ABOUT THE STRAUSS CENTER

The Robert S. Strauss Center for International Security and Law at the University of Texas at Austin is a nonpartisan research center that engages the best minds in academia, government, and the private sector to develop unique, policy-relevant solutions to complex global challenges.

ABOUT THE CCAPS PROGRAM

The Climate Change and African Political Stability (CCAPS) program conducts research in three core areas, seeking to investigate where and how climate change poses threats to stability in Africa, identify strategies to support accountable and effective governance in Africa, and evaluate the effectiveness of international aid to help African societies adapt to climate change. The CCAPS program is a collaborative research program among the University of Texas at Austin, the College of William and Mary, Trinity College Dublin, the University of Denver, and the University of North Texas.

The CCAPS program is funded by the U.S. Department of Defense’s Minerva Initiative, a university-based, social science research program focused on areas of strategic importance to national security policy. Through quantitative analysis, GIS mapping, case studies, and field interviews, the program seeks to produce research that provides practical guidance for policy makers and enriches the body of scholarly literature in this field. The CCAPS team seeks to engage Africa policy communities in the United States, Africa, and elsewhere as a critical part of its research.

ABOUT THE PROJECT DIRECTORS

Robert H. Wilson is the Mike Hogg Professor of Urban Policy at the LBJ School of Public Affairs at the University of Texas at Austin.

Todd G. Smith is a PhD candidate at the LBJ School of Public Affairs and a CCAPS research assistant.

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EXECUTIVE SUMMARY

The increasingly significant challenges posed by global climate change are compounding the many difficulties – including high levels of poverty, strained infrastructure systems, and lack of adequate housing – facing governance structures in the large, rapidly growing cities of Africa. Changing weather patterns can drive heavy rainfall and more severe and frequent storms can lead to coastal and riparian flooding that threaten housing and infrastructure. Abnormally high temperatures can place severe strain on energy, water, and health systems. Rising sea levels threaten coastal cities with inundation of inhabited areas and saltwater intrusion of groundwater aquifers. This paper summarizes the findings of a CCAPS policy research project that seeks to answer three key questions: (1) How will the consequences of future climate change affect people living in African cities and what determines the vulnerability to these exposures?; (2) How does the development of policies, plans, and initiatives to build urban resilience to climate change vary across urban areas and hazard type and what factors explain the variation?; and (3) Are these initiatives to build resilience being adequately and sustainably implemented by the relevant actors and networks and what factors impact the efficacy of such initiatives? How can the effectiveness of resilience initiatives be improved?

Using a comparative case study approach, field research was conducted on the governance systems in a set of ten African cities: Accra, Ghana; Alexandria, Egypt; Cape Town, South Africa; Casablanca, Morocco; Dakar, Senegal; Dar es Salaam, Tanzania; Johannesburg, South Africa; Kampala, Uganda; Luanda, Angola; and Maputo, Mozambique. In the case studies, factors that encourage or impede policy development and implementation across governance systems are identified. The paper first describes the institutional landscape systems in which local governments are embedded, including the international and national governance context and international non-governmental and community-based organizations. Then it presents answers to the three research questions, followed by the general conclusions of the project.

INTRODUCTION

Climate change and its potential effects are increasingly important concerns to the scientific community, governments, international organizations, and exposed populations around the world. Over several decades, efforts to adapt to the changing climate have expanded. No regions of the world are unaffected by climate change, and residents of urban areas in low- and middle-income countries are particularly vulnerable. This vulnerability stems from high rates of urbanization coupled with poor urban planning, gaps in public services and infrastructure, settlement in hazard-prone areas, and high levels of poverty, illiteracy, and poor health. These factors are particularly pressing on the African continent, where development and governance challenges contribute to low adaptive capacity. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) identifies Africa as “one of the most vulnerable continents to climate change and climate variability” due partly to climate exposure, but also to low adaptive capacity and high vulnerability to climate-related hazards such as flooding, drought, and sea level rise.

This paper presents the findings of a project under the Climate Change and African Political Stability (CCAPS) program that examined the capacity of governmental systems to prepare for and respond to climate change and climate-related hazards in a set of large urban areas in Africa. The project gives priority to local government in developing resilience due to its key role in addressing urban vulnerabilities through the provision of local infrastructure and public services, promulgation and regulation of land use and building codes, and other local services that are crucial for effective adaptation to climate change. Although local government capacity in African cities has generally improved in recent decades, the priority for state reform in Africa has been primarily focused on national governments and political legitimacy. While many countries have developed, or are developing, national climate adaptation plans, efforts to systematically address adaptation at the local level frequently face the challenge of collaboration among multiple local government jurisdictions with limited capacity.
The policy domain of climate change is complex, both with respect to climate change science, projected impacts, and to the governmental/institutional framework for policy discussions and actions. The terminology used in climate change policy discussions is also complex, and practitioners and scholars often disagree over the definitions of such important terms as resilience and adaptation. The term resilience has come to be increasingly used in policy discussions,\(^6\) even though disagreements exist over its precise meaning, at least in academic communities.\(^6\) Resilience has a connotation of a system “bouncing back” (echoing a return to equilibrium in ecological systems or a material regaining shape following a perturbation, as in material sciences). One source of criticism of the use of the term in developing countries is that the pre-climate event status quo, especially the low socio-economic characteristics, is unacceptable and, therefore, building resilience should be framed as an issue of development and transformation of social conditions.\(^7\) In other words, traditional efforts to improve social and economic development must not be displaced by initiatives that improve resilience without, simultaneously, improving socio-economic conditions. The term resilience is subject to ongoing debate, but it has gained widespread use in policy and research communities concerned with climate change adaptation in urban areas.\(^8\)

The United Nations International Strategy for Disaster Reduction (UNISDR) defines resilience as “the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.”\(^9\) Adaptation is defined as “the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.”\(^10\) This study largely adopts these definitions, but with the understanding that in practice these concepts are highly interdependent. Building resilience in the face of climate change refers to the ability of communities and cities not only to respond to and absorb the effects of individual and potentially disruptive weather-related events, but also to sustain this ability in the face of climate change that may increase the frequency or intensity of such events in the future.

This research has sought to assess the ability of local governance systems in large African cities to develop resilience and thereby enhance the collective well-being of their populations. The three primary research questions were:

1. How will the consequences of future climate change affect people living in African cities and what determines the vulnerability to these exposures?
2. How does the development of policies, plans, and initiatives to build urban resilience to climate change vary across urban areas and hazard type and what factors explain the variation?
3. Are these initiatives to build resilience being adequately and sustainably implemented by the relevant actors and networks and what factors impact the efficacy of such initiatives? How can the effectiveness of resilience initiatives be improved?

The project was exploratory in nature with conclusions drawn from current practices, issues, and constraints on action by local government. A comparative case study method was adopted as the analytical framework and ten major African cities were selected for study (see Appendix for case selection), including Accra, Ghana; Alexandria, Egypt; Cape Town, South Africa; Casablanca, Morocco; Dakar, Senegal; Dar es Salaam, Tanzania; Johannesburg, South Africa; Kampala, Uganda; Luanda, Angola; and Maputo, Mozambique. (see Figure 1).\(^11\) Each city has a unique institutional structure and context (including the authority vested in local governments by national government) and a unique set of exposures to weather-related hazards. This uniqueness creates a rich framework for drawing patterns of outcomes and factors affecting those outcomes.
POLICY SYSTEMS AND URBAN RESILIENCE

The emerging role of local government in building resilience in African cities is affected by broader policy systems, including international efforts that address climate change and related issues. A full history of the international efforts to address climate change is beyond the scope of this research, but several elements of the international framework are crucial for understanding both national and local government efforts in Africa.

The effects of human activity on the global climate system are complex and are subject to intense and ongoing scientific research. Efforts to reduce the effects of human activity, primarily by reducing greenhouse gas emissions, especially in the transportation or energy sectors, are referred to as mitigation strategies. The policies and plans of action to help human and natural systems adapt to the impacts of climate change are commonly referred to as adaptation strategies, and are the focus of this project.

The primary forum for aggregating and coordinating analytical studies of climate change and developing guidelines for mitigation and adaptation is the Intergovernmental Panel on Climate Change (IPCC), created in 1988. The primary forum for international deliberations and agreements is the United Nations Framework Convention on Climate Change (UNFCCC), established in 1992, with ongoing discussions occurring in the Conferences of the Parties (COPs) that are held annually. While the primary concern of the UNFCCC—commonly referred to as the Climate Convention—has been climate change mitigation, to “assist countries, especially developing ones, in their efforts to adapt to the effects of climate change” has become an objective.

Multilateral and nongovernmental organizations have adopted measures to encourage developing countries to engage in adaptation initiatives and these efforts are influencing national and to a lesser extent, local government adaptation strategies. While projections of adaptation costs vary widely, the World Bank estimates that the total annual worldwide cost for adaptation in developing countries will be US$75 to 100 billion per year over the next 40 years. That developing countries lack the resources to effectively address adaptation challenges is, however, widely recognized. Consequently, a multitude of funding mechanisms intended to channel funds for climate change adaptation into developing countries have emerged.

FIGURE 1. Map of Selected Cities
The Global Environment Facility (GEF), established in 1991, is the primary financial mechanism for the UNFCCC, among other conventions. The GEF provides grants to developing countries to address environmental issues and is funded by 183 countries, civil society organizations, and the private sector. The GEF supports projects both in mitigation and adaptation, and manages two funds that are specifically focused on adaptation: the Least Developed Country Fund (LDCF) and the Special Climate Change Fund (SCCF).

The LDCF has provided funding for eligible countries to prepare National Adaptation Programmes of Action (NAPAs), which identify and prioritize national adaptation activities. To be eligible for funding from this fund a country designated by the UN as a Least Developed Country (LDC) is required to submit a NAPA to the UNFCCC. Since the funds for operationalization following the COP11 in 2005, 47 LDCs have submitted NAPAs to the UNFCCC, including 33 from the African continent, five of which are included in this study. Despite the completion of these plans, resources for implementing these plans are generally not available, either through national sources or international sources.

Other sources of funding for climate change adaptation include public-private partnerships, insurance and disaster pooling, development assistance, and foreign direct investment as well as governmental resources of individual countries. The United Nations Human Settlements Program (UN-HABITAT) Cities and Climate Change Initiative collaborates with local governments to implement mitigation and adaptation measures. Since 2008, the World Bank, the African Development Bank, the Asian Development Bank, the European Bank for Reconstruction and Development, and the Inter-American Bank have supported adaptation strategies through Climate Investment Funds (CIFs), which support “low-emission and climate resilient development.” Apart from the contributions of developed countries to special climate funds and multilateral organizations, many countries are adjusting their bilateral development assistance efforts to incorporate climate change considerations, including the U.S. Agency for International Development (USAID), the Department for International Development (DfID) of the United Kingdom, the German Society for International Cooperation (GIZ), the Swedish International Development Cooperation Agency (SIDA), and the Danish International Development Agency (DANIDA), among others.

The broad, complex effects of climate change make the issue relevant to a wide range of organizations with diverse missions. Several multilateral organizations with distinct missions are also incorporating climate change into their primary objectives. For example, the United Nations Environmental Program (UNEP), which was crucial to the creation of the IPCC, has identified climate change as one of six focal points for achieving environmental goals. Similarly, the United Nations Development Programme (UNDP) has prioritized increasing awareness of climate change in its diverse set of goals that include poverty reduction and achievement of the Millennium Development Goals. In addition to adjustments in missions and goals of existing organizations, new organizations have also emerged to address climate change.

Disaster risk management is a policy area increasingly affected by international recognition of the impacts of climate change. International bodies like the International Federation of Red Cross and Red Crescent Societies (IFRC), the UNISDR, and the World Bank recognize the overlapping and reinforcing relationship between disaster risk management and climate change. Since 2005, the primary international agreement on global disaster risk reduction principles and priorities has been the Hyogo Framework for Action 2005–2015. In addition, the World Bank manages the Global Facility for Disaster Reduction and Recovery (GFDRR), which is “a partnership of 41 countries and 8 international organizations committed to helping developing countries reduce their vulnerability to natural hazards and adapt to climate change.” The World Bank’s funding of disaster risk assessments has been important to the development of urban resilience efforts in several of the cities in this study.

Two points about the international policy framework for climate change are particularly relevant to this project. First, an extensive international network of organizations and funds to assist developing countries to prepare for and respond to climate change has developed in the last decade. It is a multi-faceted network and its complexity is driven in part by the far-reaching nature of climate change and its
potential consequences; that is, its effects are germane to a multitude of concerns including economic development, environmental protection, disaster risk management, public health, food security, and others. Even though the overall level of funding may be inadequate to meet adaptation needs in developing countries, there is little doubt that the international support effort is diverse and substantial. But this leads to a second point. The diversity of organizations involved in the international effort means national governments attempting to access resources, both technical and financial, for climate change adaptation must interface with a range of actors, each with their own protocol and regulations. Meeting the requirements of each funding organization can be a complicated endeavor for governments with limited capacity, limiting their ability to access adaptation resources.

Most national governments in Africa recognize the importance of developing climate change policies required to respond to current challenges and prepare for future impacts. Motivated in part by international policy systems, these national policies serve the dual purpose of allowing countries to assess the varied and widespread impacts of climate change in their countries and to identify strategies to address these impacts. This step implies that national governments will balance a climate change agenda with other national priorities and resources. This step is also critical in demonstrating to international donors that the country has identified adaptation requirements and that resources can be used effectively. But implementation of adaptation strategies necessarily depends on the capacity of national and local governments.

Before turning to the results of the study, several points about the national and local governmental framework for addressing climate change adaptation need to be made. State reform, often undertaken simultaneously with democratic consolidation, has been a paramount issue in recent decades in many African countries, including the ones studied in this project. Governmental structure and authority of local government varies across countries, but, in general, reforms are being undertaken in the context of relatively low levels of development that necessarily imply severe constraints on the capacity of the public sector, especially at the local level. Despite efforts to decentralize governments, by strengthening local governments through broadening authority and deepening administrative capacity, the governmental structure in most African countries remain relatively centralized and this will prove to be a key factor in understanding the roles of local government in developing urban resilience to climate change. Even though international support focuses primarily on national governments, a practical choice given the levels of governmental centralization, international attention has also translated into the development of local level policies, the focus of this study.

**CLIMATE CHANGE EXPOSURES AND SOURCES OF VULNERABILITY**

Climate change exposure and vulnerability are distinct concepts. The former is the result of location in a hazard zone that puts people, property, and systems at the risk of losses as a result of a climate event. Climate projections hold considerable risk for the African continent. To limit climate change exposure, significant progress in climate change mitigation—interventions and policies that reduce greenhouse gas emissions or enhance the sinks of greenhouse gases—must be made. Vulnerability, on the other hand, is a result of the characteristics of human systems, including the built environment, that contribute to establishing the level of harm (damage) that can accrue during a climate event. The combination of exposure and high vulnerability, the topics examined in this section, due to characteristics of settlement patterns and populations and low adaptive capacity make Africa particularly vulnerable to the impacts of climate change.
Exposures

Weather patterns generate different types of hazards as well as different levels of exposure in specific geographies. Increasing atmospheric temperatures are projected to shift the frequency, intensity, duration, and timing of storms worldwide and generate greater intra-annual variation in precipitation and lead to sea level rise. Heavy but short precipitation events mean that the same areas that are subject to flooding can also be subject to drought. Significant variability in rainfall in many of the cities studied in this report already exists and climate change will likely exacerbate this variability (see Table 1).

In order to contrast the effect of different types of exposures on governmental systems and their responses, the selection of case study cities incorporated the hazard profiles of cities (see Table 2; the criteria and selection process of case studies are described in the Appendix). The three primary hazards relevant in urban Africa – flooding, water scarcity and sea level rise – are examined in the following section.

<table>
<thead>
<tr>
<th>City</th>
<th>Average</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accra</td>
<td>957.2</td>
<td>811.8</td>
<td>1179.1</td>
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<td>Alexandria</td>
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<td>109.1</td>
<td>246.1</td>
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<td>861.8</td>
<td>533.5</td>
<td>1103.4</td>
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<tr>
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<td>389.8</td>
<td>245.7</td>
<td>551.0</td>
</tr>
<tr>
<td>Dakar</td>
<td>447.9</td>
<td>271.2</td>
<td>677.3</td>
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<tr>
<td>Dar es Salaam</td>
<td>909.4</td>
<td>378.3</td>
<td>1428.5</td>
</tr>
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<td>Johannesburg</td>
<td>691.6</td>
<td>450.6</td>
<td>1073.3</td>
</tr>
<tr>
<td>Kampala</td>
<td>1362.1</td>
<td>914.8</td>
<td>1665.3</td>
</tr>
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<td>Luanda</td>
<td>821.4</td>
<td>688.1</td>
<td>1024.3</td>
</tr>
<tr>
<td>Maputo</td>
<td>892.5</td>
<td>495.3</td>
<td>2066.4</td>
</tr>
</tbody>
</table>

Source: Global Precipitation Climatology Centre

<table>
<thead>
<tr>
<th>City</th>
<th>Storms</th>
<th>Flood</th>
<th>Wildfire</th>
<th>Low Elevation</th>
<th>Drought</th>
<th>Chronic Aridity</th>
<th>Total Exposure*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alexandria</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>12.5</td>
</tr>
<tr>
<td>Maputo</td>
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<td>3</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>Dar es Salaam</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>9.5</td>
</tr>
<tr>
<td>Casablanca</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Cape Town</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>8.5</td>
</tr>
<tr>
<td>Luanda</td>
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<td>1</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
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<td>0</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Johannesburg</td>
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<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
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<td>0</td>
<td>0</td>
<td>5</td>
<td>2</td>
<td>4.5</td>
</tr>
<tr>
<td>Kampala</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>


* Total exposure = Storms + Flood + Wildfire + (Drought + Chronic Aridity) / 2. Drought and chronic aridity are two complementary measures of water scarcity
Flooding. Increasing temperatures and elevated atmospheric temperature are projected to shift the frequency, intensity, duration, and timing of storms worldwide. Although much of Africa will actually have less precipitation, the intensity of storms is projected to increase. This means that extreme heavy rainfall that previously occurred once every 20 years will now occur once every 15 years. Looking at specific regions of the continent, there are projections for increased precipitation in areas of western Africa and eastern Africa. This rain will likely be concentrated during current heavy-rain periods. This increases the chance for flooding, without improving the availability of water during the dry seasons. Researchers have also identified increased frequency of heavy rain events in many southern African nations. Coastal areas are especially subject to flooding as a result of both precipitation events and sea level rise. An estimated 54 million Africans live in vulnerable Low Elevation Coastal Zones (LECZ), defined as areas 10 meters or less above sea level. Areas around rivers and creeks are also susceptible to riverine flooding, though localized flooding occurs outside these areas as well, especially in more heavily developed settings. Flooding can cause significant human and economic losses and is unique in the visibility of its effects, as both a fast-onset and localized hazard.

Water Scarcity. Despite projections for increased exposure to flooding in many parts of Africa, many regions are also at risk of water scarcity and drought. Annual variation in precipitation and heavy but short precipitation events mean that the same areas that are subject to flooding can also be subject to drought. As depicted in Table 1, there is already significant variability in rainfall in many of the cities studied in this paper, and climate change will exacerbate this variability. Different climate models predict a 20 percent decrease in overall rainfall along the Mediterranean coast of North Africa, northern Sahara, and west coast of Africa by 2099. As can also be seen in Table 1, cities in North Africa already have little rainfall, so the effects of this decreased precipitation could be significant. Additionally, southern Africa is estimated to see a 30 percent decrease in rainfall during the already dry winter period. These projections suggest increased frequency of droughts as well as heightened water scarcity. Drought is already a major issue in Africa, with one-third of the population living in drought-prone areas. Overall, these and other trends could mean that, as soon as 2020, anywhere between 90 and 220 million people across the continent may suffer increased water stress due to climate change. While droughts are specific temporal events, water scarcity differs from flooding in that it has a slower onset time, and effects are often more distributed over space and time.

Sea Level Rise. Sea levels are rising around the globe as a result of melting land-based ice, such as glaciers and ice sheets, and thermal expansion (i.e. the expansion of water as it warms). In addition to inundation of low-lying areas, sea level rise can lead to coastal erosion and damage of infrastructure and built areas along the coast. Many major cities of Africa are coastal. Given these population concentrations and current projections for sea level rise, the homes of an estimated 16 to 27 million people across the continent could be flooded annually by 2100, amounting to US$5 to 9 billion per year in damage. North Africa is considered particularly vulnerable to sea level rise along the Nile Delta in Egypt where land elevation is especially low. Sea level rise can also contribute to water scarcity; it can lead to saltwater intrusion in underground aquifers that can be an important source of drinking water, especially for poorer populations not connected to water networks. Similarly to water scarcity, sea level rise tends to have a slower onset time, though its effects are localized and visible.

It is important to re-emphasize the uncertainty surrounding climate projections. Climate modeling tools are more effective at modeling the magnitude and distribution of global temperature change, but modeling precipitation is more problematic. The error associated with climate models is compounded by a lack of research and climate data in several African countries. Despite uncertainty on the exact nature of projections, policy makers currently face and will continue to face challenges associated with increased variability and intensity of precipitation events throughout the continent, with especially heavy rainfall in eastern Africa; drying and drought in northern, western, and southern Africa; and sea level rise along all coastal areas, especially in north Africa.
Human Created Sources of Vulnerability

The impact of weather-related hazards is related to a location’s degree of exposure to a hazard (e.g., high elevations are not exposed to sea level rise) and to levels of vulnerability at that location. In other words, vulnerability will vary by hazard type and by geographic location. For most of the ten cities studied here, the interaction of exposure to hazards and characteristics of geographic location is perilous. Most of these cities assumed enhanced roles as transportation hubs in the context of colonization and they have grown into major centers of economic activity and population, with substantial fixed investments in infrastructure and other economic assets, as they integrated into the world economy. But patterns of urbanization interact with the unique risk profiles of the cities to create vulnerabilities that may well increase over time.

**Location.** Geographic location and topography substantially contribute to vulnerability. Cape Town is at risk for storm surge and experienced significant coastal erosion during a powerful 2008 storm. Dakar sits on a peninsula that extends into the Atlantic Ocean, the most western point of mainland Africa. Every coastal city in this study is, to some extent, vulnerable to the effects of sea level rise. Rising sea levels will have a dramatic impact on industry (especially ports), residential communities, and tourism. But inland cities, such as Kampala, may also be subject to riverine and localized urban flooding. The north African cities of Casablanca and Alexandria experience arid climate conditions and are more exposed to the hazard of drought, and Johannesburg, situated between two river basins, is reliant on inter-basin transfers for its water supply making it particularly vulnerable to water shortages.

**Historical Settlement Patterns, Colonial Influences, and Political Instability.** The realities of urban life can dramatically increase vulnerability to climate hazards. Each of these major African cities has areas of high population density and poor residents. Past urban development practices, especially urban planning practices, have exacerbated vulnerability not only in these ten cities, but across urban Africa. Most cities in this study continue to be heavily influenced by colonial planning systems. The South African cities of Cape Town and Johannesburg grew under the system of racial separation established by the British colonial government and continued under the apartheid system of the National Party government, resulting in low residential densities in the city centers and higher-density, low-income areas in the cities’ peripheries and townships. Land tenure systems create uncertainty surrounding land ownership in some cities. In Accra, for example, tribal authorities often control the distribution and use of large tracts of land and lack of clear and unencumbered land titles can constrain investments in public infrastructure as well as in private residences.

Political and armed conflict can also affect urban vulnerabilities in indirect ways. The extended conflict in northern Uganda ended in 2006, but left a legacy of substantial rural to urban migration. Angola’s civil war lasted until 2002 and caused a tremendous amount of internal displacement. Rural conflict, due to resource scarcity and other issues, can drive migration into urban areas. Egypt’s ongoing revolutionary climate creates uncertainty around governmental capacity to manage urban development and strengthen local governments.

**Asset Exposure.** Many of these cities assumed roles as transportation hubs in the context of colonization and they have grown into major centers of economic activity and population, with substantial fixed investments in infrastructure and other economic assets. The Johannesburg area accounts for nine percent of the gross domestic product (GDP) of the entire continent. Major economic interests and assets in Senegal are concentrated in Dakar, a city uniquely exposed at the tip of a peninsula. The ports in coastal cities are especially vulnerable to storm events and sea level rise. In addition, tourism is a common and essential industry in many of Africa’s major coastal cities. The concentration of economic and physical assets further heightens vulnerability to hazards in these cities.

**Urban Planning and Building Regulations.** Deficiencies in land use and transportation planning, infrastructure, drainage, and sanitation, a common problem among many of the cities in this study (see Table 3), exacerbate vulnerabilities. The extent to which infrastructure serves residential populations...
varies across the cities, related in part to levels of national development. Alexandria, Cape Town, and Johannesburg, cities in middle-income countries, exhibit better infrastructure coverage than in the other seven cities in lesser-developed countries. Growing populations further strain urban services, including drainage, waste collection, and disaster response systems, that are crucial elements for resiliency. If drainage pipes and channels are too small or non-existent, relatively minor precipitation events can lead to flooding. Even with sufficient drainage systems, inadequate waste management can result in trash blocking the flow of water.48

Vulnerabilities are further accentuated by poorly regulated urban development. For example, the local government of Dar es Salaam has been without a comprehensive city plan for an extended period. In Accra, some residents have reported waiting almost 10 years for a building permit, often resulting in unregulated construction before permits are received. In Casablanca, both informal settlers and businesses routinely disregard land use regulations for riverbeds and coastal areas. Kampala's drainage system, built in 1960 and sized for the population of that period, 137,000, is ill-equipped to serve today's 1.7 million residents. Economic interests often trump zoning concerns, resulting in high-cost residential buildings constructed on the city's coastline which is vulnerable to erosion.

TABLE 3. Development Indicators for Various Years (%)

<table>
<thead>
<tr>
<th>City</th>
<th>Access to Electricity</th>
<th>Access to Improved Sanitation</th>
<th>Access to Improved Water</th>
<th>Net Primary School Attendance Rate</th>
<th>Net Secondary School Attendance Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accra</td>
<td>85.8</td>
<td>89.4</td>
<td>64.0</td>
<td>80.1</td>
<td>53.4</td>
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<tr>
<td>Alexandria</td>
<td>100.0</td>
<td>99.9</td>
<td>100.0</td>
<td>90.6</td>
<td>70.6</td>
</tr>
<tr>
<td>Cape Town</td>
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<td>95.9</td>
<td>97.1</td>
<td>76.6</td>
<td>71.0</td>
</tr>
<tr>
<td>Casablanca</td>
<td>91.8</td>
<td>96.4</td>
<td>76.8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Dakar</td>
<td>94.0</td>
<td>97.8</td>
<td>95.9</td>
<td>73.6</td>
<td>42.7</td>
</tr>
<tr>
<td>Dar es Salaam</td>
<td>63.0</td>
<td>43.0</td>
<td>59.4</td>
<td>89.0</td>
<td>42.6</td>
</tr>
<tr>
<td>Johannesburg</td>
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<td>99.0</td>
<td>97.8</td>
<td>76.8</td>
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<tr>
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<td>39.6</td>
<td>23.6</td>
<td>82.8</td>
<td>88.8</td>
<td>18.8</td>
</tr>
</tbody>
</table>

Note: Data not available for Luanda.

All cities in this study are experiencing rapid population growth which in turn increases land values. Even though land just beyond the periphery of cities is being converted to urban uses, the housing supply cannot keep pace with the population increase. Growth pressures lead to settlements in areas previously deemed unfit for development, such as on wetlands, in floodplains or natural drainage corridors, and on sandy soil with foundations that may be swept during flood events, thereby aggravating existing vulnerabilities. Zoning regulations may prohibit settlement and development in vulnerable areas but are too often not enforced. The loss of wetlands in Kampala due to urban development, for example, exacerbates flooding. Paving over previously permeable natural areas will also disrupt the natural absorption of water, and if development occurs over rivers and creeks, it can block natural outlets for water and create regular flooding. Development in coastal areas can increase coastal erosion and development in coastal wetlands can compound the effects of sea level rise. Similarly, the removal of trees and plants in Accra has destroyed natural barriers along coastlines and exacerbates coastal erosion. Since wetlands naturally expand inward with a rising sea and prevent erosion and saltwater intrusion, development in these areas prevents the wetlands from serving their natural purpose.49
Management of water resources is increasingly acute in cities both in terms of supply of water and its distribution to growing urban populations. Many countries dedicate scarce water resources to irrigating agriculture, despite typically low economic returns. Dumping of untreated water combined with agricultural and industrial runoff can pollute ground and surface water resources. Unregulated extraction of groundwater can lead to depletion of aquifers, raising the risk of saltwater intrusion and the subsequent pollution of the groundwater. Inefficient water distribution systems and inadequate water storage capacity lead to the inefficient use of precipitation. Even though climate change scientists are reluctant to attribute specific effects of climate change on water resource availability due to natural variability in precipitation, governments are fully aware that the rapidly growing demand for water due to high population growth and economic development has the potential to exhaust scarce resources. In sum, both water management policies and quality of infrastructure have significant effects on water stress and scarcity.

Each city is uniquely exposed to a range of climate hazards, and exposure to a single hazard can vary across different parts of a city. Only low-lying areas of a city may be exposed to flooding, as in Luanda where much of the city is elevated, but, in contrast, water scarcity can affect a city’s entire population as seen in Casablanca. While exposure is largely determined by weather patterns, which are changing due to climate change, vulnerabilities are determined both by geography and human settlement characteristics. Differing housing and infrastructure conditions can make some neighborhoods of a city more vulnerable than others. Now the discussion turns to efforts of local governments to address these vulnerabilities.

**FORCES SHAPING THE RESILIENCE AGENDA IN AFRICAN CITIES**

Among the ten cities examined in this project, only two local governments, in Cape Town and Johannesburg, have formally adopted climate change adaptation policies (see Table 4). As of 2012, Maputo was developing a plan but it was not yet adopted or implemented. In the other seven cities, climate change adaptation has not been formally integrated into local government initiatives. But in all ten cities, a range of local government functions, including disaster response, water resource planning, and urban infrastructure and planning, are affected directly by the three climate hazards examined here—flooding, sea level rise, and drought—and local governments have adopted plans or policies for these functions. Therefore, local climate change adaptation policies are subdivided by (1) those that are explicitly adaptation policies (see column 3 in Table 4) and (2) those that address climate change impacts even if not explicitly concerned with climate change adaptation (see column 4 in Table 4). This unanticipated categorization creates a framework for examining the introduction of the concept of climate change adaptation into local policymaking processes. This section presents the findings regarding local policymaking, but the discussion first considers national climate change policy as an important contextual factor that affects local adaptation policymaking.
### TABLE 4. National and Local Climate Change Adaptation Plans, by City

<table>
<thead>
<tr>
<th>City</th>
<th>National Change Plans</th>
<th>Plans Relevant to Climate Change Hazards</th>
<th>Local Government Plans and Initiatives Relevant to Climate Change Hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accra</strong></td>
<td>• Ghana Plan of Action for Disaster Risk Reduction and Climate Change Adaptation (DRR/CCA) &lt;br&gt; • National Climate Policy</td>
<td>• Ghana Shared Growth and Development Agenda</td>
<td>• Disaster Management Plan</td>
</tr>
<tr>
<td><strong>Casablanca</strong></td>
<td>• National Plan Against Global Warming &lt;br&gt; • Resilient Oases Plan &lt;br&gt; • Villes Sans Bidonville</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
National Adaptation Policy Context

Climate change adaptation agendas have emerged in developing countries in recent years due to concerns about potential impacts of climate change and to meet obligations under international conventions. UN organizations, the World Bank, and other parties have actively promoted the climate change mainstreaming of national ministries. The adaptation agenda tends to emerge first at the national level, as is typically the case in the countries studied here. As national governments articulate climate change policy priorities to be assigned to mitigation, adaptation, and disaster risk management, a balance must be struck with other national priorities. Reflecting these priorities, national climate change adaptation policies found in eight of the nine countries studied in this project (in Morocco national policy focused primarily on mitigation, not adaptation), rarely address urban areas.

Five of the countries have adopted National Adaptation Programmes of Action (NAPAs), under the auspices of the Least Developed Countries Fund (LDCF). These NAPAs give little or no attention to adaptation in urban areas. For example, none of the top 15 priorities identified by Angola’s NAPA address urban adaptation, and Luanda is not included among the five regions addressed by the country’s NAPA vulnerability assessment. Tanzania’s NAPA emphasizes the risks faced by the country’s interior (water scarcity, drought, and food insecurity) but pays little attention to urban coastal areas. In Uganda, all NAPA pilot projects currently underway are located in rural areas, and none are being implemented in Kampala. The national government of Mozambique has focused its efforts on rural and agricultural adaptation and urban climate change concerns are largely ignored. National prioritization of rural climate change issues, as observed in the NAPAs, partially explains the relatively modest adaptation efforts found in the five cities in LDCs (Dakar, Dar es Salaam, Kampala, Luanda, and Maputo), a finding further discussed below.
Three case study countries not subject to the NAPA requirement, Egypt, Ghana, and South Africa, have comprehensive national climate change policies and plans, some developed with support of international organizations or under obligations of international conventions. For example, the UNDP’s African Adaptation Programme supported the development of the Ghana Plan for Disaster Risk Reduction and Climate Change Adaptation. Morocco, the fourth of the non-LDC case study countries, has a national plan that focuses on global warming, rather than adaptation, but it has yet to be implemented. In addition to their NAPAs, Tanzania adopted a national climate change policy in 2012, and Uganda has completed a policy that, as of 2013, was under review for adoption by parliament. On net, local governments in urban areas find little support for local adaptation policy in national policy frameworks.

Explaining Local Adaptation Policymaking

Despite increasing interest and attention in policy communities in Africa and elsewhere devoted to climate change adaptation, the topic rarely is formalized in policies and plans of local governments. This section discusses the factors relevant to the lack of engagement of local governments, at least in terms of formal policies and plans, in adaptation efforts.

National-local Government Relations in Climate Change Adaptation Policy. The structure of governmental systems was found to be a primary consideration for understanding local policymaking capabilities for climate change adaptation. Tanzania’s national government has significant control over urban affairs, and important resources and services critical for building resilience in cities are assigned to various national ministries, reducing Dar es Salaam’s ability to act on its own. Furthermore, three municipal counties, a city council, and at least nine ministries have jurisdiction over climate change issues in Dar es Salaam and coordination among these different bodies is both limited and inefficient. In Casablanca, as in cities elsewhere, mechanisms for collaboration with neighboring local governments are unavailable. In Dakar, the national government has been known to usurp power of local authorities, as seen in the construction of the Radisson Blu Hotel on the coastline despite the objections of city planning officials.53

In addition to administrative centralization, many of these cities operate in fiscally centralized environments. In Maputo, local authorities are highly dependent on financial transfers from the central government, restricting the city’s fiscal autonomy and policymaking capabilities. Dakar also operates in a fiscally centralized environment and irregular fiscal transfers from the central government reduce operational efficiency.

Over the last two decades, many African countries have attempted to decentralize governmental systems, allowing for greater policymaking capabilities at the local level, but with limited results.54 In Morocco, for example, multiple decentralization initiatives have not produced tangible results and administrative power remains concentrated in the hands of the Wali, a regional authority appointed by the King and the Ministry of the Interior (MoI). Beyond carrying out directives from the MoI and the Wali, local authorities have a relatively limited role.

Local governments in the two cities in this study with formal adaptation policies, Cape Town and Johannesburg, have substantial capacity due in part to the relatively high level of national development as well as South Africa’s relatively decentralized administrative system. Local government capacity in Cape Town enables coordination with a variety of local and international NGOs, academic institutions, and private sector stakeholders. These two cities benefit from a supportive national environment as South Africa tends to self-identify as a leader in addressing climate change challenges. Cape Town bid for the COP17 conference (that ultimately went to Durban) and has sought opportunities to engage in international climate change initiatives.

Setting Local Policy Priorities. A local government’s decision to engage in policymaking or planning for climate change adaptation is affected by that government’s authority to make such decisions, resource capacity, the political context, and demands and needs of the city’s residents. In the cities studied here, climate change adaptation is generally not a high priority for local governments, although most are concerned with disaster response and risk management for flooding.
The linkages between climate change adaptation and disaster risk reduction are well established and reflected at the international level in the overlapping and mutually reinforcing goals of the Hyogo Framework and the UNFCCC. National efforts in these nine countries generally acknowledge that these two policy concerns are overlapping. Among the ten cities studied here, however, local governments tend to place a higher priority on disaster response, especially for flooding, than on adaptation. Given the frequency and devastating effects of flooding, the prioritization of response to this hazard is not surprising. More capable local governments examined in this study, through city planning and related departments, engage in flood mitigation efforts but they do not necessarily define or frame these actions as climate change adaptation. Cities are acting primarily in a response capacity, rather than increasing adaptive capacity through long-term mitigation efforts. Furthermore, cities, at least in terms of policies and plans, often fail to recognize and address the projected impacts from more frequent or severe floods in the future.

Water scarcity, a widespread threat to urban areas in Africa, was identified as a hazard in Dar es Salaam, Casablanca, Johannesburg, Luanda, and, to a lesser extent, Cape Town. In Egypt, the Nile River meets Alexandria’s current water supply needs of five million cubic meters per day. As the city’s population grows (by an estimated 40 percent by 2030), both residential and industrial water consumption will grow, and water supplies may be significantly strained, a challenge also faced in the other cities. The national governments often consider drought to be primarily a rural or agricultural issue, though water scarcity can clearly have pronounced impacts on urban areas.

Responsibilities for policies addressing scarcity, water production in particular, generally fall to national governments and water resource management agencies rather than local governments; a local government at the mouth of a river has little influence on water management upstream. Across the range of governmental organizations that are potentially affected by climate change, water resource management agencies are somewhat unique in that the water scarcity hazard directly affects long-term water resource security but this slow-onset hazard can be effectively addressed through long-term planning. Local governments may have influence over local water distribution systems and can encourage water conservation, which are important resiliency measures in their own right.

In Johannesburg, for example, water scarcity is very much a challenge but local government itself does not have the capability to implement policies needed to improve access to water. Rand Water, a parastatal, is responsible for delivering water to consumers in Johannesburg and other municipalities in Gauteng and neighboring provinces. It maintains reservoirs in Gauteng and obtains water through interbasin transfers, in particular from the two large dams of the Lesotho Highlands Water Project, through an international agreement between the government of Lesotho and the government of South Africa, represented by the Department of Water Affairs. This complex arrangement illustrates the vertical and horizontal cooperation necessary between multiple levels of government needed to address water security.

Sea level rise, the third hazard examined in this study, does not carry a high priority for local governments in the eight coastal cities as evidenced by the lack of plans and policies addressing this hazard. Coastal erosion, marine submersion, and saltwater intrusion have been documented as significant risks in Alexandria and in Dar es Salaam, but they have yet to be addressed by the governments of those cities in any significant way. In contrast to the short-term impacts of annual flooding, sea level rise impacts are more likely to be experienced at some uncertain time in the future. In Maputo, the UNDP estimates that the port and railway system could be at risk of seawater inundation within 20 years. Furthermore, Maputo’s beaches (a popular tourist destination) are at risk of literally being washed away due coastal erosion caused by sea level rise. Despite these risks, government officials focus on flooding, a more immediate and visible climate change hazard. Cape Town is the only city with a plan to specifically address sea level rise. This plan, however, has not been implemented effectively and was described by one city official as a “communications exercise.”

Local governments, generally resource-constrained, are faced with many pressing problems. Prioritizing adaptation efforts for slow-onset hazards, such as water scarcity or sea level rise, ahead of other immediate needs in local government decision-making is highly unlikely even when considering the long-term
consequences. If hazards result in an immediate impact, as in flooding, local governments are more likely to be motivated to address them, even though these actions are not necessarily framed as climate change adaptation. Independent of differences in the timing of public pressure associated with the impacts of each of the three hazards, local governments could, and should, have service delivery and planning responsibilities to help mitigate the array of impacts. But immediate pressures and concerns shape local government priorities, thus making the onset time for a hazard an important factor in explaining the level of local government engagement.

Other Actors Supporting Local Resilience Initiatives. Although climate change adaptation is rarely on the agenda of local governments in African cities, actors outside local government are developing a broad and substantial knowledge base about local climate change hazards and vulnerabilities. For example, in Kampala, researchers at Makerere University are using rainfall data to create models that will allow them to predict flooding, with the ultimate goal of developing a plan for flood management in the city. As noted above, knowledge of climate change impacts and vulnerabilities must be developed if local governments are to be able to develop effective adaptation policy and promoting local sources of knowledge in universities or think tanks may prove helpful.

The multiple roles of international organizations in advancing national climate change agendas were discussed above, but several engage directly with local governments and influence local priorities. The World Bank and UNISDR provide assistance for vulnerability and risk assessments and UN-HABITAT, UNEP, UNDP, and other agencies provide technical assistance for planning. In Maputo, for example, a partnership between local government and UN-HABITAT initiated the development of a local-level climate change adaptation initiative. The UNDP is active in promoting climate change issues in Accra, Alexandria, and Luanda. The World Bank is a major contributor in Dar es Salaam, Alexandria, Dakar, Maputo, Kampala, and Casablanca. In addition to funding, international organizations may provide technical expertise and human capital. In contrast, Cape Town and Johannesburg relied primarily on local and national resources for their initiatives. International networks such as the C40 Cities Climate Leadership Group and the Clinton Climate Initiative have influenced the climate agenda in Johannesburg as it strives to be a “world-class African city,” as its official branding claims. The variation among cities in the level of international support is explained by a variety of factors, among them the capacity of both local and national governments and the openness of governments to external assistance. But to be effective, international assistance needs to be framed to coincide with priorities and capabilities of local governments since a mutually shared climate change adaptation framework was not found in most cities.

This section has identified factors that help explain why resiliency initiatives are rarely conceptualized and developed at the local government level. With the exceptions of Cape Town and Johannesburg, such initiatives are frequently the product of national policy, sometimes supported by international organizations. Local policymaking for resiliency is constrained by the lack of authority and resources vested in local governments by national governments and priority setting by local governments. When a country’s governmental system is not effectively decentralized, the national government becomes key to advancing adaptation efforts. However, in the countries studied here, national priority in climate change policy is generally given to rural areas, further weakening efforts in urban areas. Local governments are found to place a priority on rapid-onset hazards such as flooding, due to the immediacy of risk and visibility of the consequences, and use their capacity and authority, albeit limited, to respond to emergencies.

BUILDING URBAN RESILIENCE: IMPLEMENTATION OF ADAPTATION INITIATIVES

Local governments are embedded in national governmental systems and the degree to which decentralization of the public sector has been consolidated varies among the nine countries. In addition and independent of the degree of formal decentralization, the roles and capacity of local governments
are affected by the nature of central-local government relations, a topic discussed above in terms of policymaking abilities. Here, the effect of central-local relations on implementing adaptation initiatives and building urban resilience is addressed. Some cities, including Kampala, Accra, Dar es Salaam, Dakar, and Casablanca, are in countries that have undertaken decentralization reforms but the authority and resource availability of local governments are still restricted. Decentralization of authority may not be comprehensive and public service provision in a city may remain the responsibility of national authorities, as found for disaster response in Ghana and for regional and local administration in Tanzania. In addition, local government decisions can be overruled by national authorities, as will be seen in an urban planning case in Dakar discussed below. Furthermore, national authorities may hold authority to appoint local administrators, thereby constraining local discretionary authority, as found in Dar es Salaam. Finally, national government may constrain local power by restricting local taxing authority and providing irregular and/or inadequate intergovernmental transfers. In sum, local governments with limited or ambiguously-defined authority and limited financial resources will be less effective in implementing resilience initiatives, as well as performing other responsibilities.

The presence of a national capital in a city provides a unique case for examining central-local government relations. Capital cities should, in principle, offer opportunities resulting from physical proximity for intensive collaboration between national and local governments. In Senegal, the national government found itself unable to implement national plans without the assistance of local authorities, including in the capital city, Dakar. Senegal's national flood response plan, Plan Jaxaay, initially failed to include local government in its efforts to relocate and rebuild housing for flood victims. For proper implementation, the plan ultimately required local authorities to assist in determining the precise location of residences. Municipal planning was introduced at the commune d'arrondissement level for the first time, highlighting the importance of vertical collaboration. This example illustrates the need for centralized policymaking systems to involve local government in implementation of policies.

Decentralization in Ghana has taken the form of deconcentration where national agency staff members are placed in local government agencies. A NADMO office is present in the Accra Metropolitan Authority, thus ensuring close coordination with local government in its first responder role. NADMO has also established Disaster Volunteer Groups, whereby community members act as liaisons between the organization and vulnerable communities. In these two cases, national-local collaboration in implementation was achieved but in distinct ways: in Dakar, the national authorities eventually recognized the importance of involving local government in implementation, while in Accra, national staff was placed in local government. These cases can be contrasted with Egypt, where the national government is deeply engaged and committed to climate change adaptation, but the highly centralized governance structure does not foster collaboration among ministries and with local governments. This leaves important cities, like Alexandria, without a strategy for action.

Municipal governments in South Africa are unique due to constitutionally defined spheres of responsibility and substantially greater autonomy and capacity than local governments in the other countries. Adaptation policies in both Cape Town and Johannesburg are being actively implemented, albeit with different levels of commitment and effectiveness. These metropolitan municipalities together with the eThekwini Municipality (Durban), a city not subject of a case study in this project, have substantially influenced the national climate change agenda. While adaptation efforts in Johannesburg have lagged those in Cape Town and Durban, municipal governments, rather than their national counterparts, have initiated local adaptation efforts in all three.

The ability of local governments to address climate hazards has an important spatial component. Local governments face a variety of climate change hazards, and each hazard has a unique geographic scale. A mismatch between the geography of local government jurisdictions and the geographic footprint of hazards requires neighboring local governments to collaborate in order to achieve the scale required for effective action, as in the case of flooding in a river basin crossing multiple local jurisdictions. Similarly,
the scale for effective action to address water scarcity must be taken beyond the jurisdictional boundary of an individual city. Thus, for some hazards, intergovernmental cooperation is essential for effective action, as is illustrated by the creation of river basin agencies in Morocco. Rather than dividing water control and management on the basis of local government administrative boundaries, new agencies were created for the water basin. This ensures that the administrative unit corresponds to the geographic scale of water management. Johannesburg is in a similar situation with respect to the previously outlined water delivery arrangement between Rand Water, the South African Department of Water Affairs, and the government of Lesotho. Johannesburg does not have its own authority to integrate climate change considerations into water planning and has very little power to implement adaptation activities beyond water conservation efforts within the city boundaries.

Another solution to the mismatch of governmental jurisdictions and hazard footprint takes the form of a higher-level government interceding to force local governments to collaborate. Alternatively, jurisdictions can be redrawn to align administrative boundaries with the geography of a hazard or more efficient service areas. In Cape Town, six municipalities were consolidated into a unicity, a single metropolitan-wide governmental entity. Even though this consolidation was not motivated by efficiencies for climate change planning, it may well have that effect. Similarly, the formation of river basin authorities, where the scope of authority coincides with the natural river system, addresses the spatial mismatch problem.

**Resource Availability**

Effective and sustainable implementation of adaptation initiatives by local government is invariably tied to the availability of financial, human, and other types of resources. The level of socio-economic development in a country can be expected to affect the level of resources made available to the public sector and, consequently, its operational capacity. The level of basic infrastructure coverage in the cities and a country’s level of development are related (see Table 3). In addition, inadequate infrastructure was found to increase vulnerability to climate-related hazards, especially flooding. The level of national development, revenues available to local governments, and international funders all play roles in determining the level of resources available to local adaptation initiatives.

Cape Town and Johannesburg are among the most developed cities in the sample and their governments have more resources available, a result both of the development levels and the allocation of tax bases within the nation’s governmental structure. Cape Town’s local government has become an innovator in urban environmental management and is recognized as a global leader. The city maintains diverse international partnerships and receives funding from international donors, but relies relatively heavily on its own resources. Like South Africa, Egypt is classified by the World Bank as an upper middle-income country, and enjoys a higher level of development than the majority of the African countries. Even though basic infrastructure coverage in Alexandria is high compared to the other cities studied (Table 3), local government in Alexandria does not have access to financial resources for adaptation initiatives. Therefore, levels of national development are not, in themselves, sufficient for explaining city level engagement in implementation.

**Urban Planning**

Urban planning and infrastructure provision significantly impact human vulnerability to climate hazards, and ineffective planning in the past has created a legacy of conditions that exacerbate these vulnerabilities today. Several explanations for this ineffective planning can be observed in these cities. First, developers may disregard urban planning and land use regulations and build in areas that are vulnerable to climate change hazards with or without the tacit approval of local regulators. In Dar es Salaam, development has occurred often at the expense of local ecosystems and coastal preservation efforts. Second, higher governmental authorities may intercede and overrule local land use decisions. In Dakar, business development priorities of national government overruled land use regulations in the decision to construct the Radisson Blu Hotel on the coast. Third, urban planning practices may themselves not be applied in certain geographic areas. In particular, effective land use regulation is largely absent...
in informal settlements, exacerbating vulnerability to some types of climate change hazards. In fact, informal settlements often develop with complete disregard to existing regulations and policies. In Dakar and Maputo, building codes are ignored and development occurs in vulnerable areas. In Kampala, there is a consensus that flooding occurs partly as a result of inadequate drainage infrastructure. In Accra, flooding is broadly perceived as a result of poor urban infrastructure and planning and not the result of increased or irregular rainfall due to climate change.

While local governments may recognize the range of issues and problems in informal settlements, they also understand informal settlement development occurs in the context of significant in-migration and the unavailability or unaffordability of housing in formal resettlements. Local governments may not feel obligated to provide services and infrastructure in these areas, justified by the very fact that informal settlements exist outside legal frameworks. But even with the growing disposition of planning communities to address issues in informal settlements, their rapid expansion creates demand for urban services and infrastructure that governments cannot meet. Furthermore, residents may not be incorporated into local political processes and, therefore, cannot use this mechanism to secure services.

Several cities have attempted to relocate informal settlement populations to less vulnerable areas of the city. The areas of resettlement, however, place residents away from the economic opportunities of the core business districts. Given the uncertain quality of infrastructure and availability of services in the areas of relocation, additional burdens fall on the newly resettled residents. Furthermore, the residents of these informal settlements are often distrustful and skeptical of government initiatives. Relocation efforts by the government, based in part on the sound assessment of vulnerabilities in existing informal settlements, have produced mixed results in Alexandria, Accra, Casablanca, Dar es Salaam, and Kampala.

While there is increasing acceptance in some cities that comprehensive urban plans must include informal settlements, the infrastructure challenges are formidable. The need to improve urban planning is frequently recognized by public officials and notable efforts to enhance the authority and capacity of local planning agencies are underway. For example, the local government in Cape Town approved an innovative municipal densification policy in 2012 that may provide an alternative to the relocation of informal settlements to the periphery. The policy aims to encourage more sustainable and efficient planning and land use. Recognizing that unregulated growth and inadequate policy initiatives made Luanda more vulnerable to flooding, the central government developed new agencies, including the Institute of Planning and Urban Management and Technical Cabinet of Urban Reconversion of Cazenga and Sambizanga (GTRUCS) to create comprehensive urban master plans.

Roles of Nongovernmental Organizations

Given the slow progress of local governments in addressing the impacts of hazards, local NGOs and CBOs are becoming engaged in resilience initiatives, particularly in informal settlements. For example, in South Africa, the NGO Slum Dwellers International is partnering with local government and academia on in situ upgrading projects, including storm water drainage to improve resilience to seasonal flooding. The presence of NGOs acting in informal settlements is not surprising given the absence of effective local government initiatives in these areas. Informal settlements, by definition, have developed outside the institutional and legal framework of local authorities, often the lag between the development of formal housing and the extension of government services and population growth. Local authorities may view these communities as illegal and refuse to recognize a municipal responsibility to deliver services in these areas. These inadequacies generate tensions between local government and populations in the settlements but a range of cases illustrate strategies to reduce these tensions. Nongovernmental actors may provide an alternative mechanism for involving residents in informal settlements, who tend to be quite vulnerable to hazards.

In Kampala, as the local government faced resource constraints and competing priorities, NGOs have taken the initiative to develop programs that increase the resilience of vulnerable populations. In Dakar, a local NGO works directly with informal settlement residents to facilitate dialogue with the national
government. In Accra, YES-Ghana, a local NGO, works in informal settlements to address waste disposal, an issue central to flooding in the city due to waste buildup in drainage ditches. In some cities, the local government has identified NGOs as potential partners. Angola's GTRUCS, an urban planning agency in local government, collaborates with NGOs in community outreach to implement its programs. The absence of effective networks incorporating community-based or nongovernmental organizations, as in Alexandria and Casablanca, can impede effective resilience planning and implementation.

A case that is particularly instructive of the potential role of NGOs in securing collaboration across multiple actors is seen in an urban-agricultural partnership developed in response to flooding in Dakar. UrbaDTK, a local NGO, argued that flooding was less related to heavy rainfall than to the decision of city officials to end pumping water from underground aquifers due to its contamination. UrbaDTK developed a multi-sector approach in which water in urban areas is sanitized and pumped to agricultural areas, thereby lowering Dakar's underground water table and increasing capacity to absorb water during rainfall. The interaction of weather events, ecological systems, and infrastructure was complex and required an innovative solution involving collaboration among multiple actors facilitated by an NGO.

**CONCLUSIONS: URBAN RESILIENCE AND LOCAL GOVERNMENT**

Climate change adaptation strategies and policies are found in Africa with increasing frequency, but local governments in the large cities in this study are yet to engage in such policies, with the important exception of the South African cities. Although many local initiatives address climate hazards, especially flooding, building urban resilience in the context of climate change is typically not a policy priority of local governments. In this section, final observations are offered on factors that seem to constrain deeper engagement and effective implementation by local governments in developing resilience measures. At the time the field research for this project concluded, March 2013, the climate change adaptation and urban resilience efforts of local governments could be characterized as incipient in most cities, with the exception of Cape Town and Johannesburg where adaptation efforts are quite substantial. Awareness of and knowledge about the need to build resilience to climate change are developing and some resources, such as technical and scientific resources and studies, required to improve these efforts are present, albeit not effectively integrated into government action.

**Engaging in Climate Change Policy: Managing a Complex Agenda**

Climate change is affecting both human and natural systems. Developing concrete, actionable policies to address the resulting challenges presents a formidable task to both national and local governments. Adaptation efforts, the focus of this study, must take into account a range of exposures, each with varying impacts and uncertainty around frequency of events and each affecting a different set of government functions. Furthermore, the impact of one hazard can be affected by other hazards; sedimentation derived from flooding can later affect river flows and contribute to water scarcity. Current urban development practices and behaviors found in local populations can actually exacerbate vulnerabilities. Even though these deleterious effects of current practice are known, establishing a policy framework that accounts for the diversity of the challenges and integrates new policy concerns into existing governmental structures and policy systems is daunting.

A climate change adaptation agenda can be assigned to a new governmental organization, such as a new ministry in the national government or a new department in the local government, thus differentiating its mission from those of other governmental organizations. In assigning the climate change agenda to a single organization, the organizational mission is defined and clarified. Alternatively, the adaptation agenda can be incorporated into existing governmental organizations, such as those devoted to development, infrastructure, environmental and energy issues, and disaster risk management, a process often referred to as mainstreaming. A hazard-based approach focused on a specific hazard, e.g. water
scarcity, might provide a sufficiently well-defined scope to facilitate collaboration among a set of governmental organizations directly affected by the hazard. But two major management issues emerge: ensuring the prioritization of adaptation in mission-driven agencies and achieving effective coordination across agencies required to address the diverse impacts of exposures and diverse sources of vulnerability.

Competing Priorities and Capacity of Local Governments

African cities, like cities elsewhere in the world, face a host of challenges. Given resource constraints, the burden on local governments to provide public services, including responding to emergencies, is challenging. Local officials understandably prioritize immediate concerns, such as public health and safety, over long-term climate change adaptation efforts. The urban planning shortfalls of local governments are understood and remedial action is being taken in many cities. Examples of progress are observed in the efforts toward densification in Cape Town, improvement in water distribution in Luanda, and flood mitigation in Dar es Salaam. But the large number of informal settlements and high population growth makes it difficult to address these issues. Limited efforts by local governments to address climate change challenges result, in part, from the presence of more immediate and pressing issues on the local policy agenda.

Furthermore, climate change projections are frequently uncertain, and local governments face dilemmas in setting priorities when confronted with uncertainty around future events. Impending sea level rise is an illustrative example. Although forecasts of the magnitude and rate of increase are imprecise, the quality of information is improving and it is fairly certain that seas will rise in coming decades. Nevertheless, at least in the coastal cities studied here, the availability of scientific information has not led to governmental action. In addition, a single local government is, on its own, simply ill-equipped and without adequate capacity to address certain hazards due to their geographic scale, a problem referred to above as a mismatch between the geography of governmental jurisdictions and the footprint of a hazard. Even when substantial assets are at risk, as in the port areas facing sea level rise, action by local governments has not been prioritized. In the one case to the contrary, the city of Cape Town formally adopted a Coastal Zone Management Strategy in 2003 and published a sea level rise risk assessment in 2011, but the city has largely failed to act on its recommendations. In sum, political systems may deal with future uncertainty by postponing action.

Partnerships and Collaboration for Adaptation and Urban Resilience

The organizational capabilities and resources required to address the multidimensional and complex nature of climate change impacts are not found in local government alone, but are dispersed across many governmental and nongovernmental organizations and local communities. The national governments examined in this study have tended to initiate the in-country policy discussions concerning climate change. Given the relatively high degree of centralization and the need for international organizations to maximize their influence, national government leadership in climate change policy is eminently sensible. National climate change policies and plans, however, rarely include an urban component and do not recognize the unique vulnerabilities of urban areas to climate hazards, at least in the countries and cities studied here. The unique circumstances of large cities receive little consideration in national plans and the centralized public sector tends to create additional challenges for local adaptation efforts. A centralized structure offers the potential for unified and coordinated action between national and local governments, especially in instances where centralized agencies have spatially deconcentrated administrative resources, as in Tanzania and Ghana (NADMO). Unfortunately, centralized structures do not, necessarily, lead to effective intergovernmental coordination. Furthermore, local governments with limited authority and capacity will not be effective, even as a partner with national governments, in building urban resilience. South Africa, with its relatively empowered local governments, offers an enlightening contrast. With a more decentralized system, bottom-up pressure from local government officials and nongovernmental actors allows local government to influence national policy.
Given limited authority and capacity of local governments, collaboration among a range of actors seems to be a prerequisite for promoting the resilience agenda. The extensive collaboration in Maputo between international organizations and NGOs mobilizes desperately needed resources for adaptation. Given the special circumstance of informal settlements, community-based NGOs can help overcome the political and public service divide between local government and these communities. Promising avenues for collaboration are strategies that draw upon local governments as conveners or facilitators. But local governments will be more effective in developing urban resilience if amenable and able to collaborate with other actors. Strengthening local governments and creating incentives for collaboration are needed if the potential of these governments in building resilience is to be realized.

This study sought to assess the ability of the governance systems in large African cities to build resilience to climate change challenges. While local governments generally do not explicitly address climate change or have formal adaptation policies, they are building resilience through a variety of plans and actions that address climate hazards, particularly flooding. However, the plethora of competing priorities, restricted authority, and limited capacity of local governments, among other factors, prevents the effective implementation of these plans. Despite the necessity of improved resilience and some progress toward meeting the climate change challenges in Africa, the local governance systems are not being effectively empowered and utilized to build the resilience needed to protect and improve the collective well-being in cities.

APPENDIX: METHODS AND CITY SELECTION

An exploratory comparative case study methodology, with individual cities serving as the cases, was chosen to answer the research questions posed by this project. Drawing upon the findings from individual cities, comparisons across cities are used to identify patterns that help answer the research questions. The comparative case study methodology provides the opportunity to assess how governmental structure and the powers of local government affect urban resilience initiatives but offers the flexibility to devote additional attention to those aspects of a city that are particularly important in explaining these initiatives.

The decision to limit the study to large cities in Africa was based on the expectation that large cities would have particularly complex exposure and vulnerability profiles due to the prevalence of informal settlements and economic assets of national importance. It is also the case that the complex institutional contexts resulting from the existence of multiple local governments in a single urban agglomeration raise the opportunity to examine issues of local government coordination that are less likely present in rural or smaller urban areas.

The first step in the selection process identified a pool of 38 urban agglomerations in Africa with populations of 1.5 million or more according to The Principal Agglomerations of the World. Four criteria were applied to the 38 urban agglomerations with variation on each sought in the set of cities selected:

1. Climate hazards to which the city is exposed;
2. Geographic location, region of the continent, as well as coastal and inland cities;
3. Colonial legacy and the institutional development;
4. Socio-economic conditions and level of development.

Hazard type was chosen as a major criterion with the expectation that it could affect local policymaking: first, adaptation strategies differ across hazard type; second, different hazards generate different types of vulnerabilities; and third, different hazards have different on-set times. Therefore, it was hypothesized that resilience efforts in the cities would vary according to each city’s unique hazard profile. This creates, methodologically, the opportunity to contrast resilience strategies across hazard type, thus, addressing one of the key research questions.
Hazard profiles for each city were developed. The pool of cities was narrowed to those with high exposure scores or exposure to multiple climate hazards. Travel restrictions imposed on the research eliminated some destinations. Given that coastal cities tended to have higher hazard scores, several inland cities were intentionally retained in the pool to ensure variation in hazard type. Having reduced the number of eligible cities, the remaining factors—institutional development and governance capacity—were applied in order to find variation across governance capacity and level of development. For example, given the comparable hazard profiles of many coastal West African cities, Accra and Dakar were selected because they developed from different colonial legacies and represent different institutional practices.

Research teams conducted field research in each city, including interviews with officials in local, regional, and national government agencies, as well as multilateral and bilateral organizations, university researchers, and non-profit and community-based organizations. The field research was conducted in December 2012, with the exception of Alexandria, which was conducted in March 2013.
ENDNOTES

1 This paper summarizes the findings from Urban Resilience to Climate Change in Africa, eds. Robert H. Wilson and Todd Smith (Austin: LBJ School of Public Affairs, forthcoming). The research effort was conducted under the Climate Change and Africa Political Stability (CCAPS) program at the Robert S. Strauss Center for International Security and Law at the University of Texas at Austin.


7 Mark Pelling, Adaptation to Climate Change: From Resilience to Transformation (London: Routledge, 2010).


10 UNISDR, “Terminology.”


16 The UN Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries, and Small Island Developing States classifies countries as LDCs if they meet certain criteria. See: “The Criteria for the Identification of the LDCs,” UN Office of the High Representative for the Least Developed Countries, http://unohrlls.org/about-llds/criteria-llds/.


31 Ribot, African Decentralization: Local Actors, Powers, and Accountability.

32 UNISDR, “Terminology.”


34 UNISDR, “Terminology.”


38 Water scarcity and drought are two different but related phenomena. A meteorological drought is any extended period in which actual rainfall is significantly lower than the average, expected rainfall. A hydrological drought exists when a shortfall in precipitation depletes water resources, such as rivers, lakes, and aquifers. Agricultural drought occurs when crop water requirements are unable to be met, resulting in lower than expected crop yield. Finally, socioeconomic drought is when water distribution systems are unable to meet consumer demand because of precipitation shortfall or inadequate infrastructure. See: Ashok Mishra and Vijay Singh, “A Review of Drought Concepts,” Journal of Hydrology 391, 1–2 (2010), 206. Water scarcity, on the other hand, is a more consistent state in which demand for water exceeds water resources. However, water scarcity is heightened in times of drought, and more droughts occur when water is scarcer. See: Peter Gammeltoft, “Water Scarcity and Drought in the EU” (Brussels, April 27, 2012), http://ec.europa.eu/environment/water/quantity/pdf/stakeholders/0%20Overview%20Water%20Scarcity%20Droughts%20PG.pdf.


40 Note that water scarcity is determined based on quantity of water per capita. The Falkenmark Indicator is one important indicator: If the amount of renewable water is below 1700 cubic meters per person per year, the region is undergoing water stress. If the region contains less than 1000 cubic meters of renewable water resources per person per year, the country is undergoing water scarcity. Finally, if the region contains less than 500 cubic meters of renewable water resources per person per year, the region is undergoing absolute water scarcity. See: M. Falkenmark, J. Lundquist, and C. Widstrand, “Macro-scale Water Scarcity Requires Micro-scale Approaches: Aspects of Vulnerability in Semi-arid Development,” Natural Resources Forum 13, 4 (1989): 258-67.


54 Ribot, African Decentralization: Local Actors, Powers, and Accountability.


57 The experience of informal settlements in Latin America is relevant on this point. As informal, and “illegal,” settlements developed in the large cities in Latin America, local governments pursued various attempts to prevent and remove them. Over time, however, the policy focus shifted to legalization and urbanizations of informal settlements. If the likely event that this process develops in Africa, local governments will likely embrace improvement in public infrastructure in informal settlements. See: Janice E. Perlman, Favela: Four Decades of Living on the Edge in Rio de Janeiro (New York: Oxford University Press, 2010).