



Guide to Climate Change Adaptation in Cities

Executive Summary



THE WORLD BANK GROUP

Cities face significant impacts from climate change, both now and into the future. These impacts have potentially serious consequences for human health, livelihoods, and assets, especially for the urban poor, informal settlements, and other vulnerable groups. Climate change impacts range from an increase in extreme weather events and flooding to hotter temperatures and public health concerns. Cities in low-elevation coastal zones, for instance, face the combined threat of sea-level rise and storm surges. The specific impacts on each city will depend on the actual changes in climate experienced (for example, higher temperatures or increased rainfall), which will vary from place to place.

Climate change will increase the frequency at which some natural hazards occur, especially extreme weather events, and introduce new incremental impacts that are less immediate. However, few climate impacts will be truly unfamiliar to cities. Cities have always lived with natural hazards, such as earthquakes, tsunamis, hurricanes, and flooding. In some situations, cities will experience an increase in the frequency of existing climate-related hazards, such as flooding.

Climate change adaptation is the process of preparing for, and adjusting proactively to, climate change—both negative impacts as well as potential opportunities. Cities are often the

first responders to climate impacts. Because cities are dynamic systems that face unique climate impacts, their adaptation must be location specific and tailored to local circumstances. The starting point in managing risks and building long-term resilience is for a city to understand its exposure and sensitivity to a given set of impacts, and develop responsive policies and investments that address these vulnerabilities.

A resilient city is one that is prepared for existing and future climate impacts, thereby limiting their magnitude and severity. Once an impact occurs, a resilient city is able to respond quickly and effectively, in an equitable and efficient way. Building resilience requires not only robust decision making by those in positions of formal authority, but also a strong web of institutional and social relationships that can provide a safety net for vulnerable populations. Through both formal planning activities and informal preparations, cities can build their capacity to adapt effectively to existing and future climate impacts, while also experimenting and innovating in policy making and planning.

Increasing resilience in cities involves addressing basic poverty reduction and sustainable development goals. Instead of seeing vulnerability to climate impacts as an additional concern, cities can mainstream resilience into existing efforts. Many

cities are challenged by rapid urbanization, expansion of informal settlements, substantial poverty, inadequate infrastructure, and environmental degradation. These and other concerns (the “development deficit”) constrain cities’ ability to grow and prosper. Many of these same conditions also limit resilience to current climate variability (the “adaptation deficit”).

Climate change considerations can be integrated with disaster risk reduction (DRR) in cities. DRR efforts—already familiar to many—may be used as a platform from which to develop climate change adaptation plans. In practical terms, disaster risk reduction and climate adaptation can be integrated in many instances, although cities should also consider incremental or gradual changes in climate that affect government operations or community life in less immediate and visible ways than conventional disasters. Entry points other than DRR, such as development planning, can also be used for adaptation efforts in cities.

Approaches to collecting information on climate change impacts in a city can range from highly technical and resource-intensive, to simple and inexpensive. Technically complex assessments are likely to require collaboration with external experts, if a city is not large or well-resourced with sufficient in-house capacity. Cities can look to local universities or regional collaborations, supplemented by international expertise,

if needed. Community-based participatory approaches can integrate community perspectives and priorities, improving understanding of the social and locally specific consequences of climate change. Taking a combined or tiered approach can yield assessments of impacts that are grounded in community priorities and supported by sound science.

An increasing number of cities around the world have begun to plan for climate change by developing stand-alone climate plans or incorporating climate considerations into existing plans, policies, and projects. City officials are making major development

decisions today that will have long legacies, offering important and time-sensitive opportunities to adapt. Addressing climate change adaptation through the formal planning or policy-making process can make an effort more durable in the long term, especially for a city in which a commitment to addressing climate change is largely based on a few public officials. Informal efforts, as well as initiatives that do not address climate change explicitly but still contribute to resilience, can also be valuable starting points.

Adaptation efforts in cities offer co-benefits for climate change mitigation and for local economic development.

Green building investments, for instance, provide natural cooling to occupants in times of extreme heat, while also reducing greenhouse gas emissions and offering benefits in terms of energy efficiency and cost savings. More broadly, adaptation investments in cities, such as those that increase the resilience and reliability of urban infrastructure, can improve broader economic performance by increasing city competitiveness and attractiveness for investors and the private sector in general.

Cities can identify simple and low-cost (or no-cost) actions that can be implemented to increase resilience in their day-to-day operations. At the



same time, given resource constraints and competing priorities, many cities may be able to pursue only a few large investments in climate change adaptation. This makes the evaluation and prioritization of potential adaptive responses all the more important. Cities can apply tools to identify and prioritize which proposed adaptive actions to pursue, as well as to evaluate the effectiveness of these actions once implementation is underway. Based on these analyses, cities can identify “no-regrets” actions that generate net social or economic benefits independent of climate change. Low-cost actions can include short-term clearing of solid waste from urban waterways to prevent localized flooding because of clogged drains and public awareness efforts to share information about emergency evacuation and public health risks.

Climate change will place unique burdens on the urban poor, residents of informal settlements, and other vulnerable groups, such as women, children, the elderly and disabled, and minority populations. To build resilience among these vulnerable groups, a city can do the following: 1) raise awareness about specific climate change impacts on the most vulnerable; 2) include vulnerable groups in the adaptation planning and policy-making process; 3) incorporate community-based adaptation into city plans, when appropriate; 4) support

organizations that already work with the vulnerable groups; and 5) strengthen land administration and regulation, including considering the benefits of improving security of tenure and service provision in informal settlements. In pursuing such efforts, it is important to fully recognize the resourcefulness of the informal sector in cities.

Climate change adaptation in cities requires collaborative problem solving and coordination across sectors. Cities are well positioned to act as conveners of a wide range of partners.

Climate change will have impacts on many sectors: land use, housing, transportation, public health, water supply and sanitation, solid waste, food security, and energy (see the table below for a sample of climate impacts and corresponding adaptive responses in cities). Adaptation efforts in any of these sectors will often involve multiple government agencies, as well as broad partnerships that include other governments, local communities, nonprofit organizations, academic institutions, and the private sector.

Financing adaptation in cities will involve drawing upon a combination of sources. Climate finance is a complex field, and adaptation-specific funding is still relatively limited. Sources of concessional finance are mostly structured for access at the national level, posing an additional

challenge for cities. Opportunities that cities can consider include the following: 1) existing own-source revenues and tools and national sources of municipal finance; 2) grant resources and concessional finance from multilateral or bilateral institutions; and 3) market-based mechanisms to increase efficiency and the involvement of the private sector. Cities can use funding for adaptation to pilot new tools, scale up and catalyze action, and leverage more funding from other donors or the private sector.

In summary, adaptation is not a one-time effort but an ongoing cycle of preparation, response, and revision. It is a dynamic process, and one that should be revised over time based on new information. Underpinning the strongest adaptation processes will be leadership and commitment to measuring progress and assessing effectiveness. This will help ensure that cities invest scarce resources in truly adaptive ways and achieve the maximum cobenefits, while avoiding unintended consequences. Those cities that are able to integrate adaptation well with a broad spectrum of existing planning processes and goals—including priorities in disaster risk reduction, sustainable development, and poverty reduction—will be best positioned to thrive in this new era of climate change.

SAMPLE OF CLIMATE HAZARDS AND ADAPTIVE RESPONSES ACROSS SECTORS

Projected Change in Climate Phenomena (Likelihood)	Drivers of Urban Exposure and Vulnerability	Consequences for Cities, if Unaddressed	Sectors Involved	Sample Adaptive Responses (not an exhaustive list)	Relative Investment Level / Cost
Warmer with fewer cold days and nights, more hot days and nights (virtually certain) Hot spells/heat waves—increased frequency (very likely)	Urban heat island effect. Lack of electricity and cooling systems, especially in many informal settlements.	Exacerbated air pollution Heat-induced illness and death	Transportation, housing, private sector building industry, public health	Green infrastructure, including improved vegetation and green building investments for natural cooling.	Medium to high with significant economic and sustainable development cobenefits
				Retrofit of existing bus fleet with white roofs to reduce solar heat gain and ventilation to ensure adequate air circulation. Undertaking public relations campaigns to encourage passengers to carry water with them to avoid heat stroke.	Low to medium
	Lack of diversified energy supply and substandard energy infrastructure.	Energy shocks and disruptions because of increased demand	Energy	Investment in clean energy and energy efficiency.	Low to high, depending on the specific energy investment; significant cobenefits for economic prosperity and “green growth.”
Heavy precipitation events—increased frequency (very likely) Intensity of tropical cyclone activity increases (likely) Rising sea level (virtually certain)	Rapid urban growth leading to informal settlements on marginal land with no roads or drainage systems, or drains that are clogged with debris and silt.	Exacerbated flooding and landslides	Land use, housing, solid waste, public health, emergency management	Development and enforcement of a sound land use plan that a) is based on understanding of climate change vulnerabilities, b) effectively encourages dense, mixed-use development in resilient areas, and c) engages ecological planning approaches outside of city limits (for example, village-level watershed management on the outskirts of a city or protection of mangroves and wetlands on nearby coastline).	High, involving significant political and staff investment
				Contaminated waters and spread of disease in stagnant waters	Improved solid waste handling practices (for example, proximity to drinking water supply or corrosive-resistant containers) to prevent leakage and contamination.
				Short-term clearance/disposal of solid waste from drains to prevent clogging.	Low
				Public health engagement and risk prevention around likely flood-related diseases.	Low
	Nonexistent or substandard transportation infrastructure.	Blockage of emergency routes because of road flooding, resulting in delayed emergency evacuations Losses in commercial activity	Transportation, emergency management, private sector	Investment in roads and other transportation choices for informal settlements.	Medium to high
				Green infrastructure.	Medium to high with significant economic and sustainable development cobenefits
				Relocation of storage yards for buses and train cars out of flood-prone areas to reduce the risk of damage or loss of this equipment.	High

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Projected Change in Climate Phenomena (Likelihood)	Drivers of Urban Exposure and Vulnerability	Consequences for Cities, if Unaddressed	Sectors Involved	Sample Adaptive Responses (not an exhaustive list)	Relative Investment Level / Cost
	Storm water infrastructure unable to deal with current or future runoff, compounded by deforestation / degradation of natural storm water filtering functions.	Increased runoff in absence of vegetated land Increased flooding	Sanitation, solid waste Natural resources management	Short-term clearance/disposal of solid waste from drains to prevent clogging.	Low
				Investment in "green infrastructure" and ecosystem planning to improve natural storm water function (for example, contour planting, terracing, and afforestation for erosion control).	Low (localized planting) to high (large-scale infrastructure or afforestation) with significant economic and environmental cobenefits.
	Already high population densities and concentrated commercial activities (for example, ports and industry), located in coastal cities or in river deltas.	Loss of property and infrastructure, potentially before the end of their useful life	Private sector	Relocation of facilities out of flood-prone areas.	High
				Sea walls or other structural investments to protect against coastal flooding.	High
	Lower structural quality of homes, especially in informal settlements.	Loss of property and life	Housing, emergency management	Retrofit of old buildings and improved design of new buildings (if residents remain in vulnerable location).	Medium to high
				Stricter risk disclosure requirements for housing developers.	Political and staff investment for sound enforcement
				Public awareness / emergency preparedness initiatives to educate residents on flooding risks.	Low
Location of aquifers, wastewater treatment plants, and other infrastructure in coastal areas or on river deltas.	Saltwater infiltration of infrastructure (for example, potable water supplies and wastewater treatment)	Water supply Wastewater treatment	Modification of pipes.	Medium	
Areas affected by drought increase (likely)	Existing water scarcity and competing pressures for water use (for example, potable water, irrigation, wastewater, or hydropower).	Exacerbated water scarcity and competition	Water supply (with implications for energy sector in areas of hydropower generation)	Utility piped water supply (assuming water supply is resilient).	Medium to high
				Reclaimed wastewater (resilient if properly managed).	High
				Long-term demand management and water use efficiency programs.	Low to medium
	Food shortages or higher food prices because of impacts in other parts of the region or world.	Food and agriculture	Raising public awareness and developing municipal competency about food supply.	Low; with staff investment	
			Promotion of urban agriculture.	Staff investment and potential high costs, if involving land purchase	
			Development of city-level food storage infrastructure.	High	

Sources: IPCC 2007; Foster and others 2011; Horton 2009; Action Aid 2006; UN-Habitat 2011; Simply Green 2009; Henriques 2009. See end of Chapter 6 for full list of citations.



photo: John Isaac / WorldBank

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The full guide, including an interactive online version, is available at go.worldbank.org/EEBXSYP0 and www-esd.worldbank.org/citiesccadaptation.

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