in public space (from 2 to 30 hectares between 1981 and 1998 including the reclamation of beaches and the seafront for public use). Most of this has been financed and implemented through partnerships between the municipal government and community-level management committees. One of the most unusual aspects of this was a municipal programme that ensured that land was available for low-income households on which they could organize and manage the construction of their homes.

Despite the fact that the city's population increased fivefold between 1960 and 2000, there have been no land invasions. A municipal government programme of providing land for housing has avoided this. All new settlements have been developed within municipal and housing association programmes in which housing plots are provided with infrastructure and services. The municipality acquired land in an area known as *Pampa Inalambrica* and subdivided it into lots; by 2005, 6,000 lots had been serviced for housing here. Three different groups supported the construction of housing on these lots: private housing associations, national government housing programmes and municipal housing programmes. This allowed a range of lots to be developed for different income groups

The lowest income households acquired lots within the Municipal Housing Programme. The household applies for a lot and if the application is accepted (for instance after checking that they do not already own a house or plot), a land plot is provided. The households that have been allocated plots then work together to help clear the site with streets and plots laid out and public water taps and septic tanks constructed with the support of the municipal water and sanitation company. Plans are then developed with the residents for provision for electricity, roads and provision for sanitation. As the plots are developed, households receive title to the land. All the work is jointly managed and funded – with support also provided for self-help housing construction. The households who receive the plots contribute to these costs but costs are kept down and their contributions do not exceed the equivalent of US$60.

Orangi Pilot Project: Research and Training Institute (OPP-RTI):[38] Pakistan requires 350,000 new housing units per year for its urban areas. The formal sector is able to supply only 120,000 housing units per year. This gap is accommodated in *katchi abadis* (squatter settlements on government land) or through the informal subdivision of agricultural land on the periphery of cities and towns. It is estimated that nine million people live in *katchi abadis* in the urban areas of Pakistan and another 15 million in informal subdivisions. Both types of settlements are unserviced to begin with but over a 15 to 20 year period, residents manage to acquire water, electricity, gas and some sort of social infrastructure. However, sewage invariably flows into cesspools or into the natural drainage system. Since 1973, the government has been operating a *Katchi Abadi* Improvement and Regularisation Programme but this

[37] Díaz Palacios, Julio and Liliana Miranda (2005), "Concertación (reaching agreement) and planning for sustainable development in Ilo, Peru", in Steve Bass, Hannah Reid, David Satterthwaite and Paul Steele (editors), *Reducing Poverty and Sustaining the Environment*, Earthscan Publications, London, pages 254-278; Lopez Follegatti 1999, op. cit.

[38] Hasan, Arif (2006), "Orangi Pilot Project; the expansion of work beyond Orangi and the mapping of informal settlements and infrastructure", *Environment and Urbanization*, Vol. 18, No. 2, pages 451-480.

reaches only a small proportion of those living in these settlements. There is no programme for the improvement on informal subdivisions, although their conditions (except for security of tenure) are no different from that of the *katchi abadis*.

A local NGO, the Orangi Pilot Project (OPP) was established in 1980 with the purpose of overcoming the constraints faced by the government in regularising and improving *katchi abadis*. The objective of the new organization was to: i) understand the problems of Orangi (a large informal settlement which now has over a million inhabitants) and their causes; ii) through action research develop solutions that the inhabitants of informal settlements can manage, finance and build; iii) provide the inhabitants with technical guidance and managerial support to implement the solutions; iv) in the process overcome constraints that governments face upgrading *katchi abadis*. Participatory research identified four major problems: sanitation, unemployment, health and education. Sanitation was considered the most important. The OPP-RTI was very clear from the very beginning that the answer lay in local resources and local expertise – with resources drawn both from the low-income communities and from local government. OPP-RTI supports the inhabitants of a lane to plan, implement and finance the 'internal components' - sanitary latrines in the houses, underground sewers in the lanes and neighbourhood collector sewers. All these costs can be covered by the inhabitants if the cost of improvement or constructing the infrastructure is kept down – by eliminating contractors and modifying engineering standards. The cost of the OPP supported sewers per household were around a fifth of what municipal authorities would have charged. OPP-RTI then supports local government to plan and finance the larger 'external' trunk sewers into which the neighbourhood sewers feed and treatment plans. Again, there is a strong focus on keeping down unit costs – and building on existing systems (for instance mostly 'boxing' existing natural drains).

In around 300 locations in Pakistan, communities have financed, managed and built their own internal sanitation systems. Local governments can also afford to install the external systems as they no longer have to fund the internal components and as OPP-RTI has helped them develop much lower-cost methods for planning and building trunk sewers. In Orangi, 96,994 houses have built their neighbourhood sanitation systems by investing Rs 94.29 million (US$ 1.57 million). In effect, what this small local NGO has done is to demonstrate the major improvements that are possible within informal settlements by careful use of household's resources addressing community-level problems supported by well-designed local government investment in the larger systems into which community-level improvements link.

OPP-RTI has also helped the government agencies convert natural drains into sewers and develop drainage plans for most of Karachi. One of the underpinnings of this was an OPP-RTI programme to map and survey informal settlements, as investments in improving provision need accurate maps that show plot boundaries and the infrastructure that has already been constructed. This was done by youth teams, supported by a youth training programme. This is one of a number of examples of grassroots organizations and local NGOs taking on a task that would normally be considered a government role. But as low-income communities and local NGOs provide governments with maps and detailed household information on informal settlements, this provides the information needed to support provision for piped water, sanitation and drainage and supports partnerships between government agencies and resident organizations. Thus, community organizations and local NGOs have been able to transform planning and investment in sewers and drains in Karachi in ways that have brought major benefits to large sections of the low-income population. This was also done without a need for large loans from international agencies, which inevitably increase debt burdens.

The partnerships between municipal governments and 'slum' federations for public toilets and washing facilities[39]: Slum dweller federations operating at city level and at national level formed during

[39] Burra, Sundar, Sheela Patel and Tom Kerr (2003), "Community-designed, built and managed toilet blocks in Indian cities", *Environment and Urbanization* Vol 15, No 2, October, pages 11–32. See also Appadurai, Arjun (2001),

the 1980s to try to protect their members from eviction. The leader and founder of the India-wide National Federation of Slum Dwellers, Jockin Arputham, recognized that if government authorities always saw the slum dwellers as opponents and protesters, no major solution would be possible. So this Federation changed its approach from opposing governments and making demands that governments were incapable of fulfilling to offering governments partnerships in developing solutions. This Federation then joined with *Mahila Milan*, a federation of women's savings groups to offer to government agencies (especially local government agencies) the knowledge, strengths and capacities of their members. These are mass organizations, with hundreds of thousand of members. This change in tactic by the federations has led to many government-supported programmes being undertaken by these federations supported by the Mumbai-based NGO, SPARC. This includes a very large scale programme for community-designed and managed public toilet and washing facilities that now serve hundreds of thousands of slum households. The largest programmes have been in Pune and Mumbai, where city government has provided large scale support, although *Mahila Milan* groups have also designed and build these toilets in many other places. The federations are currently working with the Mumbai Metropolitan Region Development Authority to design, build and manage hundreds of community toilets with washing facilities that will serve hundreds of thousands of low-income households. The federations in Mumbai are also working with the police to set up and manage police stations in hundreds of "slums" that work with and are accountable to community organizations.[(40)] There is also an ambitious house-building programme. All these illustrate a scale of action that is far beyond what civil society organizations usually engage in and far beyond what government agencies would usually support.

Urbanization and Disaster Risk (or intensive risk)

The urban population in low- and middle-income nations now totals close to 2.5 billion; it is growing at around 60 million a year. From the discussions above, it is clear that a very significant proportion of this population lives on sites at risk of disasters and is ill-served by protective infrastructure and services. The question is – what proportion of this population (and of its annual increase) is protected from disaster risk or served by measures that reduce the impacts, if a disaster does occur.

"In Latin America disasters comes to people's attention during weather related extreme events such as floods, droughts, extreme temperatures, heavy rains and storms. These events are perceived as unusual and extraordinary and during several days the media is full of press releases and interviews with authorities and experts commenting on the status of the situation and what should be done to prevent future disaster situations. Disasters are still associated with deaths, damages to infrastructure, and economic losses. A few days later everything is forgotten, though those affected continue to struggle with the situation. Many factors contribute to this kind of thinking, in part related to old paradigms where disasters are ¨natural¨ extreme events that happen occasionally and nothing can be done, or to the lack of rigorous data collection and analysis at country, regional and local level that can justify interventions and guide decision – making over conflicting priorities. However, much has to do with the historical incapacity to tackle underlying causes and the understanding of the construction of risk as a product of the combination of hazards and vulnerability, related to political decisions that define the development

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"Deep democracy: urban governmentality and the horizon of politics", *Environment and Urbanization* Vol 13 No 2, October, pages 23–43; also Burra, Sundar (2005), "Towards a pro-poor slum upgrading framework in Mumbai, India", *Environment and Urbanization* Vol 17, No 1, April, pages 67–88; and Patel, Sheela, Celine d'Cruz and Sundar Burra (2002), "Beyond evictions in a global city; people-managed resettlement in Mumbai", *Environment and Urbanization* Vol 14, No 1, April, pages 159–172.

[40] Roy, A, Jockin Arputham and Ahmad Javed (2004), "Community police stations in Mumbai's slums", *Environment and Urbanization* Vol 16, No 2, October, pages 135–138

pattern chosen. In urban areas, hazards and vulnerability mutually reinforce each other augmenting risk levels."[41]

Many aspects of urban areas are vulnerable to disasters and climate change. Economies, livelihoods, physical infrastructure and social structures are all important components of urban systems and are vulnerable to disasters and climate risk in different ways. Different stakeholders view cities in different ways – see Table 4. These 'visions' affect the priorities that are set, and the actions that are taken to respond to these. In cross-cutting issues like Disaster Risk Reduction, it is important to acknowledge these visions and their implications in order to work with them where useful, and to counteract them where they are harmful.

Table 4: Conceptualizing Urban Vulnerability[42]

Vision of the city	Holders of this vision	Aspects of urban life seen to be vulnerable	Resulting pathways for managing vulnerability
An engine for economic growth	Economists	Physical assets and economic infrastructure	Insurance, business continuity planning
A system linking consumption and production	Politicians and planners	Infrastructure networks: roads, electricity, water, drainage	More resilient infrastructure networks, technical and project-based approaches, disaster preparedness
A source of livelihoods	Urban labour force (including the urban poor) and potential migrants	The urban poor's livelihoods and homes	Extending and meeting entitlements to basic needs including shelter, education. health care, transport
A stock of accumulated assets	Property owners, urban developers and planners	Housing, physical infrastructure, social infrastructure	Safe construction and land-use planning, insurance
A political and cultural arena	Residents as a whole, artists (of all forms), social scientists	Political freedoms, cultural and intellectual vitality	Inclusive politics and the protection of human rights

As noted already, we know far more about the environment of risk (for instance about the squatter settlement lacking infrastructure at risk from flooding) than of the risk impact (the number of deaths and serious injuries and the damage to property and livelihoods when the flooding occurs). But the (limited) available evidence suggests that the number of serious injuries and deaths from disasters in urban areas has been growing in most low- and middle-income nations.[43] It may be that the proportion of all such disaster related injuries and deaths worldwide that occur in urban areas is increasing – or that this applies to particular kinds of disasters (for instance storms, floods, fires and technological disasters). The proportion of disaster-related deaths and injuries that occur in urban areas in low- and middle-income

[41] Hardoy, Jorgelina (2008), *Poverty and Disaster Risks across Latina American Urban Contexts*, Paper prepared for ISDR, IIED America Latina, 30 pages.

[42] Adapted from Pelling M (2008) The vulnerability of cities to disasters and climate change: A conceptual introduction, in Brauch HG, Spring UO, Mesjasz C, Grin J, Kameri-Mbote P, Chourou B, Dunay P and Birkmann J (Eds.) *Coping with Global Environmental Change, Disasters and Security - Threats, Challenges, Vulnerabilities and Risks*, Hexagon Series on Human and Environmental Security and Peace, vol 5. Springer: New York.

[43] UN Human Settlements Programme (2007), *Enhancing Urban Safety and Security; Global Report on Human Settlements 2007*, Earthscan Publications, London, 480 pages.

nations is likely to grow, in part because an increasing proportion of the world's population live and work there (and almost all the world's population growth anticipated in the next few decades is likely to occur in urban areas in low- and middle-income nations[44]), in part because many successful cities are on sites where part of their population is at risk (see the later section on cities and sites at risk), in part because of government failures to address risk (and lack of international aid to help them do so). Climate change is likely to increase the number of serious injuries and deaths from disasters in urban areas significantly – and many cities in low- and middle-income nations are at high risk from climate change (see later section on this). In addition, there are disaster risks that are inherent in an increasingly urbanized world that do not take place in urban areas – for instance many road, air and sea transport accidents take place outside urban areas but are often linked to the increasing flows of people and goods between urban centres or between rural and urban areas. However, there is no automatic link between increasing urban populations and increasing disaster risk; indeed, the experience in high-income nations and some middle-income nations has been that highly urbanized populations and production structures can also develop with much reduced risk from most kinds of disaster.

A large part of development is reducing or removing the "preventable disease / injury / premature death burden" – as it eliminates or reduces risks from infectious and parasitic diseases that are easily prevented or cured and reduces exposure to chemical pollutants and risks from physical hazards. This is what underlies the dramatic falls in infant, child and maternal mortality rates and the large increases in average life expectancy that have long been recognized as critical indicators of development success. The impacts of disasters are an important component of this "preventable disease / injury / premature death burden" in many urban centres. This is especially so, if account is taken of the contributions of 'small disasters'[45] to serious injury and premature death.

Perhaps not surprisingly, many city case studies also highlight how 'big' and 'small' disaster risk is heavily concentrated within low-income populations or within urban districts with high concentrations of low-income groups. It is also likely that the contribution of disasters to causing or exacerbating urban poverty is increasing, although the databases on disasters record so little of this. Even where urban disasters are included in disaster databases, there is little or no documentation of, for instance, the livelihoods and other income-sources disrupted or lost, the homes and other assets destroyed or damaged. Official statistics on the scale of economic losses from disasters can also be misleading in underplaying the impact of losses on low-income groups. For instance, the economic value of houses destroyed by floods or fires in, for instance, illegal settlements or of the possessions they contained may be low in monetary terms yet devastating to the lives of large numbers of low-income groups. In addition, many losses are qualitative and hard to measure – for instance the work and school days lost and the disruptions to informal income-earning activities.[46]

There is also the contribution of the inadequacies in disaster response to urban poverty through the failures in disaster preparedness, immediate post-disaster response and support for longer term rebuilding. The literature on needed links between post-disaster response and development is there but it seems so little acted on. There are many case studies showing this, especially in the many failures in response to the Asian Tsunami which at their core failed to engage with and work with the women, men and children who were displaced and most affected in supporting rebuilding and developing stable, adequate livelihoods.[47] As will be discussed in more detail later, one of the key characteristics of urban

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[44] United Nations 2008 and Satterthwaite 2007, op. cit.

[45] Disasters too small to be officially classified as disasters and thus included in official statistics of disaster impacts

[46] Hardoy, Jorgelina and Gustavo Pandiella (2008), "Urban poverty and vulnerability to climate change in Latin America", Background paper, prepared for the World Bank, IIED, London; Bartlett, Sheridan (2008), Climate Change and Urban Children: Implications for Adaptation in Low and Middle Income Countries, IIED Working Paper, IIED, London.

[47] Asian Coalition for Housing Rights (ACHR) (2005), *Tsunami; How Asia's Precarious Coastal Settlements are Coping after the Tsunami*, Housing by People in Asia 16, ACHR, Bangkok, 52 pages; Asian Coalition for Housing

poverty is poorer groups' voicelessness and powerlessness within political systems and bureaucratic structures[48] and this voicelessness and powerlessness is also so often evident for the poorer groups impacted by disasters.[49] The organizations responsible for disaster-response (whether local, national or international) often have little capacity or incentive to work with low-income groups and little capacity to address issues in a pro-poor way – for instance in allowing displaced groups a key influence in recovering their land and rebuilding their homes and livelihoods. In many instances, local governments in disaster areas do not want disaster-response agencies working with the poorer groups and also oppose solutions worked out with displaced groups.

In regard to local governments, urban populations in high-income nations take for granted that a web of institutions, infrastructure, services and regulations protect them from disasters – including extreme weather, floods, fires and technological accidents. Many of the measures to protect against these also supply everyday needs; health care services integrated with emergency services and sewer and drainage systems that serve daily requirements but also can cope with storms. Almost everyone lives and works in buildings that meet health and safety regulations that is served by infrastructure designed to cope with extreme weather. The police, armed services, health services and fire services, if or when needed, provide early warning systems and ensure rapid emergency responses. Consequently extreme weather events rarely cause a large loss of life or to serious injury. Although occasionally such events cause serious property damage, the economic cost is reduced for most property owners by property and possessions insurance. The monetary cost of all the above is also accepted by almost all the population and the costs of these routinely funded through charges and taxation. 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. All the above have contributed much to higher life expectancies and much reduced risk from disasters.

Only a very small proportion of urban centres in low- and middle-income nations have a comparable web of institutions, infrastructure, services and regulations, although there are very large variations between such centres in the extent of provision and the extent of coverage. For instance, the proportion of cities' populations living in legal homes built meeting appropriate building regulations varies from 10-20 percent to close to 100 percent. The proportion of the population living in homes adequately served by sanitation, waste water removal and storm drains varies as much; most urban centres in Africa and Asia have no sewers and for many of those that do, these serve only a very small proportion of the population.[50] No family in urban areas in high-income nations, however poor, expects to have to walk several hundred yards to collect water from a communal standpipe shared with hundreds of others or to have no toilet in their home or to have no service to collect household wastes. It is common for 30-50 percent of the population to live in illegal settlements to which the local authorities and utilities refuse to extend all the infrastructure and services that do so much to reduce disaster risk (or are prevented from doing so by law or regulation). There are no statistics on the proportion of the urban population covered by good quality fire services or rapid response to serious injuries or illnesses (including ambulances and hospitals able to provide rapid treatment) but the inadequacy or complete absence of such services is evident in many informal settlements.

Rights (ACHR) (2006), *Tsunami Update*, ACHR, Bangkok, 16 pages; See also http://www.achr.net/000ACHRTsunami/index.htm

[48] Chambers, Robert (1995), "Poverty and livelihoods; whose reality counts?", *Environment and Urbanization*, Vol.7, No.1, April, pp. 173-204; Satterthwaite, David (1997), Urban Poverty: Reconsidering its Scale and Nature, *IDS Bulletin*, Vol.28, No.2, April, pp. 9-23.

[49] Bartlett 2008, op. cit.

[50] Hardoy, Mitlin and Satterthwaite 2001 and UN–Habitat 2003, op. cit.

Urban Poverty

At least 800 million urban dwellers in low- and middle-income nations 'live in poverty' (Table 5). There are no precise figures because many aspects of poverty are not measured. For instance, in most nations, no data are available on two of the most important indicators for assessing the scale of poverty: household incomes and the cost of non-food necessities. Most poor urban households derive most or all their income from work in the informal economy for which there are no data on incomes. Most poverty-lines are set without any data on the costs of non-food necessities.[51] However, there is strong evidence on the scale of urban poverty from other sources – for instance from data on the number of urban dwellers with inadequate nutrition levels and the numbers living in housing of very poor quality (with particular problems in relation to poor quality structures, overcrowding, insecure tenure and inadequate provision for water, sanitation and drainage). One other indication of the scale of urban poverty is the number of people living in illegal settlements because they cannot afford to buy, build or rent legal accommodation. In many cities, 30-60 percent of the entire population live in settlements that were developed illegally.

Table 5: Estimates for the number and proportion of 'slum' dwellers in low- and middle-income nations in 2005

Region	Percentage of urban population living in slums	Slum population (millions)
Low- and middle-income nations	36.5	810
Northern Africa	14.5	12
Sub-Saharan Africa	62.2	165
Latin America and the Caribbean	27.0	117
Eastern Asia	36.5	216
Southern Asia	42.9	201
South-east Asia	27.5	67
Western Asia	24.0	31
Oceania	24.1	0.5

Note: The slum population is the population living in households that lack either improved water, improved sanitation, sufficient living area (more than three persons per room) or durable housing. If more accurate and detailed data were available for the proportion of the urban population that has 'safe and sufficient' water and sanitation to a standard that greatly reduced health risks and eliminated a need for open defecation, the number and proportion of people living in slums would increase very considerably.

Source: UN Habitat (2008), *State of the World's Cities 2008/9*, UN Habitat, Nairobi.

[51] Satterthwaite, David (2004), *The Under-estimation of Urban Poverty in Low and Middle-Income Nations*, IIED Working Paper 14 on Poverty Reduction in Urban Areas, IIED, London, 69 pages.

Table 6: Estimates for the scale of different aspects of urban poverty in low- and middle-income nations

Type of poverty	Numbers of urban dwellers affected	Notes
Inadequate income in relation to the cost of basic needs	750-1,100 million	No accurate figures are available on this and the total varies, depending on the criteria used to set the poverty line (the 'income-level' required for 'basic needs').[52]
Inadequate or no provision for safe, sufficient water and sanitation	More than 680 million for water and 850 million or more for sanitation	These are estimates for 2000, drawn from a detailed global UN review of individual city/urban studies.[53] They differ from the official WHO/UNICEF statistics but these official statistics recognize that they are not measuring the proportion of people with access to adequate provision.
Under-nutrition	150-200 million	In many Asian and sub-Saharan African nations, 25-40% of urban children are underweight.
Living in housing that is overcrowded, insecure and/or of poor quality	800+ million	Based on a global UN review of the proportion of people living in 'slums' in 2000.[54]
Homelessness (i.e. living on the street or sleeping in open or public places)	c. 100 million	UN estimate.[55] There are also large numbers of people living on temporary sites (for instance construction workers and often their families) living on construction sites) that are close to homeless.

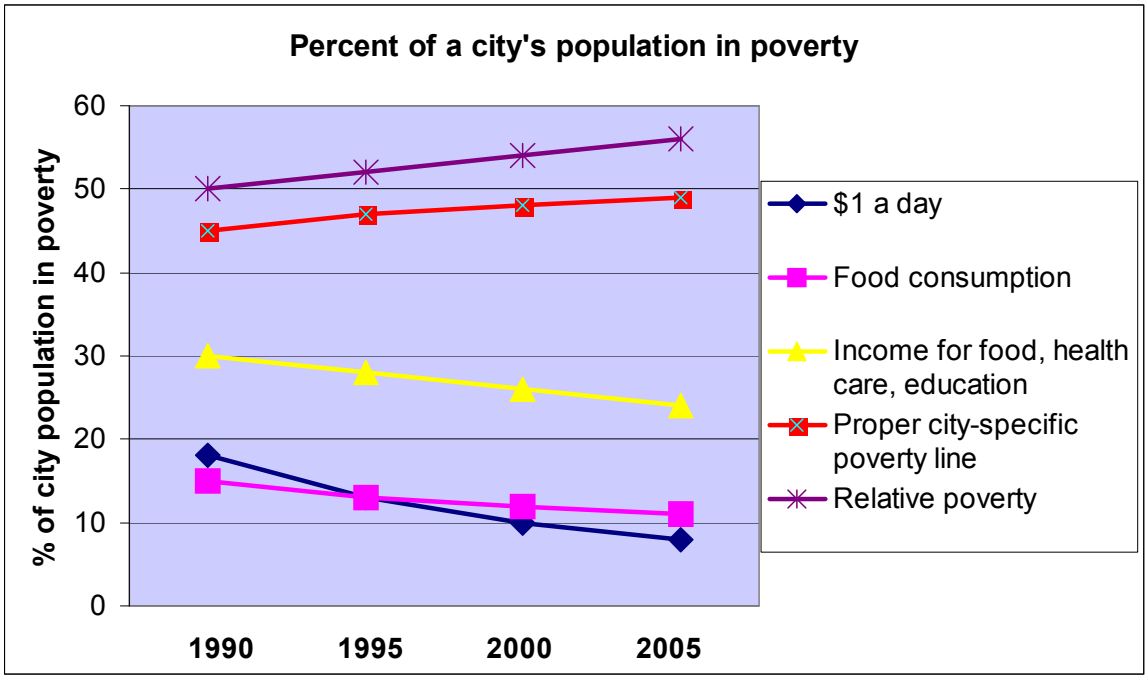
The number of urban dwellers who are 'poor' is always much influenced by how poverty is defined and measured. Most governments measure poverty by setting poverty lines based on the cost of a minimum 'food basket' and calculating what proportion of the population have incomes or consumption levels below this. But the scale of poverty is hugely influenced by the extent to which these poverty lines make an additional allowance for individuals or households to pay for non-food necessities – for instance for housing (much of the urban poor pay rent for their accommodation), water (often purchased from vendors), access to toilets (many urban poor have no toilet in their home and have to use public pay-to-use facilities), health care, keeping children at school and the cost of travelling to and from work. Some poverty lines make no provision at all for the cost of these non-food necessities – so they greatly under-estimate the scale of urban poverty. The key issue here is that when poverty lines include a reasonable allowance for the cost of non-food necessities, it is common for 35-60% of the urban population in low and middle-income countries to have incomes below the poverty line. The use of the US$1 per person per day as a poverty line is also completely inappropriate to many urban settings, because of the high monetary costs of so many non-food necessities.

Figure 2 illustrates this. This is not a figure drawn from any city but is possible for a prosperous city to have 'poverty decreasing' using conventional measures (poverty lines based primarily on the cost of

[52] Ravallion, Chen and Sangraula suggest a lower figure but as discussed later, this is based on poverty lines whose validity is questionable; Ravallion, Martin Shaohua Chen and Prem Sangraula (2007), *New Evidence on the Urbanization of Global Poverty*,WPS4199, World Bank, Washington DC, 48 pages.
[53] UN–Habitat (2003), *Water and Sanitation in the World's Cities: Local Action for Global Goals*, Earthscan Publications, London.
[54] UN Habitat (2008), *State of the World's Cities 2008/9*, UN Habitat, Nairobi; a higher figure of over 900 million was given in UN–Habitat (2003), *The Challenge of Slums: Global Report on Human Settlements 2003*, Earthscan Publications, London.
[55] UNCHS 1996, op. cit.

food, the $1 day poverty line) but poverty increasing based on a poverty line that takes account of the cost of non-food necessities in that city or that is based on relative poverty.

Figure 2: How poverty lines using different criteria show very different levels of poverty and trends in poverty for a particular city



If poverty is considered to encompass all those who have difficulties affording basic necessities and who are either homeless or live in poor quality, overcrowded and often illegal accommodation (because they cannot afford safer legal housing), then in 2000, at least 900 million urban dwellers are poor and the numbers are likely to have risen significantly since then (the urban population in low and middle-income countries has grown by around 300 million since 2000).[56] If poverty was to include all those who live in accommodation lacking protection from the most common life- and health-threatening diseases and injuries, then it is also likely to number at least 900 million. The proportion of a nation's or city's population that are poor can vary from a few percent to 50-75 percent, depending on how this poverty line is defined. For instance, during the late 1990s, there were at least four figures for the proportion of Kenya's urban population who were poor, ranging from 1.2 percent to 49 percent,[57] although the 1.2 percent figure was very unrealistic and based on faulty data.[58] In the Philippines, in 2000, the proportion of the national population with below poverty line incomes was 12 percent, 25 percent, 40 percent or 45–46 percent, depending on which poverty line is used.[59]

[56] United Nations 2008, op. cit.
[57] Sahn and Stifel suggest 1.2 percent in 1998; official statistics suggested three different figures in 1997: hardcore poverty 7.6 percent; food poverty 38.3 percent; absolute poverty 49 percent. Sahn, David E and David C Stifel (2003), "Progress towards the Millennium Development Goals in Africa", *World Development*, Vol 31, No 1, pages 23-52.
[58] Satterthwaite 2004, op. cit.
[59] World Bank (2002), *Philippines Country Assistance Strategy*, Report No 24042-PH, Philippines Country Management Unit, East Asia and Pacific Region, World Bank, Washington DC.

Table 7: Different degrees of poverty in urban areas

Aspects of poverty	Degrees of poverty			
	Destitution	Extreme Poverty	Poverty	At risk
Income	Income below the cost of a minimum food basket	Income just above the cost of a minimum food basket but far too low to allow other necessities to be afforded	Income below a realistic poverty line but enough to allow significant expenditure on non-food essentials	Income just above a realistic poverty line.
Housing with access to infrastructure and services	Homeless or living in a very poor quality shack that is no-cost or close to no-cost.	Very little to spend on housing - often renting a room in tenement or illegal or informal settlement shared with many others	More accommodation options - e.g. slightly more spacious, better quality rental housing or capacity to self-build a house if cheap or free land is available. The extent and quality of low-cost housing options is much influenced by government land, infrastructure and services policies and investments	
Financial assets	Typically none or very little (although membership of a community-based savings group may provide access to small amounts of credit for emergencies)		Often some capacity to save, especially within well managed savings and credit schemes; housing the most valuable asset for those who manage to 'get their own home' even if it is illegal	
Social and economic vulnerability	Extreme vulnerability to food price rises, loss of income or illness or injury. Often also to discrimination and unfair practices (from employers, landlords, civil servants, politicians, the law, etc).		Similar kinds of vulnerability to those faced by people facing destitution or extreme poverty, although usually less severe; often vulnerability to running up serious debt burdens; always vulnerability to illness/injury and its direct and indirect impacts on income.	
Vulnerability to disasters	Common for those in extreme poverty to live or work in areas at high risk from extreme weather or other potential catalysts for disasters in part because of the location, in part because of the lack of protective infrastructure and services		Much of the housing that is affordable by those in these categories is in locations at risk and/or lacking the infrastructure and services that reduces or removes such risk.	

Of course, within these hundreds of millions of people suffering urban poverty, there is considerable variation – from those who are destitute and suffering from acute malnutrition to those who are managing or at least avoiding poverty, as long as there is no crisis (for instance a drop in their income, a rise in food prices or in other major costs such as rent for housing or an income-earner being sick or injured) (Table 7).

Urban poverty also has a direct effect on human health and wellbeing, including infant and child survival, nutrition, and life expectancy. In most low-income and many middle-income nations, infant, child or under-five mortality rates in urban areas are five to twenty times what they should be if the urban populations had adequate nutrition, good environmental health and a competent health care service.[60] As well as the ultimate consequence of mortality, urban poverty can lead to a variety of other health

[60] Montgomery, M. R., Stren, R., Cohen, B. and Reed, H.E. (eds) (2003) *Cities Transformed; Demographic Change and its Implications in the Developing World*, The National Academy Press/Earthscan, Washington DC

implications for children. It is common for up to one-third of all urban children to be stunted within low-income nations,[61] and as with infant and child mortality rates, there are large differentials in most cities in the prevalence of severe malnutrition between wealthy and poorer areas.[62]

Infant and child mortality rates in urban areas

Table 8 gives examples of nations with high infant and child mortality rates within their urban populations. These are all the more astonishing in that in all these nations, most middle and upper income groups live in urban areas and will generally experience much lower infant and child mortality rates. So these 'averages' for national urban populations can hide the extent of the problem faced by low-income populations. **For many of the nations listed below, in 'slums' and informal settlements, it would be common for one child in five to die before their fifth birthday.**

Table 8: Examples of high infant and child mortality rates among national urban populations

Urban infant (Age <1) mortality rates of 80-101, per 1000 live births	Average for sub-Saharan Africa. Mozambique (1997), Chad (1997), Mali (1996), Ethiopia (2000), Zambia (1996), Rwanda (1992), Haiti (2000), Benin (1996), Malawi (2000), Tanzania (1996), Central African Rep. (1994/95), Eritrea (1995), Niger (1998)
Urban infant (Age <1) mortality rates of 60-79, per 1000 live births	Guinea (1999), Madagascar (1997), Côte d'Ivoire (1994), Yemen (1997), Pakistan (1990/91), Sudan (1990), Uganda (1995), Bangladesh (2000), Cambodia (2000), Burkina Faso (1998/99), Togo (1998), Comoros (1996), Namibia (1992), Cameroon (1998), Gabon (2000), Nepal (1996)
Urban child (1-4 year) mortality rates of more than 100	Niger (1998), Mali (1996), Chad (1997)
Urban child (1-4 year) mortality rates of 80-100	Zambia (1996)
Urban child (1-4 year) mortality rates of 60-79	Guinea (1999), Rwanda (1992), Benin (1996), Malawi (2000), Burkina Faso (1998/99), Uganda (1995)

SOURCE: Drawn from DHS data

Many other nations not listed in the above table also have infant and child mortality rates within their urban population that are far higher than they should be.
For particular cities, under five mortality rates of over 150 per 1000 live births were reported for Addis Ababa, N'djamena and Lilongwe with rates of over 100 per 1000 live births in Phnom Penh, Gaborone, Karachi, Nairobi, Porto Novo, Lome, Brazzaville, Libreville, Nouakchott and Kinshasa. [63]
The few empirical studies on infant and child mortality rates in low-income settlements in urban areas within low-income nations suggest that these are generally at least twice the urban average. Infant mortality rates in 'urban' slums in Bangladesh in 1991 were nearly twice that of the urban average: 134 per 1000 live births compared to 68. For Nairobi, Kenya, under-five mortality rates were 150 per 1,000

[61] Ruel, Marie T. and James L. Garrett (2004), "Features of Urban Food and Nutrition Security and Considerations for Successful Urban Programming", electronic *Journal of Agricultural and Development Economics*, Vol. 1, No. 2, pages 242-271.
[62] Satterthwaite, David (2007), "In pursuit of a healthy urban environment in low- and middle-income nations", In Marcotullio, Peter J. and Gordon McGranahan (editors) (2007), Scaling Urban Environmental Challenges: from Local to Global and Back, Earthscan Publications, London, pages 69-105; UNICEF (2000), *Progotir Pathey; On the Road to Progress; Achieving the Goals for Children in Bangladesh*, Bangladesh Bureau of Statistics and UNICEF, Dhaka.
[63] Tables in the statistical annex of UN Habitat (2005), *Financing Urban Shelter; Global Report on Human Settlements 2005*, Earthscan Publications, London, 245 pages.

live births in its informal settlements (where over half the population live) and 61.5 for Nairobi as a whole (see Table 9).

Table 9: Infant and under five mortality rates in Kenya

Location	Infant mortality rare	Under five mortality rate
Kenya (rural and urban)	74	112
Rural	76	113
Nairobi	39	62
Other urban	57	84
Informal settlements in Nairobi	91	151
Kibera	106	187
Embakasi	164	254

SOURCE: APHRC (2002), *Population and Health Dynamics in Nairobi's Informal Settlements*, African Population and Health Research Center, Nairobi.

Table 9 shows that rural areas have a higher average infant and child mortality rate than urban areas (with Nairobi having a lower average than urban areas in general). Almost twice as many infants or children under five years of age die per 1000 live births in rural areas compared to Nairobi. But infant and under five mortality rates are much higher in the informal settlements where around half of Nairobi's population lives. This shows how aggregate statistics for a whole city or for all 'urban populations' can hide severe disadvantage. Kibera in Nairobi is one of Africa's largest informal settlements with around 600,000 inhabitants; at the time of the survey, nearly one child in five died before its fifth birthday – which is hardly evidence of urban bias. In the wealthier parts of Nairobi, under five mortality rates are likely to be one tenth or even one twentieth of this.

This survey also found that the prevalence of diarrhoea with blood in children under 3 in two weeks prior to interview was far higher in Nairobi's informal settlements than among the rural population. Surveys in many other cities have also shown under-five mortality rates of 100–250 per 1,000 live births in particular settlements.

Even if indicators for urban populations are better than for rural populations, it does not imply no need to address urban problems. For instance, in Chad, the infant mortality rate in 1997 was 99 per 1000 live births for urban areas and 113 for rural areas. In Mozambique in 1997, it was 101 for urban populations and 160 for rural populations. Both nations also have most of their population in rural areas. But in many ways, the scale of these infant mortality rates in urban areas is all the more shocking, given how much easier (and cheaper) it is to provide the services that cut infant mortality rates in urban areas.

Table 10 shows infant and child mortality rates for urban and rural populations for a range of nations. What is perhaps surprising is how high these mortality rates remain for urban populations in most nations, especially when considering the common assumption that urban populations benefit from 'bias' in government services. In many nations, the differences between the rural and the urban infant and child mortality rates are not very great. This is also surprising in that most urban areas have economies of scale and proximity in most of the measures that help reduce infant and child mortality rates (such as good provision for water and sanitation and for health care).

Table 10: **Infant and child mortality rates for urban and rural populations in selected nations,**

Estimated mortality rates among infants (age less than 1) and children (ages 1-4)

	Deaths per 1,000 births*					
	Age <1			Age 1-4		
Country and Year	Urban	Rural	Total	Urban	Rural	Total
SUB-SAHARAN AFRICA						
Benin (1996)	84	112	104	72	98	90
Burkina Faso (1998/99)	67	113	109	66	137	130
Cameroon (1998)	61	87	80	53	80	72
Central African Rep. (1994/95)	80	116	102	53	70	63
Chad (1997)	99	113	110	101	103	103
Comoros (1996)	64	90	84	18	36	32
Côte d'Ivoire (1994)	75	100	91	49	73	65
Eritrea (1995)	80	74	76	53	92	83
Ethiopia (2000)	97	115	113	58	88	85
Gabon (2000)	61	62	61	30	40	32
Ghana (1998)	43	68	61	36	58	52
Guinea (1999)	79	116	107	76	107	99
Kenya (1998)	55	74	71	35	38	37
Madagascar (1997)	78	105	99	53	77	72
Malawi (2000)	83	117	113	71	106	102
Mali (1996)	99	145	134	102	149	137
Mozambique (1997)	101	160	147	55	92	84
Namibia (1992)	63	61	62	25	36	32
Niger (1998)	80	147	136	107	212	193
Nigeria (1999)	59	75	71	52	73	67
Rwanda (1992)	88	90	90	74	80	80
Senegal (1997)	50	79	69	41	94	75
Sudan (1990)	74	79	77	46	71	63
Tanzania (1996)	82	97	94	42	59	56
Togo (1998)	65	85	80	38	79	69
Uganda (1995)	74	88	86	64	78	77
Zambia (1996)	92	118	108	90	98	95
Zimbabwe (1999)	47	65	60	23	37	33
NEAR EAST & NORTH AFRICA						
Egypt (2000)	43	62	55	10	19	15
Jordan (1997)	27	39	29	5	7	5
Morocco (1992)	52	69	63	7	31	22
Turkey (1998)	42	59	48	10	16	12
Yemen (1997)	75	94	90	22	38	35
EUROPE & EURASIA						
Kazakhstan (1999)	44	64	55	7	10	9
Kyrgyz Republic (1997)	54	70	66	4	13	10
Uzbekistan (1996)	43	44	44	9	14	12
ASIA & PACIFIC						

Bangladesh (2000)	74	81	80	24	35	33
Cambodia (2000)	72	96	93	22	34	32
India (1999)	49	80	73	17	35	31
Indonesia (1997)	36	58	52	12	22	19
Nepal (1996)	61	95	93	23	53	51
Pakistan (1990/91)	75	102	94	21	33	29
Philippines (1998)	31	40	36	15	23	20
Vietnam (1997)	23	37	35	7	12	12
LATIN AMERICA & CARIBBEAN						
Bolivia (1998)	53	100	74	20	38	28
Brazil (1996)	42	65	48	7	15	9
Colombia (2000)	21	31	24	3	5	4
Dominican Republic (1996)	46	53	49	9	18	13
Guatemala (1998/99)	49	49	49	9	20	16
Haiti (2000)	87	91	89	27	65	53
Nicaragua (1997)	40	51	45	9	14	11
Paraguay (1990)	33	39	36	13	10	11
Peru (2000)	28	60	43	11	27	18

SOURCE: Demographic and Health Surveys (DHS); STATcompiler. http://www.measuredhs.com/

When viewing the above figures, it must be remembered that in all nations, a high proportion of their middle- and upper-income groups live in urban centres and such groups are likely to have relatively low infant and child mortality. So these 'averages' for nations' urban populations can hide the extent of the problem faced by low-income urban populations. In virtually all cities for which data are available in low-income nations, and for most in middle-income nations, there are also dramatic contrasts between different areas (districts, wards, municipalities) of the city regarding living conditions and health outcomes.[64]

Another striking difference between urban areas in high-income nations and low- and most middle-income nations is the scale of the health burden generated by infectious and parasitic diseases. Again, the documentation is incomplete, but it is clear that infectious and parasitic diseases have a very large impact in terms of serious illness and premature death among large sections of the young populations in most urban centres in low- and middle-income nations, and very little impact among young populations in high-income nations.[65] There is also some evidence of the much larger health burdens for adults.[66]

Physical hazards evident in the home and its surroundings are also among the most common causes of serious injury and premature death in most urban areas in low- and middle-income nations[67]– for

[64] Stephens, C. (1996) "Healthy cities or unhealthy islands: The health and social implications of urban inequality", *Environment and Urbanization*, Vol 8, no 2, October, pages 9–30; Hardoy, Mitlin and Satterthwaite 2001, op. cit.
[65] WHO (1992) *Our Planet, Our Health*, Report of the WHO Commission on Health and Environment, World Health Organization, Geneva; Satterthwaite, D., Hart, R., Levy, C., Mitlin, D., Ross, D., Smit, J. and Stephens, C. (1996), *The Environment for Children*, Earthscan and UNICEF, London and New York.
[66] See for instance Bradley, D., Stephens, C., Cairncross, S. and Harpham, T. (1991) *A Review of Environmental Health Impacts in Developing Country Cities*, Urban Management Program Discussion Paper No. 6, The World Bank, United Nations Development Program and United Nations Centre for Human Settlements (Habitat), Washington DC; also WHO 1992, op. cit. and Pryer, J. A. (2003), Poverty and Vulnerability in Dhaka Slums; the Urban Livelihoods Study, Ashgate, Aldershot..
[67] Goldstein, G. (1990), "Access to life-saving services in urban areas", in J. E. Hardoy, S. Cairncross and D. Satterthwaite (eds) *The Poor Die Young*: *Housing and Health in Third World Cities*, Earthscan, London, pages 213–

example, burns, cuts and scalds and injuries from falls. The health burdens these cause are particularly large in districts where housing quality is poor (especially where flammable materials are used for housing), infrastructure deficient and there are high levels of overcrowding. Large health burdens and high levels of accidental death from physical hazards are also related to the lack of provision for rapid and appropriate treatment, both from health care and emergency services. In most cities, accidental deaths and serious injuries from road traffic have become important components of health burdens.

A study of the contribution of illness to poverty in the slums in Dhaka highlights another aspect of the scale of the health burden faced by low-income groups –the extent to which ill health caused a deterioration in households' financial status. In this study of 850 households, ill-health was the single most important cause of such a deterioration, explaining 22 per cent of cases where households reported a deterioration in their financial status. Illness led to reductions in income and increased expenditures; often more loans taken out, assets sold and more adults resorting to begging.[68] This link between illness, increasing indebtedness to cope with the drop in income and increase in health care expenditure and poverty was also described in a study of Visakhapatnam, India.[69] Although it is dangerous to draw general conclusions from one or two studies, the living conditions described by these two studies are similar to those in informal settlements or tenements in many other urban centres in low- and middle-income nations, so comparable links between high health burdens and impoverishment would be expected. In addition, many case studies focusing on low-income urban populations or those living in particular urban settlements that show very large health burdens from diseases that should be easily prevented or cured – for instance diarrhoeal diseases, intestinal parasites, TB and acute respiratory infections.[70]

Urban Poverty and Intensive and Extensive Risk

Urban areas increase extensive risk, almost by definition – in that an urban area is a physical concentration of people, enterprises, motor vehicles and their wastes. But as discussed in an earlier section, the programmes and practices of government can reduce this. This concentration also means many economies of scale and proximity in the means to reduce extensive risk.

Urban poverty almost always increases extensive risk – see Table 11. Except where the programmes and practices of government limit or remove this. Household and community-based action can help reduce extensive risk in urban areas but there are limitations in what this can achieve without government support and without the 'big' infrastructure and service framework into which community-provision can integrate. On their own, community-based action cannot finance and build water treatment plants and trunk infrastructure, deal with the causes of flooding that are outside their community, equip and staff hospitals……

So poverty plus urban concentration usually means extensive risk. 'Good local governance' both in the sense of competent, effective, accountable local government and good working relationships with civil society is perhaps the most important factor that can limit this, as described in the many case studies in

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227; WHO (1999), "Creating healthy cities in the 21st Century", in D. Satterthwaite (ed), *The Earthscan Reader on Sustainable Cities*, Earthscan, London, pages 137–172.

[68] Pryer 2003, op. cit.

[69] Amis, P. and Kumar, S. (2000) "Urban economic growth, infrastructure and poverty in India: lessons from Visakhapatnam", *Environment and Urbanization*, Vol 12, no 1, pages 185–197.

[70] To this should be added the very large health burden from HIV/AIDs evident among the urban populations of many nations for which inadequate attention has been given in prevention, in protecting the groups most at risk and in guaranteeing those who are infected have the treatment and support that greatly diminishes the health impacts – see van Donk, Mirjam (2006), "'Positive' urban futures in sub-Saharan Africa: HIV/AIDs and the need for ABC (a broader conceptualisation)", *Environment and Urbanization*, Vol. 18, No. 1, pages 155-176; Mabala, Richard (2006), "From HIV prevention to HIV protection; Addressing the vulnerability of girls and young women in urban areas", *Environment and Urbanization*, Vol. 18, No. 2, pages 407-432.

earlier sections. **In effect, good local governance reduces or removes the relationship between low-income and extensive risk.**

But 'good local governance' is also the key to reducing intensive risk too. Table 11 seeks to make explicit how different aspects of urban poverty influence intensive and extensive risk. Note should be made of the multiple connections between these different aspects of poverty. However, the value in discussing these different aspects of poverty separately is that they can highlight specific links between poverty and intensive and extensive risk which in turn highlights specific actions that can reduce these risks. One of the reasons why most data on poverty is of so little value in showing links to extensive and intensive risk is that it only covers consumption levels or income levels. There are large differences in exposure to extensive risk and often intensive risk among those classified as 'poor' by income or consumption based poverty lines. So a household living in a squatter settlement that floods regularly in a small, poor quality overcrowded home made of flammable materials at risk from storms and fires with no police service, no vote and no possibility of getting their children into local government schools is classified as 'poor' in exactly the same way as a household living in a home of permanent materials on a safe site with adequate infrastructure and services, if they have comparable income-levels.

Table 11: What different aspects of poverty imply for extensive and intensive risk

ASPECT OF URBAN POVERTY	IMPLICATIONS FOR EXTENSIVE RISK	IMPLICATIONS FOR INTENSIVE RISK
1. **Inadequate and often unstable income** (and thus inadequate consumption of necessities, including food and, often, safe and sufficient water; often, problems of indebtedness, with debt repayments significantly reducing income available for necessities) and/or incapacity to afford rising prices for necessities (food, water, rent, transport, access to toilets, school fees.....)	Very limited capacity to pay for housing which in urban areas means living in the worst quality homes and neighbourhoods in the least advantageous locations. This often means living in poor quality housing in illegal settlements on dangerous sites lacking provision for infrastructure and services – so very high levels of extensive risk	In most cities and many urban centres in low- and middle-income nations, most low-cost housing is on land sites at risk from flooding or landslides, in part because of the location, in part because of the lack of public provision for infrastructure and services. Housing often of poor quality so at risk from storms/high winds
2. **Inadequate, unstable or risky asset base** (non-material and material including educational attainment and housing) for individuals, households or communities, including those assets that help low-income groups cope with fluctuating prices or incomes.	Very limited capacity to cope with stresses or shocks in everyday life – including rising prices or falling incomes, injuries and diseases	Very limited capacity to cope with disaster events when they occur and to protect material assets
3. **Poor quality and often insecure, hazardous and overcrowded housing**.	High risk levels from physical accidents, fires, extreme weather and infectious diseases	High risk of household accidental fires becoming larger settlement wide fires; conditions favouring disease transmission may cause epidemics. Large concentrations of housing at risk of damage or collapse from storms/floods and earthquakes.
4. **Inadequate provision of 'public' infrastructure** (piped water, sanitation, drainage, roads, footpaths, etc.), which increases the health burden and often the work burden.	High levels of risk from contaminated water, inadequate sanitation, house flooding from lack of drainage	Lack of infrastructure often the main underpinning of flooding. Lack of roads, footpaths and drains inhibiting evacuation when disaster threatens or happens
5. **Inadequate provision of basic services** such as day care/schools/vocational training, health care, emergency services, public transport, communications, law enforcement.	Unnecessarily high health burden from diseases and injuries because of lack of treatment including emergency response	Lack of health care and emergency services that should provide rapid response to disaster (and should have had a role in reducing disaster risk and disaster preparedness including where relevant early warning and designation/management of safe sites)
6. Limited or no safety net to ensure	Very limited capacity to cope with	Very limited capacity to recover

basic consumption can be maintained when income falls; also to ensure access to housing, health care and other necessities when these can no longer be paid for (or fully paid for).	stresses or shocks in everyday life – including rising prices or falling incomes, injuries and diseases	from disaster – for instance to afford sufficient food and water, rebuild homes and livelihoods; official bodies may prevent households rebuilding on their original sites…..
7. Inadequate protection of poorer groups' rights through the operation of the law: including laws, regulations and procedures regarding civil and political rights, occupational health and safety, pollution control, environmental health, protection from violence and other crimes, protection from discrimination and exploitation.	Most homes and neighbourhoods that low-income groups can afford are constructed outside official building and land-use regulations that are meant to safeguard health and reduce extensive risk	Most homes and neighbourhoods that low-income groups can afford constructed outside official regulations which means no attention to codes and standards that ensure these can withstand extreme weather and earthquakes or avoid large scale fires
8. Poorer groups' voicelessness and powerlessness within political systems and bureaucratic structures, leading to little or no possibility of receiving entitlements to goods and services; of organizing, making demands and getting a fair response; and of receiving support for developing their own initiatives. Also, no means of ensuring accountability from aid agencies, NGOs, public agencies and private utilities, and of being able to participate in the definition and implementation of their urban poverty programmes.	This lack of political voice and powerless within bureaucratic structures a key reason for the lack of government action or support for reducing extensive risk in all the above.	This lack of political voice and powerless within bureaucratic structures a key reason for the lack of government action or support for reducing intensive risk in all the above

Urban areas and dangerous sites

Previous sections have described how urban poverty is strongly associated with extensive risk and that the scale of extensive risk is strongly related to the quality and capacity of city and municipal governments. Previous sections have also pointed to the large and probably growing number of people killed by disasters in urban areas – and where studied, by small disasters. It is clear from the table above that there are strong links between poverty and the scale of intensive risk in urban areas and that the scale of intensive risk is also related to the quality and capacity of city and municipal governments. But is there another aspect to this discussion in that many successful cities and many non-poor urban citizens face high levels of intensive risk.

Certainly, in most cities in low and middle income nations, large concentrations of low-income households face high levels of risk for the whole continuum of risk (every day, small disaster, disaster) because they live on dangerous sites – for instance large concentrations of poor settlements can be seen on hills prone to landslides in Rio de Janeiro (Brazil), La Paz (Bolivia) and Caracas (Venezuela); or in deep ravines (Guatemala City); or in sandy desert as in Lima (Peru) and Khartoum (the Sudan); or on land prone to flooding or tidal inundation or under water as in Guayaquil (Ecuador), Recife (Brazil), Monrovia (Liberia), Lagos and Port Harcourt (Nigeria), Port Moresby (Papua New Guinea), Delhi (India), Bangkok (Thailand), Jakarta (Indonesia), Buenos Aires and Resistencia (Argentina), Accra (Ghana) and many others.[71] Low-income settlements develop on such sites because the land is unsuited for residential or commercial development so those who settle there and build their homes have more chance of avoiding eviction – and these sites are often chosen because they are also good locations in regard to income-earning opportunities. Because most such settlements are illegal, these usually also have serious deficiencies in provision for the infrastructure and services that prevent physical accidents or that limit their health impact. Certainly, these sites (and their lack of infrastructure and services)

[71] Hardoy et al 2001, op. cit.

increase the incidence and seriousness of physical traumas that affect one or two people, and it is likely that a disproportionate number of deaths and serious injuries from physical traumas from everyday events, small disasters and disasters occur in these settlements. Thus in any urban centre, the proportion of the population living in informal settlements on dangerous sites lacking infrastructure and services will be a major influence on the scale of disaster impacts. Of course, so too will the extent and frequency of extreme weather and other potential catalysts for disasters. If there is a growing number of people living on such sites, in effect, there is a risk-accumulation process underway – and one that is socially constructed. There is little that is 'natural' to a flood with disastrous impacts on homes and neighbourhoods that were constructed on floodplains because this was the only site available to their low-income inhabitants. Here, high levels of death and injury from extensive risk ('everyday risk' and 'small disasters') are likely to be indictors of vulnerability to larger disaster events in most locations.

This provides powerful evidence that disasters are not inherent to urban development but produced by poor governance. The vulnerability of urban populations to disasters is not 'natural', but constructed and amplified by poor governance – and good practice in planning and management can greatly reduce these vulnerabilities.[72]

However, another part of this story is that prosperous cities grow and develop on sites that have high levels of intensive risk. The IPCC Working Group II noted that rapid urbanization in most low- and middle-income nations is often in relatively high-risk areas, and that this is placing an increasing proportion of those nations' economies and populations at risk.[73] The issue then is why so many cities or small urban centres developed on dangerous sites in regard to risks from storms, sea surges and floods, which now make many of them even more at risk from the impacts of climate change; also why many developed on sites at high risk from earthquakes.

Six reasons can be suggested for this, although for most cities with populations facing high levels of intensive risk, several of these are play

1: **Economic or political reasons outweighed considerations of risk:** Sites that are at risk from storms, floods, earthquakes…..were attractive to those who originally founded and developed a city – for instance, because of a good river or sea harbour, a strategic location in regard to trade or territorial control, a ready supply of freshwater or a fertile delta. Most of the world's major cities are on the coast or beside major rivers because they were already important urban centres before railways, new roads and air transport changed transport systems. Most relied on river or sea ports as their main transport and communication link with other places – and, of course, river and ocean transport is still a key part of the increasingly globalized economy.

2: **The original city site may have been safe, but the city has outgrown this site and expanded onto land that is at risk** – for instance onto floodplains or up unstable hills or mountains. Many city sites that were safe and well-chosen for cities of 50,000 inhabitants (a comparatively large city 200 years ago) are not safe when the city expands to several million inhabitants. There are comparable problems in regard to fresh water supplies in many cities – i.e. where the size of the city and the increased demand for water has gone far beyond local water resources. Box 1 gives some examples

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[72] Bull-Kamanga, Liseli, Khady Diagne, Allan Lavell, Fred Lerise, Helen MacGregor, Andrew Maskrey, Manoris Meshack, Mark Pelling, Hannah Reid, David Satterthwaite, Jacob Songsore, Ken Westgate and Andre Yitambe (2003), "Urban development and the accumulation, *Environment and Urbanization*, Vol. 15, No. 1, pages 193-204.

[73] Wilbanks, Tom and Patricia Romero Lankao with Manzhu Bao, Frans Berkhout, Sandy Cairncross, Jean-Paul Ceron, Manmohan Kapshe, Robert Muir-Wood and Ricardo Zapata-Marti (2007), "Chapter 7: Industry, Settlement and Society", in Parry, Martin, Osvaldo Canziani, Jean Palutikof, Paul van der Linden and Clair Hanson (editors) *Climate Change 2007: Impacts, Adaptation and Vulnerability*, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge and New York, pages 357-390.

Box 1: The contribution of ill-planned urban expansion to disaster risk

SANTA FE: The city of Santa Fe in Argentina (with a population of over 480,000) has increasingly expanded onto the Río Salado floodplain. To defend the city from floods, embankments and dykes were created. A flood in 2003 resulted in 140,000 evacuees (one third of the city population), 23 official deaths (local sources suggest at least 100 more than this), 180 cases of leptospirosis, 200 cases of hepatitis and losses estimated at around US$1 billion. Among the factors contributing to the flood were increased rainfall (and more intense storms) and deforestation and land-use changes around the city – but the flood caught the city authorities completely unprepared. Floods in 2006 and 2007 also caught the government unprepared; there were several deaths, tens of thousands of evacuees, highways and roads flooded, and bridges down. A third of the city was turned into shallow lake – the same part of the city hit by the 2003 flood. The director of a local foundation noted: "there has always been heavy rains in the city of Santa Fe"; he also noted that the contingency plan for flooding existed only on paper and no one really knew what they were supposed to do. The pumps did not work because of inadequate maintenance and vandalism. He complained that local authorities favour the urbanization of at-risk areas by bringing piped water and electricity to the neighbourhoods, "where they have their loyal voters". But they fail to follow up with preparations for emergencies and do not maintain the pumps and drainage systems. There is also no land-use policy to ensure land for housing available on lower risk sites.[74]

QUITO: The city of Quito is at the foots of the Pichincha Volcano, on very steep slopes. Population has increased fourfold over the last 30 years or so, and a combination of problems (economic crisis, debt, fast urban growth, lack of planning, etc) has led to legal and illegal occupation of slopes. The costs of providing services and infrastructure to these areas are very high, especially for the case of illegal settlements. The lack of sewers and drainage systems increases the risk of floods, while the lack of proper waste collection systems and waste accumulation in ravines and gorges that clogs natural water flow also generates floods and landslides.[75]

CARACAS: In Caracas, city expansion has greatly increased the impermeable surfaces, increasing water runoff. Without planning, low income neighborhoods have occupied unstable land and gorges. Neighborhood layout together with waste accumulation act as dykes to water runoff. The devastating floods in December 1999 killed hundreds of people. Rainfall was unusual for its intensity, time of the year and in that it was not produced by hurricane or tropical cyclone. Death tolls were high due to the large numbers of people settled on slopes and low – lying lands[76]. The most impacted state is heavily urbanized, with high population densities on a narrow strip between the mountains and the sea, crossed by 37 rivers and 42 canyons. Rapid urban growth led to the occupation of slopes with no controls (the rich occupying floodplains and near river banks while poor households settled on slopes and near ravines).[77]

SOURCE: Hardoy, Jorgelina and Gustavo Pandiella (2008), "Urban poverty and vulnerability to climate change in Latin America", Background paper, prepared for the World Bank, IIED, London.

3: **City expansion and development can create new risks** – for instance as urban development occurs without the needed investments in protective infrastructure such as a fast growing concentrated impermeable surface, a lack of investment in storm and surface drains and new urban developments actually encroaching on and building over important natural drains.

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[74] Drawn from Hardoy and Pandiella 2008, op. cit. For the information presented here, Proyecto de Ley – Diputado Eduardo Di Pollina – Ley Nacional Indemnización Inundaciones Santa Fe; www_partidosocialista_com_ar – inundaciones santa fe.htm; Valente, Marcela (2007) Cambio Climático – Inundación Santa Fe: Aguas Violentas, Desidia Humana, Buenos Aires, 2 April (IPS) in: http://www.proteger.org.ar/doc621.html.

[75] Zeballos Moreno, Othon (1996) Ocupación de laderas: incremento del riesgo por degradación ambiental urbana en Quito, Ecuador, in M A Fernández (ed) *Ciudades en Riesgo, Degradación Ambiental, Riesgos Urbanos y Desastres*, La Red, Peru; also in United Nations Human Settlement Programme (UN – HABITAT) 2003) Water and Sanitation in the World Cities: Local Action for Global Goals. Earthscan Publications, London p. 154, and UNDP (2004) *Global Report. Reducing Disaster Risk: A Challenge for Development*. UNDP, Bureau for Crisis Prevention and Recovery. New York

[76] Mata J.L and Carlos Nobre (2006). *Background paper: Impacts, vulnerability and adaptation to climate change in latin America.* Presented at Regional Workshop on: Latin American Adaptation, UNFCCC, 18 – 20 April, Lima, Peru

[77] UN Habitat (2003) *Water and Sanitation in the World´s Cities: Local Action for Global Goals*, Earthscan, London, pages 150 – 151

4: **Dangerous sites serve low-income households well in that they are the only places where they can find accommodation, close to income-earning/livelihood opportunities.** There is a tension inherent to all cities between the need for a labour force willing to work for low wages and the way that city land-markets push up house prices beyond what much of this labour force can afford. This can be resolved or lessened by a range of means that reduce the cost of housing (including measures to increase the supply and reduce the cost of land for housing and high quality public transport - bus, metro, light rail, suburban rail…….) or increase the income or house-purchasing capacity of low-income groups (eg housing subsidies for low-income households as used at scale in Chile and South Africa). But where it is not, large sections of the low-income population have to find accommodation within informal or illegal settlements and the only way that prices for these are brought down are by distance from economic opportunity (which means long and expensive commutes), poor quality, overcrowded and often insecure housing (including lack of provision for infrastructure and services) and intensive or extensive risk (eg sites at risk of flooding, landslides or earthquakes).

5: **Once a city has developed, it rarely disappears, even if it experiences some disastrous flood or earthquake – because there are too many individuals, enterprises and institutions with an interest in that city's economy**. Most of the world's largest cities have been successful cities for hundreds of years; many have experienced catastrophic disasters but were rebuilt rather than being relocated.

6: **In most cities at risk from floods and storms, the wealthier groups and most formal enterprises do not face serious risks**.

Note that much of the risk noted above is not inherent to urban centres or cities or large cities but a result of the failures of governments in their urban policies and investments.

The spatial distribution of urban populations in any nation is not the result of any careful plan to guide urban expansion to "safe" sites. The main driver of urban expansion (or stagnation or contraction) is where new or expanding private enterprises choose to concentrate (or avoid). This is also largely true for how each individual urban centre develops – as the localities within and around the urban centre with the most rapidly growing populations are associated with where new or expanding economic activities concentrate – although the physical growth of the urban centre is also influenced by where lower-income groups can (or cannot) get accommodation or land on which housing can be built.[78]

So, in seeking to understand the links between city development and intensive risk, one of the key issues is – to what extent are private enterprises influenced in their choice of location by disaster risk? Obviously, formal-sector private enterprises will not generally invest in sites that are risky – unless the risk of loss can be reduced by insurance or by the risk not actually threatening their production (it is particular geographic areas and particular population groups – usually low-income groups – that are most at risk). In regard to risks from climate change, if these are seen as distant threats that may affect city sites 20 or 50 or more years in the future, this will not provide much discouragement to invest, especially in successful cities. Dhaka, Mumbai and Shanghai have attracted much private investment, despite their vulnerability to storms and sea-level rise.

Climate change is changing or will change forms and levels of intensive risk for most cities as discussed in detail in a later section. So there is the potential impact on each city's economy (and employment opportunities) and on the local government's tax base if companies and corporations move, when risk levels increase – or after some particular extreme weather event. Even if such enterprises are not directly affected by an extreme weather event, the indirect effects – the disruption for electricity, water supplies or climate-sensitive inputs, the delay in deliveries of key inputs or difficulties in shipping goods to

[78] Torres, Haroldo, Humberto Alves and Maria Aparecida de Oliveira (2007), "São Paulo peri-urban dynamics: some social causes and environmental consequences", *Environment and Urbanization*, Vol. 19, No. 1, pages 207–233.

customers, inconvenience to senior staff – may encourage movement elsewhere or the choice of new locations when enterprises expand.

Small urban centres

A very considerable proportion of the population of Africa, Asia and Latin America live in tens of thousands of small urban centres and in hundreds of thousands of large villages that have several thousand inhabitants and that might also be considered as small urban centres.[79] The extent to which their populations face intensive and extensive risk needs consideration – especially given the over-concentration in the literature on large cities or mega-cities. Far more people live in small urban centres in low- and middle-income nations than in mega-cities (see Table 12).

Table 12: Population distribution between different size categories of urban centres and rural areas in 2005

Nations and regions	Percentage of the total population in 2005 in:					
	Rural areas	Urban areas with fewer than 500,000 inhabitants	Urban areas with 0.5 to1 million inhabitants	Urban areas with 1 to 5 million inhabitants	Urban areas with 5 to 10 million inhabitants	'Mega-cities' with over 10 million inhabitants
Africa	62.1	22.1	3.3	9.5	1.7	1.2
Asia	60.3	19.7	4.0	8.9	3.2	3.9
Europe	28.1	48.8	7.0	11.4	3.3	1.4
Latin America and the Caribbean	22.5	37.9	7.9	16.2	4.7	10.9
Northern America	19.3	29.7	8.5	25.8	7.4	9.3
Oceania	29.5	28.6	1.5	40.4	0.0	0.0
World	51.4	25.4	4.8	10.9	3.3	4.1
High-income nations	26.0	39.9	6.7	16.2	4.0	7.2
Low- and middle-income nations	57.3	22.1	4.4	9.7	3.2	3.4
Least developed nations	73.0	15.8	2.2	6.4	0.9	1.6
China	59.6	17.4	5.6	12.7	2.8	1.9
India	71.3	14.7	2.8	4.9	2.2	4.2

SOURCE: Derived from statistics in UN Population Division 2008, op. cit.

But few generalizations are valid for small urban centres and large villages. What they share is their relatively small population (in comparison to all urban centres); most will have economies linked to the provision of goods and services for local agricultural, fishing or forestry enterprises while a proportion will be linked to tourism. Most of those designated as urban centres will function as a low level government headquarters – for instance a district or sub-district headquarters. A proportion of small urban centres will be close to major cities and often growing rapidly, as some production and population move out of the city. However, even within the small urban centres within a nation, there will be great diversity in their prosperity, economic base and speed with which their populations are growing. It is not

[79] There are very significant differences in how governments define their urban populations; at one extreme, some classify all settlements with more than a few hundred inhabitants as urban, at the other, some still classify settlements with many thousand inhabitants as rural.

true that small urban centres are growing faster than large cities; in every nation, there will be a considerable range of population growth rates for their small urban centres, often including some that are declining while others that are growing rapidly. One other characteristic that almost all these 'small urban centres and large villages' will share is weak and poorly resourced local governments and this also means large backlogs in provision for infrastructure and little investment capacity. Also (generally) limited capacity and technical knowledge on needed investments in reducing intensive risk.

Table 12 also shows how small a proportion of the world's population lives in 'mega-cities' with 10 million or more inhabitants; by 2005, only 4.1 percent of the world's population lived in such mega-cities. In addition, there are good grounds for questioning whether the proportion of the world's population living in mega cities will increase substantially in that in most successful economies, smaller cities are attracting much of the new investment. Note too the very low concentration of Europe's population in mega-cities; here is one of the world's most successful, prosperous, urbanized regions with has little more than one person in 100 living in mega-cities.

The number of people living in 'small urban centres' also depends on how small urban centres are distinguished from urban centres that are not small. Table 12 shows that urban centres with fewer than 500,000 inhabitants have large populations in all regions; in 2005, they had a fifth or more of the population in all regions - from 20 percent in Asia to 38 percent in Latin America and the Caribbean to 49 per cent in Europe. But an urban centre with half a million inhabitants is hardly small. Although detailed analyses of how nations' national populations are distributed between settlements of different population size classes are rare, it is clear that hundreds of millions of people in low- and middle-income nations live in urban centres with less than 50,000 inhabitants and hundreds of millions more live in large villages with several thousand inhabitants and other urban characteristics. Many Latin American nations had more a fifth of their total populations living in urban centres with less than 50,000 inhabitants in their last census including some that had more than a fifth of their population in urban centres with less than 20,000 inhabitants.[80] Generally, African and Asian nations have lower proportions of their national population in urban centres with less than 50,000 inhabitants (although with some exceptions such as Ghana, Botswana, Mauritania and Namibia all with more than 15 percent of their national population in urban centres with less than 50,000 inhabitants in the last census for which data were found). But the proportion of a nation's population living in urban centres with fewer than 20,000 or fewer than 50,000 inhabitants obviously depends on how urban centres are defined. Many nations still classify much of their population living in settlements of 5,000 to 20,000 inhabitants as rural. In 1996. 18 percent of Egypt's population lived in settlements with between 10,000 and 20,000 inhabitants with urban characteristics yet these were still classified as rural settlements.[81] In India, an analysis of the 1991 census showed that over 100 million lived in 'rural settlements' with more than 5,000 inhabitants and in most nations these would be considered as urban.[82]

The fact that most small urban centres (and large villages) in low- and middle-income nations have a lack of infrastructure, limited coverage for services and the weakness and lack of investment capacity within their governments would suggest that large sections of their population face extensive risks. Those that begin to grow very rapidly may also face a large increase in extensive risk as the backlogs in infrastructure and services increase. But leaving aside nations where conflict or war is driving large migration flows and rapid growth within some urban centres, the smaller urban centres that are growing rapidly are generally those with stronger economies and with ties to larger cities or direct to international

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[80] Satterthwaite, David (2006), *Outside the Large Cities; the demographic importance of small urban centres and large villages in Africa, Asia and Latin America*, Human Settlements Discussion Paper; Urban Change-3, IIED, London, 30 pages.

[81] Denis, Eric and Asef Bayat (2002), *Egypt; Twenty Years of Urban Transformations*, Urban Change Working Paper 5, IIED, London.

[82] Visaria, P (1997), "Urbanization in India: an overview" in Jones, G and P Visaria (editors), *Urbanization in Large Developing Countries*, Clarendon Press, Oxford, pages 266–288.

market (producers of goods, key transport points or tourism). So the possibility of mobilizing capital for investment in infrastructure and services in small rapidly growing urban centres should be there, although building the institutional capacity to do this is often problematic.

In terms of intensive risk, it is likely that most small urban centres have lower levels of risk than larger urban centres in their nation. Much of the intensive risk for large cities is the result of large sections of the rapidly growing population being pushed onto dangerous sites. As discussed above, most of today's largest cities were formed on safe sites and it is only their very large demographic and physical expansion that has pushed parts of their population onto dangerous sites. Or the failure to make provision for infrastructure and other risk-reduction measures as the city expanded. In addition. the more difficulty low income groups have in affording or otherwise getting land for housing, the more likely these are to resort to land sites that face intensive risks.

There are examples of innovations in relatively small cities in Latin America that reduce extensive risk and probably intensive risk too – for instance in Manizales (Colombia) and in Ilo (Peru). Sometimes, there is more room for innovation and for pro poor mayors because these small urban centres are not seen as important by national governments. But this is less likely in low income nations. There are also many examples of what were relatively small cities becoming much larger because of their economic success – for instance in Brazil, Curitiba and Porto Alegre are now large, successful cities because they competed successfully with larger cities for new investment.

Who is most at risk from intensive risk in urban areas?

Although it has long been recognized that there are strong links between urban poverty and intensive/disaster risk, these are still frequently discussed separately.[83] There is also a worry now that risks relating to climate change in urban areas will attract its own specialist group, independent of those working on disasters and on urban poverty reduction; certainly, the knowledge-base developed over the last 30 years on disaster prevention and disaster preparedness in urban areas was not adequately reflected in the IPCC's Fourth Assessment published in 2007.

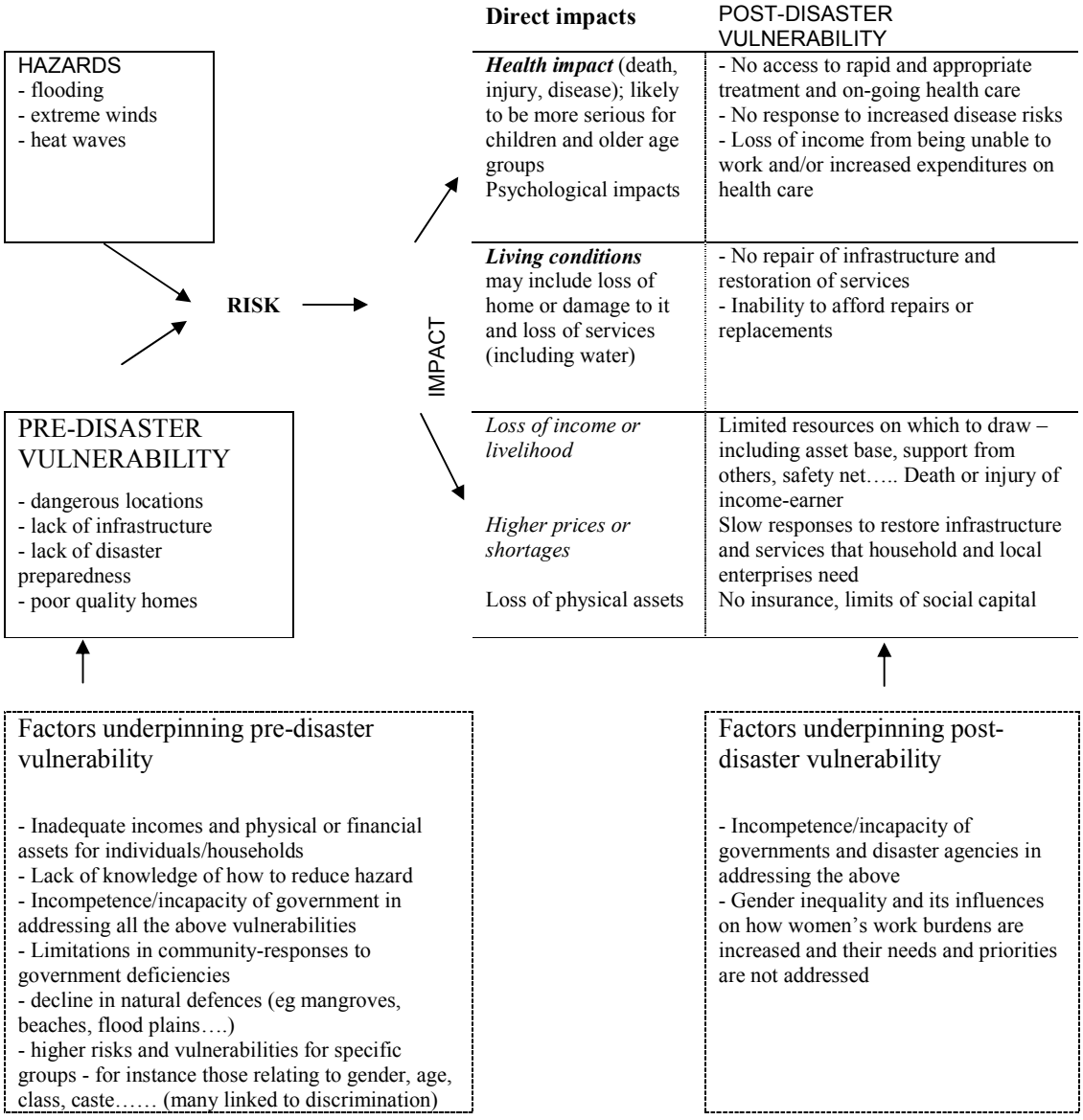
Within urban areas, poorer groups get hit hardest by a combination of:

- greater exposure to hazards (e.g. a high proportion living in makeshift housing on unsafe sites – and often with much of the housing built of flammable material)
- lack of hazard-removing infrastructure (e.g. effective drainage systems)
- less capacity to cope with impacts (e.g. lack of assets that are 'safe' from disasters and/or protected by insurance)
- less adaptive capacity (for instance the capacity to move to better quality housing and less dangerous sites)
- less state provision to help them cope when a disaster occurs (and for many, state action actually increases exposure to hazards by limiting access to safe sites for housing)
- less legal protection (for instance a lack of legal tenure for housing sites).

Figure 3 outlines some of the factors that contribute to pre-disaster and post-disaster vulnerability.

[83] For instance, the words 'disaster', 'risk' and 'vulnerability' are not mentioned at all in a 2007 paper on "New Evidence on the Urbanization of Global Poverty;" Ravallion, Martin Shaohua Chen and Prem Sangraula (2007), *New Evidence on the Urbanization of Global Poverty*,WPS4199, World Bank, Washington DC, 48 pages.

Figure 3: Pre- and post disaster vulnerabilities to extreme weather-related disasters in urban areas



It is worth noting how many of the factors underpinning pre-disaster and post-disaster vulnerability listed above arise because of the incapacity of urban governments or their unwillingness or refusal to work with low-income groups. The two underpinnings of reduced disaster risk for urban populations are higher incomes for poorer groups and the presence of competent and accountable local governments. Higher incomes allow individuals and households to reduce risks – for instance by having safer housing, choosing safer jobs or locations to live in, having assets that can be called on in emergencies and protecting wealth by insuring assets that are at risk.[84] Although it should be through good governance that

[84] Hardoy and Pandiella 2008 (op. cit) note that many middle and upper income neighbourhoods also develop in high risk areas near rivers or coasts or on slopes but they have the political influence to ensure public provision of infrastructure to reduce risks and the resources to strengthen their homes and insure their property and possessions.

provision for much risk reduction is ensured for the whole city population and disparities in risk between income-groups reduced, wealthier groups often have more influence on public investments – and it has long been common for middle- and upper-income groups to be the main beneficiaries of government investment in 'risk-reducing' infrastructure and services. If governments do not provide these, higher-income groups have the resources to solve this problem themselves – for instance by developing their own provisions for water, sanitation and electricity, or by moving to private developments which provide these.

A consideration of city environments needs a focus on three aspects: the environmental health aspects (which includes both intensive and extensive risk); the aspects relating to over-use or degradation of resources in their surrounds; and their contribution to global problems (including their contribution to global warming). These are obviously not the same, although they are often confused. Cities can have very good environmental health while they contribute much to the over-use or degradation of resources in their surrounds. Or they can have very good environmental health and well-managed surroundings but with high contributions to global warming – generally a characteristic of relatively wealthy cities (although recent evidence suggests that wealthy cities tend to have lower levels of greenhouse gas emissions than rural areas within the same country in high-income nations: for example, the average New Yorker generates only 29 percent of the greenhouse gas emissions of the average US citizen).[85] Cities can also have very poor environmental health yet contribute relatively little to over-use or degradation of resources and very little to global warming – a characteristic of most small urban centres in low-income nations. Poverty is often assumed to be associated with environmental degradation but it is actually associated with very low levels of resource use and waste generation, including greenhouse gas emissions.[86] However, poverty is often strongly associated with very poor environmental health.

It is puzzling that this issue has been given so little attention in most nations and by most international agencies. One reason discussed in detail earlier is the complete absence of any consideration of risk (and of health status) in most measures of poverty.[87] Another is the inappropriate transfer of 'high-income nation' concerns (often increased by local middle class pressures) – as in, for instance, more attention to air pollution, toxic wastes and the loss of agricultural land to urban expansion than to the infectious and parasitic diseases and the physical hazards that underpin most serious injury and premature death (but whose impacts are heavily concentrated among low-income populations). In addition, many international agencies have been reluctant to or even to refuse to engage in urban issues on the (unproven and probably mistaken) belief that urban populations are being privileged over rural populations. [88]

The Additionality Of Climate Change

The preceding sections have explained the extent and nature of linkages between poverty and intensive risk in urban centres. Although these risks have not always been specifically recognised, they have always been unevenly distributed among different groups within cities. However, the impacts of climate change – some of which have already been felt, and others of which will become increasingly evident in coming decades – are likely not only to increase the frequency and intensity of events that could cause disasters but also to accentuate the socially uneven consequences of these. Although global agreements to reduce greenhouse gas emissions and limit the extent of climate change are vitally important, the major implication of climate change for most cities in low- and middle-income countries is the necessity to start adaptation now. Hundreds of millions of urban dwellers in low- and middle-income nations are

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[85] New York City (2007), *Inventory of New York City Greenhouse Gas Emissions*, Mayor's Office of Operations, New York City.
[86] Satterthwaite, David (2003), "The links between poverty and the environment in urban areas of Africa, Asia, and Latin America", *The Annals of the American Academy of Political and Social Science*, Vol. 590, pages 73-92.
[87] There are important exceptions – for instance in poverty measures that incorporate some index of unsatisfied basic needs, as is common in Latin America
[88] Satterthwaite 2007, op. cit.

vulnerable to extreme weather related disasters and poverty, and these include most of the urban citizens who are also the most vulnerable to the direct and indirect impacts of climate change.

The scale of the devastation of urban populations and economies caused by floods, storms and other extreme weather events in recent years highlights their vulnerabilities. Climate change is likely to have been a factor in much of this, but even if it was not, it is proof of the vulnerability of urban populations to these events whose frequency and intensity is likely to be increased by climate change. As well as increasing the frequency and intensity of extreme events, climate change will also lead to a series of less dramatic stressors, including changes in temperature and precipitation, as well as sea-level rise for coastal cities. Some of these changes are likely to increase disaster risks from secondary effects – for instance fires after storms or contamination of water supplies after floods. Without major changes in the ways that governments and international agencies work in urban areas, poor urban dwellers will increasingly be exposed to these changes, and these changes will contribute to their continued poverty.

The IPCC Fourth Assessment Report of 2007 states that the earth's climate system has been undergoing warming over the last fifty years. Projected future global averaged surface warming (for the decade 2090-99 relative to 1980-99) ranges from 1.1° to 6.4°C, whilst sea level rise (for the same period) is predicted at 18 to 59cm.[89] The effect of climate change on urban poverty and disaster risk can be examined in three main areas: changes in the mean climate; changes in climatic extremes; and changes in exposure (Table 13). Mean temperatures are likely to increase, mean precipitation will fluctuate, and mean sea-level will rise; extreme rainfall events and tropical cyclones are likely to be more frequent and intense, leading to flooding (both riverine and storm surge). Population changes and ecological changes may result in increased exposure to disaster risk; many current changes are certainly doing this. Changes in means will intensify the stresses faced by poor urban residents on a day-to-day basis, and may reduce or deplete their stocks of assets and resources they require to face occasional extreme events; while increases in the intensity of these extreme events will have significant implications for the households, livelihoods and lives of these groups of people.

Table 13: Climate Change Impacts on Urban Areas

Change in climate	Impact on urban areas	Implications for health and households
Changes in means		
Temperature	• increased energy demands for heating / cooling • worsening of air quality • exaggerated by urban heat islands	• increased vulnerability to respiratory diseases • young children and elderly most vulnerable to heat stress
Precipitation	• increased risk of flooding • increased risk of landslides • distress migration from rural areas • interruption of food supply networks	• higher prevalence of water borne / water washed diseases (particularly among children) • food shortages and malnutrition
Sea-level rise	• coastal flooding • reduced income from agriculture and tourism • salinisation of water sources	• loss of land and property • health problems from salinated water (children at highest risk)
Changes in extremes		
Extreme rainfall / Tropical cyclones	• more intense flooding • higher risk of landslides • disruption to livelihoods and city	• higher levels of mortality • higher levels of morbidity (especially among children)

[89] Intergovernmental Panel on Climate Change (2007). *Climate Change 2007: Synthesis Report: Summary for Policymakers*.

	economies • damage to homes and businesses	• loss of income and assets
Drought	• water shortages • higher food prices • disruption of hydro-electricity • distress migration from rural areas	• higher prevalence of water borne / water washed diseases (particularly among children) • food shortages and malnutrition
Heat- or cold-waves	• short-term increase in energy demands for heating / cooling	• mortality from extreme heat or cold • reduced economic productivity
Abrupt climate change	• possible significant impacts from rapid and extreme sea-level rise • possible significant impacts from rapid and extreme temperature change	• significant effects on morbidity and mortality, particularly among most vulnerable groups (including children)
Changes in exposure		
Population movements	• movements from stressed rural habitats	• increased population • increased stress on infrastructure and resources
Biological changes	• extended vector habitats	• increased risk of diseases such as malaria and dengue

SOURCE: Adapted from Wilbanks *et al Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

Among urban centres in low- and middle-income nations, perhaps the most obvious increased risk associated with climate change comes from the likely increase in the frequency and intensity of extreme weather events such as heavy rainstorms, cyclones and hurricanes. Of course, there are large differentials in the scale of such risks between urban centres in each nation. The urban centres most at risk are generally those where these events are already common and cause serious damage and disruption – although there is some evidence of the geographic range of some extreme weather events expanding. Coastal cities that are at risk from storms will be doubly at risk as sea-level rise increases hazards from coastal flooding and erosion. There is some evidence that hurricane-force winds will become more frequent and intense, and possibly also that the hurricane belt will move southwards. Highly urbanized coasts most at risk therefore include Vietnam in Asia; Gujarat in west India and Orissa in east India, the Caribbean including major urban settlements like Santo Domingo, Kingston, and Havana and those on Mexico's Caribbean coast and Central America.

Dramatic impacts on water supplies could arise as a result of climate change, particularly drought and flooding. Water-supply abstraction and treatment works are sited beside rivers and are often the first items of infrastructure to be affected by floods. Electrical switchgear and pump motors are particularly at risk. In severe riverine floods with high flow velocities, pipelines may be damaged.[90] Sanitation can also be affected. Flooding often damages pit latrines (and most of Africa's and Asia's urban population relies on pit latrines) and floodwaters are usually contaminated by the overflow from pit latrines or septic tanks – and often sewers too. Most cities in Africa, Asia and Latin America and the Caribbean will also experience more heatwaves; for larger, higher-density cities – the temperatures in central "heat islands" can be several degrees higher than in surrounding areas. The scale of the health burdens arising from heat stress remains poorly understood[91] – and there is some evidence that the combined effects of heat stress (e.g. urban heat-island effects) and air pollution may be greater than the simple additive effects of the two

[90] Wilbanks, Romero Lankao et al 2007, op. cit.

[91] Kjellstrom, Tord and Susan Mercado (2008), "Towards action on social determinants for health equity in urban settings", *Environment and Urbanization*, Vol. 20, No 2.

stresses.[92] Climate change is also likely to bring an increased burden of diarrhoeal disease and altered spatial distribution of some infectious disease vectors – for instance as warmer average temperatures permit an expansion of the area in which many "tropical" diseases such as malaria, dengue fever and filariasis – can occur.[93]

In general, in any urban area, the people most at risk from climate change are those who are:

- least able to avoid the direct or indirect impacts (e.g. by having good-quality homes and drainage systems that prevent flooding, by moving to places with less risk or by changing jobs if climate-change threatens their livelihoods);
- likely to be most affected (for instance infants and older groups who are less able to cope with heat waves);
- least able to cope with the illness, injury, premature death or loss of income, livelihood or assets caused by climate change impacts.

Poorer groups get hit hardest by this combination of greater exposure to hazards (e.g. a high proportion living in makeshift housing on unsafe sites), lack of hazard-removing infrastructure and less capacity to cope (e.g. lack of assets and insurance), less adaptive capacity, less state provision to help them cope, and less legal protection or protection from insurance. Low-income groups also have far less scope to move to less dangerous sites; indeed, the more dangerous sites are often the only sites where lower-income groups can find housing they can afford or can build their own homes.

Total, rural and urban populations in the Low Elevation Coastal Zone by region and by nation

It is difficult to estimate with any precision how many people are at risk from the increased frequency and intensity of extreme-weather events and the sea-level rise that climate change will bring. The first detailed analysis on the number and proportion of rural and urban dwellers living in the low-elevation coastal zone was published recently.[94] This zone – the continuous area along the coast that is less than 10 metres above sea level (referred to in this paper as the Low Elevation Coastal Zone - LECZ)– represents 2 per cent of the world's land area but in 2000, contained 10 per cent of its total population (i.e. over 600 million people) and 13 per cent of its urban population (around 360 million people). In this year, Asia had close to three quarters of the world's total population and two thirds of its urban population in the LECZ. In all the regions listed in Table 14, in 2000, there were more urban dwellers in the LECZ than rural dwellers; in many regions listed, there are four or more times more urban dwellers than rural dwellers in the LECZ. If nations are classified by their average per capita income, there were more urban dwellers in the LECZ in lower-middle, upper-middle and high-income nations but not in low-income nations which had 102 million urban dwellers and 145 million rural dwellers in the LECZ.

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[92] Patz, J. and J. Balbus (2003), "Global climate change and air pollution: interactions and their effects on human health" in Aron, J. and J. Patz (editors), *Ecosystem Change and Public Health*, Johns Hopkins University Press, Baltimore, pages 379–402.

[93] Adger, Neil, Pramod Aggarwal, Shardul Agrawala et al. (2007), *Climate Change 2007: Impacts, Adaptation and Vulnerability: Summary for Policy Makers*, Working Group II Contribution to the Intergovernmental Panel on Climate Change; Fourth Assessment Report, IPCC Secretariat, WHO AND UNEP, Geneva subsequently published in Parry, Martin, Osvaldo Canziani, Jean Palutikof, Paul van der Linden and Clair Hanson (editors) *Climate Change 2007: Impacts, Adaptation and Vulnerability*, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge and New York, pages 7-22t; WHO 1992, op. cit.

[94] McGranahan, Gordon, Deborah Balk and Bridget Anderson (2007), "The rising tide: assessing the risks of climate change and human settlements in low-elevation coastal zones", *Environment and Urbanization*, Vol. 19, No. 1, pages 17–37.

Table 14: Population And Land Area In Low Elevation Coastal Zone By Region – 2000

	Region's populations and land areas in low elevation coastal zones				*Shares of region's population and land in low elevation coastal zones*			
Region	*Total Population*	*Urban population*	*Total Land*	*Urban Land*	*Total Population*	*Urban population*	*Total Land*	*Urban Land*
	(millions)	(millions)	(thousand km^2)	(thousand km^2)	(per cent)	(per cent)	(per cent)	(per cent)
Africa	56	31	191	15	7	12	1	7
Asia	466	238	881	113	13	18	3	12
Europe	50	40	490	56	7	8	2	7
Latin America	29	23	397	33	6	7	2	7
Australia and New Zealand	3	3	131	6	13	13	2	13
North America	24	21	553	52	8	8	3	6
Small island states	6	4	58	5	13	13	16	13
World	634	360	2 700	279	10	13	2	8

SOURCE: McGranahan, Gordon, Deborah Balk and Bridget Anderson (2007), "The rising tide: assessing the risks of climate change and human settlements in low-elevation coastal zones", *Environment and Urbanization*, Vol. 19, No. 1, pages 17–37.

Obviously, only a proportion of those within this zone are at risk from the sea-level rises that are likely within the next 30–50 years. Estimates for sea-level rise vary from 18cm to 59cm up to the end of the 21st century; these will certainly multiply the number of people flooded by storm surges. One estimate has suggested that 10 million people are currently affected each year by coastal flooding and that the numbers will increase under all the climate-change scenarios.[95] The problems with coastal flooding will obviously be much more serious if certain potentially catastrophic events whose probability is uncertain were to happen – for instance the accelerated melting of Greenland's ice sheet or the collapse of the West Antarctic ice sheet.[96]

Nations with the largest total populations in the LECZ

Figure 4. Ten countries with the largest total populations in the low elevation coastal zones, 2000

[95] Nicholls R.J., (2004), "Coastal flooding and wetland loss in the 21st century: changes under the SRES climate and socio-economic scenarios", *Global Environmental Change*, Vol. 14, No. 1, pages 69–86.
[96] Adger, Aggarwal, Agrawala et al. (2007, op. cit. .

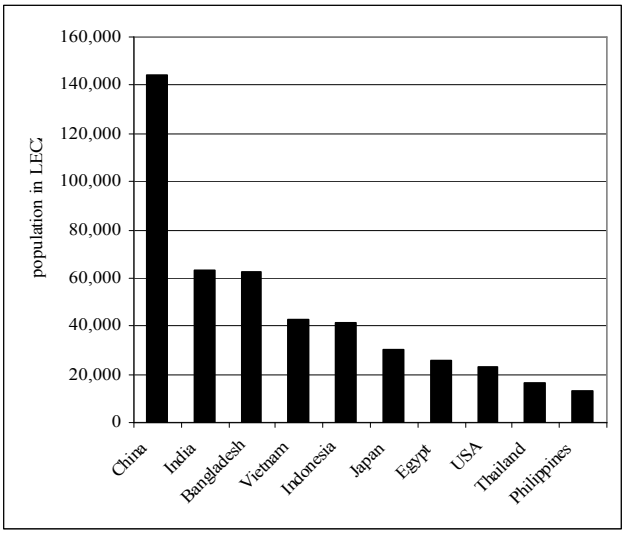
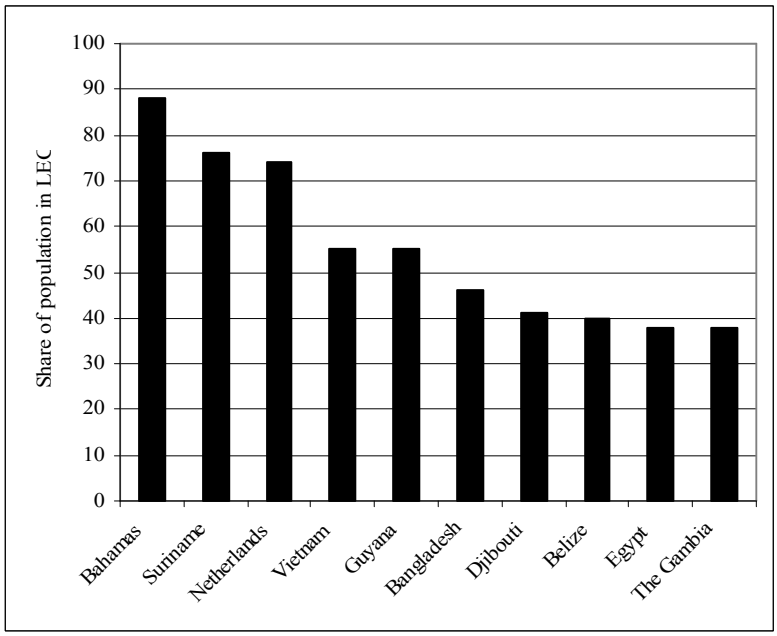


Figure 5: Ten countries with the highest population shares in the low elevation coastal zones, 2000



SOURCE AND NOTES: Figure 4 and 5 are drawn from McGranahan, Gordon, Deborah Balk and Bridget Anderson (2007), "The rising tide: assessing the risks of climate change and human settlements in low-elevation coastal zones", *Environment and Urbanization*, Vol. 19, No. 1, pages 17–37. For Figure 4, countries with a population of under 100,000 or smaller than 1,000 square km were excluded.
Note that Vietnam, Bangladesh and Egypt appear in both Figure 4 and 5.

The concentration of urban populations and of major cities in the LECZ

As noted above, in all the regions listed in Table 14, in 2000, there were more urban dwellers in the LECZ than rural dwellers; in many regions listed, there are four or more times more urban dwellers than rural dwellers in the LECZ. If nations are classified by their average per capita income, there were more urban dwellers in the LECZ in lower-middle, upper-middle and high-income nations but not in low-income nations which had 102 million urban dwellers and 145 million rural dwellers in the LECZ.

Low-income and lower-middle-income nations have a higher proportion of their urban population in this zone than high-income nations. The least developed nations, on average, have nearly twice the proportion of their urban population in this zone, compared to high-income nations.

Figures 6 and 7 give the ten nations with the largest urban populations and the largest proportion of their urban population in this zone.

Figure 6: Nations with the largest urban populations in the Low Elevation Coastal Zone, 2000

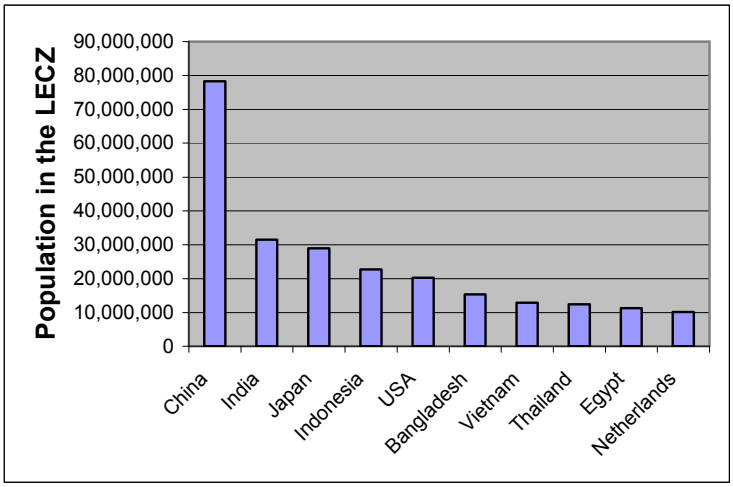
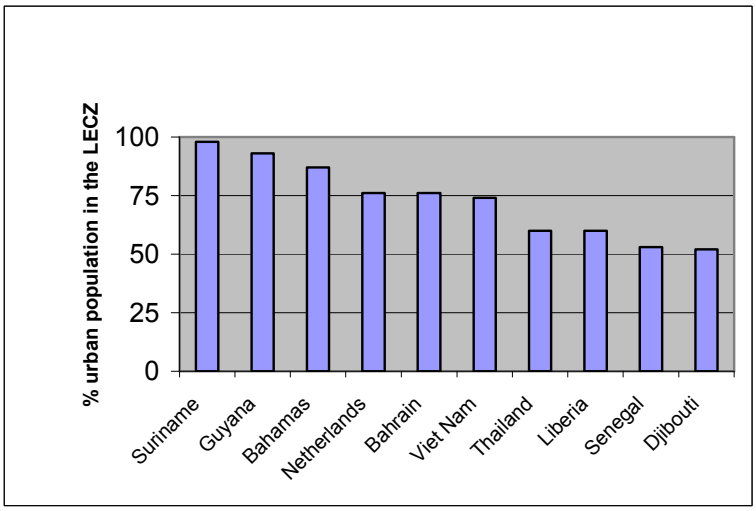


Figure 7: Nations with the highest proportion of their urban populations in the Low Elevation Coastal Zone, 2000



SOURCE AND NOTES: Figure 6 and 7 are drawn from Haq, Saleemul, Sari Kovats, Hannah Reid and David Satterthwaite (2007), "Editorial: reducing risks to cities from disasters and climate change", *Environment and* Urbanization Vol 19, No 1, pages 3-15. These figures were prepared by Gordon McGranahan, Deborah Balk and Bridget Anderson from the GRUMP database. See also McGranahan, Gordon, Deborah Balk and Bridget Anderson (2007), "The rising tide: assessing the risks of climate change and human settlements in low-elevation coastal zones", *Environment and Urbanization*, Vol. 19, No. 1, pages 17–37. For Figure 6, countries with an urban population of fewer than 100,000 were excluded.

Two key issues: most large cities have part of their population in the LECZ and most nations have their largest city in part in this zone. Of the 183 countries with people living in the LECZ, 130 have their

largest urban centre extending into the LECZ.[97] But most of the urban population living in the LECZ are in small urban centres.

On the first of these, almost two-thirds of the world's cities with more than 5 million inhabitants fall in this zone, at least partly. However, only one fifth of the total population of these large cities and one sixth of their land area is within the LECZ.[98] "While only 13 per cent of urban settlements with populations under 100,000 overlap with low elevations coastal zones, 65 per cent among cities of five million or more do. Seven of the 10 largest cities identified in 2005 by the United Nations (Tokyo, New York, Bombay, Shanghai, Kolkata, Jakarta and Buenos Aires) extend into the zone. Indeed, more than 55 million people in these cities and their contiguous urban areas live in low elevation coastal zones."[99]
Asia has 91 cities of more than one million persons within the low elevation coastal zones: China alone has 26 cities over one million persons in these zones and Japan and Indonesia have 11 cities each.
However, most of the urban population in the LECZ lives in cities of 500,000 residents or less. In Japan, 78 per cent of urban dwellers in low elevation coastal zones live in these smaller cities, while in China 91 per cent of urban dwellers in these zones do (the city-state of Hong Kong is an exception to this pattern).[100] Overall, more than half the urban population in Asia that lives in urban centres that are at least partly within the LECZ had less than 100,000 inhabitants in 2000.[101]

In Africa, most of the urban population in low elevation coastal zones is found in cities of 500,000 or less inhabitants. Africa has 22 cities of more than one million persons in these zones. Although Egypt alone has 11 cities with over 500,000 persons, 79 per cent of urban dwellers in these zones are in cities with less than 500,000 inhabitants. Similarly, for South Africa, Algeria, Libya and Morocco, looking at urban centres that are least in part in the LECZ, each have three cities that have over 500,000 persons but the majority of urban dwellers – from 73 per cent in Libya to 81 percent in Morocco – live in smaller urban centres.

Urban trends

There appears to be increasing population concentrations in low-elevation coastal zones in most nations.[102] China provides the most dramatic example as it is the nation with the largest number of urban and rural dwellers in the low-elevation coastal zone and it still has a very strong trend towards increasing population concentration in this zone. Increasing trade and market-driven movements, often supported by government incentives, are still attracting people to the coast. The coastal provinces of China experienced a net in-migration of about 17 million people between 1995 and 2000, creating pressures in an already crowded coastal zone.[103] National population growth in 1990-2000 was approximately one per cent, while growth in LECZs was 1.9 per cent, and urban populations in the zone grew by 3.4 per cent. In Bangladesh, movements towards the coastal zone are evident. For example, the country's total population growth rate is 1.2 per cent, while the growth rate in its LECZs is 2.1 per cent and growth in the urban population living within these zones is 2.8 per cent.[104]

Cities at risk

The latest IPCC Working Group II report notes the particular vulnerabilities to sea-level rise and changes in run-off of large sections of the urban and rural population in heavily populated Asian deltas such as the Ganges-Brahmaputra (that includes Dhaka), the Mekong, the Chang jiang (also known as the Yangtze

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[97] Balk, Deborah (2008), Urban Population Distribution and the Rising Risks of Climate Change,, Paper presented at the United Nations Expert Meeting on Population Distribution, Urbanization, Internal Migration and Development, Population Division, United Nations Secretariat, New York, 10 pages.
[98] Balk 2008, op. cit.
[99] Balk 2008, op. cit. page 339
[100] Balk 2008, op. cit.
[101] McGranahan, Balk and Anderson 2007, op. cit.
[102] McGranahan, Balk and Anderson (2007), op. cit.
[103] McGranahan, Balk and Anderson (2007), op. cit
[104] McGranahan, Balk and Anderson (2007), op. cit

which includes Shanghai) and the Chao Phraya (with Bangkok). Many other deltas in Asia and Africa also have large urban and rural populations at risk, especially the Nile but also including the Niger (with Port Harcourt) and the Senegal (with Saint Louis[105]) – and, of course, in the Americas the Mississippi (with New Orleans).[106]

Many cities in Africa are also at risk from sea-level rise and storm surges. Half of the continent's 37 "million-cities" are within or have parts within the low-elevation coastal zone. Banjul, Lagos and Alexandria are among the cities most at risk although many others are also likely to face much-increased risks from storms and flooding but because of the lack of local analysis, the scale of these risks has yet to be documented.[107] Many Asian cities are also particularly at risk. Asia has many of the world's largest cities or metropolitan areas that are in the floodplains of major rivers (including those noted above in deltas) and cyclone-prone coastal areas (Bay of Bengal, South China Sea, Japan and the Philippines). Large sections of Mumbai, Dhaka and Shanghai are only 1 to 5 metres above sea level.[108] Much of central Mumbai is built on landfill, as the city developed on seven islands that became joined into a single land mass over time, as the city expanded. Mumbai is also likely to suffer from more serious storm surges and increased frequency and intensity of extreme weather (cyclones) as a result of climate change. The likely long-term trend of sea-level rise is likely to prove very damaging, as this combined with storm surges may make large areas of the city uninhabitable. Perhaps not surprisingly, it is mostly low-income households living in informal or illegal settlements that face the greatest risks from flooding.
In Latin America, the coastal plain of north-east South America is very low-lying, generating risks for major settlements from north-east Brazil to Venezuela. The coastal zone of Guyana holds 90 per cent of national population and 75 per cent of the national economy; its highest point is 1.5 metres above sea-level with much residential land, including the capital Georgetown, below high-water sea level. In many Caribbean states, between 20 and 50 per cent of the population resides within the low-elevation coastal zone.

There is some evidence that hurricane-force winds will become more frequent and intense, and possibly also that the hurricane belt will move southwards. Highly urbanized coasts most at risk therefore include Vietnam in Asia; Gujarat in west India and Orissa in east India, the Caribbean including major urban settlements like Santo Domingo, Kingston, and Havana and those on Mexico's Caribbean coast and Central America – as we have seen from Hurricane Mitch. A sea-surface temperature rise of 2–4^{o}C, as expected in the Indian Ocean over the century, is expected to induce a 10–20 per cent increase in cyclone intensity.[109] Since cyclone-formation frequency in the Bay of Bengal is about five times that of the Arabian Sea,[110] India's east coast is clearly at more risk. The high concentration of population, especially on the eastern coasts of India and Bangladesh, has led to extremely high vulnerability in this region, leading to very large loss of life and property. The 1999 Orissa super cyclone killed over 10,000 people, devastated buildings, lifeline infrastructure and economic assets across ten coastal and six inland

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[105] See Diagne, Khady (2007), "Governance and natural disasters: addressing flooding in Saint Louis, Senegal", *Environment and Urbanization*, Vol. 19, No. 2.
[106] Nicholls, R.J., P.P. Wong, V.R. Burkett, J.O. Codignotto, J.E. Hay, R.F. McLean, S. Ragoonaden and C.D. Woodroffe (2007), "Coastal systems and low-lying areas", Chapter 6 in Parry, Martin, Osvaldo Canziani, Jean Palutikof, Paul van der Linden and Clair Hanson (editors) *Climate Change 2007: Impacts, Adaptation and Vulnerability*, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge and New York, pages 315-356.
[107] http://www.grida.no/climate/ipcc/regional/index.htm; *IPCC Special Report on The Regional Impacts of Climate Change An Assessment of Vulnerability*.
[108] de Sherbinin, Alex, Andrew Schiller and Alex Pulsipher (2007), "The vulnerability of global cities to climate hazards", *Environment and Urbanization*, Vol. 19, No. 1, pages 39–64; Alam and Golam Rabbani (2007), op. cit.
[109] Aggarwal, D. and M. Lal (2001), *Vulnerability of Indian Coastline to Sea Level Rise*. Centre for Atmospheric Sciences, Indian Institute of Technology, New Delhi.
[110] India Metrological Department (1979), Tracks of Storms and Depressions in the Bay of Bengal and the Arabian Sea 1877 to 1970, New Delhi; India Metrological Department (1996), Tracks of Storms and Depressions in the Bay of Bengal and the Arabian Sea 1971 to 1990, New Delhi; TARU (2005) Disaster Management Plan Blueprint for the Hazira Area Development Committee, Gandhinagar.

districts, which included a number of towns and cities, due to a mixture of devastating storm surge, cyclonic winds and coastal flooding.[111] Cyclone and storm surge could have a devastating impact on large urban centres including two mega-cities (Mumbai and Chennai) and several million-cities and important ports.[112]

Box 2: Examples of cities at risk from sea level rise

ALEXANDRIA (Egypt): An assessment of the vulnerability of the most important economic and historic centres along the Mediterranean coast (the cities of Alexandria, Rosetta and Port-Said) suggests that, for a sea-level rise of 50cm, over 2 million people will have to abandon their homes, 214,000 jobs would be lost and the cost in terms of land and property value and tourism income lost would be over $35 billion. Alexandria alone has more than 3 million inhabitants. But it is not really possible to put a monetary value on the loss of the world-famous historic, cultural and archaeological sites.[113]

COTONOU (Benin): Cotonou is Benin's largest urban centre, its main port and a key part of the national economy; it has around 700,000 inhabitants. Large sections of the city economy and of its residential neighbourhoods are particularly vulnerable to sea-level rise and storm surges. The continued advance of the sea, coastal erosion and the rise in sea level, exacerbated by human activity on the coast, have medium- and long-term consequences that are already threatening vulnerable communities and disrupting the least-protected sensitive ecosystems. Some roads, beaches and buildings have already been destroyed by the coastline's regression in the last ten years.[114] In addition, provision for drainage is inadequate; the city has no sewer system and only a small proportion of solid wastes are collected; in addition, most of the population lives in informal settlements.[115]

DHAKA (Bangladesh): Dhaka, the capital of Bangladesh, has over 10 million inhabitants and is central to Bangladesh's economy (and its economic success in recent years). Its population has grown more than 20-fold in the last fifty years. This is a city already very vulnerable to flooding, especially during the monsoon season – as shown by the major floods in 1954, 1955, 1970, 1980, 1987, 1988, 1998 and 2004; the 1988, 1998 and 2004 floods were particularly severe, with very large economic losses. These were mainly caused by the spill-over from surrounding rivers. Large sections of the city are only a few metres above sea level. Much of Bangladesh outside Dhaka is also very vulnerable to floods – and the combination of sea-level rise and increased frequency and intensity of storms that climate change is likely to bring greatly increases these risks.[116]

LAGOS (Nigeria): With a total population of around 10 million inhabitants,[117] Lagos has very inadequate provision for basic infrastructure to cope with flooding. "Normal" rainfall brings flooding to many areas of the city, largely as a result of the inadequacies in provision for sewers, drains and wastewater management. Any increase in the intensity of storms and storm-surges is likely to increase such problems; much of the land in and around Lagos is less than 2 metres above sea level. The site on which Lagos is built is not well suited to a city this size; when the colonial government moved the capital here, no one would have anticipated the city growing to such a size. However, the lack of good local governance is far more important as a cause of so many people and enterprises being at risk of flooding. In many areas, roads have been built without complementary gutters for rainwater. Where a drainage system exists, it is often not properly constructed and maintained. The lack of solid-waste collection compounds the problem as wastes block gutters and drains. In addition, many buildings have been erected in ways that block storm-water routes. Little attention is given to clearing the drains, in advance of periods of the year when rain is expected.

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[111] TARU/BMTPC (1998), Rapid Damage Assessment of Cyclone Affected Areas of Kachchh & Saurashtra in Gujarat, Taru, New Delhi.
[112] GSDMA/TARU (2005), *Gujarat Vulnerability and Risk Atlas*, Gandhinagar; TARU (2005), op. cit.
[113] El-Raey, M. (1997), "Vulnerability assessment of the coastal zone of the Nile Delta of Egypt to the impact of sea level rise", *Ocean and Coastal Management*, Vol. 37, No. 1, pages 29–40.
[114] Dossou, Krystel and Bernadette Glehouenou-Dossou (2007), "The vulnerability to climate change of Cotonou (Benin): the rise in sea level", *Environment and Urbanization*, Vol. 19, No. 1, pages 65–79.
[115] Dedehouanou, Houinsou (1998), "Coping with house waste management in Cotonou", *Environment and Urbanization*, Vol. 10, No. 2, October, pages 191–208.
[116] Alam, Mozaharul and M.D. Golam Rabbani (2007), "Vulnerabilities and responses to climate change for Dhaka", *Environment and Urbanization*, Vol. 19, No. 1, pages 81–97.
[117] Many sources suggest that Lagos has a much larger population than this – but these may overstate its population. The preliminary census data for 2006 suggest that Lagos State in which the city is located had 9 million inhabitants. The 1991 census suggested that Lagos urban agglomeration had around 5 million inhabitants. The movement of the federal capital to Abuja will also have taken away one of the key drivers of Lagos's growth.

Many low-income settlements are built in areas at high risk of flooding (many on stilts), largely because safer sites are too expensive.[118]

BANJUL (Gambia): Banjul has more than half a million inhabitants. Most of the city is less than 1 metre above sea level and flooding is common after heavy rain in the city, in settlements established on reclaimed land in dried-up valleys, and in settlements close to mangrove swamps and wetlands. Problems with flooding are likely to increase under a warmer climate with an increase in the strength and frequency of tropical storms. In the coastal zones of the Gambia, a sea-level rise of 1 metre is likely to inundate 92 square kilometres. Shoreline retreat would vary from around 100 metres in the harder cliffed zone to 839 metres in the gently sloping, sandy plain near Sanyang Point.[119]

ABIDJAN (Cote D'Ivoire). Abidjan's population in the 1998 census was 2.8 million. A sea-level rise of 1 metre is likely to inundate 562 square kilometres along the coastline of the Abidjan region; lowland marshes and lagoons dominate the coastal zone. Average retreat will vary from 36 to 62 metres. Although some important areas of Abidjan lie on a plateau and may escape the direct effects of sea-level rise, major economic centres including the nation's largest port and much of the international airport are on land less than 1 metre above sea level.[120] Around half a million inhabitants live in precarious housing in informal settlements; a high proportion of these are tenants.[121]

PORT HARCOURT (Nigeria): An extreme 10-hour rainfall in July 2006 drove 10,000 residents out of their homes and caused widespread traffic chaos. The Niger delta frequently experiences flood problems that are aggravated by structures such as the Port Harcourt–Patani–Warri highway that cuts across natural drainage lines and acts as a barrier to floodwaters.[122] Blockage of channels by debris and obstruction of floodways by new construction were seen as the main obstacles contributing to Port Harcourt's flooding. The city has more than a million inhabitants.

MOMBASA (Kenya): Mombasa is Kenya's second-largest city (with over 700,000 inhabitants) and the largest seaport in East Africa serving many counties other than Kenya. An estimated 17 per cent of Mombasa's area (4,600 hectares) could be submerged by sea-level rise of 0.3 metres,[123] with a larger area rendered uninhabitable or unusable for agriculture because of waterlogging and salt stress. Sandy beaches, historic and cultural monuments and several hotels, industries and port facilities also negatively affected. Mombasa already has a history of disasters related to climate extremes, including floods that cause serious damage and often loss of life nearly every year.[124]

BUENOS AIRES (Argentina): The urban agglomeration of 14 million inhabitants with Buenos Aires at its centre is located on the banks of the Rio de la Plata. Floods are common; there were 35 floods in the metropolitan area from 1985 to 2003. With its close proximity to the Rio de la Plata, the urban area is highly vulnerable to sea-level rise and storm surges – and from flooding from intense rainfall – because of the inadequacies in provision for storm and

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[118] http://allafrica.com/stories/200704020193.html; Aina, Tade Akin (1995), "Metropolitan Lagos: population growth and spatial expansion; city study", background paper for the Global Report on Human Settlements, 31 pages; Aina, Tade Akin, Florence Ebam Etta and Cyril I. Obi (1994), "The search for sustainable urban development in metropolitan Lagos, Nigeria", *Third World Planning Review,* Vol. 14, No. 2, pages 1–18; Iwugo, Kenneth O., Brian D'Arcy and Robert Andoh (2003), "Aspects of land-based pollution of an African coastal megacity of Lagos", paper presented at Diffuse Pollution Conference, Dublin, pages 14-122 to 14-124; Adeyinka Sunday, Okude and Taiwo Olalekan John (2006), "Lagos shoreline change pattern: 1986–2002", *American-Eurasian Journal of Scientific Research*, Vol. 1, No. 1, pages 25–30; Nwafor, J.C. (1986), "Physical environment, decision-making and land use development in Metropolitan Lagos", *GeoJournal*, Vol. 12, No. 4, pages 433–442.

[119] Jallow, Bubu P., Sekou Toure, Malang M.K. Barrow and Assa Achy Mathieu (1999), "Coastal zone of The Gambia and the Abidjan region in Cote D'Ivoire: sea level rise vulnerability, response strategies and adaptation options", *Climate Research*, Vol. 12, pages 129–136.

[120] Jallow et al. (1999), op. cit; Attahi, Koffi (1992), "Planning and management in large cities: a case study of Abidjan, Cote D'Ivoire", in UNCHS (Habitat), *Metropolitan Planning and Management in the Developing World: Abidjan and Quito*, Nairobi, pages 31–82; Semboloni, Ferdinando (1999), "Planning the evolution of a city. A case study of Abidjan", *Third World Planning Review*, Vol. 21, No. 2, pages 201–355; Dubresson, Alain (1997), "Abidjan: from the public making of a modern city to urban management of a metropolis" in Rakodi, Carole (editor), *The Urban Challenge in Africa; Growth and Management of its Large Cities*, United Nations University Press, Tokyo, pages 252–291; Appessika, Kouamé (no date), The case of Abidjan, Ivory Coast, case study for the Global Report, 2003, UN Habitat, Nairobi.

[121] Yapi-Diahou, Alphonse (1995), "The informal housing sector of the metropolis of Abidjan, Ivory Coast", *Environment and Urbanization*, Vol. 7, No. 2, October, pages 11–29.

[122] Abam, T.K.S., C.O. Ofoegbu, C.C. Osadebe and A.E. Gobo (2000), "Impact of hydrology on the Port-Harcourt-Patani-Warri Road ", *Environmental Geology*, Vol. 40, Nos 1 and 2, pages 153-162.

[123] Mahongo, S. (2006), "Impacts of Sea Level Change", presented at the ODINAFRICA/GLOSS Training Workshop on Sea-Level Measurement and Interpretation, Oostende, Belgium, 13–24 November, quoted in Awuor, Cynthia B. Victor A. Orindi and Andrew Adwerah (2008), "Climate change and coastal cities: The case of Mombasa, Kenya", *Environment and Urbanization*, Vol. 20, No. 1, pages 231-242

[124] Awuor et al 2008, op. cit.

surface drainage.[125] In 100 years, the Rio de la Plata is expected to have average water levels of 60–100cm higher than today, and stronger winds and storm surges. Within the metropolitan area, the zones most at risk are the low-lying lands of the lower basins of the rivers Reconquista and Matanza-Riachuelo, and these have high concentrations of informal settlements.

Reducing Risk through Urban Governance

Introduction

Local government limitations are an important factor affecting intensive and extensive risk within urban areas as a whole, and vulnerable locations within these in particular. Most city and municipal governments in low-income nations and many in middle-income nations have almost no investment capacity; and most have political structures with limited or no accountability to their citizens, especially the lower-income groups. It is important to understand the scale and scope of local government involvement in urban centres if their potential role in reducing intensive and extensive risk is to be understood. When city and municipal governments are considered only in terms of their contributions to all new investment within their jurisdiction, their role is usually relatively small – and in many urban centres almost insignificant – compared to investments by households and private enterprises. However, their planning and regulatory framework and infrastructure investments can profoundly influence the scope and location of all other investors from large enterprises to small informal entrepreneurs, from large property developers to low-income households seeking land on which to build. A large part of a good government planning and regulatory framework is encouraging new investment while also reducing risks within new and existing settlements, buildings and infrastructure. Indeed, the competence and capacity of local governments influences what is possible and what local disaster risk reduction processes ought to be supported by external agencies (Table 15).

Table 15: Different local contexts through which national governments and international agencies can pursue 'good governance' for extensive and intensive risk reduction

Resources available to local government	**The quality of local government / governance**	
	From democratic and accountable local governance structures…	…to undemocratic, unaccountable and often clientelist local government
From relatively well-resourced, local governance institutions with the necessary technical competence…	Local government can channel external funding, including funding to support disaster risk reduction by households and private enterprises, and funding for needed infrastructure and support services (whether provided by community organizations, NGOs, private enterprises or government agencies)	Long-term support needed for governance reforms at all levels of government; also support needed for local private and community provision both to improve conditions/reduce risks and to build local pressure on government for better governance
…to poorly resourced local governments lacking funding, a strong local revenue base, and technical capacity	Need for a strong focus on capacity building for local government and support for its partnerships with civil society and local private-sector infrastructure and service providers (including informal providers)	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

[125] Hardoy, Jorgelina and Gustavo Pandiella (2007), Background paper on climate change and cities in Argentina, prepared for the Rockefeller Foundation's meeting on Building for Climate Change Resilience.

City and municipal governments generally have a range of departments to address different aspects of urban management: including finance; engineering and public works; development planning and development control; public and environmental health; social services; emergency services; and administration. They generally have the primary role in a great range of infrastructure and service provision that is essential for good quality living standards and for livelihoods[126] – for instance, provision for water, sanitation, drainage and solid waste collection – and often for some schools and health care facilities and for fire and other emergency services. They also generally have the primary role in implementing the regulatory framework essential for ensuring public health and safety (for instance through building and sub-division regulations, occupational health and safety, pollution control, traffic control and police) and in theory, a key role in urban planning (and within this land-use management). Of course, there are many variations in the form of local government intervention in these, including what is done or what is contracted out and the extent to which some infrastructure and service provision within their jurisdiction are the responsibility of higher levels of government. But the extent to which city and municipal governments actually meet their responsibilities has very large implications for living standards, quality of life (including the quality of the urban environment), and the ability to reduce disaster risk.

It is relatively easy to list a set of local government responsibilities for infrastructure, buildings, services and transport management that have great importance for reducing intensive and extensive risk. It is also easy to point to large inadequacies in what is provided. However, there is such diversity in the forms of local government and their relationships to higher levels of government that it is impossible to generalize in regard to how many of these responsibilities fall to local governments to fulfil, and the extent of local government engagement with each of these in terms of who has responsibility for planning, constructing and maintaining the buildings and infrastructure or providing the services, coordination, finance, monitoring and regulation. Despite this, Table 16 illustrates the wide range of areas in which local governments can be active in reducing disaster risk and responding to events when they take place. In terms of the intensive/extensive distinction, Table 16 is certainly about reducing intensive risk but it is also about reducing risks for disasters that are smaller than the criteria set for intensive risk – including small disasters.

Table 16: The role of city / municipal governments in disaster protection and response

Role for city / municipal government	Long term protection	Pre-disaster damage limitation	Immediate post-disaster response	Rebuilding
Built environment				
Building codes	High		High*	High
Land use regulations and property registration	High	Some		High
Public building construction and maintenance	High	Some		High
Urban planning (including zoning and development controls)	High		High*	High
Infrastructure				
Piped water including treatment	High	Some	High	High
Sanitation	High	Some	High	High

[126] UNCHS (Habitat) 1996, op. cit.; Stren, Richard E. (1991), "Old wine in new bottles? An overview of Africa's urban problems and the 'urban management' approach to dealing with them", *Environment and Urbanization*, Vol. 3, No. 1, pp. 9-22; Davey, Kenneth (1992), *The Structure and Functions of Urban Government: The Institutional Framework of Urban Management*, Working Paper No. 1, Development Administration Group, University of Birmingham, Birmingham, 129 pages; Shah, Anwar with Sana Shan (2006), "The new vision of local governance and the evolving roles of local governments", in Anwar Shah (editor), *Local Governance in Developing Countries*, The World Bank, Washington DC, pages 1-46.

Drainage	High	High**	High	High
Roads, bridges, pavements	High		High	High
Electricity	High	Some?	High	High
Solid waste disposal facilities	High	Some?		High
Waste water treatment	High			High

Services				
Fire-protection	High	Some	High	Some
Public order/police/early warning	Medium	High	High	Some
Solid waste collection	High	High**	High	High
Schools	Medium	Medium		
Health care/public health/environmental health/ambulances	Medium	Medium	High	High
Public transport and transport management	Medium	High	High	High
Social welfare (includes provision for child care and old-age care)	medium	High	High	High
Disaster response (over and above those listed above)			High	High

* Obviously it is important that these do not inhibit rapid responses

** Clearing / desilting drains and ensuring collection of solid wastes has particular importance just prior to extreme rainfall; many cities face serious flooding from extreme rainfall that is expected (for instance the monsoon rains) and this is often caused or exacerbated by the failure to keep storm and surface drains in good order

Note. The actual allocation of responsibility and of access to funding between city/municipal governments and other institutions will obviously differ between countries; the intention of this table is to make clear the many roles city/municipal governments should have in disaster protection and response. High denotes that they have the sole or main responsibility; medium indicates that they have substantial responsibility; some means some role or responsibility but with other institutions having the main responsibilities.

SOURCE: developed from a table in Satterthwaite, David (2007), *Integrating Adaptation to Climate Change in Decision-making at the Urban/Municipal Level in Low- and Middle-income Countries*, (first draft), prepared for the OECD Development Assistance Committee, OECD, Paris, 33 pages.

Earlier sections highlighted how almost all city and municipal governments in low- and middle-income nations fail to meet many of the responsibilities listed above or only meet them for particular sections of their population. However, the scale of these inadequacies varies greatly. At one extreme, there are cities and smaller urban centres where most of the population live in homes and neighbourhoods that are illegal and informal with very inadequate or no public provision for infrastructure and services. These inadequacies reflect local governments lacking the resources to meet their responsibilities – and often with very limited capacities to invest (as almost all local revenues go to recurrent expenditures or debt repayment). These inadequacies often reflect local governments that are unrepresentative, unaccountable and anti-poor – as they regard the population living in informal settlements and working within the informal economy as 'the problem'. At the other extreme are examples of cities and smaller urban centres that still have some inadequacies and deficiencies in provision for infrastructure and services but these affect a much smaller proportion of the population. This often reflects city and municipal governments that are more accountable to the citizens in their jurisdiction and within national government structures that have strengthened and supported this level of government – with stronger local democracies in many instances. For instance, in many urban centres in Latin America, the quality and coverage of provision for water and sanitation has improved very considerably over the last two decades; there are also many urban centres with close to 100 percent coverage.[127] Several nations have

[127] UN Habitat (2006), *Meeting Development Goals in Small Urban Centres; Water and Sanitation in the World's Cities 2006*, Earthscan, London; Heller, Léo (2006), Access to water supply and sanitation in Brazil: historical and

also had constitutional or legal changes that have increased the revenues of city and municipal governments and strengthened local democracies.[128] 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.[129]

However, even in middle-income nations where considerable progress has been made in more effective local government, much needs to be done – see for instance the weakness in the local governments on the coast of Mexico as they lack the financial, human and technical capacity to fulfil responsibilities for urban development plans, zoning and land-use management (including granting permits for construction).[130] The profits that can be generated by changes in land-use designation in and around urban centres and in public works or services contracts make corruption in local government difficult to control.

What underlies the inadequacies in urban governments?

Many reasons can be given for the inadequacies in local government. In most nations in Africa and Asia, these include institutional legacies from colonial rule which neglected local government and where the whole structure of urban planning and regulation was developed mainly to serve only those parts of the city in which the 'foreigners' lived and worked. They also include centralization in post-independence governments (which included keeping local governments weak and dependent on centrally allocated resources). There is also the application of imported models of urban planning and government that proved inappropriate to local contexts and possibilities. For instance, the utility of housing sub-division standards that have minimum lot-sizes and infrastructure standards that make it impossible for most of a city's population to get land for housing is obviously questionable. If half a city's population is living in housing and settlements that are 'illegal', it suggests that the law is at fault, not the illegal housing and settlements.[131]

But in the last two decades or so, other factors have had importance in reducing the capacity of local governments, including the external pressures from international agencies for dismantling or weakening the state and support for deregulation and privatisation.[132] This was driven by the hope that this would help underpin stronger, more successful economies. It can be argued that the lack of progress in most urban centres in improving provision for water and sanitation over the last 20 years was the result of many international agencies greatly over-estimating the potential role of privatisation to improve and extend provision.[133]

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current reflections; future perspectives, Background paper for the 2006 edition of the Human Development Report, 51 pages.

[128] Campbell 2003, Fernandes 2007 and Cabannes 2004, op. cit.

[129] D'Cruz and Satterthwaite 2005, op. cit.; Hasan, Arif (2006), "Orangi Pilot Project; the expansion of work beyond Orangi and the mapping of informal settlements and infrastructure", *Environment and Urbanization*, Vol. 18, No. 2, pages 451-480.

[130] Levina, Ellina, John S. Jacob, Luis E. Ramos and Ivonne Ortiz (2007), *Policy frameworks for Adaptation to Climate Change in Coastal Zones: The Case of the Gulf of Mexico*, Paper prepared for the OECD and International Energy Agency, 68 pages.

[131] Hardoy, Jorge E. and David Satterthwaite (1989), *Squatter Citizen: Life in the Urban Third World*, Earthscan Publications, London, UK, 388 pages

[132] Rakodi, Carole (1999), Urban Governance, Partnerships and Poverty: A Preliminary Exploration of the Research Issues, Urban Governance, Partnerships and Poverty Research Working Paper 8, International Development Department, University of Birmingham, Birmingham.

[133] Budds, Jessica and Gordon McGranahan (2003), "Are the debates on water privatization missing the point? Experiences from Africa, Asia and Latin America", *Environment and Urbanization*, Vol. 15, No. 2, pages 87-114. Warwick, Hugh and Vicky Cann (2007), *Going Public: Southern Solutions to the Global Water Crisis*, World Development Movement, London, 72 pages.

In addition, although international agencies began to recognize the importance of supporting 'good governance' in the early 1990s, their 'good governance' programmes were generally at national level with little attention paid to increasing the competence, capacity and accountability of local governments. In the end, almost all development in urban areas requires supportive accountable local governments. Much of what the poor require – schools, healthcare, water and sanitation, safe land sites, safer homes, social safety nets, getting onto voter registers – needs more competent local organizations. Much of what has to be changed to support poverty reduction is also local - local power structures, land owning patterns and anti-poor politicians, bureaucracies and regulations.[134]

There is also the fact that most bilateral aid agencies and many international NGOs have long refused to work in urban areas, underpinned by (a usually mistaken) belief that urban populations benefited from 'urban bias'.[135] The backlog in the population lacking provision for infrastructure and services continues to grow in most urban centres in low-income nations.

What disaster risk reduction needs

As well as the creation of specific policies to address those aspects of disaster risk reduction listed in Table 16, disaster risk in urban areas can also be reduced through the formation of appropriate partnerships between stakeholders at a variety of scales. The capacity of any city or municipal authority to act and to obtain the resources needed to do so is obviously influenced by its relationship with higher levels of government. However, city governments are increasingly implicated in broader, trans-national networks of funding and knowledge transfer, and the outcomes of these relationships can also feed into the creation and implementation of appropriate policies.

Disaster risk reduction needs to involve a wide range of urban government divisions and departments, some of which may be semi-autonomous public agencies. It will often need to involve many government agencies that work within sub-city or municipal levels and at higher (provincial/state and national) levels. It is difficult to specify the most appropriate intervention points within local government structures. First, this depends on the structure of the city or municipal government and often also on higher levels of government (which may control or have a major role in many city-level aspects of government). Super- or supra- government levels are often important – for instance for many urban centres, there are key functions managed at sub-municipal level (e.g. district or ward level). Many large cities are also formed by many separate municipalities with serious constraints on inter-municipal cooperation (for instance because of different parties in power) and with great variation in the extent of functions managed at a higher (metropolitan or provincial) level. There is also the need to engage a great variety of local government staff – from elected councillors to particular specialists and specialist departments with technical insights.

Urban authorities and international donors

There are three ways to look at the role of international donors in supporting the development of disaster risk reduction capacity within urban governments. The first is to examine funding flows and to consider

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[134] Satterthwaite, David and Gabriela Sauter (2008), *Understanding and Supporting the Role of Local Organisations in Sustainable Development*, IIED Gatekeeper 137, IIED, London, 23 pages.

[135] There may be evidence of particular cities benefiting from urban bias in government policies and expenditures but in general this bias brings little or no benefit to the majority of those living and working there – especially low-income groups. In addition, in most nations, there is little or no evidence of policy or expenditure biases benefiting most urban centres. See Satterthwaite, 2007, op. cit.; Corbridge, Stuart and Gareth A. Jones (2005), *The Continuing Debate about Urban Bias: The Thesis, its Critics, its Influence, and Implications for Poverty Reduction*, Department of Geography and Environment, London School of Economics and Political Science, 46 pages.

whether the sectoral priorities seem appropriate: is enough being spent on those forms of urban infrastructure that are most needed in urban areas to reduce disaster risk? The second is to consider the role of international donors in increasing national risk reduction capacity for urban areas: by supporting the development of the needed national or state / provincial level financial and regulatory capacity to support urban governments developing adaptive capacity. The third is to support local disaster risk reduction directly, working with city and municipal governments that want to innovate in this area through working with lower income groups and other groups at particular risk.

In regard to the first of these, existing official statistics show that most bilateral aid agencies give a low priority to "economic infrastructure" (for instance for transport and communications and energy) and to water supply and sanitation. Economic infrastructure generally gets less than 10 per cent of bilateral agency commitments, while water supply and sanitation generally gets less than 5 per cent.[136] In most middle-income nations and in India and China, the proportion of total funding into infrastructure that comes from aid agencies and multilateral development banks is a very small percentage of government investments. In many low-income nations, it is more significant, but often only because of so little investment by national and local governments. The key point to note here is that the scale of donor funding for urban infrastructure is very small in relation to the deficits in urban infrastructure provision.

One of the evident failings of development assistance is the lack of support for cities that have faced serious climate-related disasters to have the investment capacity to reduce future risks. In many nations, a substantial municipal infrastructure fund to which local governments and civil society groups can apply may be the most appropriate way through which international donors can channel needed funding of infrastructure. Such a fund should also be pro-active in helping identify cities or smaller urban centres most at risk and helping develop appropriate local responses. It should also encourage and support civil society engagement with adaptation.

In addition to their relationships with donors, urban authorities are increasingly integrated within global networks of knowledge transfer. For example, the Cities Alliance is a global coalition of cities and their development partners that aim to 'scale up' successful approaches to poverty reduction. An integral part of this process is to bring cities together in a direct dialogue with bilateral and multilateral agencies and financial institutions. Other networks, although until recently primarily including cities from high-income countries, have expanded their membership. C40 is a group of the world's largest cities working together to tackle climate change, and includes several African, Asia and Latin American cities. United Cities and Local Governments seeks to ensure that urban and local government issues get the attention they deserve within development agencies. These types of international networks can be used not only as a means of identifying funds to support the implementation of urban policies, but also as a forum to share knowledge about best processes for addressing disaster risk reduction.

Urban authorities and national governments

One of the most important factors influencing the ability of urban governments to reduce disaster risk is whether higher levels of government provide the legislative, financial and institutional basis to allow them to do so. It also depends on the conditions required to receive funding from higher levels of government, and whether the responsibilities allocated to local governments can be fulfilled based on the technical and financial capability of these institutions. Clearly, national funds on which urban governments can draw that encourage and support municipal innovation and needed investment are important. Obviously, these need to be set up to support locally-developed responses; within almost all nations, there will be great diversity in the range and relative importance of different disaster risks in different urban centres.

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[136] Statistics in this and the subsequent paragraph on development assistance flows and priorities come from the statistical annex of the 2006 OECD Development Cooperation Report (accessed at http://www.oecd.org/statisticsdata/0,2643,en_2649_33721_1_119656_1_1_1,00.html).

Central government institutions generally have important roles in helping local governments develop disaster-risk management strategies. For nations or cities that have already have in place disaster-risk management strategies, these need to be reviewed in light of the increased or new risks that climate change is likely to bring. For nations where extreme weather events are already causing disasters, clearly there is a need for a national fund that supports disaster-risk reduction but also responds rapidly to support rapid response when disasters occur and support local governments in rebuilding processes. There are also some obvious tasks and responsibilities for urban adaptation that fall to higher levels of government – for instance the weather information system that supports local assessments. There is also a need for a clear articulation of roles for planning and implementation, pre- and post-extreme weather events between local governments, higher levels of government (often including provincial/state and national), government agencies that have key roles in disaster response (for instance often including the army and the police) and civil society organizations (including NGOs and grassroots organizations). It will fall to higher levels of government to identify which urban areas need priority action and what forms of external support are required – for instance existing cities currently at high risk, new developments or city expansions that need to take account of climate-change and urban centres and neighbourhoods that have been hit by extreme events and need support for rebuilding with resilience built in. Well organised disaster preparedness agencies at the national level should also have clearly defined points of articulation and information-sharing with local authorities.

National governments in Central America have recognized that disaster management is not the exclusive concern of civil defence institutions or of a single institution, especially after Hurricane Mitch and later Hurricane Stan. They also recognize that disaster risk reduction has to be an integral part of policies and actions at different government levels, involving different sectors and offices[137]. But these programmes and networks usually have been set up at the national level, without sufficient coordination and implementation at the local level and with weak links to key sectors and institutions such as the housing and urban-planning sectors. Risk reduction on the ground is not really being addressed and many governments and international aid organizations continue to favour structural measures over non-structural, even though they have proved their limitations.

Urban authorities and citizens

The ultimate purpose of urban authorities is to serve the interests of their inhabitants. For this reason, the relationship between urban authorities and urban residents is perhaps the most important set of relationships entered into by urban authorities. Urban authorities have often lacked accountability to their residents, yet a more accountable structure of governance can reduce many aspects of poverty and reduce disaster risk. The cultivation of more responsive systems of governance is an issue both of justice and efficiency: representatives should be accountable to their electorate and to represent their best interests; and a more accountable structure of governance will also be better equipped to identify and meet the needs of citizens. The example of Ilo in Peru given earlier is a reminder of how a good urban authority-citizen relationship can form the basis of a major risk reduction programme, even with limited local government funding.

A better relationship between urban authorities and the urban poor can take place within the framework of more participatory structures of governance. The last decade has seen many local governments, citizen groups and social movements develop more participatory ways of working together. Much has been made possible by more democratic and decentralized government structures and by bottom-up pressures. Even more has been made possible by citizens and civil society organizations demonstrating coherent and realistic alternative approaches to development, including many examples of co-production for

[137] Gavidia Jorge (2006) Priority Goals in Central America. The Development of Sustainable Mechanisms for Participation in Local Risk Management, in *Milenio Ambiental*, No. 4, pages 56 – 59. Journal of the Urban Environment Program (UPE) of the International Development Research Centre (IDRC), Montevideo.

homes, infrastructure and services.[138] For example, federations formed by the urban poor in the Philippines and Kenya have driven innovations in more participatory governance[139]; while urban centres in Latin America (and elsewhere) have implemented various mechanisms for participatory budgeting[140].

The experiences of more successful local governments described earlier illustrate how a conventional local democracy (local authorities accountable to their citizens through a fair and transparent electoral process) needs to be complimented with a more direct local government engagement with community-based and non-government organizations. This is especially the case where a high proportion of the local government's population live in informal settlements and where the role of grassroots organizations and local NGOs has particular importance. CBOs and NGOs can act as conduits for the transfer of information between urban residents and urban authorities, but can also be effective implementers of projects to reduce disaster risk, for example through assisting in the maintenance of infrastructure (such as drain cleaning). They can also help to facilitate disaster preparedness including where needed evacuation to well identified safe sites and the distribution of emergency supplies in the event of disasters.

Urban governments need to develop a capacity to catalyze and support large numbers of locally-determined community-managed risk-reduction initiatives, many of which may have low-costs and where local government funding also mobilizes and supports many household and community contributions. Of course, this works particularly well where local authorities have the capacity to provide the local-government wide supporting infrastructure or services – for instance, the trunk drains into which community-managed local drains feed. In a sense, local government needs to generate and support the web of institutions that were described earlier, which reduce disaster risk in high-income nations, although the form that many of these institutions take will differ – for instance often with much more important roles for grassroots organizations and local NGOs.

Policies and Strategic Interventions to Address Urban Poverty and Disaster Risk

Clearly, success in development means success in reducing both intensive and extensive risk. An urban centre where development needs are met - a high proportion of the population living in legal homes meeting building regulations served by good quality provision for piped water, sanitation and drainage and with good health care, schools and emergency services – is likely to be far less at risk from most disasters and has the governance basis to be far better prepared when they occur and to respond appropriately. But this needs to be acted on. Health care and emergency services used to dealing with rapid responses to extensive risks are not necessarily equipped for implementing needed pre-disaster damage limitation and post-disaster responses. Conventional building codes and land-use regulations may not have been adjusted to local contexts to reduce disaster risk.

Reducing both intensive and extensive risk involves changes in policies and practices within many parts of local government. The key question is whether there are mechanisms by which these can be encouraged and integrated. For instance, if an urban centre has a strong local development plan that provides the framework for future investments and land use management, then it is possible to incorporate disaster risk reduction measures into this. But most urban centres have no such development plan – or a plan that is not enforced, as many new investments, urban developments and buildings fall outside it.

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[138] Mitlin 2008, op. cit.
[139] Yu, Sandra and Anna Marie Karaos (2004). 'Establishing the role of communities in governance: the experience of the Homeless People's Federation Philippines' *Environment and Urbanization* Vol 16, No 1, pages: 107-120; Weru, Jane (2004). 'Community federations and city-upgrading: the work of Pamoja Trust and Muungano in Kenya' *Environment and Urbanization* Vol 16, No 1, pages 47-62.
[140] Cabannes 2004, op. cit.

Urban governments can have a central role in reducing disaster risk because they can address both the factors leading to exposure and the factors affecting the resilience of individuals and communities. It can be argued that they have the central role in disaster risk reduction within their jurisdictions, although it is obvious that they need a supportive institutional, regulatory and financial framework from higher levels of government and, for most low- and middle-income nations, also from international agencies. This critical role for urban (local) governments is in part because urban governments have responsibility for most of the interventions that can and should reduce hazards or reduce their population's vulnerability. They can address the impacts of disasters on a variety of urban sectors, including the urban economy, health, and housing. In addition, their spatial proximity to the consequences of disasters means that they are 'on the ground' to play an active role in the immediate pre-disaster preparations and post-disaster response.

Any well-conceived city development plan or strategy is inevitably seeking to reduce both intensive and extensive risk. Many regulations, many forms of infrastructure and many services are not designed to be specific to particular hazards but to provide general protection. For instance sewers and drains usually serve both to reduce risks for a range of water-related diseases and to reduce flooding risks. Health care systems are intended as responses to all illnesses and injuries, regardless of whether these arise from pathogens, pollutants or physical hazards or from everyday hazards or small or large disasters. Insurance – for property, possessions, workplace equipment or life – is also intended to serve within a 'multi-hazard' environment. Building regulations are also intended to reduce risks to a range of environmental hazards including extreme weather. Infrastructure standards, building regulations, land-use controls and the organization of services should also be incorporating elements to cope with extreme weather events – including all those whose intensity or frequency that climate-change is likely to increase. So a key part of any well-conceived city development plan is building resilience to a range of hazards and the risks they produce individually and as they combine. To be effective, this not only has to reduce the vulnerability of urban dwellers and infrastructure but should also address the factors that generate both vulnerability and poverty.[141]

Urban planning, land use, and land rights

From an 'intensive risk reduction' perspective, the goal of a government land use policy is to minimize the use of land sites that are at risk from all possible disasters and maximize the quality of buildings on new land developments. Most urban governments influence the use of land for different purposes through zoning and planning controls and through the allocation and use of public land. As noted already, the availability of land for housing has particularly strong implications for both urban poverty and urban disaster risk. National and local government attitudes toward informal settlements and the extra-legal means by which low-income groups acquire land for housing range from support for upgrading and legalization, to tolerance, to opposition and support for eviction. The links between access to housing and livelihoods are significant, in terms of the proportion of household income that has to be spent on housing, the access to income-earning opportunities provided by housing location, and the capacity of housing to serve directly as a space for particular income-generating activities. The links between housing and disasters are also substantial, as individuals who are unable to afford housing in safe sites are more likely to be pushed to occupy locations that are vulnerable to flooding, slope failure, or other disaster risks.

Urban planning, land use, and land rights policies therefore need to take disaster risk reduction into account; climate change adds to the urgency of doing so. These policies need to place a high priority on ensuring there are appropriate and safe locations for low income households, that facilitate livelihoods (whether through the provision of an accessible location or adequate space for income-generating

[141] Adger, Agrawala, Mirza et al. (2007), op. cit

activities) whilst reducing exposure to the risks of flooding, slope failure, and other disasters. Note should be made of the example given earlier as to how changes in official sub-division regulations and infrastructure standards in Namibia greatly increased the possibilities of low-income groups to afford legal land sites for housing.[142]

Peri-urban areas

The term peri-urban is used constantly to refer to the land sites (and the developments on it) that are 'around' or at the edge of urban areas but it used with great imprecision. Sometimes, peri-urban settlements is used as a term for informal settlements, as if all informal settlements are peri-urban (which is clearly not the case in most cities) and as if all peri-urban areas are poor (which is also clearly not the case as certain peri-urban areas around cities house high concentrations of middle and upper income groups, including elite suburbs, elite gated communities and elite 'country clubs').

For most large and rapidly growing cities in low- and middle-income nations, there are zones around them where new investments and developments are taking place, with little or no control. Some of these raise serious concerns for pollution and occupational health and safety – for instance industries moving outside city limits to avoid pollution controls. Some raise concerns for the larger city – for instance the expansion of settlements within flood plains or in and around water sheds and reservoirs.

Areas of concern in regard to extensive and intensive risk for peri-urban areas:

1: The expansion of city populations (or more commonly of low-income populations) in peri-urban areas where there is a lack of provision for infrastructure and services and often the occupation of sites with high levels of intensive risk (as described in detail already)
2: The expansion of city populations into peri-urban areas with particularly weak or ineffective or disinterested local governments. This expansion might be taking place outside the city boundaries within the political jurisdiction of a 'district' or 'provincial' government that has little interest in addressing the needs of this expanding population or little capacity to do so. Or where government structures for cities are composed of different municipal authorities, it may be happening in a relatively newly formed and low-income municipality that lacks the capacity to address this. Analyses of the population growth rates in each municipality within large, multi-municipality cities or metropolitan areas often shows particularly rapid population growth rates in certain peripheral municipalities with high concentrations of poverty and with very weak municipal authorities.

Building standards[143]

From a disaster avoidance perspective, the obvious goal for building standards is to support as high a proportion of all buildings as possible having a capacity to withstand all likely weather extremes and other potential disaster catalysts. But the best ways of achieving this depend so much on the incomes of residents and the investment capacities of local governments.

Although the creation of building standards is seldom within the remit of local authorities, their enforcement usually is. In low-income and most middle-income nations, there is a need to shift from a focus on enforcement to a focus on support for new and existing buildings to meet appropriate standards. This includes supporting low-income residents living in self or artisan-built construction to upgrade at an appropriate pace and cost. This will require changes in legal, regulatory, planning and design guidelines; also changes in many urban centres towards working with the inhabitants of informal settlements. This will require considerable enterprise and institutional developments, but if structured imaginatively, these

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[142] Muller, Anna and Diana Mitlin (2007), "Securing inclusion: strategies for community empowerment and state redistribution ", *Environment and Urbanization*, Vol. 19, No. 2, pages 425-439.
[143] This section draws on Revi, Aromar (n.d.) 'Furthering pro-poor urban climate change adaptation in low- and middle-income countries'

could be part-funded via carbon credits. In addition, current buildings will often require retrofitting and strengthening, but at a typical 5-15 percent of capital investment this is relatively cost-effective.

Provision of infrastructure and services

Good quality, universal provision for infrastructure and services for all those within a municipality's boundaries is the core of disaster prevention – although clearly all infrastructure needs standards ensured to deal with (for instance) extreme weather and all service organizations need to understand and be capable of reacting appropriately to any disaster. But as noted earlier, most urban centres in low- and middle-income nations have large sections of their population not served and large backlogs in needed infrastructure investment. All city or municipal governments have some responsibility for ensuring provision of infrastructure and services, and as described earlier, this can have a substantial role in reducing intensive and extensive risk. However, the form this responsibility takes varies greatly between cities and municipalities: some have sole responsibility, some share responsibility with higher levels of government, and some take a supervisory and regulatory role for private sector or NGO providers. There are obvious links between access to infrastructure and access to land, particularly because agencies responsible for infrastructure and services may be reluctant or unable to serve those living on illegally occupied or sub-divided land. There are also practical difficulties in providing infrastructure to many informal settlements, such as those on steep slopes or flood plains.

Basic infrastructure and services play a critical role in disaster risk reduction and in many aspects of poverty reduction. Illness, injury and premature death can often be avoided through better quality housing and adequate provision for water, sanitation and drainage. These services also play a crucial role in enabling households and communities to respond to the challenges of disasters. Well-built and properly maintained drainage systems can help to prevent flooding in the first place, whilst well-maintained water supplies and sanitation facilities can reduce the spread of water-borne and water-washed diseases in the aftermath of a disaster event.

The provision of roads and public transport may also fall in the remit of local authorities. Adequate and affordable transportation systems play an important role in facilitating the movement of poor urban residents to take advantage of livelihood opportunities elsewhere in the city, and so can increase income-earning opportunities and keep down transport costs. These services need to be sufficiently resilient to enable urban residents to resume these activities as soon after an extreme event as possible. In addition, transportation infrastructure (and the management of this, for example by the identification of designated evacuation routes and the provision of public transport facilities along these routes) can play an important role in facilitating the evacuation of urban residents from vulnerable locations in the event of a disaster.

Local government authorities therefore need to provide a framework for the adequate provision of infrastructure and services, as a strategy for both poverty reduction and disaster risk reduction. The precise role to be played by these authorities can vary between cities: in some cases, it may require direct provision of these services; in others the appropriate regulation of service providers (whether at the level of the national government or the private sector). In all cases, however, local authorities can provide an appropriate enabling framework to facilitate the involvement of local communities and residents in planning these services, and encourage local involvement in their maintenance and upkeep. The creation of infrastructure for a city typically takes decades, and needs to have a lifetime of a century or more, and it is important that these plans adequately take into account not only current disasters, but also the potential increases in frequency and extremes that are likely to be caused by climate change.

Financial facilities and insurance

There is a long history of driving risk management through pricing risk, providing incentives to reduce risk and imposing risk-related terms on insurance policies.[144] Insurance can spread risks and reduce the financial hardships faced by individuals and enterprises linked to extreme events, and can also provide incentives for risk reduction.[145] The extra costs of insurance can also discourage households or enterprises taking risks – for instance building on areas of high flood risk. Governments, including urban governments, need to establish policies that provide individuals and firms with better information about risks from extreme events.

One area of growing interest is the use of insurance as a means of spreading and reducing the losses from climate-related events for those who would not normally be considered as potential policy holders: low-income households and small businesses in low- and middle-income countries.[146] There is also an interest in the potential for public/private partnerships between governments and insurance companies to help realize this. This is important in view of the failure of purely market-driven processes to provide adequate insurance at affordable rates. Public-private partnerships have been suggested where "the public sector sets a rigorous framework to reduce the physical risks, provides cover for high levels of risk or segments with high administration costs and sets the rules for a private market for other risks, while the private sector provides services and offers coverage for lower levels of risk and segments that are more easily accessible."[147] But in most urban areas in low- and middle-income nations, governments do not provide the framework for risk reduction for lower-income households. It is difficult to see how insurance companies can offer good coverage at affordable premiums to low-income households that live in particularly dangerous sites to which governments will not provide infrastructure. The potential of public-private partnerships to address other development issues such as improving provision for water and sanitation for low-income households in urban areas has long-been greatly over-stated[148] and there is a danger that it will be overstated for insurance too.

Disaster preparedness and response

Local authorities can also have a key role in developing policies for disaster preparedness and response. The place-based and local nature of these authorities means that they ought to have a deeper awareness of the precise nature of risk and vulnerability in particular locations. They also ought to have effective and locally-based communication systems for the spread of information before, during and after a disaster event.

Urban policies can help to improve the quality of provision for disaster preparedness. This includes issuing warnings, taking measures to limit damage, and – if needed – good provision to help people move to safer areas quickly. These policies can also improve the quality of planning for and coordinating disaster response, such as rescue services and appropriate emergency and health care services. Urban authorities have a particular role to play in the reconstruction process, through assisting those who have lost their homes and livelihoods – although this should aim to improve resilience, this is seldom achieved. Finally, and as emphasized throughout this chapter, urban policies ought to create an enabling environment for local civil-society action to contribute towards addressing these practical aims.

Addressing disaster risk through urban policies also requires a set of strategic actions, outlined below.

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[144] Adger, Agrawala, Mirza et al. (2007), op. cit.
[145] Adapted from Stern, Nicholas (2007), *The Economics of Climate Change: The Stern Review*, Cambridge University Press, Cambridge, 692 pages .
[146] Burton, I. (2006). 'Climate Change Insurance' *Tiempo: a Bulletin on Climate and Development* 58, p26.
[147] Dlugolecki, Andrew and Erik Hoekstra (2007), "The role of the private market in catastrophe insurance", in Gurenko, Eugene N. (editor), *Climate Change and Insurance: Disaster Risk Financing in Developing Countries*, Earthscan Publications, London, page 648.
[148] Budds and McGranahan (2003), op. cit.

1. *Develop an information base on current conditions, including provision for infrastructure and services and details of environmental hazards and vulnerability*. An important part of this is considering the impact of past extreme weather and other disasters on each city or municipality. This should seek as much detail as possible, drilling down to include 'small disasters' (disasters that do not get included in international disaster databases).[149] This can draw on the *DesInventar* methodology developed in Latin America and now widely applied elsewhere which looks more intensively at disasters in any locality and includes "small disasters." For instance, a database in Cape Town that sought to record all events registered over 12,500 incidents which contrasts with the 600 identified large events and declared disasters.[150] Almost half of these occurred in informal settlements. An analysis of disaster events in Mexico, 1970 to 2001, sought to document all events with at least one mortality and found that floods were the most common disaster, and a quarter of all deaths from flooding came from events with fewer than four deaths – i.e. much too small to be included in international disaster datasets.[151]

2. *Initiate risk/vulnerability assessments for the city with as much geographic detail as possible;* this needs to link hazard maps with details of what is currently located within the hazardous zones – including identifying population groups or settlements most at risk and activities that may pose particular risks (for instance water treatment plants vulnerable to flooding). From this, an assessment can be developed of whether the infrastructure and buildings will be able to withstand extreme events.

3. *Based on the above, discuss how addressing the above can be incorporated into the different aspects of local government.* These strategies can then form the basis for specific interventions to reduce disaster risk. The possible elements of a city development strategy that incorporates disaster risk reduction issues might include:[152]

- *Initiating a City Development Strategy Process*
  Agreement is reached on the need to undertake a City Development Strategy by senior officials and politicians leading to the formation of a key stakeholder group chaired by the mayor and with representatives of key developmental constituents (including formal local and foreign businesses, the informal business community, labour and low-income residential communities). For climate change to be considered, it is obviously important that environmental issues and poverty reduction issues are represented at this level.
- *Establishing initial parameters*
  Guidelines for the process agreed by this group who also define the spatial scale, scope and key issues to be addressed. They also need to reach agreement on undertaking a careful assessment involving all stakeholder groups that develops a forward-thinking vision and strategic actions identified that would contribute to its realization. This has to involve all the key sectors within government and all interest groups. Its success depends on commitment and compromise by all key groups.
- *Assessment*
  This identifies the internal and external drivers of the city's economy including what is driving growth and what is underpinning stagnation or decline; this has to identify the city's local, national and global roles. It includes city-wide scans of the economy, public service delivery, environment,

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[149] 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), *World Disasters Report: Focus on Reducing Risk*, Oxford University Press, Oxford and New York, 239 pages.

[150] Bull-Kamanga et al 2003, op. cit.

[151] Data source is DesInventar http://www.desinventar.org/desinventar.html

[152] This is drawn from text in Cities Alliance (2006), *Guide to City Development Strategies: Improving Urban Performance*, Cities Alliance, Washington DC, 79 pages.

spatial and built form and social conditions. The review of data may be complemented with cluster analysis (to allow coverage of issues for which there are limited or no data). This provides an assessment of infrastructure and services in regard to quality, coverage and fiscal sustainability and should include a review of data on environment, if possible reviewing trends over time. Spatial scans looking at the way the city is developing (including interviews with key actors such as real estate agents, property developers and transport planners) should identify key spatial dynamics and their drivers. Interviews, discussions and workshops are always valuable – but especially so in cities with very limited official data. Benchmarking is often useful so conditions and trends can be compared with other cities.

- *Vision*
  A statement of where the city wants to be in 10-15 years, drawing on the assessment and on the city's comparative and competitive advantages; also drawing on the values and preferences of residents, relationship to local, regional and global economies within local context of history and culture, location and climate. This should be short, precise and unifying; it should help encourage diverse stakeholders to work together and with long term goals that also motivate short term action.
- *Identify strengths, weaknesses, opportunities and threats*
  Within this, there is an obvious need for opportunities to build on the institutions with most capacity for implementing strategic thrusts.
- *Select a few key strategic thrusts*
  These might include a set of actions pursued to produce results within a given time period, measured by key indicators (relating to outputs, outcomes and impacts). These almost always involve capital investment from the public and private sector and usually involve changes to policy frameworks, modifications to regulatory frameworks and strong awareness-raising and education components.
- *Awareness building*
  Disseminating details of the vision and strategic thrusts to get buy-in and contributions from different stakeholder groups. Action plans and implementation task forces are developed for each strategic thrust that are explicit about who does what and which have clear financial and economic analyses with needed funding sources identified. These often begin with early, rapid implementation, high profile, low-risk initiatives.

For cities and smaller urban centres without a clear or effective plan, it is still possible to take steps that will be important for disaster-risk reduction by adjusting their planning and regulatory framework to support adaptation by households, community organizations, NGO and the private sector. One returns to the point that in most urban centres in low- and middle-income nations, the key influence of local government is not in what they build or invest in but in what they encourage, facilitate or prevent in the actions and investments by households, community organizations, NGO and the private sector. This is especially the case in local governments with limited capacities and finances and where a high proportion of housing and new housing development is within informal settlements (as in most urban centres in low- and middle-income nations). There are many examples of urban governments that have demonstrated how much can be done with limited resources through such an approach. Most of these examples are, not surprisingly, in urban centres with strong participatory processes within local government (for instance participatory budgeting) within nations with legal or institutional reforms that encouraged more accountable, democratic local government structures. Many of these innovations have also been in urban centres where urban poor groups are organized – for instance the growing number of nations where there are national federations formed by slum or shack dwellers or the homeless that undertake many initiatives themselves (house construction, upgrading, services) and offer local governments partnerships.

An important part of building local capacity to reduce disaster risk involves supporting low-income groups, especially those that live in the most risky locations. There are good experiences on which to draw on, including the process of 'slum and squatter upgrading' in which local governments have worked with the inhabitants of informal settlements to provide infrastructure and services and improve the quality of housing. There are also many examples of 'upgrading' and of new housing developments undertaken by federations formed by 'slum' or 'shack' dwellers themselves that are both more effective and less

costly than those supported by international agencies – and where these receive support from local government, these have demonstrated a very considerable capacity to 'go to scale' (as in, for instance, India, South Africa, Thailand and Malawi). These kinds of grassroots initiatives also require donor support and there are some bilateral agencies (and international foundations) that have recognized this, including DFID and Sida.[153] And this should not be seen as funding alternatives to local government but as central to building the competence, capacity and accountability of local governments. In conclusion, therefore, support for reducing disaster risks 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 grassroots organizations – and that reinforces and works with 'good local development' and 'good local governance'.

[153] Mitlin, Diana and David Satterthwaite (2007), "Strategies for grassroots control of international aid", *Environment and Urbanization*, Vol. 19, No. 2, pages 483-500.