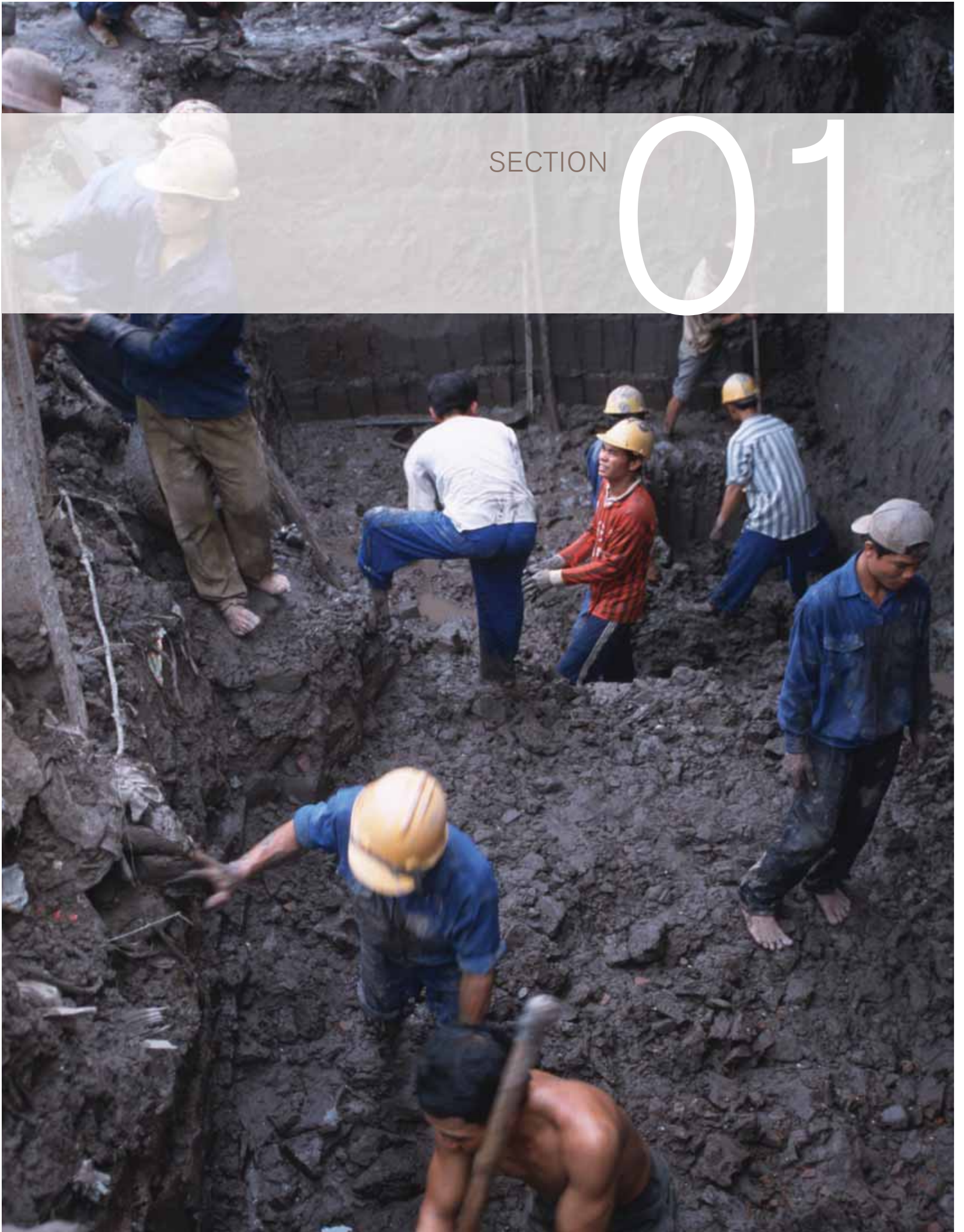


SECTION

# 01



# Understanding the Impacts of Climate Change and Disaster Risk Management

This Primer is intended to be a tool and an applied knowledge resource for local governments and their stakeholders to address climate change impacts and disaster risk management issues in their cities. It is not an exhaustive compilation of thought and practice to “prove” that climate change is a threat, and does not present recipes for action. Rather, it offers principles and examples of sound practice that a city can adapt to its particular context.

## A/ PRIMER OBJECTIVES

The Primer is an information resource for initiating a dialogue with local governments and their stakeholders. It emphasizes the importance of long-term communication and outreach and presents information that can be used by local governments in awareness campaigns and education programs at schools and community groups to explain potential impacts; who and what could be affected; and ultimately, what can and should be done.

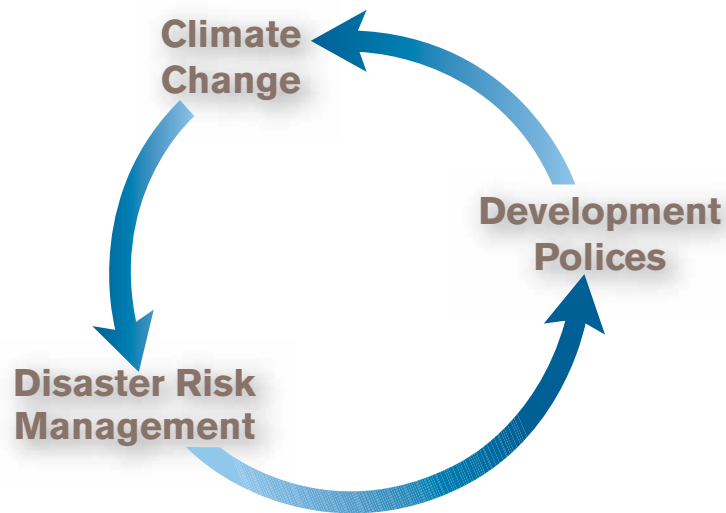
The Primer offers illustrative examples of addressing disaster risk management and climate change as essential components of urban development and management. The Primer reinforces the idea that sustainable development in urban areas must include disaster risk reduction and climate change actions to reduce vulnerabilities. Figure 1.1 illustrates the linkages between disaster risk management, climate change, and development policy. Action on any front impacts the city on the other two fronts, and the impact may be either positive or negative. It therefore becomes imperative to ensure that the agenda on any one front does not increase the vulnerability on others. The climate change agenda needs to be viewed through the prism of the development agenda and should be embedded in the policies for disaster risk management. Forging links to citizen and volunteer groups is becoming an important part of disaster risk management in many cities and could play a role in a city’s mitigation and adaptation programs as well.

### OBJECTIVES OF SECTION 01:

- Present objectives of the Primer.
- Discuss climate change and the need to address its impact.
- Highlight the linkage between climate change impact management, disaster risk management, and sustainable development in the context of urban management.

### OUTCOMES OF SECTION 01:

- Gain an understanding of the reason climate change impacts may affect cities.
- Understand the linkages between climate change impacts and disaster risk management with sound urban planning.
- Use the information and resource material of the Primer for planning, outreach, and educational initiatives.

**FIGURE 1.1** / Integrating climate change and disaster risk management into development policies

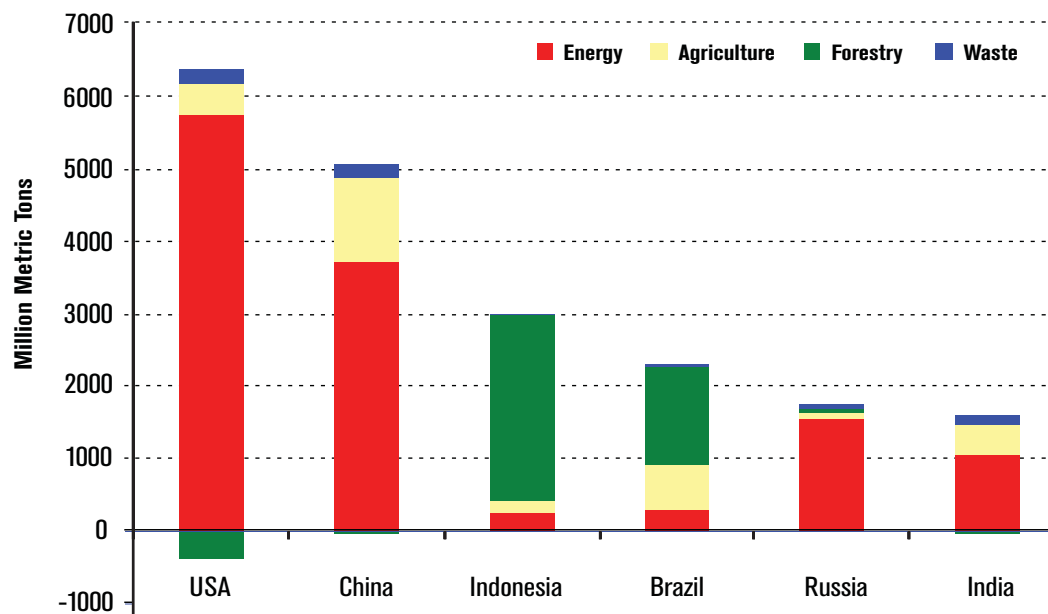
This Primer initiates a learning process that can be carried forward by local government on the issues of climate change, the potential consequences of climate change, and the critical relationship between current urban and financial trends with climate change, disaster risk management, and sustainable development.

## **B/ THE IMPERATIVES OF ACTION**

*East Asia is rapidly becoming a major contributor to GHG emissions.*

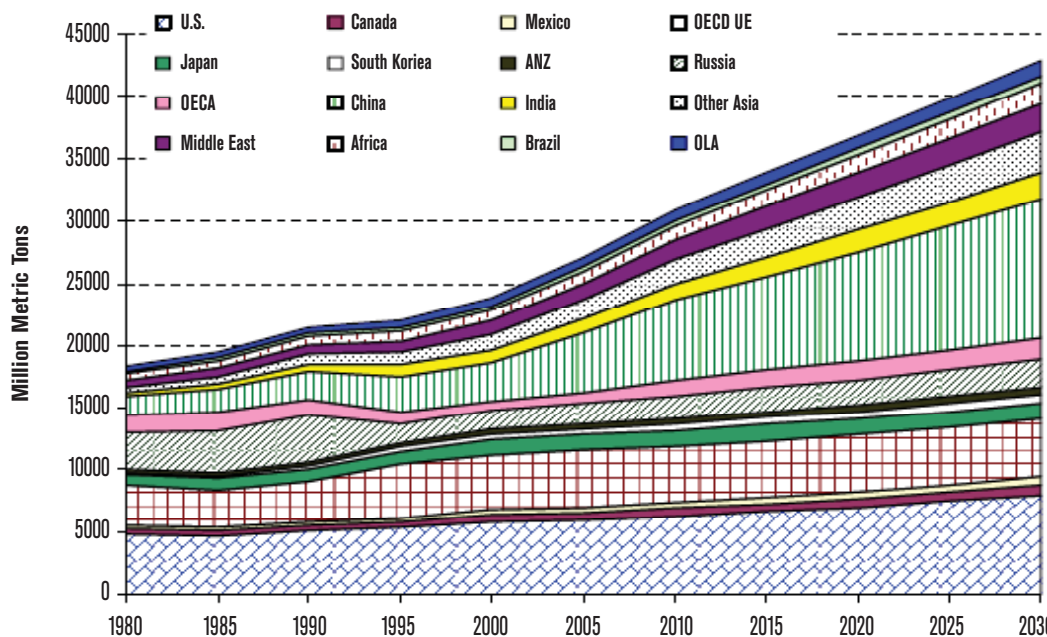
It is now undeniably evident that the global climate is changing, and that anthropogenic (human-induced) greenhouse gas (GHG) emissions are largely to blame. East Asia is rapidly becoming a major contributor to GHG emissions. In 2000, an estimated 18.7 percent of global emissions from fossil fuel combustion originated in the East Asia Region. By 2025, China alone is expected to increase its emissions by 118 percent.<sup>7</sup> Projections are showing increases in emissions across Asia and other parts of the world (Figure 1.3). According to the World Resources Institute, China ranked second (with 20 percent emissions) behind the United States (with 28 percent emissions) in the 2007 list of largest global emissions countries.<sup>8</sup> Sectoral sources of GHG, as shown in Figure 1.2 are from energy, agriculture, forestry, and waste.

FIGURE 1.2 / Largest global CO<sub>2</sub> emitters



Source: World Bank, *East Asia Environmental Monitor: Adapting to Climate Change* (Washington, D.C. 2007) and IEA, *World Energy Outlook* (Paris, France, 2007) for energy except for Indonesia, which uses 2005 PIE data; 2005 USEPA data for agriculture; Houghton, J., "Modeling Technological Change in Climate Policy Analyses," *Energy Economics*, Vol. 28, Issue 5-6, November 2006 for forestry data; and 2005 USEPA data for waste.

FIGURE 1.3 / Emissions across the world



Source: Energy Information Administration ([www.eia.doe.gov](http://www.eia.doe.gov), 2007) for historical emissions; and IEA, *World Energy Outlook* (Paris, France, 2007) for projected emissions.

*The International Red Cross and Red Crescent indicate that there is an increase in the intensity and frequency of disasters that climate change will only make worse.*

The International Red Cross and Red Crescent indicate that there is an increase in the intensity and frequency of disasters that climate change will only make worse. For the period 1994–1998, reported disasters averaged 428 per year. That figure jumped to 707 during the period 1999–2003 with the greatest rise in developing countries where there was a devastating increase of 142 percent.<sup>9</sup>

The Primer discusses an approach to deal with climate change impacts and disaster risk management issues that runs on a dual track for a resilient community. One track is to inform local officials of the need to lower carbon emissions. This track is illustrated with sound practices from cities that have implemented mitigation programs for energy efficiency, the use of nonfossil fuels, controlled urban sprawl, improved public transport, waste recycling, and water reclamation. The other track addresses the consequences of climate change and the increased frequency and intensity of extreme events and disasters related to this change. Adaptive measures are discussed to prepare for and control the conditions and disasters that climate change will only make worse. A resilient community is one that maintains a current information base to understand potential hazards, and is well informed in the preparation and implementation of its future growth and improvement plans. A resilient community also collects and reserves the financial resources required from a variety of sources, including national capital markets for climate change mitigation and adaptation initiatives as well as for response and reconstruction in times of natural disasters, especially earthquakes, floods, and storm surges endemic to the East Asia Region.

Through self-assessment and participatory activities, the Primer facilitates city governments and their stakeholders in identifying assets and liabilities and how climate change may impact them.

The Primer promotes the notion of investing in adaptation, preparedness, and mitigation through actions and investment programs as sound urban management for resilient communities. Successful initiatives to address climate change impacts and disasters will require human, technical, and financial resources. The Primer will guide users through city assessments and participatory activities in an exercise to consolidate a City Information Base and review local government organizations. City Profiles present successful approaches to building local expertise and teams. Incentives presented as sound practice are useful to engage the private sector and civil society in behavior and technology change. It is critical that the definition of urban infrastructure must be expanded from just basic services to include climate change impact and hazard management investments for a resilient built environment.

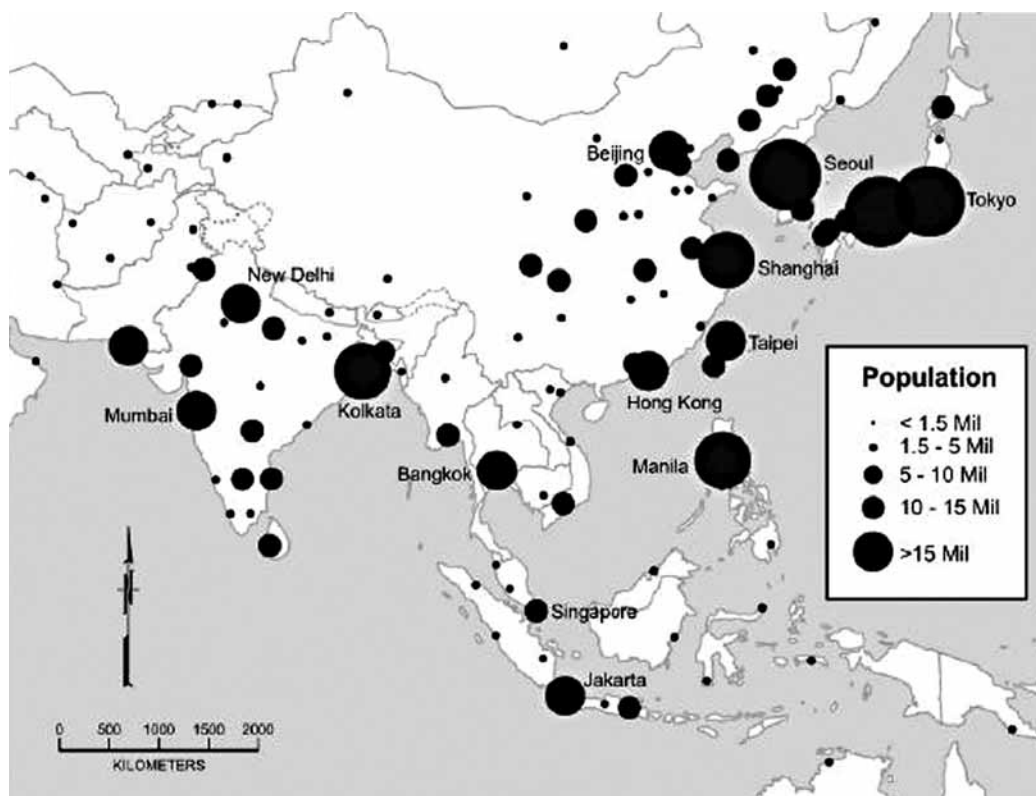
## **C/ DEVELOPING A RESILIENT CITY OF THE FUTURE**

The urban world is at a unique moment in time, especially in the East Asia Region. Three social, political, and financial movements are coming together in ways that will define future cities. The three movements are *urbanization*, *decentralization*, and *domestic capital market development*. How a city is structured to manage its growth and vulnerabilities is critical. A city's access to domestic capital markets opens up opportunities to reduce its dependence on uncertain and/or politically motivated national government grants, subsidies, and allocations. Cities are implementing their identified priorities with capital improvement programs through a stream of dedicated resources.

Climate change will impact future city spatial patterns, growth, and development. The world's population is moving to cities; one-half of the global population is already urban. By 2030 at least 61 percent of the world's population will be living in cities. Cities of the developing world will absorb 95 percent of all urban growth and will be home to almost 4 billion people, or 80 percent of the world's urban population. What was once dispersed rural poverty is now concentrated in urban informal and squatter settlements. Asia holds more than one-half of the world's slum populations of 581 million.<sup>10</sup> By 2015, 12 out of the largest 15 cities in the world will be in developing countries, and 4 of those will be in Asia.

The concentration of population in cities increases opportunities for people as well as their vulnerabilities to natural hazards, civil strife, and climate change impacts. In East Asia there are more than 30 mega cities (with populations of more than 5 million). The map in Figure 1.4 shows that most of the mega cities are in vulnerable areas for climate change (coastal cities) and with high disaster risks, as shown in Figure 1.5. The map in Figure 1.5 shows that seismic and climatic natural disasters are likely to occur mostly in Asia. Higher risk zones are in red for seismic events and in blue for climatic events.

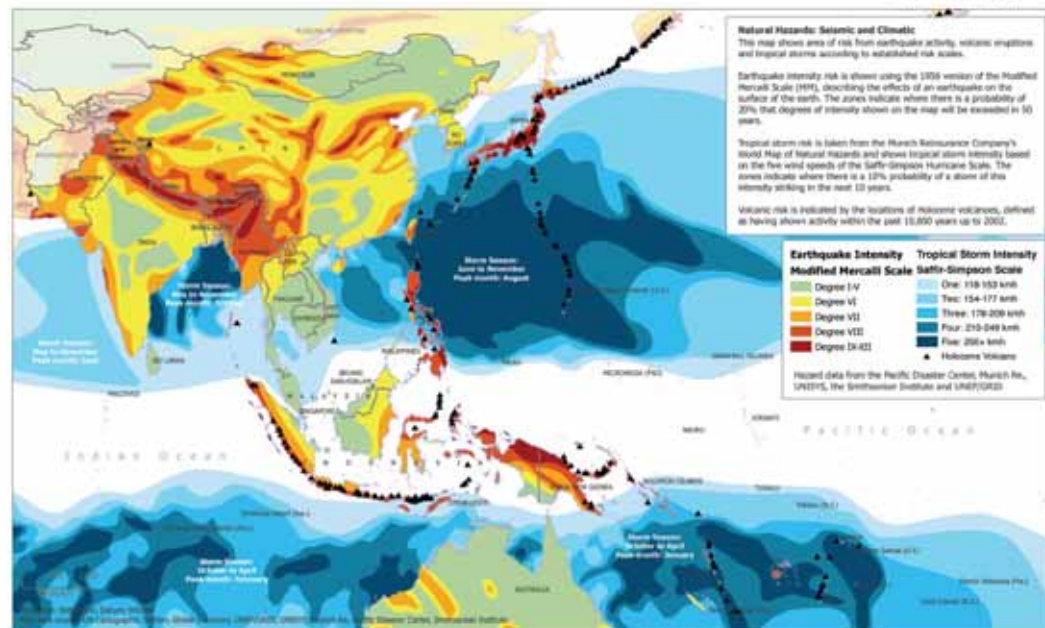
**FIGURE 1.4 /** Mega cities in East Asia



Source: Gill, I., and H. Kharas, *An East Asian Renaissance: Ideas for Economic Growth* (Washington, D.C.: World Bank, 2007).

**FIGURE 1.5** / Natural hazards: Seismic and climatic

Source: Map provided courtesy of the United Nations Office for the Coordination of Humanitarian Affairs, Regional Office for Asia and the Pacific (OCHA ROAP), <http://ochaonline.un.org/>

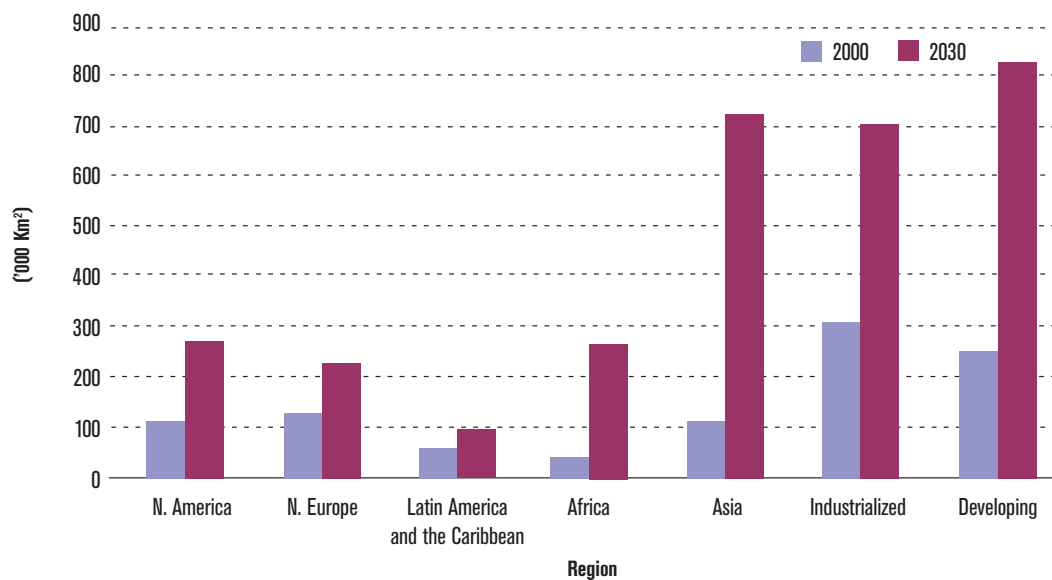


Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

*The lack of integrated land use and transport policies often do not allow for efficient, compact cities to develop.*

Climate-related vulnerability increases not only from flooding due to more precipitation and storm surges, landslides, drought, saltwater intrusion, and typhoons, but also because of earthquakes and other similar hazards, particularly where poor quality and ill-maintained infrastructure, low-quality building stock, and lower resilience of the high-density society come into play. For example, out of the 10 most populous cities in the world, Tokyo/Yokohama, Seoul/Incheon, Osaka/Kobe/Kyoto, Metro Manila, and Jakarta, all in East Asia, have moderate to high earthquake hazard.<sup>11</sup> Similarly, Of these, most are located on the coast and are vulnerable to storm surges and tsunami waves. Resilient cities need to develop plans with climate change in mind—new shelter options that are not located on marginal land in flood plains and steep slopes, at densities that control urban sprawl.

If average densities continue to decline, doubling of the developing world's urban population by 2030 will result in a tripling of their built-up areas. It is projected that Asia will see the largest increase during this time (Figure 1.6). While some of this increase is the natural consequence of urban population growth, inefficient land use and planning policies are partly to blame for urban sprawl. Furthermore, the lack of integrated land use and transport policies often do not allow for efficient, compact cities to develop with clusters of high-density nodes that can support mass transit options and efficient grouping of residential developments, commercial services, and centers of employment. This would create lower transit emissions, less energy-intensive development, and proximity to shelters and services in the case of emergencies.

**FIGURE 1.6 /** Built-up area projections by region

Source: Angel, S., S.C. Sheppard, and D.L. Civco, *The Dynamics of Global Urban Expansion* (Washington, D.C.: World Bank, 2005).

*What can a city do about warming temperatures, rising sea levels, and more frequent storms?* Cities are experiencing these consequences caused by increased levels of heat trapped in the atmosphere that modify weather patterns. While changes in average conditions can have serious consequences by themselves, the main impacts of climate change will be felt due to weather extremes and the consequent risk of natural disasters. For East Asia this means more frequent and intense floods, storm surges, and winds.<sup>12</sup>

Decentralization, an ongoing force in East Asia, represents a major shift in the way cities are managed. Local governments are now being endowed with responsibilities for self-managing as they struggle for the required authority to do so in a successful manner. Accessing domestic capital markets can make a difference in the way cities are governed. Addressing climate change impacts in city plan development requires capital, and the domestic capital market provides an attractive avenue for resources for sustainable programs to reduce climate change impacts.

#### **D/ MAINSTREAMING POLICY AND PRACTICE FOR LOCAL IMPACT**

The approach to dealing with climate change has focused on national or regional plans to reduce contributions to global warming. Much of this will be implemented in urban areas. However, climate change impacts and natural hazards challenge the resilience of cities (Table 1.1) and are, in their essence, urban governance and management issues.

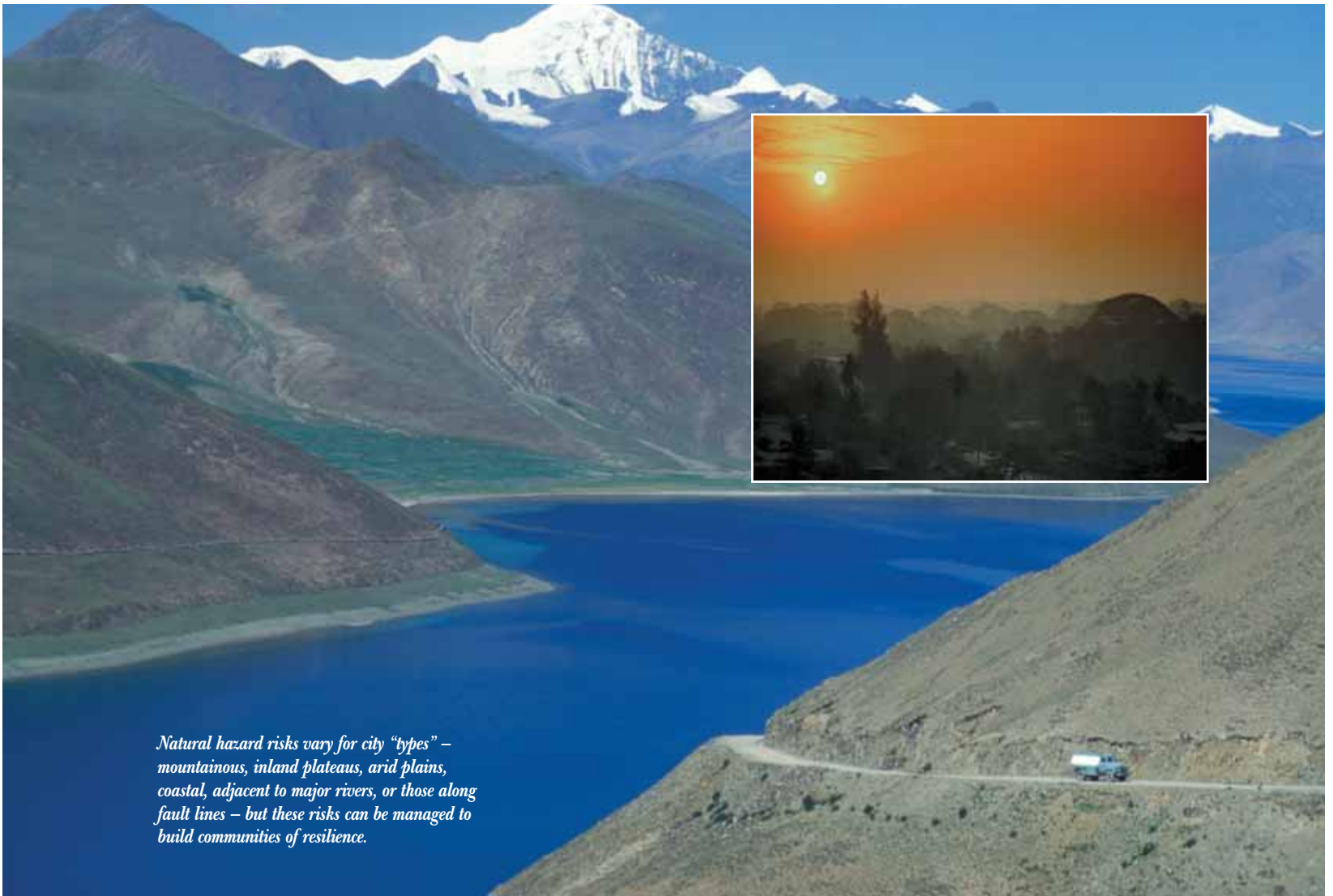
*Local governments are now being endowed with responsibilities for self-managing as they struggle for the required authority to do so in a successful manner.*

**TABLE 1.1 / Possible impacts of extreme climate change relevant to urban areas (mostly adverse in East Asia)**

Source: IPCC, *Synthesis Report – Summary for Policymakers*. Assessment of Working Groups I, II, and III to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC: Cambridge University Press, 2007).

Projected change in extreme climate phenomena and their likelihood	Consequences of climate change
Warmer with fewer cold days and nights, warmer and more frequent hot days and nights  (virtually certain)	<ul style="list-style-type: none"> <li>❑ Heat island effect</li> <li>❑ Increased demand for cooling</li> <li>❑ Declining air quality in cities</li> <li>❑ Effects on winter tourism</li> <li>❑ Reduced energy demand for heating (a short-term benefit but not in East Asia)</li> <li>❑ Reduced disruption to transport due to snow, ice (a short-term benefit, but not in East Asia)</li> </ul>
Warm spells/heat waves. Frequency increases over most land areas  (very likely)	<ul style="list-style-type: none"> <li>❑ Increased water demand</li> <li>❑ Water quality problems</li> <li>❑ Increased risk of heat-related mortality, especially for the elderly, chronically sick, very young and socially isolated</li> <li>❑ Reduction in quality of life for people in warm areas without appropriate housing</li> </ul>
Heavy precipitation events. Frequency increases over most areas  (very likely)	<ul style="list-style-type: none"> <li>❑ Adverse effects on quality of surface and groundwater</li> <li>❑ Contamination of water supply</li> <li>❑ Increased risk of deaths, injuries, and infectious, respiratory, and skin diseases</li> <li>❑ Disruption of settlements, commerce, transport, and societies due to flooding</li> <li>❑ Large displacement of people</li> <li>❑ Pressures on urban and rural infrastructures</li> <li>❑ Loss of property</li> <li>❑ Water stress may be relieved (short-term benefit)</li> </ul>
Intense tropical cyclone activity increases  (likely)	<ul style="list-style-type: none"> <li>❑ Power outages</li> <li>❑ Distress migration to urban areas</li> <li>❑ Disruption of public water supply</li> <li>❑ Increased risk of deaths, injuries, water and food-borne diseases; post-traumatic stress disorders</li> <li>❑ Disruption by flood and high winds</li> <li>❑ Withdrawal of risk coverage in vulnerable areas by private insurers</li> <li>❑ Potential for population migrations</li> <li>❑ Loss of property</li> </ul>
Increased incidence of extreme high sea level (excludes tsunamis)  (likely)	<ul style="list-style-type: none"> <li>❑ Decreased freshwater availability due to saltwater intrusion</li> <li>❑ Increased risk of deaths and injuries by drowning in floods and migration-related health effects</li> <li>❑ Loss of property and livelihood</li> <li>❑ Permanent erosion and submersion of land</li> <li>❑ Costs of coastal protection versus costs of land-use relocation</li> <li>❑ Potential for movement of populations and infrastructure</li> </ul>

A supportive institutional and policy environment at the state and national levels can enable local adaptation. Mainstreaming these issues into policy and practice leads to holistic rather than sectoral engagement in climate change. Cities act cross-sectorally, a critical approach for dealing with climate change and disaster management. In this context, mainstreaming implies integrating awareness of future climate change impacts into existing and future policies and plans of developing countries, as



*Natural hazard risks vary for city “types” – mountainous, inland plateaus, arid plains, coastal, adjacent to major rivers, or those along fault lines – but these risks can be managed to build communities of resilience.*

well as those of multilateral organizations. At the national and regional level, mainstreaming shifts responsibility for implementing change-response strategies from single ministries or agencies dealing with climate change (such as environmental departments) to all sectors of government, civil society, academia, and the private sector<sup>13</sup>. Similarly, mainstreaming requires that the division of local-level responsibility between the separate and distinct entities of a Sustainability Office and a Disaster Management Office should be integrated for a more comprehensive strategy to reduce carbon emissions and create effective responses to disasters and the consequences of climate change.

Local governments must be better informed to confront the potential impacts of climate change. Equally important will be the need to promote changes in technologies, citizen participation, and urban growth patterns all important parts of the behavior of urban populations that contribute to global warming and create vulnerabilities to disasters.

## **E/ THE RISKS OF DOING NOTHING**

As exemplified in the City Profiles, proactive leadership in dealing with climate change impacts mitigation, and adaptation are an exercise in good local government resource management practice. Leadership in Seattle (King County, Washington, USA), Singapore, Tokyo, and other cities,

*The risks of “doing nothing” can have disastrous consequences. ►*



who are dealing with potential climate change impacts, sum up their attitude about the uncertain future as their “no-regrets” policy. No-regrets policies and actions are those that make good sense to implement whether or not the consequences of climate change turn out to be as projected. These endeavors thus discount the uncertainty generated by climate change projections and predictions by supporting adaptation and mitigation strategies along with hazard-specific response capacity building. The strategies, plans, and activities are the cornerstone for sound planning.

Fear of change fuels resistance to the idea of climate change and thus action, especially in the industrialized world. Preventing a reduction in the standard of living is often the justification for inaction. Such a position denies the fact that, without action to address potential climate change impacts, the standard of living will suffer far worse consequences. What will become of natural resources if we do not learn to do more with less, or at least differently, especially related to water? How do we cope with increasing demands for energy if we are not generating more from sources other than fossil fuels? These are just a couple of risks to the standard of living that industrialized countries cherish and developing countries may adopt soon.

Climate change impacts and consequences can wipe out development gains and significantly reduce the standard of living. The recent cyclone that devastated Myanmar affected the lives of more than 2.4 million people and caused estimated damage in the billions of dollars. In the 1990s, disasters killed almost seven times more people in developing countries than in industrialized countries.<sup>14</sup>

The GDP will be affected by climate change impacts on water security, with increased competition for supply among urban water users, including domestic water supply and industrial and commercial usage. The GDP will also be affected by macro water policy that has favored agriculture and

irrigation over urban use. The unregulated distribution of water to agriculture in neighboring states continues to over-draw on the supply forcing Delhi, India, into a severe water shortage. The once free-flowing Yamuna River that supplied Delhi has been reduced to a slow trickle of sludge. The Mekong River provides water to the six countries through which it runs and borders—Cambodia, China, Myanmar, Lao PDR, Thailand, and Vietnam. Increased temperature in this region will increase evaporation and transpiration by 10–15 percent, affecting the Mekong’s supply of water to the towns and cities that now depend upon it.

*Climate change impacts and consequences can wipe out development gains and significantly reduce the standard of living.*