Editorial: Reducing risks to cities from disasters and climate change

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I. INTRODUCTION

The lives and livelihoods of hundreds of millions of people will be affected by what is done (or not done) in cities with regard to climate change over the next 5–10 years. As the paper by Patricia Romero Lankao points out, cities are key players both in the generation of greenhouse gases and in strategies to reduce this generation, especially in reducing our dependence on carbon-based fuels. Cities also concentrate a large proportion of those most at risk from the effects of climate change. While the need for city governments and civil society groups to act to reduce greenhouse gas emissions is well established – and with many city governments in Europe and North America already acting on this – the need to act to reduce vulnerability to climate change is not. In addition, most of the cities (and nations) that face the highest risks from the negative effects of climate change are those with almost negligible contributions to atmospheric greenhouse gases.

Take, for instance, Cotonou, the economic capital of Benin, with around one million inhabitants, whose vulnerability to climate change is described in the paper by Krystel Dossou and Bernadette Gléhouenou-Dossou. In 2004, average emissions of carbon dioxide per person in Benin were around one-fiftieth that in high-income nations – or one-eightieth that in the USA.[1] Like many cities on the coast of West Africa, large parts of Cotonou's economy and residential neighbourhoods are particularly vulnerable to sea-level rise and storm surges. Some roads, beaches and buildings have already been destroyed by the regression of the coastline in the last 10 years.

Many other cities in Africa are also at risk from sea-level rise and storm surges. Half of the continent's 37 "million cities" are either within or have parts that are 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.[2]

Many Asian cities are also particularly at risk. Asia has many of the world's largest cities/metropolitan areas that are in the floodplains of major rivers (e.g. the Ganges–Brahmaputra, the Mekong and the Yangtze) and cyclone-prone coastal areas (the Bay of Bengal, the South China Sea, Japan and the Philippines).The IPCC (Intergovernmental Panel on Climate Change) has emphasized how river deltas are among the world's most valuable, heavily populated

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1. In this editorial, figures for carbon dioxide emissions per person are drawn from the World Bank's World Development Indicators On-line, accessible at http://www.worldbank.org/reference/.

2. *IPCC Special Report on the Regional Impacts of Climate Change; An Assessment of Vulnerability*, accessible at http://www.grida.no/climate/ipcc/regional/index.htm.

3. Chapter 6 on Coastal Zones and Marine Ecosystems, in IPCC (2001), *Climate Change 2001; Impacts, Adaptation and Vulnerability, Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, 1,032 pages.

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and vulnerable coastal systems.[3] The paper by Mozaharul Alam and MD Golam Rabbani describes the vulnerability of Dhaka, the capital in Bangladesh, to flooding. Dhaka has over 10 million inhabitants and is central to Bangladesh's economy (and its economic success in recent years). This is a city already very vulnerable to flooding – as shown by the devastation and very large economic losses from floods in 1988, 1998 and 2004. Large sections of the city are only a few metres above sea level. Much of Bangladesh outside of 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. Yet in 2004, the average contribution of each Bangladeshi to carbon dioxide emissions was also around one-fiftieth that in high-income nations – or one-eightieth that in the USA.

Mumbai and Shanghai are also very vulnerable to storms and sea-level rise, as described in the paper by Alex de Sherbinin, Andrew Schiller and Alex Pulsipher. As in Dhaka, large sections of these cities are only 1 to 5 metres above sea level. Much of central Mumbai is built on landfill – the city developed on seven islands, which joined into a single landmass 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 for Mumbai 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.

Although in aggregate, China and India are major contributors to global greenhouse gas emissions, emissions per person of carbon dioxide are still relatively small – for India less than one-tenth the average per person in high-income nations; for China about one-fifth. In addition, their contribution to greenhouse gases already released is much smaller. If a global agreement was to be reached to reduce total greenhouse gas emissions by the amount needed to minimize potentially damaging levels of global warming, by allocating each person a "carbon" budget, both China and India would still be well below their allocation.

II. WHAT ARE THE RISKS FROM CLIMATE CHANGE?

For cities, perhaps the most obvious increased risk from climate change comes from the increased number and intensity of extreme weather events such as heavy rainstorms, cyclones and hurricanes. The cities most at risk are the cities where these events are already common – although there is some evidence that the geographic range of some extreme weather events is expanding. For any city, the scale of the risk from these extreme weather events is also much influenced by the quality of housing and infrastructure in that city and how well prepared the city's population and key emergency services are. Generally, cities in high-income nations have had their risks much reduced as a result of decades of investment in housing and infrastructure.

But the devastation of New Orleans by Hurricane Katrina in 2005 is an example of how, even in high-income nations, flood defences and well-resourced emergency services can be overwhelmed (and how the poorer citizens are the ones most affected). Although buildings and infrastructure are often built to withstand extreme weather events of an intensity judged to be very unlikely (i.e. once in 1,000 years), these can still be overwhelmed by the increased intensity of storms or of associated rainfall. In many cities, there is already evidence that what used to be a "once in a 100 year event" is becoming more common. In addition, cities are also vulnerable to any damage to the larger systems on which they depend – for instance, water supply and treatment, transport and electricity (and thus everything that depends on electricity, including lighting, pumping and communications).

It is worth noting the scale of the devastation from some recent extreme weather events. The issue with these is not so much that "these are proof of climate change" (which is difficult to ascertain) but rather, proof of the vulnerability of cities and smaller settlements to extreme weather events – for example, the devastation brought by Hurricane Mitch to Central America in 1998 (thousands killed, millions homeless, billions of dollars worth of damage to already fragile economies);[4] or the devastation brought

4. EM–DAT: The OFDA/CRED International Disaster Database, accessible at www.em-dat.net, Université Catholique de Louvain, Brussels, Belgium.

by flooding in and around Caracas in Venezuela in 1999 (around 30,000 people killed, some 600,000 others seriously affected). The Tsunami in late 2004, which killed over 200,000 people and destroyed the homes and livelihoods of millions, was not related to climate change – but it was a demonstration of the vulnerability of so many urban (and rural) areas on the coast.[5]

There are also many other risks from climate change that are less dramatic but nonetheless very serious, especially for low-income groups. Climate change will bring changes in rainfall patterns, both in terms of how much rain each area receives and its distribution over the year. Some areas will become wetter and others drier. Many cities will get less precipitation (and have more constrained freshwater sources). This implies a need to adapt water supply systems, as well as drainage systems, and this is discussed in the paper by Mike Muller, which focuses on how water management must change in sub-Saharan Africa. At least 14 African nations are already facing water stress or water scarcity, and many more are likely to join this list in the next 10–20 years. There is already a failure to manage water resources well in much of this region, independent of climate change. It is an area where around half the urban population already lack adequate provision for water and sanitation, although this is linked far more to inadequate governance than to water shortages.[6] Mike Muller's paper also points to one of the difficulties in addressing this: the uncertainties within each locality of what changes are likely and the difficulties of incorporating this into water infrastructure investment planning, as the useful life of large water infrastructure is often measured in hundreds of years. Uncertainty about changing flood risk can lead to over-design, which is expensive, or under-design, with serious implications for risk.

It is not yet possible to predict with any precision how climate change will affect each particular place or sector – whether by downscaling global climate change models or extrapolating from past experiences with climate variation. In addition, there are multiple interactions between different vulnerabilities – as discussed in the paper by Alex de Sherbinin, Andrew Schiller and Alex Pulsipher, which can produce a variety of unanticipated effects.

Most cities will experience more heat waves and more problems with certain air pollutants; for larger, denser cities, the temperatures in central "heat islands" can be several degrees higher than in surrounding areas. Many tourist cities on the coast will have their "tourist assets" damaged because of flood damage to coastal reefs and loss of beaches. Warmer average temperatures will allow an expansion of the area where many "tropical" diseases can occur – for instance, where mosquitoes that spread malaria, dengue fever and filariasis can survive and breed.[7]

Many city economies will suffer from decreasing possibilities for agriculture in their surrounds – both as local supplies diminish and as local farmers' incomes (and thus spending on goods and services within the city) decrease. Generally "urban" issues and "rural" issues are discussed as if they were somehow separate. But a considerable part of the urban population in low- and middle-income nations derive their livelihoods from producing or selling goods and from providing services to rural producers or inhabitants. There are also the obvious rural–urban links for all industries that rely on crops or forest products as inputs. Thus support for rural populations and production systems to reduce their vulnerability to climate change is important for urban livelihoods and economies – just as protecting urban economies and livelihoods is important for so many rural households whose livelihoods depend on goods sold to urban populations or whose incomes are in part derived from household members working in urban areas.

III. FLOODING

Climate change has the potential to increase flooding risks in a number of ways: from the sea (higher sea levels and storm surges); from glacial lake outburst (a problem in countries such as Nepal); and from rainfall – for instance, heavier rainfall or rainfall that is more prolonged than in the past. For some cities and regions, climate

5. See reference 4.

6. UN–Habitat (2003), *Water and Sanitation in the World's Cities; Local Action for Global Goals*, Earthscan Publications, London, 274 pages.

7. WHO (1992), *Our Planet, Our Health*, World Health Organization, Geneva.

change is likely to reduce annual average rainfall – but this does not necessarily mean reduced risk of flooding, because the reduced rainfall may be more concentrated.

For most of the cities with increased levels of flooding risk induced directly or indirectly by climate change, this comes on top of already serious deficiencies in provision for storm drainage. A recently published study by ActionAid, *Unjust Waters*, documents the lack of provision in six African cities for reducing flood risks or for managing floods when they occur.[8] Floods are already having very severe impacts on cities, smaller urban centres and rural areas in many African nations – for example, the floods in Mozambique in 2000, which included heavy flooding in Maputo; the floods in Algiers in 2001 (with around 900 people killed and 45,000 affected); heavy rains in East Africa in 2002 that brought floods and mudslides and forced tens of thousands to leave their homes in Rwanda, Kenya, Burundi, Tanzania and Uganda; and the very serious floods in Port Harcourt and in Addis Ababa in 2006.

Discussions with residents in informal settlements in various African cities concluded that flooding is more frequent and intense, and often occurs in locations that previously were not at risk. It also emerged how little local government was doing to address these issues. There is an obvious need in most cities for far better drainage, including maintenance of existing drains – whether or not climate change is increasing risks from flooding.

Concerning Asia, the massive floods in Dhaka have already been mentioned. Mumbai had very serious floods in 2005, which left over 1,000 dead and massive damage to people's homes, livelihoods and asset bases. Jakarta (and other areas in Indonesia) suffered very serious floods in February 2007. And of course, for every flood that is large enough to get noticed internationally, there are dozens or hundreds that do not get counted as a "disaster", yet they kill and seriously injure many people and destroy or damage many people's homes and assets.[9]

Urban areas always present some risk of flooding when rainfall occurs. Buildings, roads, infrastructure and other paved areas in cities prevent rainfall from infiltrating the soil – thus producing more run-off. In well-governed cities this is rarely a problem, because good provision for storm and surface drainage can easily be built into the urban fabric, along with complementary measures to protect from flooding – for instance, the use of parks and other areas of open space as places to safely accommodate flood waters from unusually serious storms. But in poorly governed cities, this does not happen – and it is common for buildings or infrastructure to be constructed that actually obstruct natural drainage channels. In rapidly growing cities, it is common for natural drainage channels to be built over. For example, the paper on Dhaka points out that buildings often encroach on or fill in drains, and many natural drains have been filled up to construct roads. Heavy and/or prolonged rainfall produces very large volumes of surface water in any city, which can so easily overwhelm drainage systems – especially if there is inadequate provision for drains or if the drains have not been maintained (for instance, many are full of silt or clogged with garbage).

IV. THE URBAN POPULATION AT RISK IN COASTAL ZONES

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 paper by Gordon McGranahan, Deborah Balk and Bridget Anderson presents the first detailed analysis, based on data for each nation, of the number and proportion of urban dwellers (and total populations) living in the low elevation coastal zone (LECZ). This zone – the continuous area along the coast that is less than 10 metres above sea level – represents 2 per cent of the world's land area but contains 10 per cent of its total population (i.e. over 600 million people) and 13 per cent of its urban population (representing around 360 million people). Almost two-thirds of the world's large cities with more than 5 million inhabitants fall at least partly within this zone. Low-income and lower-middle income nations have a higher proportion of their urban population in this zone than high-income

8. A summary of this report will be published in the October 2007 issue of *Environment & Urbanization*. The report can be obtained from ActionAid and is also downloadable from its website at www.actionaid.org.

9. The October 2007 issue of *Environment & Urbanization* will include a case study of flood risks in unplanned settlements in Lusaka, Zambia, by Wilma S Nchito.

nations. The least-developed nations, on average, have a higher proportion of their total population in this zone than high-income nations; they also have nearly twice the proportion of their urban population in this zone, compared to high-income nations. Figures 1 and 2 show the10 nations with the largest urban populations and those with the largest proportion of their urban population in this zone.

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 between 18 and 59 centimetres by the end of the twenty-first century; this will certainly multiply the number of people flooded by storm surges. One estimate suggested that some 10 million people are currently affected each year by coastal flooding and that this number will increase under all the climate change scenarios.[10] The problems with coastal flooding would obviously be much more serious if certain potentially catastrophic events, whose probability is uncertain, were to occur – for instance, the accelerated melting of Greenland's ice sheet or the collapse of the west Antarctic ice sheet.

The paper by Gordon McGranahan, Deborah Balk and Bridget Anderson also notes how there appears to be increasing population concentrations in low elevation coastal zones in most nations. 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, for example, experienced a net in-migration of about 17 million people between 1995 and 2000, creating pressures in an already crowded coastal zone.

V. WHO IS MOST AT RISK?

In general, the people most at risk from climate change are those living in affected areas who:

- are least able to avoid the direct or indirect impacts (e.g. by having good quality homes

10. Nicholls R J (2004), "Coastal flooding and wetland loss in the 21st century: changes under the SRES climate and socioeconomic scenarios", *Global Environmental Change* Vol 14, No 1, pages 69–86.

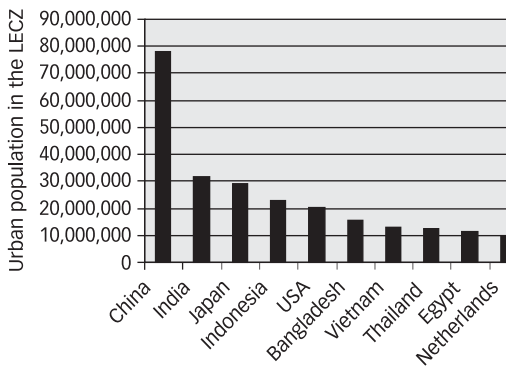

FIGURE 1
Nations with the largest urban populations in the Low Elevation Coastal Zone (LECZ)

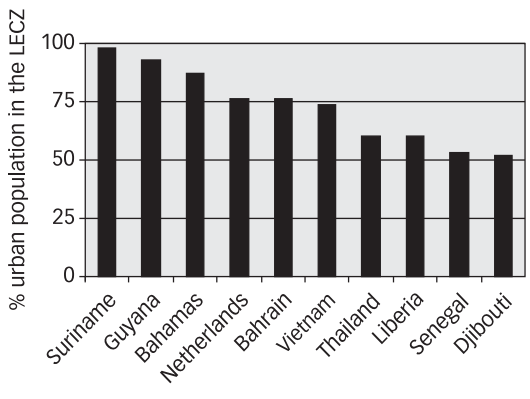

FIGURE 2
Nations with the highest proportion of their urban populations in the Low Elevation Coastal Zone (LECZ)

NOTE: In Figure 2, countries with an urban population of fewer than 100,000 were excluded from the list.

SOURCE: These figures were prepared by Gordon McGranahan, Deborah Balk and Bridget Anderson from the GRUMP database; see their paper for more details of the methodology and the source.

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

Generally, wealth allows individuals and households to reduce these risks – for instance, by having safer housing, choosing safer jobs or locations to live in, and protecting their wealth by insuring assets that are at risk. Also, having assets that help with recovery. Low-income groups have far less scope to reduce the risks and many live in the areas most at risk. Indeed, for most cities in Africa, Asia and Latin America, low-income groups not only live in settlements with the worst quality housing and least provision for drainage but also in the districts most at risk from floods and landslides. 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.[11]

The quality of government – both at the national level and, as crucially, at the local (district or municipal) level – also has a very large influence on the level of risk from climate change faced by those with limited incomes or assets. For instance, the quality of government influences the quality of provision for infrastructure (which should limit risks of flooding for the whole city area, not just for the wealthier areas), for disaster preparedness (including warnings, measures taken to limit damage and, if needed, good provision to help people move to safer areas quickly) and for disaster response (for example, rescue services and appropriate emergency and health care services and programmes, to help those who lost their homes and livelihoods to rebuild these). The potential "co-benefits" from investments to improve living conditions and to reduce risks from climate change are obvious. However, much current city development increases risks from climate change – for instance, by not preventing new development on areas at risk of flooding (and not providing alternative, safer sites for low-income groups), and by not protecting areas that should be left undeveloped because these help buffer flooding risks (for example, wetlands). Climate will never be the main driver of urban growth but the drivers of urban growth have to be adjusted to make them take account of climate change risks, as well as better address the needs of low-income groups. This will not be done by the market, and can only be done by governments working with, and accountable to, those who are most at risk.

But how is this possible when most local governments are weak and ineffective – and often refuse to allow any public services or investments in informal/illegal settlements, even when these house one-third to one-half of the entire city's population and workforce. Christine Wamsler's paper gives a clear indication of the difficulties in getting appropriate risk reduction action for lower-income groups in any city. Drawing on interviews and discussions with people living in 15 disaster-prone "slum" communities in El Salvador and with local organizations, these difficulties became apparent. Low-income households recognized that flooding and landslides were the most serious risks to their lives and livelihoods, although earthquakes and windstorms, the lack of job opportunities and water provision, and insecurity due to violent juvenile crimes were also highlighted. These households also invested in risk reduction and, on average, spent 9 per cent of their incomes doing so. Many took measures to lower risks – for instance, diversifying their livelihoods, or having easily sold assets should a disaster occur. Remittances from family members working abroad were important for many families, especially in providing support for recovery after a disaster. But a complex range of issues limits their effectiveness – for instance, the individualistic nature of households' investments, the lack of representative community organizations through which to design and implement settlement-wide measures, and the lack of support from government agencies (most residents viewed local and national governments as unhelpful or even a hindrance to their efforts). Meanwhile, most of the institutions that supported social housing and housing finance initiatives – local and international NGOs, government agencies – did not consider risk reduction in detail. Although their programmes usually supported

11. 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 Publications, London, 448 pages.

safer houses, which reduced risks in the event of a disaster, they did nothing to support insurance or to enhance family or community capacity for recovery. There is a need to support the capacity to work collectively, so that each household's individual efforts contribute to community-wide risk reduction (individual investments can often increase risks for others); there is also a need for local governments that can be trusted and, often, good professional advice on the cheapest ways to secure and protect homes.

VI. WHY CITIES DEVELOP ON RISKY SITES

Many cities are located on dangerous sites with regard to risks from storms and floods. This took place completely independently of climate change – but climate change has increased the level of risk and the number of people at risk. There are four main reasons why so many cities are on dangerous sites. The first is that these locations were attractive to those who originally founded and developed the city – for instance, because of a good river or sea harbour, or a strategic location with regard to trade or territorial control, or a ready supply of fresh water, 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 and road 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, ocean transport is still a key part of the increasingly globalized economy.

The second reason is that the original city site was often safe but the city has now outgrown this site and expanded onto land that is at risk – for example onto floodplains or on unstable hillsides or mountains.[12] The third reason is that 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. The fourth reason is that in most cities at risk from floods, the wealthier groups and most formal enterprises do not face serious risks.

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 city expansion (or stagnation or contraction) is where new or expanding profit-seeking enterprises choose to concentrate (or avoid). This is also largely true for how each individual urban centre develops – as the localities or districts within and around the urban centre with the most rapidly growing populations are associated with where new or expanding economic activities concentrate. However, the physical growth of the urban centre is also influenced by where lower-income groups can (or cannot) get accommodation or land on which to build housing.[13] Attempts by governments to change the spatial distribution of their urban populations or of the economic activities that underpin urban development can impose high economic costs – as this undermines the economic success of enterprises. Large public investments in infrastructure and expensive financial incentives in locations judged to be "desirable" by governments may fail to attract much investment; or the locations that get such preferential support are more determined by the political power of the politicians that represent them than by any potential to attract new investment – a problem that is also evident in high-income nations.

So in seeking to understand the links between city development and risk from climate change, one of the key issues is – to what extent are profit-seeking enterprises influenced in their choice of location by climate change-related risks? Obviously, private enterprises will not generally invest in sites that are risky – unless the risk can be reduced by insurance, or the risk does not actually threaten their production (in most cities on risky sites, it is particular geographic areas and particular population groups – usually low-income groups – that are most at risk).[14] In addition, if risks from climate change are seen as distant threats that may affect city sites 20 or 50 or more years in the future, then 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.

12. See reference 11.

13. See the paper in this issue by Haroldo Torres, Humberto Alves and Maria Aparecida de Oliveira.

14. See reference 11.

But larger companies and corporations also have far more possibilities to move when risk levels increase – in ways that most individuals, households and local enterprises do not. It is possible to envisage a trend in new investments by larger companies and corporations away from cities and city sites most at risk from floods and storms, which will hardly affect their operations. They have long been adept at shifting production to locations where profits are maximized, and it is easy for them to factor in risks from climate change. But it is difficult to conceive of how many of the largest and most successful coastal cities that are most at risk from storms and sea-level rise will manage. As papers in this issue make clear, cities such as Mumbai, Shanghai and Dhaka are very vulnerable to sea-level rise. All are very large (each has well over 10 million inhabitants), all have had considerable economic success in the last few decades, all are very important to their nations' economies and cultures, all concentrate very large investments and economic interests.

So what long-term perspectives can guide settlement/urban development away from the urban centres or urban zones most at risk from storms and floods, without threatening a nation's economic success? One of the most important factors is to remove a key constraint on new investments away from cities on the coast, namely the weakness of local governments in urban centres or zones in less risky locations. More competent and effective city and municipal governments in urban centres or zones outside the more risky locations will allow these locations to compete for new investments – and this has been a factor in developing less primate city-dominated urban systems in many middle-income nations. Of the many new economic activities currently concentrating in coastal locations at risk from storms and sea-level rise, a significant proportion do not require a coastal location, but are concentrating there because of other supporting factors – for instance, good infrastructure and services and easy access to government (perhaps an important source of business). This is obviously far more amenable to change than where businesses (and workforces) concentrate on coasts because of (for instance) port activities, fishing and coastal tourism. It is also likely that insurance cover will influence spatial location for both businesses and home owners that can afford it, as the cost of insurance rises in locations where the frequency and intensity of storms and floods is increasing or likely to increase; it may be that insurance cover will not be available in increasing numbers of coastal locations.

There is also the dramatic difference in the speed at which climate change is changing risk maps and the speed of adaptation. The speed at which city systems change to reflect the new "risk map" from climate change is likely to be slow in relation to how rapidly this "risk map" is likely to change – especially if no global agreements are in place within the next few years to halt and then reduce global greenhouse gas emissions. Part of this is because powerful economic and political interests want "their city" to continue. Large cities, once developed, acquire a capacity to remain as cities, even as their economic base declines. There are surprisingly few "great cities" from history that aren't still cities (even if their relative importance may have changed). Did the obvious and well-documented risk that New Orleans faced before Katrina actually cause many enterprises to move? New Orleans also faced an additional difficulty in that a high proportion of its economic base is related to its historic city and its rich culture, and this cannot be moved. Venice is at high risk from sea-level rise and storms – but Venice cannot be "moved". Nor can Alexandria. Many of the sites most at risk from sea-level rise in many coastal cities are also among the most desirable residential areas and areas for popular recreation.

There is also the issue of how the political economy of any city influences what is done and what is likely to be done to reduce risks from climate change-related impacts. A city as wealthy and successful as Mumbai has resources that could have done far more to reduce the risks from flooding (better drains, better garbage collection systems, ensuring poorer groups could find land for housing that was not on land at high risk from flooding, etc.). Why this was not done needs exploring. In part, it is because most of the risks from flooding are borne by lower-income groups. But cities such as Mumbai can invest in protection against floods and sea-level rise in ways that have strong "co-benefits" with development, as this also improves the homes and neighbourhoods of the millions of low-income households. They can greatly reduce risks by ensuring that low-income households can find and afford housing or land on which they can build on sites less at risk from flooding.

Or the city can ensure that its investments do exactly the opposite, as informal settlements at risk of flooding are bulldozed and no measures are taken to provide their inhabitants with alternative housing. Or if some provision is made for re-housing, this further impoverishes those who are forced to move, as they are dumped in distant locations, far from their sources of livelihood and social networks. As the risks facing so many major coastal cities in Africa, Asia, and Latin America and the Caribbean become evident, one of the greatest worries is that this will draw attention and investment away from the unfulfilled development needs.

So if city and national governments and international agencies do begin to factor climate change-related risk reduction into their urban policies, how can this avoid further disadvantaging the urban poor? How can the interests of those who live in the informal settlements and work in the informal economy come to represent a sufficiently potent political force to get risk reduction investments that benefit them? How can the inhabitants of informal settlements most at risk from flooding get to influence "solutions"? There are examples of how this can be done. For instance, there are precedents for the relocation of those living in informal settlements on risky sites, in which the inhabitants of these settlements and their own representative organizations were fully involved in where, when and how they were moved.[15] There are also the political innovations that have given low-income groups more influence over public investment decisions and brought greater accountability to them in how government resources are used.[16] There are also many examples of federations formed by groups of slum and shack dwellers or homeless groups that are pushing pro-poor political changes and also implementing many upgrading and new-house developments. Some city and national governments have recognized that these can be powerful and very effective partners in improving living conditions.[17] There are also many other civil society organizations that can help ensure that city planning and investment are less anti-poor and anti-environment. The institutional profile in this issue of the Urban Resource Centre (URC) in Karachi by Arif Hasan has considerable relevance to this. It shows the influence on urban planning in Karachi of a small NGO founded by teachers, professionals, students, activists and community organizations from low-income settlements. The URC's influence lies in the creation of an information base about Karachi's development on which everyone can draw, combined with research and analysis of government plans (and their implications for Karachi's citizens), advocacy, mobilization of communities, and drawing key government staff and the media into discussions. The network that the URC has built has successfully challenged many government plans that are ineffective, over-expensive and anti-poor, and it has devised and promoted alternatives. It shows how the questioning of government plans in an informed manner by a large number of interest groups, community organizations, NGOs, academics, political parties and the media can force the government to listen and make modifications to its plans, projects and investments. Comparable urban resource centres have also been set up in other cities in Pakistan and in other nations.

Another paper in this issue that is of great relevance to reducing risks from climate change (and other hazards), but that is not actually on climate change, is the paper by Edésio Fernandes on implementing the urban reform agenda in Brazil. This describes the urban reform process in Brazil and its legal and institutional innovations since the promulgation of the 1988 Federal Constitution. These include the 2001 City Statute and the creation of the Ministry of Cities and the National Council of Cities in 2003. As the

15. Patel, Sheela, Celine d'Cruz and Sundar Burra (2002), "Beyond evictions in a global city; people-managed resettlement in Mumbai", *Environment & Urbanization* Vol 14, No 1, April, pages 159–172.

16. Menegat, Rualdo (2002), "Participatory democracy and sustainable development: integrated urban environmental management in Porto Alegre, Brazil", *Environment & Urbanization* Vol 14, No 2, October, pages 181–206; also Souza, Celina (2001), "Participatory budgeting in Brazilian cities: limits and possibilities in building democratic institutions", *Environment & Urbanization* Vol 13, No 1, April, pages 159–184; and Cabannes, Yves (2004), "Participatory budgeting: a significant contribution to participatory democracy", *Environment & Urbanization* Vol 16, No 1, April, pages 27–46.

17. See case studies of federations in the Philippines, India and Zimbabwe in *Environment & Urbanization* Vol 13, No 2 (October 2001); see also Weru, Jane (2004), "Community federations and city upgrading: the work of Pamoja Trust and Muungano in Kenya", *Environment & Urbanization* Vol 16, No 1, April, pages 47–62. The October 2007 issue will include a profile of the Malawi Homeless People's Federation. See also www.sdinet.org for up-to-date profiles of the different federations.

author notes, while recognizing the limitations in these innovations, and the many issues that still need to be addressed, this is an important example of a national government striving to provide city governments with the legal and institutional base they need to be more effective and more accountable to their citizens. Without this, it will not be possible to reverse the spatial and social exclusion that has characterized most urban development in Brazil in recent decades. Nor will it be possible for most city governments to be effective in reducing risks associated with climate change in ways that also benefit poorer groups.

VII. THE UNFAIRNESS WITH REGARD TO WHO CAUSES THE PROBLEMS AND WHO IS MOST AFFECTED

There is a profound unfairness globally between those who cause climate change and those who are most at risk from its effects. This can be seen in three aspects. First, with regard to people, it is the high-consumption lifestyles of the wealthy (and the production systems that profit from their consumption) that drive climate change;[18] it is mostly low-income groups in low- and middle-income nations with negligible contributions to climate change that are most at risk from its impacts. Second, with regard to nations, it is within the wealthiest nations that most greenhouse gases have been emitted but it is mostly low- and middle-income nations that are bearing and will bear most of the costs. Third, with regard to cities, larger companies and corporations can easily adjust to new patterns of risk induced by climate change and can move their offices and production facilities away from cities at risk. But cities cannot move. And all cities have within them the homes, cultural and financial assets, and livelihoods of their inhabitants, much of which cannot be moved.

18. This statement might be considered to understate the role of industry or particular sectors such as fossil fuel-powered electricity generation but their production (and the climate change implications of their production) are underpinned by consumer demand, much of it from those with high-consumption lifestyles. It might also be considered to understate the contributions of middle-income groups in high-income nations, but these are among the wealthy if the whole planet's population is considered.

There are figures to show the dramatic differences between nations in the average contributions per person to greenhouse gas emissions, and some were noted above – for example, the 80-fold difference between that in the USA and many low-income nations. But these actually understate the scale of these differentials. Greenhouse gas emissions in high-income nations are kept down by the fact that they import many of the energy-intensive goods used or consumed by their citizens and businesses. In addition, a concentration on comparing "averages" for nations obscures just how much the wealthy groups drive the problem. The differentials in greenhouse gas emissions per person between rich and poor groups can be much larger than the differentials between rich and poor nations. For instance, the greenhouse gas emissions generated as a result of the high-consumption lifestyle of someone like Donald Trump are likely to be hundreds of thousands, or even millions, of times more than that generated by many low-income rural and urban households in low-income nations.

The very survival of some small island nations and low-income nations is in doubt as much of their land area is at risk from sea-level rise, yet their contributions to global greenhouse emissions have been very small. There are also tens of millions of people in low- and middle-income nations whose homes and livelihoods are at risk from sea-level rise and storms, yet they have made very little contribution to global warming. With regard to cities, in economic terms, it may be easy to write off the cities most at risk from climate change, but what will this do to international relations? One wonders what new levels of violence and international terrorism will be generated as increasing numbers of people lose their homes, assets, livelihoods and cultural heritages to global warming – especially when the main causes of this global warming are strongly associated with the lifestyles of high-income groups in high-income nations, and the reasons for their losses is the failure of high-income nations to cut back their emissions? Would the US government oppose the Kyoto Protocol's modest targets for emission reductions if Washington DC, New York and Los Angeles faced risks comparable to those facing Dhaka, Mumbai and Bangkok today as a result of greenhouse gas emissions the US had not generated?

VIII. THE NEED FOR ACTION

The initial response to climate change by the scientific community was to focus on the need to reduce greenhouse gas emissions. It seemed wrong to focus on adaptation to the impacts of climate change because this was only needed if emissions were not reduced. It also seemed unfair in that most adaptation would have to be done in nations with very limited resources and very limited contributions to climate change. In addition, there are other pressing developmental needs, and thus the worry that focusing on adapting to climate change would draw attention and resources away from these.

But the need to focus on adaptation has been much increased by the failure among high-income nations to act to reduce greenhouse gas emissions. There is also the worrying time lag between when emissions are reduced and when this reduces climate change; emissions already released will be driving climate change for the next 10–20 years, even if dramatic emissions reductions are achieved in the next few years. For sea-level rise, the time lag is even greater. So however unfair this is, action is still needed everywhere – to reduce emissions, to adapt to reduce risks. And action is needed in each locality, with actions that are tailored to the specifics of that locality – which means a need for local government to have the knowledge, capacity and legitimacy to act effectively. The earlier that action is taken to reduce greenhouse gas emissions *and* to adjust the drivers of urban development to contribute to reducing the vulnerability of settlements to climate change, the lower the costs.

There are those who still argue that development needs are so pressing that any attention to climate change diverts attention and resources from more immediate needs – the billions of people who have difficulty meeting their food needs and who lack basic services. There is also the worry that any action on climate change will not only draw resources from more pressing immediate needs but also will be twisted by local, national and international interests to serve themselves. Building over-expensive and often ill-considered flood defences can generate very large profits. The risks of this happening are much enhanced where mechanisms of accountability to citizens and civil society for government investments, or loans taken to fund such investments, are weak. If the need to reduce greenhouse gas emissions were less pressing, there would be a strong case for saying that this was entirely the responsibility of the rich world. But one of the key determinants of future greenhouse gas emissions is how cities develop in the more prosperous low- and middle-income nations (which is also where most of the world's population growth is being accommodated). Are the rapidly expanding and successful cities in China, India, Brazil, South Africa, etc. increasing or decreasing the dependence of middle- and upper-income groups on private car use? Are the houses and apartments favoured by middle- and upper-income groups increasing or decreasing the consumption of carbon-based fuels or electricity generated by the combustion of such fuels? Are enterprises in these cities successfully encouraged to invest in measures to reduce their direct and indirect contributions to greenhouse gas emissions? Here too, there are important potential co-benefits, as many measures to reduce carbon emissions can also reduce air pollution and greatly improve air quality. The precedents are there to show how much can be done[19] – but these precedents remain the exceptions, not the rule. In addition, to date, most of the discussion in relation to cities has been on reducing emissions, not on needed adaptation. The paper by Pierre Mukheibir and Gina Ziervogel discusses the development of a Municipal Adaptation Plan (MAP) for climate change for Cape Town, and the steps and methods needed to do this. This is also an example of how local adaptation needs a strong local information base and local governance systems that allow voice and influence to poorer groups.

Adaptation plans must also bring benefits to the billion urban dwellers who currently live in very poor quality housing, in tenements, cheap boarding houses and illegal or informal settlements. These billion people include a large part of the population whose homes and livelihoods are most at risk from climate change. As Patricia Romero Lankao's paper discusses, a technology-driven, market-led response to climate change does little for them. In addition, there are often

19. The two issues of *Environment & Urbanization* published in 2006 on ecological urbanization included many case studies showing these possibilities.

pressing local concerns: it should be difficult politically to get serious action on reducing carbon emissions in a city where much of the population lacks provision for piped water, sanitation and drainage.

But many local adaptation measures for climate change can also support better quality, more secure housing provided with sewers, drains and other measures to protect them from storms and floods. The kinds of changes needed in urban planning and governance to "climate proof" cities are often supportive of development goals. But as discussed already, they could also do the opposite – as plans and investments to cope with storms and sea-level rise forcibly clear the settlements that are currently on floodplains, or the informal settlements that are close to the coast. Most city governments in Africa, Asia and Latin America have not found ways to support low-income households in finding and moving to land on which they can develop their homes on safe, secure, well-located sites. Yet for many coastal cities, the need to achieve this will multiply if they are to adapt to climate change.

So there is a clear urban agenda. But where is the evidence of national governments and international agencies responding to this? In most nations, national and state/provincial governments still concentrate most of the power and the control over public investments. Most international agencies and development banks reinforce the power of central governments, as their funding goes through central governments. Unfortunately, too many city-level policy makers see climate change as a global issue that is not their concern. In addition, too many climate change experts see urban change as a local issue that they do not need to understand, let alone address. It is within urban centres and urban governments that so much of the battle to prevent climate change from becoming a global catastrophe will be won or lost – at least for the human species. Yet when urban governments do try to respond, they receive little support. Hopefully this will change as the full import of the challenge becomes apparent. Since most of the growth in the world's population over the next few decades will be in urban centres in low- and middle-income nations, this can be seen as an opportunity to plan and manage their expansion in ways that enhance their resilience (especially for their lower-income citizens) and support much lower greenhouse gas emissions – rather than enhancing their vulnerability and increasing their greenhouse gas emissions (as seems to be the case at present).

POSTSCRIPT

A Royal Commission Report produced for the UK government on East Africa: Wishing "*…to emphasize the importance of finding an answer to the problems which have been created by the rapidity with which urban areas have developed. We consider that in the past, too little attention has been paid by East African governments to the problems which arise from this development…*". A report presented by the Secretary of State to the UK Parliament, 1955.

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CLIMATE CHANGE 2007

The 4th Assessment of the Intergovernmental Panel on Climate Change (IPCC)

On 6 April 2007, the report *Climate Change 2007: Impacts, Adaptation and Vulnerability* will be released; this is IPCC Working Group II's contribution to the Fourth Assessment Report. It includes chapters on assessments of future impacts and adaptation relating to industry, settlement and society, human health, freshwater resources and their management, and coastal systems and low-lying areas; it also has chapters on each of the world's regions, and chapters on assessments of responses to impacts.

The report of Working Group I, on *The Physical Science Basis*, was released on 2 February; the report of Working Group III, on *Mitigation of Climate Change*, will be released on 4 May 2007.

For more details of these and other IPCC publications, see http://www.ipcc.ch/