SUMMARY

Climate Change, Disaster Risk, and the Urban Poor

Cities Building Resilience for a Changing World

THE WORLD BANK

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June 2011

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First printing June 2011

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Acknowledgments

This study was prepared by a team led by Judy L. Baker, Lead Economist, World Bank. Key contributions to the overall study and case studies were provided by Christa Anderson and Catalina Ochoa. Background papers were prepared by Anthony Bigio and Stephane Hallegatte (Planning, Policy, Synergies and Tradeoffs for Urban Risk Management, Climate Change Adaptation and Poverty Reduction); JoAnne Carmin, Sabrina McCormick, Sai Balakrishnan, and Eric Chu (Institutions and Governance in a Changing Climate: Implications for Service Provision for the Urban Poor); Soumya Dharmavaram (Courting Hazards: Where the Urban Poor Live); Ari Huhtala, Daniel Hoornweg and Marcus Lee (Climate Finance for Cities), Kristina Katich (Beyond Assessment: A Review of Global Best Practices Addressing Climate Change and Disaster Risk Management for the Urban Poor, and The Impacts of Climate Change and Disaster on Urban Services), David Satterthwaite (How Local Governments Can Work with Communities in the Delivery of Basic Services). Background research was carried out by Aafrin Kidwai and Austin Kilroy.

The study was part of the work program of the Mayor's Task Force on Climate Change, Disaster Risk and Urban Poverty comprised of the Mayors of Dar es Salaam, Jakarta, Mexico City and São Paulo and Mayor David Miller, former Mayor of Toronto and former Head of C-40.

The preparation of city level case studies for Dar es Salaam, Jakarta, Mexico City and São Paulo were carried out as part of the work program with teams led by each city government. From the World Bank, these studies were led by Eric Dickson (Mexico City) with Gisela Campillo, Marcus Lee and Peter Ellis (Jakarta), Federica Ranghieri and Andre Herzog (São Paulo and Dar es Salaam). Each of the case studies has resulted in an individual report which acknowledges the extensive teams involved in their preparation. We are grateful for the considerable financial support and insight provided by WBICC to the Mayors' Task Force work.

Peer Reviewers include Margaret Arnold, Uwe Deichmann, and Abhas Jha. Helpful comments were also received by David Miller, Glen Pearce-Oroz, Apurva Sanghi, and team members listed above.

The work is a joint effort by the Finance, Economics and Urban Department and the World Bank Institute with support from Cities Alliance and the Global Facility for Disaster Risk Reduction. The Study was carried out under the overall guidance of Zoubida Allaoua, Marianne Fay, Abha Joshi-Ghani, Christine Kessides, and Konrad von Ritter.

Overview

For those that live in slums in cities throughout the developing world, the daily challenges of accessing safe and reliable drinking water, proper sanitation facilities, transport services to commute to and from work, regular solid waste collection, and health and education services can be enormous. These challenges are increasingly exacerbated by the impacts of climate change and natural hazards. Residents, especially the poor, are increasingly exposed to the impacts of landslides, sea level rise, flooding and other hazards, increasing risks in already vulnerable communities and impacting health and the spread of disease, livelihoods, and the very limited assets of the poor.

This is the reality in city after city around the developing world. But that reality does not have to be destiny. A set of broad actions as outlined here can help build resilience for those at greatest risk in cities. Implementing these will involve a strong commitment by local governments working with communities, as well as national and international institutions.

This summary provides an overview of the report on *Climate Change, Disaster Risk, and the Urban Poor: Cities Building Resilience for a Changing World*. It is part of a broader effort under the Mayors' Task Force on Climate Change, Disaster Risk and the Urban Poor that was launched at the Mayors' Summit in Copenhagen in 2009. The Task Force is comprised of the Mayors of Dar es Salaam, Jakarta, Mexico City and São Paulo who have recognized the importance of these issues in their cities and demonstrated strong support. The three key objectives of the Task Force include: i) better understanding the links among climate change, disaster risk and the urban poor; ii) identifying good practice examples where resilience of the urban poor has been improved; and iii) proposing policy and investment programs for scaling up efforts to reduce risk for the urban poor. This World Bank global report, as well as case studies in the four member cities, has been carried out to better understand climate change and disaster risks for the urban poor, and form the basis for developing strategies to address those risks.

The report highlights the following main messages:

- ***The urban poor are on the front line.*** The poor are particularly vulnerable to climate change and natural hazards due to where they live within cities, and the lack of reliable basic services.
- ***City governments are the drivers for addressing risks through ensuring basic services.*** Local governments play a vital role in financing and managing basic infrastructure and service delivery for all urban residents. Basic services are the first line of defense against the impacts of climate change and natural hazards.
- ***City officials build resilience by mainstreaming risk reduction into urban management.*** Climate change adaptation and disaster risk reduction can be best addressed and sustained over time through integration with existing urban planning and management practices. Good practice examples exist and can be replicated in cities around the world.
- ***Significant financial support is needed.*** Local governments need to leverage existing and new resources to meet the shortfalls in service delivery and basic infrastructure adaptation.

1

Vulnerable Cities: Assessing Climate Change and Disaster Risk in Urban Centers of the Developing World

Urbanization has brought tremendous opportunity to many, and will continue to do so at an unprecedented pace throughout the developing world. Cities are centers of economic activity, innovation, and wealth. They attract migrants in search of better jobs, services and prospects for improved living conditions. While many who come are poor, they represent an enormous contribution to a city's economy through employment in manufacturing, services, and other sectors

As some 70 million people in the developing world move to urban areas each year, cities are increasingly stretched to provide urban infrastructure, services, and safe land. Some one billion people already live in slums, and this is projected to double by 2030.[1]

Further exacerbating this challenge, are the risks associated with climate-related and natural hazards. Cities are particularly vulnerable due to the high concentration of people and economic assets, and in many cases, their hazard-prone location in coastal areas, along rivers, and in seismic zones. Risks are especially high in low- and middle-income countries where a third to one-half of the population in cities lives in slums. Rising sea levels, storm surges, earthquakes, floods and droughts have enormous impacts in urban areas and are likely to intensify over time.

A number of studies have been carried out to estimate the magnitude of urban exposure to natural hazards and climate impacts. While each uses a different approach, covering different sets of cities, different types of hazards, different time frames, and different asset measurements, all confirm that such risk is increasing and that with the increasing changes in climate, risk will significantly rise in the coming decades.

The impacts on urban residents as well as urban systems, including the built environment and ecosystems, are significant. In addition to the well-known disaster impacts of natural hazards such as destruction of infrastructure and loss of lives, natural hazards and climate change incur a wide range of less obvious incremental impacts on urban systems and residents (see table 1). Based on historical data (2002–2010), the number of recorded events was highest for flooding (1501), followed by storm and cyclones (899), earthquake (228), ex-

Table 1
Incremental Impacts of Climate Change and Natural Hazards on Urban Systems and Residents

Incremental impacts on urban systems	*Impacts on urban residents*
Built environment • Stress on building foundations • Road washouts • Changing disease vectors • Stress on stormwater and sewage systems • Stress on water treatment systems • Disruption to shipping and ports • Increased energy demand • Increased road surface damage • Increased demand for water	• Illness: heat stress, stroke, malnutrition, water borne disease, asthma, physical and mental disability • Exposure to elements from substandard construction • Disruption of basic service provision and access to supplies • Housing instability • Property loss and relocation • Loss of livelihoods • Community fragmentation • Exposure to flood-related toxins and wastes • Disruption in availability of potable water, food, and other supplies • Water shortages • Food shortages; Higher food prices • Disruptions of electricity
Natural environment • Coastal erosion, altered ecosystems and wetlands • Salinization of water sources • Slope instability • Groundwater depletion • Reduction in greenspace and growing conditions including urban agriculture • Changes in fish populations • Increased runoff contamination • Increase heat island effect • Increased air pollution	

Source: Adapted from Carmin and Zhang, 2009; Dickson, et al., 2010; Dodman and Satterthwaite, 2008; Wilbanks, et al., 2007

treme temperature (173), mass movement (landslides, subsidence, avalanche (167)), drought (133), wildfire (101), volcano (53), storm surge (25) and Tsunami (19).[2]

The case studies in Dar es Salaam, Jakarta, Mexico City and São Paulo carried out as part of this report are illustrative of the vulnerability and adaptive capacity that cities are facing. Tables 2a and 2b summarize the key issues for each city. It is evident that the four cities are very diverse, confronting different types of challenges. That being said, in all four cities, it is those living in informal settlements that are found to be most vulnerable to climate-related and disaster risk.

Table 2a

Summary of Main Findings of City Level Risk Assessments: Dar es Salaam and Jakarta

		Dar es Salaam	*Jakarta*
Overview	*Population*	• 2.5 million in 1590 km^2 • Between 4–8% annual population growth	• 9.6 million in the metro area in 650 km^2 • 250,000 immigrate to Jakarta yearly
The vulnerability of the urban poor	*Hazards, vulnerability, and basic services*	• Main hazards: heavy rainfall, flooding, droughts • 70% percent of Dar es Salaam's population lives in poor, unplanned settlements; human development indicators very low • Basic infrastructure is very low; access to clean water and sanitation is a major problem; less than 60% of the road network is paved • Drainage channels are regularly blocked, causing houses to be flooded by sewage-based wastewater causing water borne diseases	• Main hazards are water management and flood control. About 40% of the city is below sea level. • Regular flooding affects city throughout the year with impacts on traffic, damage to homes and economic losses • There is currently no city-wide solid waste-management plan for Jakarta • Poorest live close to river banks, canals, drainage areas.
Building resilience for the urban poor	*Achievements*	• The government is identifying all properties in informal settlements in Dar es Salaam and issuing land/property licenses or right of occupancy to improve security of tenure, which could be used as collateral for economic empowerment • Significant slum upgrading program is also underway	• Large-scale adaptation infrastructure projects being developed including: Jakarta Coastal Defense to protect from tidal surges, and Jakarta Urgent Flood Mitigation Plan • Innovative early warning systems via SMS at the urban ward level inform people of upcoming floods
	Challenges	• Disaster risk management has largely been ignored and needs to be integrated in all aspects of urban planning in Dar es Salaam • Limited capacity in city planning departments to assess the long-term sectoral impacts of climate change for the city	• Adaptation plans to cope with extreme weather events and sea level rise are not coordinated across multiple agencies • Lack of comprehensive disaster risk management program or disaster response plan for the City of Jakarta

Source: City Level Risk Assessments, Mayor's Task Force.

Table 2b

Summary of Main Findings of City Level Risk Assessments: Mexico City and São Paulo

		Mexico City	*São Paulo*
Overview	*Population*	• 21.2 million in the metro area in 4250 km^2 • 3% annual population growth rate	• 19.7 million metro area in 2140 km^2 • Increasing population in the periphery with household incomes three times lower than city average
The vulnerability of the urban poor	*Hazards, vulnerability, and basic services*	• High seismic risk, no natural drainage for runoff from the surrounding mountains, and vulnerable to flooding. Regularly affected by severe storms, heat waves and droughts • Projections estimate rise in mean temperature by 2–3 °C by end of this century; extreme precipitation episodes expected to increase • By 2015 water consumption rates will increase by 20% compared to 2000 levels • Infrastructure and public services are stretched thin • City's generation of garbage is increasing at a rate of 5%/ year • 15% of the population is ranked with high level of housing and population vulnerability	• Main hazards include heavy rains, flooding, landslides and washouts • 13% of the population are considered as having high or very high social vulnerability • Over 85% of high risk households (890,000) are located in slums across the city • More than 5% of slum areas are highly prone to be affected by destructive events • 52% of households in slums are without access to sanitation facilities and 33% of households in slums without access to paved roads close to their homes • 20% of sewage lacks proper treatment
Building resilience for the urban poor	*Achievements*	• First city in Latin America to introduce a local climate action strategy to reduce emissions by seven million MT between 2008 and 2012 • Strategy is part of a 15-year plan where city is investing US$1 billion a year (9% of the yearly budget) on: land conservation, public spaces, air pollution, waste management and recycling, water supply and sanitation, transportation and mobility	• The São Paulo Agenda 2012 and the Municipal Climate Law sets out targets by sector to be taken by the municipality, private actors and other public bodies • Risky areas for landslides are already identified and geo-referenced by the municipality, allowing the prioritization of adaptation actions • Major slum upgrading efforts based on social vulnerability index and incidence of areas subject to landslidesThe São Paulo Agenda 2012 and the Municipal Climate Law sets out targets by sector to be taken by the municipality, private actors and other public bodies • Risky areas for landslides are already identified and geo-referenced by the municipality, allowing the prioritization of adaptation actions • Major slum upgrading efforts based on social vulnerability index and incidence of areas subject to landslides
	Challenges	• Disaster risk in Mexico City is primarily handled in a reactive manner and limited preventative measures have been implemented • Evident need to improve the sharing of information among the relevant government agencies	• Additional efforts are needed to increase coverage of sewage system and avoid illegal disposal of sewage into water courses • Mitigate risks in flood and landslide prone areas and consider relocating families where mitigation proves not to work

Source: City Level Risk Assessments, Mayor's Task Force.

2
The Vulnerability of the Urban Poor

The urban poor living in slums—now estimated at approximately one billion people—are at particularly high risk from the impacts of climate and natural hazards in large part due to where they live. As cities grow, land becomes scarcer and thus more expensive. The choice of where to live is driven by a series of tradeoffs between what is affordable, proximity to income earning opportunities, and where individuals may have social networks and kinship ties. The areas that are affordable to the poor are typically on hazard-prone lands, in areas that are deemed undesirable to others. They are also often informal settlements with insecure tenure.

People in low-income neighborhoods are made even more vulnerable by overcrowded living conditions, the lack of adequate infrastructure and services, unsafe housing, inadequate nutrition and poor health. These conditions can easily turn a natural hazard into a disaster, with impacts including the loss of basic services, damage or destruction of homes, reduction or loss of livelihoods, the rapid spread of water- and vector-borne diseases, disability, and loss of life.

The impacts of natural hazards and climate change can vary substantially with important distinction in spatial and location characteristics. For example, inner city slums which are typically located in the historic core of a city and are highly dense, such as in Delhi, Dhaka, Cairo and Istanbul, face risks due to the dilapidated condition of structures, overcrowded conditions, and difficulty in evacuating and getting services, including emergency vehicles through narrow roads.[3] Peri-urban slums such as in many cities in Latin America and elsewhere may face other challenges such as poor services, haphazard layout, drainage problems, limited accessibility and proximity to environmental hazards.

For the poor, it is often the more frequently occurring low or moderate intensity events such as localized flooding and fires that have the most significant impact. In Katmandu, Nepal, rapidly growing squatter settlements are located along the banks of the city's three rivers on steep slopes. Because there is no solid waste collection services, waste is regularly thrown in the rivers. The existing stormwater and sewage networks operate at only 40 percent of their capacity because they are blocked by sludge and debris. During the monsoon

season, approximately 25 percent of the households there flood regularly due to inadequate drainage. These residents are also susceptible to water-borne diseases that then go untreated because of the lack of affordable medical treatment.[4]

In Dhaka, Bangladesh, the situation is similar. Only 10 percent of slum dwellers have sufficient drainage to avoid waterlogging during heavy rains.[5] In most low income settlements, the existence of open drains results in accumulated garbage, preventing drainage systems from working during heavy rains. Where there is insufficient drainage, stagnant floodwater provides an ideal breeding ground for parasites and mosquitoes, which may lead to an increase in malaria and other vector-transmitted diseases.

Other issues such as tenure security, employment and financial insecurity and social networks also affect the sensitivity of the urban poor to climate change and disaster risk. The lack of tenure hampers investments in services and housing improvements. The urban poor rely on the informal sector for their income and thus they have limited access to formal safety nets. Strong social networks are important for some communities where residents work together to build resilience at the local level.

Traditionally vulnerable individuals and communities have managed risk through ad hoc coping mechanisms that draw on their local knowledge of hazards and community resources. In slums where social networks and kinship ties are stronger, communities tend to be more resilient. Older communities tend to have stronger social networks than newer settlements where residents may be more transient. Active internal leadership in close-knit communities can organize relief and rehabilitation more effectively and efficiently. This is especially the case for fast-onset events that require temporary relocation; at these times residents rely on their existing social capital and existing networks.

In Mombasa, Kenya and Esteli, Nicaragua one study shows that the asset that the poor value and tend to protect the most during extreme events is their house.[6] Other important assets were businesses and electrical appliances. The study also found that the majority of the households were resourceful at developing resilience measures (e.g. 91% of the households implement some kind of adaptation action before a severe weather event, 100% during the event, and 91% after the event).

Furthermore, the study revealed that the most critical dimension of vulnerability of the poor was weak or unclear tenure rights, and that owner occupiers tend to invest more resources in adaptation measures than tenants, especially in reinforcing the house structure before heavy rains.

Access to safe shelter, water, sanitation, proper drainage, and reliable solid waste removal, transport, roads and public health services remains an elusive goal for many of the urban poor. Cities typically do not have the resources or capacity to keep up with the growing needs of service provision. Issues of informality further exacerbate the challenges given that many governments, non-governmental organizations (NGOs) and the private sector are reluctant to invest in areas without secure tenure as they perceive this as risky. There is also a perception that the urban poor are unable to pay for basic services, yet in many cities, the urban poor pay more than the non-poor as they have to rely on expensive delivery systems.

With poor basic services, the effects of climate related and natural hazard risk can turn a heavy rain into a disastrous flood with the spread of disease. Destruction or damage to infrastructure can lead to water scarcity or contamination. Lack of access to safe housing

with good provision for water, sanitation, health care and education affects the capacity of slum residents to recover.

Many of the impacts of climate change and natural hazards on the urban poor are most notable in the area of risks to public health. Exposure to changing weather patterns in temperature, precipitation, sea-level rise and more frequent extreme events (such as earthquakes and landslides) have direct consequences for people's health: morbidity and mortality. Many communicable diseases are highly sensitive to changing temperatures and precipitation. These include vector-borne diseases such as malaria and dengue and water-borne diseases such as diarrhea and cholera. The pathogens that cause these diseases thrive in poor living conditions typically found in slums. Worse, their impact is also likely to be more severe in populations with pre-existing burden of disease.[7]

There are also indirect consequences from climate change and natural hazards on health via exposure to declining water, air and food quality, alterations in ecosystems, agriculture, industry and settlements and the economy (such as migration and poverty), and effects on food security. To complicate things further, this direct and indirect exposure also has short and long term implications for human health. For instance, a landslide not only kills people, but also leaves some people physically and mentally disabled for the rest of their lives.

3
Building Resilience for the Urban Poor

The challenges of service delivery in slums outlined above are not new, however, the risks from changes in climate and increasing exposure to natural hazards accentuate the growing urgency in proactively addressing them. There is much accumulated experience in efforts to improve living conditions for the urban poor, yet many cities have not been able to achieve these goals largely due to the pace of urbanization, ineffective policies, resource constraints, lack of political will and weak capacity.

This report underscores several recommended actions based on experience to help cities build resilience for those at greatest risk. These recommendations are rooted in the need for strong institutions for better urban planning and management, and sustainable urban policies that consider the positive and negative outcomes of the difficult decisions which city officials must make.

In implementing these actions, it is city governments that are the drivers for addressing risks, through the provision of public infrastructure, delivery of basic services and mainstreaming climate change adaptation and disaster risk reduction into urban planning and management practices. Such investments will have the biggest impact when implemented in partnership with communities that have much to contribute to the process.

Assessing risk at the city and community level to inform decision making

The case studies carried out as part of this report have demonstrated the importance of understanding hazards, socioeconomic and institutional risks for any city as an important first step to developing adaptation and disaster risk reduction plans. *A risk assessment can define the nature of risks*, answer questions about characteristics of potential hazards, and identify vulnerabilities of communities and potential exposure to given hazard events. Risk evaluation helps in the prioritization of risk measures, giving due consideration to the probability and impact of potential events, the cost effectiveness of the measures and resource availability.

Relevant and up to date information can allow all stakeholders to assess risk and make informed policy and investment decisions. Such information will affect zoning, property markets, location choices and adaptation investments. Investing in regular data collection is necessary for monitoring changes over time and continually updating risk reduction plans.

Mapping informal settlements can be a first step to assessing risk for the urban poor. In a growing number of communities, the poor themselves are carrying out this work. In Cuttack, India, community-driven data gathering includes the preparation of digital maps at the city scale for city authorities with input from an NGO.[8] The work begins with residents mapping their communities with a GPS device, commenting on boundaries and characteristics (risk profile, services, etc.) that help the visiting NGO team understand the settlement. Points marked with the GPS are uploaded to Google Earth and when aggregated into a city-wide map, provide the location and boundaries of all informal settlements, as well as their risk profile.

The process of carrying out a risk assessment can be equally as important as the results. The experiences from the Dar es Salaam, Jakarta, Mexico City, and São Paulo cases point to a few lessons:

i) High level support from the mayors and heads of key agencies was essential to giving priority and support to the work. Working level focal points were key to ensuring accountability and getting the work done.
ii) In all of the cities, an inter-agency working group was set up to carry out the risk assessments. This included agencies working on urban development, service provision, poverty reduction, disaster management and climate change. In some cases, this was the first time these agencies worked together which created synergies for a more integrated and comprehensive risk assessment and began the process for adaptation planning. However, it is unclear that these inter-agency working groups will be sustained without a more formal working arrangement.
iii) In some of the cities, there was a big disconnect between knowledge at the institutional and community level. This was addressed by involving city officials in site visits to poor neighborhoods, and in two cases, involving stakeholders in the workshops. Communicating in a language that all stakeholders could understand was fundamental. In that regard, producing materials in a simple format and local language was important for communicating results. In Jakarta and Mexico City, short films have been produced for broad dissemination of key messages.
iv) Across the four cities, accessing data, maps, and climate projections was problematic. Information is scattered across many different agencies, departments, organizations, and research institutions, with some reluctant to share data. Enormous effort went into collecting the information that was made available. To benefit from and sustain this effort, setting up a permanent institutional "home" to maintain and update this inter-agency information in each city would be beneficial for any future work.
v) The risk assessments were perceived as a useful framework for understanding climate change, disaster risk and impacts on residents. The multidimensional approach to assessing hazards, socioeconomic and institutional risks brought together key issues in a comprehensive way. This was, however, found to be only the first step. Stakeholder workshops held in all of the cities were useful in discussing key issues,

but follow up will be needed to integrate these findings into adaptation and risk reduction planning across city agencies.

Integrating climate change and disaster risk reduction policies for the poor into urban planning and management

Better urban planning and management is imperative to reducing disaster risk and climate change impacts on the urban poor. Policies to mitigate such risks have links to multiple sectors and thus can come with important synergies. For example, urban policies can be designed to be pro-poor with positive impacts on poverty reduction policies. Similarly policies can be designed to have co-benefits with climate change mitigation policy goals. Such policy choices also, however, come with tradeoffs and often difficult decisions. The outcomes of policy choices will have both positive and negative consequences that decision makers must carefully weigh.

Urban systems have long time scales and physical form cannot be changed easily, thus decisions made now will have impacts for decades to come. This is due to i) the long life span of urban infrastructure and buildings, which can be as much as one hundred years or more for high value buildings, bridges, or water systems; and ii) the location decisions of infrastructure and buildings typically goes well beyond their life span. For example, when railways reach their replacement time, they are almost always replaced at the same location. In the same way, new urban development is a somewhat irreversible choice as it is economically and politically difficult to relocate people.

The policy area that is most instrumental is land use planning and management. As cities in developing countries grow, they often expand into marginal areas such as flood plains, water catchments, and steep hillsides. Poor urban planning and management policies exacerbate this. At the city scale, there is a need for land use planning to consider flood, seismic, and other hazard zones when determining where new development should be permitted. Efficient transport systems can increase land supply in new areas by enabling access and mobility, thus reducing incentives to develop in vulnerable locations. Preventing building and settlements in high risk areas can save lives and prevent destruction. A framework for the regularization of land tenure, including partial or incremental solutions, can spawn investments and encourage improvements in infrastructure. Proactive policies aimed at the prevention of new slums which may involve changes in the legal and regulatory framework and draw on lessons of the past experiences with sites and services projects can help to curtail the rapid growth of new slums on vulnerable lands. In some cases, governments and municipalities would acquire land for block-level infrastructure rights of way around the peripheries of rapidly growing cities.

Table 3 outlines some of the policy choices and actions cities can consider when addressing climate change, disaster risk and the urban poor, along with the positive co-benefits and possible negative consequences of each. From an operational perspective, governments must make these policy choices in the context of broader priorities which include quality of life for city residents, economic competitiveness and attractiveness for investors, other environmental goals such as greenhouse gas emissions and protection of natural areas, public health and social concerns such as equity and social capital.

Table 3
Consequences of Risk Reduction Policies in Urban Areas

Risk reduction policy	*Actions*	*Positive co-benefits*	*Potential negative consequences*
1. Protection for many areas against extensive risk (versus few areas against intensive risk)	• Investments in basic services such as water, sanitation, waste, drainage, transport in poor areas • Investments in early warning systems, insurance schemes • Regulations to mitigate increases in exposure through land-use planning, zoning and building norms • Delay large, costly, investments against extreme events such as drainage, urban transport and buildings	• Large quality of life benefits from improved basic services • Most cost-effective given majority of risks for urban poor are extensive • Improvements in city economy from increases in productivity and competitiveness • Reduction in overall risk from frequent events • Reductions in local air and water pollution • Large health co-benefits • Improvements in social equity from pro-poor investments	• Increase in vulnerability to the most extreme events • Increase in population and asset risk
2. In-situ upgrading in at-risk informal settlements (versus relocation to safer areas)	• Investments in basic services in at-risk informal settlements • Avoid more costly investments in dykes and drainage systems • Avoid relocation to new areas (could be cost-neutral)	• Similar benefits as listed in 1. • Residents may benefit from location choice close to jobs and services • Avoid new urbanization, and reduce urban sprawl and destruction of preserved areas. • Avoid negative social impacts of relocation programs (loss of jobs, social networks, culture)	• Investments may further attract people to high risk areas and increase the population and assets at risk • Increase in vulnerability to extreme events • Poor population investments made at risk of extreme weather events; Risk of poverty trap if disasters too frequent
3. Zoning to prevent occupation of at-risk areas	• Regulations to prevent development, investments and hosing in at-risk areas.	• Reduction in overall risk and potential losses • Decrease in population and asset at risk (i.e., smaller likelihood of large-scale disasters with significant effects) • Avoid negative health effects from occupying unsafe or polluted land • Protect mainly poorest households which generally occupy the most at-risk areas	• Decrease in overall available land, increase in land pressure, general increase in housing and office-space prices in the city • Possible acceleration of urban sprawl; soil consumption and water-proofing; loss in natural areas and biodiversity; competition with agriculture • May increase travel distances in the city and commuting times • Environmental concerns from additional mobility needs and energy consumption • Perverse incentive of attracting illegal settlements in no-building zones

Table 3 (continued)
Consequences of Risk Reduction Policies in Urban Areas

Risk reduction policy	*Actions*	*Positive co-benefits*	*Potential negative consequences*
4. Develop new, less risky land with efficient transport	• Invest in urban infrastructure and basic services in new areas • Invest in new transportation networks which are efficient and affordable (train, metro, dedicated bus line, highways)	• Creation of new urban area with provision of basic services and high accessibility • Increase in available land, reduction in land pressure, and general reduction in housing prices in the city; development and competitiveness benefits. • Reduced pressure to urbanize at-risk areas (flood, landslide, subsidence) in city centers; reduction in overall risk and average losses • Avoid undesired development in natural areas and ecosystem losses • Improve access to adequate housing and basic services; poverty reduction benefits	• Increased car use, energy consumption, local and noise pollution and congestion particularly if based on individual-vehicle transport • Environmental concerns from additional energy consumption • High cost of new infrastructure (transport and other services) • Accelerated urban sprawl with higher cost to provide public services; possible higher property taxes • Additional soil water-proofing, increased run-off and possible increase in flood risks. • Accelerated urban sprawl; loss in natural areas and biodiversity; competition with agriculture • Risk for the poor to be relocated causing social segregation
5. Promote dense urbanization	• Containment policies that determine where growth can and cannot happen	• Modal shift to public transport yields reductions in noise and traffic • Lower cost of providing public services (water and sanitation, electricity, education, health) • Gain in competitiveness through reduced energy expenditures and lower taxes • Higher density facilitates zoning to avoid development in at-risk areas • Reduce mobility needs and energy consumption • Reduced urban sprawl and protected natural areas; increased competition with agriculture. • Improved social equity through reducing segregation	• Reduced access to housing, dwelling size • Reduction in available land for construction, increase in construction costs, increase in housing prices in the city; possible reduction in competitiveness • Potentially larger urban heat island and larger vulnerability to heat waves • Possible increase in natural hazard risk if containment land-use plans do not control for additional density in flood-prone or landslide areas

To help with prioritization and decision making, robust, multi-criteria decision-making tools can be useful. This approach can be used to ensure that any given policy, has no unacceptable consequences for stakeholders. The approach helps build policy mixes that are robust in most possible future scenarios. The application of robust decision making strategies can be a lengthy process, requiring the involvement of many stakeholders including city officials, multiple agencies, private developers and community residents. The process of such decision making, however, can help stakeholders assess their own choices towards higher resilience and lower vulnerability.

New York City has completed a city-wide adaptation plan, as well as comprehensive sustainability plan and update to that plan.[9] The plans use spatial planning in conjunction with risk mapping to understand and regulate how the city will be affected by climate change. The process included extensive public engagement. In the case of New York, unlike in many other cities, planning focuses on improvement of current buildings, building codes, and the strategic placement of public facilities, rather than guiding outward urban expansion. The plan calls for a community-based approach to deal with the most vulnerable communities. As a response, the city is now also working on site-specific adaptation plans through a community planning process with stakeholder groups.

Jakarta's plan for 2010–2030 calls for incorporating risk reduction activities into long-term spatial planning for the city.[10] Such approaches include restoration of mangrove forests, improvement in public facilities and mass transit, refinement of building and environmental regulations that consider hazard risk, redesign of technology and engineering in disaster areas, and improvements of provision of open space for anticipated increases in intense rainfall.

In three cities in Vietnam, Dong Hoi, Can Tho, and Hanoi, local governments have extended the work of risk assessment to a second phase in resilience planning, completing a Local Resilience Action Plan (LRAP).[11] This includes not only a vulnerability assessment and spatial planning, but also an inventory of planned capital investments and policy changes to address high-risk areas, gap analysis, and a multi-stakeholder priority-setting based on comparison of alternatives in light of limited budgets and fundraising prospects. The LRAP identifies short, medium, and long-term adaptation priorities for project investment with specific costs, timelines, and responsible actors. In the case of Can Tho, the outcomes of the LRAP process are currently being integrated into local urban planning efforts.

Other good examples where adaptation plans are being integrated into urban planning include Boston, Cape Town, Ho Chi Minh City, London, Quito, Rotterdam, and Toronto.[12] At a minimum, these cities have identified risk-prone areas and through urban planning discouraged new construction in these areas.

Strengthening institutional capacity to deliver basic services and reduce vulnerability to climate and disaster risk

Cities have a range of institutional structures and capacity for dealing with service delivery, disasters, and climate change. The institutions that are typically involved with the response and management of disasters include departments of public health, security, police, fire and those that serve vulnerable populations like the elderly and young. Plans often provide a

structure through which departments communicate with one another and many cities prepare by running simulations.

The institutional arrangements to cope with and plan for climate change, particularly adaptation, are somewhat less developed as it is a relatively new field of policy and planning. Furthermore, the institutional structures for delivering services to the urban poor have the longest history, yet in many cities they are weak. A major constraint has been capacity as local governments struggle with inadequate staffing, technical skills or financial resources. This is further complicated in many places by the lack of legal tenure which means that governments are reluctant or unable to invest in services in informal areas.

In the absence of strong formal institutions, informal institutions such as NGOs and community-based organizations (CBOs) play an important role in responding to the needs of the urban poor. In many cities they address gaps in service delivery, and at times are the first responders in disaster events. In Mombasa, local religious organizations are recognized as key players when extreme events occur and facilitate evacuation, emergency relief assistance and provisional shelter. The earthquake in Haiti in 2010 saw the emergence of volunteer technology communities who mobilized through the Global Watch Observation Catastrophe Assessment Network (GEO-CAN) to develop a comprehensive and rigorous damage analysis to assist with relief and recovery efforts.[13]

There are also numerous examples where progress has been made in addressing risks for the poor through slum upgrading programs, service delivery improvements in slums, emergency warning systems, and other initiatives. Such efforts were implemented with strong political commitment, community participation, and institutional support.

In Dar es Salaam, the local government has successfully implemented the *Community Infrastructure Upgrading Program* which has targeted unplanned areas in three municipalities.[14] Through a structured process communities have prioritized technical improvements in roads, drains and public toilets. The new community infrastructure allows safe access to homes on a regular and emergency basis, and improved drainage dramatically decreases flooding in the affected areas.

A relatively well-known effort in Pakistan through the Orangi Pilot Project Research and Training Institute supports local governments as well as slum dwellers in building capacity for the planning, implementation and financing of basic sanitation provision—at far lower costs than government built infrastructure—which have brought major benefits to large sections of the urban poor in more than 300 communities in Karachi.

There are also a number of good examples of disaster planning and climate adaptation planning. For example, plans in Istanbul, Ho Chi Minh and Cape Town have identified risk-prone areas and discourage new construction in these areas.[15] They have called for the resettlement of communities in the most risk-prone areas, in addition to improved construction and regulation of low income and informal housing.

Safety nets can be critical in building resilience for the urban poor as well as in post-disaster recovery. Safety nets have traditionally focused on the chronic poor through targeted cash transfers, both conditional and unconditional, workfare programs, and in-kind transfers. In Bangladesh, under the National Disaster Management Prevention Strategy, an early warning system triggered safety nets in response to Cyclone Sidr in 2007.[16] The program began distributing cash, rice and house building grants even before the main impacts of the cyclone were felt.

Table 4
Capacity Programs Aimed at Knowledge Sharing, Education, and Training for Urban Resilience

Agency/program	*Capacity building*
African Centre for Cities (ACC)	Interdisciplinary research and teaching program for sustainable urbanization in Africa
C-40	Establishing activity-specific sub committees which include city resilience planning and focus on the unique needs of port cities
International City/County Management Council (ICMA)	Provides knowledge-based assistance in disaster mitigation and preparedness for vulnerable communities, and recovery and restoration of basic municipal services
International Institute for Environment and Development (IIED)—Capacity Strengthening of Least Developing Countries for Adaptation to Climate Change Network.	Experts work to strengthen organizations through publications and capacity-building workshops mostly in Africa, South Asia, and active support for Conference of the Parties (COP) negotiations
International Strategy for Disaster Reduction (ISDR) – My City is Getting Ready Campaign	Focuses on raising political commitment to disaster risk reduction and climate change adaptation among local governments including high profile media and public awareness activities, and develops technical tools for capacity building.
International Organization for Standardization	Development of ISO 31000—a set of principle and guidelines for risk management.
Local governments for Sustainability (ICLEI)	Works with U.S. cities to conduct climate resiliency studies and develop adaptation plans
Rockefeller Foundation	Asian Cities Climate Change Resilience Network (ACCRN) helps cities to develop adaptation plans with civil society (10 cities in Vietnam, Indonesia and Thailand)
UCLG/Metropolis	United Cities and Local Governments (UCLG) represents and defends the interests of local governments on the world stage. In the area of cities and climate change, Metropolis is working on a range of projects and knowledge products
World Bank Group	
• Urbanization Knowledge Platform (UKP)	New UKP which includes extensive provisions for peer-to-peer exchange and knowledge sharing
• World Bank Institute	Global capacity building programs include: • E-Learning Safe and Resilient Cities Course • Networking • Mentoring • On-Demand Knowledge and Capacity Building

Programs can be designed to also assist at-risk households and communities to help people cope with hazard risk. For example, social funds, community-driven development and slum upgrading programs can be designed to support adaptation and risk reduction in low income communities by scaling up their work on actions most relevant for creating resilience such as improving drainage, water supply and sanitation, and setting up community-maintenance programs. Indonesia's National Community Empowerment Program (PNPM) which currently operates in all urban areas of the country, finances investments in flood prevention, water retention and storage facility and slope stabilization to prevent landslides as well as building emergency evacuation routes.

Such programs have been instrumental in post-disaster recovery as well. In Indonesia, efforts were rapidly mobilized following the disasters in Aceh (2004 Tsunami), Yogyakarta and Central Java (2006 Earthquake) and most recently in Central Java (2010 Mt. Merapi eruption) via community-driven development programs. On the very day the government says it is safe for residents to return to their neighbourhoods, trained facilitators that are already working in the communities are available to work with beneficiaries in identifying needs, preparing community settlement plans and allocating block grants. The key is to

have programs in place before the onset of natural disasters, with flexible targeting, flexible financing, and flexible implementation arrangements.

At the institutional level, success translates to good leadership, good governance and good management. These elements can be built through changes in incentive systems to promote reform and improve performance, for example through better accountability, financial management and coordination across agencies, with a structured reward system. Other methods that have proven successful are professional certification programs for municipal staff that elevate, professionalize and promote their development.

There are several programs available which provide advisory assistance to decision makers such as city technicians and city managers, and key actors in civil society. These programs range in levels of engagement and development, but all have the common goal of building capacity among decision makers.

There is also much capacity building that can happen as cities learn from each other. Successful experiences include city and local government networks at the country, regional and international level, training programs, and knowledge exchange through twinning and other programs that allow cities to share knowledge and information.

Bridging communities and local governments to work together on local solutions

It is clear that the urban poor are on the front line in addressing the impacts of climate change and disaster risk. There is much already happening at the household and community level that local governments can draw upon. For example, in Esteli, Nicaragua and Mombasa, Kenya, over 90 percent of households took some kind of adaptation action before, during and after a severe weather event.[17] Such actions included repairing roofs, building stronger foundations, digging trenches, clearing drainage and ditches, repairing leaks, channeling water and planting trees. These efforts are especially important for cities that have limited capacity and resources.

At the same time, much of what is needed to reduce risk in low income urban communities depends on the availability of infrastructure that residents cannot provide themselves. Storm and surface drainage, road and path networks, links to water networks, and health care services require specialized skills and substantial resources that communities may not have.

Despite the obvious benefits of partnerships between local governments and communities, this does not always happen in part due to negative perceptions particularly around policies related to informal settlements. There are a number of good examples of partnerships between community organizations and local governments in working in poor urban communities on risk reduction.

In the Philippines, a partnership between a grass roots organization, the Philippines Homeless People's Federation (PHPF), and local governments has worked to secure land tenure, build or improve homes, and increasingly to design and implement risk reduction strategies.[18] Following the devastation caused by Typhoon Frank in 2008, the local government in the city of Iloilo worked closely with PHPF in technical working groups, mapping of high risk areas, and identification and prioritization of communities to be given post-disaster assistance.

In one of the oldest and largest slum areas in Jakarta, Kampung Melayu, residents have responded to an increase in the severity and frequency of flooding by developing an early warning flood system. Neighborhood and village heads receive SMS messages on their mobile phones from floodgate areas upriver when the water level is getting high. They can then spread the news in the community by broadcasting from the minaret of the local mosque so that residents can prepare for the coming inundation.

One of the more complex but impressive examples is in Quelimane City, Mozambique, where local communities have partnered with the City Council and several international organizations to work on upgrading for communities particularly affected by cyclical floods.[19] The city and community worked together on developing an upgrading strategy that had a special focus on water and sanitation conditions. In implementing the strategy, the City Council provided an in-kind contribution of US$100,000 by providing office space, equipment, a meeting room, technical and administrative staff, and vehicles. The community provided an in-kind contribution of US$150,000 through provision of subsidized labor, conducting awareness campaigns, forming operational management teams, and reducing their plot size or, in extreme cases, moving to another area because of improvement works. UN-HABITAT, the World Bank, DANIDA, UNICEF, and WaterAid in combination contributed US$440,000 in cash and in-kind. Other in-kind contributions totaling US$30,000 were secured from a

state water supply institution, and from a private-sector firm which made its trucks available during weekends in exchange for paying only for fuel and for the driver.

Among the lessons learned from experience of partnerships between communities and local governments are that such cooperation can be facilitated through mutual recognition of the role that each group plays; improving the dialogue and discussion to dispel misunderstandings; understanding and recognizing what is happening at the local level and forming partnerships with local organizations.

For the poor, understanding what the city can and ca cannot provide and what its constraints are is a first step. Strong community groups and detailed community-level information systems can be extremely effective for initiating engagement in such partnerships. For local governments, this means recognizing the contribution that the urban poor make to a city's economy and society and involving them in discussions about needs and priorities. Local participation is crucial to ensure that the approach taken suits the needs of residents, and in ensuring quality standards. Many of the examples of local government-community organization partnerships in Africa and Asia have been initiated by federations of slum dwellers who are engaged in initiatives to upgrade slums, secure land tenure, develop new housing that low-income households can afford, and to improve provision of infrastructure and services.

Opening new finance opportunities for cities to finance basic services and other needs to address climate change adaptation and disaster risk reduction

The analysis of the risks for the urban poor associated with climate change and natural hazards point to significant financing needs for cities. Adaptation and risk reduction costs include both physical investments such as urban infrastructure and basic services in slum areas, but equally important are investments in good information systems and tools for integrating climate change and disaster risk management into urban planning, safety nets, and capacity building to help local governments better deliver services and manage risk for their residents.

Cities in developing countries currently rely on national and local tax revenues, the private sector, public-private partnerships, and loans and concessional sources through the World Bank and other multilateral development banks to finance infrastructure and social needs. There are also a number of existing programs that provide smaller-scale grants or technical assistance for projects and programs at the city level. In practice, such resources are vastly insufficient to meet the service needs of the population, particularly in slums.

When reviewing potential financing needs for climate adaptation and disaster risk reduction, it is important to consider that not all investments are necessarily high and some can have more direct impacts on the poor than others. Large scale city-wide infrastructure investments for flood protection or measures to make roads, ports and power generation facilities more resilient to extreme events may be necessary in many cities over time, but they are expensive and will not improve conditions for those living with the debilitating impacts of the more frequent less extreme events.

Smaller-scale investments in drainage and improvements in basic infrastructure need not be expensive, and are catalytic in building resilience for the urban poor. Slum upgrading pro-

grams take a neighborhood approach and in addition to local infrastructure improvements, often include social programs aimed at community development. Such programs are most effective when coupled with policies that tackle difficult issues related to land. Innovative approaches to financing such as output-based aid, offering pro-poor incentives to utilities and the private sector, and policies that promote an enabling environment for small private sector service providers while ensuring quality and affordability for residents offer much potential for scaling up.

In low income communities in western Jakarta, a scheme developed through the Global Partnership on Output Based Aid (GPOBA), the city government, and the local water utility, PALYJA, is designed to subsidize the cost of water supply connections for almost 12,000 households in a number of poor areas, including 2,200 in informal settlements where PALYJA had previously not been authorized to provide services.[20] Concessionaires are given grants for the cost of installing connections to the networks provisional on two measureable outputs—the provision of a working household connection, and the delivery of acceptable service for a period of three months. While the project has faced some difficult challenges in implementation related to water availability, and problems dealing with existing informal water suppliers, these eventually were resolved, with the help of the NGO Mercy Corps, paving the way for further expansion to other communities.

Another financing approach used is individuals and communities spreading the cost of risk across a population through the establishment of insurance or catastrophic risk pools. These instruments are generally for upper- and middle-income families, large businesses and wealthy governments, but not for the urban poor. Microfinance schemes, however, can be used to finance risk reduction and recovery efforts by the poor. They have been used to improve resilience through housing improvements, and livelihoods assets. In low-income communities in El Salvador self insurance schemes include encouraging family members to migrate to provide remittance income, and stockpiling building materials which can either be used or resold.[21] One study estimated that residents spend approximately nine percent of their income on risk reduction measures. At the community level, many contribute to community emergency funds or join religious institutions that traditionally offer post disaster help.

In Manizales Colombia, the city has arranged for insurance coverage to cover the urban poor through municipal tax collection. Any city resident may purchase insurance coverage for their property, and once 30 percent of the insurable buildings participate, the insurance coverage is extended to tax exempted properties, including properties with a value of 25 monthly salaries or less (estimated at US$3400).[22] Despite the municipal administration collecting a handling fee of six percent, the insurance company has a direct contractual relationship with the individual taxpayer and bears responsibility for all the claims.

In the context of the Mayor's Task Force on Climate Change, Disaster Risk and the Urban Poor, a Program for Climate Finance and Assistance for Cities is proposed. This Program would bring together many of the existing resources that are available and draw on some innovative instruments such as green bonds for cities and results based financing for basic services. With regard to climate support alone, the World Bank offers more than 30 potential programs including capacity building and technical assistance programs, and funding initiatives. An efficient combination of such instruments could leverage public and private sources while encouraging low carbon development. One approach to facilitating ac-

cess would be creating one access window for the programs. This would enable city-specific partnerships similar to the Bank's Country Partnership Strategies.

To encourage cities to achieve specified targets, such a program could consider a more standardized approach to benchmarking and monitoring through a set of metrics commonly agreed upon by the international community such as a City Level GHG index, urban risk assessments, or Local Resilience Action Plans. By meeting specified targets, cities would then be eligible for accessing such financing through the designated window.

In conclusion, the challenges are great for cities around the world confronting the risks associated with climate change and natural hazards, but understanding the challenges is the first step in overcoming them. As is apparent in this summary and in the report, there are examples in cities all over the world, good practices that show how cities can help build resilience for their urban poor in the face of risk. In doing so, cities are benefiting not just the poor, but future generations.

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