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The Challenges of Global Environmental Change for Urban Africa

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Abstract

Cities—especially those with substantial poor populations—will face increasingly severe challenges in tackling the impacts of global environmental change (GEC). As economic dynamos and increasingly important population concentrations, cities both contribute substantially, and often are very vulnerable, to the impacts of GEC. This applies strongly in Africa, one of the world's poorest regions. The inability of even a relatively wealthy and well protected city such as New Orleans in the USA to withstand Hurricane Katrina has helped focus attention on the vulnerability of cities that are less protected. Coastal cities and towns from Dakar (which is used as a case study) via Lagos, Cape Town, Maputo and Mombasa to Djibouti contain many low-lying areas, often accommodating concentrations of poor residents, strategic infrastructure and economic production. However, different combinations of challenges will affect many inland urban centres. Tackling GEC successfully will require more than enhanced disaster preparedness. Action to address unsustainable aspects of everyday life and current corporate and institutional activity will be necessary. There can be no simple or universal strategy to reduce urban footprints. Local conditions (biophysical, structural, socioeconomic and cultural) produce specific constraints and opportunities in each context.

Keywords: global environmental change, climate change, African cities, mitigation, adaptation, coping strategies

JEL classification: R0, Q00, Q01

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1 Introduction

This paper surveys the phenomenon of global environmental change (GEC) and its implications for cities and urban populations in Africa. Today, GEC and the narrower concept of climate change are fast becoming buzzwords at all levels of society except, perhaps, those for whom its impacts are likely to be most profound, namely the poor. This is true in rural and urban areas alike, but the focus here is specifically urban.

Severe setbacks to household, local or national developmental efforts can take diverse forms, perhaps most obviously so-called 'natural' or anthropogenic disasters such as floods, droughts, famines, hurricanes, earthquakes, tsunamis, volcanic eruptions or polluting accidents at nuclear power stations or petro-chemical complexes. Most of these are sudden and of short duration; but longer-term, insidious pollution episodes can be as debilitating for those most vulnerable to them (and the local environment) yet seldom receive equivalent attention since they are not dramatic, headline-grabbing incidents.

Vulnerability can be understood in different, often cross-cutting, ways. Geographical or spatial vulnerability refers to those locations that are most likely to be affected by an extreme event, e.g. seashores to tidal waves, river valleys to floods, steep slopes to landslides. Social vulnerability refers to those people who are most vulnerable by virtue of poverty (low financial and often human capital), low levels of resources (financial and physical capital), lack of support networks (social capital), and poor access to the corridors of power (political capital). The disaster risk literature has demonstrated that poor people generally live in undesirable areas where shelter is cheaper or vacant land available for irregular/informal occupancy. It is thus the coincidence of vulnerable places and vulnerable people that identifies priorities for preventative, forecasting and coping strategies (see, for example, Douglas et al. 2008). This awareness is now increasingly being taken up in policy and development agency circles (for example Commission for Africa 2005; DFID 2006; Sachs 2005).

Over the last 15-20 years, a substantial body of evidence and practical experience has been built up on 'natural' disasters and vulnerability to them, with particular emphasis on prediction and subsequent coping and reconstruction strategies. Indeed, the 1990s were the United Nations (UN) Decade of Natural Disaster Reduction, a major global initiative in this field. For the first time, the 2006/7 edition of *State of the World's Cities* (UN-HABITAT 2006) included a brief section on the impact of conflicts and natural disasters on cities. This is welcome progress, but the narrow focus on the 'natural' omitted many relevant categories of disaster such as those listed above. Furthermore, a clear opportunity to introduce readers to the related concept of GEC was unfortunately missed. This was remedied in the 2008/9 edition (UN-HABITAT 2008).

2 Understanding GEC

Most disasters, 'natural' or anthropogenic, are one-off events of sudden onset and short duration, lasting from a few seconds to a few days. Following rescue operations of perhaps a week's duration, the response shifts to reconstruction—with an emphasis on mitigation to reduce vulnerability to future occurrences—and, at least in theory, special assistance to the most vulnerable affectees.

By contrast, GEC comprises two complementary elements. The first is a process of slow-onset changes, such as increasing prevailing atmospheric temperatures, climatic humidification or desiccation through changing precipitation patterns, and sea level rise. Such trends are being monitored and predicted over a period of decades, providing an opportunity to tackle their causes and prepare to reduce their impact through various mitigation strategies. However, once they occur, these environmental changes will be (semi-)permanent. The second element of GEC comprises the increasing frequency and severity of extreme events like hurricanes, tornadoes, droughts and floods. This second trend arises because the events are 'piggy-backing' on the first, which also provides them with a stronger cumulative effect.

2.1 Distinguishing mitigation from adaptation

Actions to address GEC fall into two categories. *Mitigation* comprises efforts to reduce the contributions of current activities to GEC, as well as to reducing the impact of, and vulnerability to, the various dimensions of GEC. Examples include strengthening coastal sea defences, rehabilitating mangroves or reed beds along shorelines and riverbanks, increasing the capacity of urban storm water drainage, strengthening and protecting vulnerable buildings and infrastructure such as electricity pylons and substations, promoting energy efficiency and savings (for example through improved insulation of buildings and fitting of low-energy light bulbs), promoting car-sharing and use of public transport, or ensuring that resource extraction for urban construction and consumption (such as sand and gravel extraction, brick making, fuel wood and reed harvesting, groundwater abstraction) do not increase vulnerability. This includes both industrial/commercial-scale operations and 'informal' activities (themselves now often commoditized and commercialized) by the urban poor. They also reduce an urban area's ecological footprint. Such actions are sometimes relatively straightforward, inexpensive, quick and short-term. However, they still commonly meet resistance, ranging from inertia to scepticism that they will make a significant difference, to opposition on cost grounds (because the need may not be immediately evident) and from those with vested interests in the status quo (including people whose livelihoods might be perceived to be threatened).

The second category of response is known as *adaptation*. These responses are generally the more difficult, fundamental, long-term and expensive changes required to our lifestyles, consumption patterns and behaviour (Adger et al. 2003). In an urban context, this would include reducing intra-urban travel through making multipurpose trips and using local facilities; addressing urban structure to reduce haphazard suburban and peri-urban sprawl, promote sustainable densification and multifunctional land use; and revising building regulations and standards to use appropriate materials, enhance insulation and (in hot climates) reflectivity of roofing, reduce energy consumption and enhance resilience to the relevant aspects of GEC (including the risk of flooding or chronic water shortages). Many adaptive strategies take more time; require careful planning; far larger investments of scarce capital and political will; and are vulnerable to the twin challenges of not being immediately and demonstrably necessary and of being likely to lose out in the political process to urgent priorities of vocal, powerful or politically valuable constituencies. There will also be predictable opposition from those who perceive vested interests—either individual or collective—to be challenged by changes to norms, investments and practices. However, there are some overlaps between the two categories: for instance, a shift to cycling and use of public transport

can be a mitigation effort but also part of a longer-term adaptive strategy involving urban redesign. This underlines the important point that well targeted mitigation and adaptation strategies are neither mutually exclusive nor in conflict with each other.

Publication of the Intergovernmental Panel on Climate Change's (IPCC) *Fourth Assessment Report* (AR4) (IPCC 2007, 2008a, 2008b) marked something of a watershed in climate change science and policy as climate sceptics and deniers have, in effect, now lost credibility. Moreover, the IPCC AR4 added to the debate fostered by the *Stern Review Report on the Economics of Climate Change* (Stern 2006), which argues that there was now compelling evidence that it would be cheaper to tackle climate change than to continue avoiding doing so. In other words, climate change was real and unavoidable and the longer appropriate mitigation and adaptation were delayed, the more costly such actions would become. On the basis of preliminary IPCC data and other evidence, the report also indicates the substantial scale of greenhouse gas emissions reductions required but points optimistically to these challenges as tremendous economic and innovative opportunities.

2.2 GEC and urbanization

The dominant foci in GEC research to date have been on global-scale modelling, the monitoring and prediction of land use and cover change or water availability in implicitly rural contexts, and national policy responses. Yet, as economic dynamos and increasingly important population concentrations, cities both contribute substantially to, and often are very vulnerable to the impacts of, GEC. This bidirectional relationship between urban areas and GEC (Sánchez-Rodríguez et al. 2005) is now the subject of increasing research effort, although hitherto concentrated heavily in and on mega- and other strategic cities in North America, Western Europe and Japan (for example, Bulkeley and Betsill 2003). Disasters and vulnerability thinking (for example, Parker and Mitchell 1995; Pelling 2003) remains dominant in urban management as in other spheres, but is gradually shifting to include GEC (Leichenko and Solecki 2006).

The term 'urban areas' is used here in order to include intermediate and smaller urban areas. The bias of size is already evident in two respects. First, research, perhaps inevitably, has been focused almost exclusively on the largest cities, which contribute most to GEC and have the largest numbers of people likely to be affected by it. Second, whatever the deficiencies (which, in poor countries may be substantial), such cities tend to have some in-house professional planning and governance capacity (Wilson 2006).

Urban areas also form integral parts of wider systems—defined in physiographic, politico-administrative and/or functional terms—which traverse peri-urban and rural areas within one country and increasingly also across national boundaries. GECs do not respect such boundaries and it is therefore important to bear these broader interactions and 'urban footprint' issues in mind. This may also provide comfort to urban leaders, enabling them to attempt to deflect responsibility through blaming external factors and processes from beyond their administrative boundaries. Such covert denialism should not be acceptable; the transboundary nature of GEC merely underlines the need for partnerships among all relevant authorities.

Towns and cities everywhere contribute to GEC and the impacts of GEC are being, or will be, felt globally. Globalization processes also mean that the systems of cities at the heart of the world economy are increasingly closely interconnected. Clearly, therefore,

there are good reasons to approach GEC research and policymaking from and with a global perspective. However, as indicated above, local appropriateness will remain important. Particularly in poor and middle-income countries, circumstances are very diverse. Generally, though, available resources and relevant standards and strategies may be rather different from those formulated in, and relevant to, wealthy countries. Importantly, too, the strategic and priority-setting contexts will be different.

Parnell, Simon and Vogel (2007) see tackling GEC very much as part of broader development challenges. Making this connection is vital if GEC is not to be relegated by politicians and urban managers to the margins as a longer-term, less certain set of future risks and threats than their immediate priority of assuaging basic-needs demands. The current resurgence of interest in developmentalism enables and requires engagement with debates on the developmental state (central, regional and local). This re-engagement with developmentalism represents part of the challenge to neoliberal orthodoxies, recognizing that states do need effective capacity and an ability to intervene.

As spatial concentrations of resources, investment and people, including elites, urban areas often have greater potential to address the causes and effects of GEC than non-urban areas. Indeed, some large urban-based national and transnational corporations are already taking a lead in adapting their own activities to reduce environmental impacts (for example emissions levels, waste production and fossil fuel-derived energy utilization) and to move towards a low-carbon economy. Such private sector initiatives may also have significant social benefits and should be leveraged to maximize the latter element. However, economic and political elites do not always act in the public interest. Their interventions in the context of GEC may therefore involve spatially and socially selective investments in mitigation that largely ignore, or actually worsen conditions in, vulnerable areas inhabited by poorer and marginalized groups. Furthermore, formal processes and regulations may everywhere be bypassed through corruption, patronage/clientelism or informal relations, the last-mentioned especially in situations where non-formal economic activities are prominent. Such factors can be examined by means of the analytical perspectives just outlined.

3 Addressing GEC in African urban areas

Urban GEC research and planning in poor countries are still in their infancy. This is very evident in Africa, one of the world's poorest regions, with many impoverished countries that lack adequate skills and resources to undertake adequate research, to formulate appropriate policies or to implement them in order to address the impacts of GEC. Indeed, many urban officials and elected representatives remain largely unaware of the seriousness of the hazards. They often find the global-level scientific reports and debates unintelligible or, as already suggested above, regard supposedly remote threats well into the future as representing a very low policy priority relative to the numerous immediate demands on their time and scarce resources. Moreover, detailed local data and supporting information, which should inform policy and action, are rarely available.

3.1 Raising awareness: Initiatives and networks

Initiatives to address these challenges have recently been launched through a variety of organizations, including the UN, other intergovernmental and international non-governmental bodies and city networks at different geographical scales. The International Human Dimensions Programme on GEC's (IHDP's) 10-year 'core project' on Urbanization and GEC (UGEC)[1] is distinctive in being dedicated to these issues. It is undertaking some research in Africa and is currently establishing a regional network of researchers, local authority officials, elected city representatives and agencies in West Africa, following a highly successful workshop in Dakar in February 2008 (UGEC 2008). This, together with an earlier engagement with civil society in Lagos (Simon 2007), identified some of the needs and current deficiencies in this respect. Similar networks exist or are being established in other regions, and it is hoped to extend the West African one to eastern and southern Africa or to establish a separate one.

UN-HABITAT is collaborating with UGEC on the West African network and since 2007 has been gearing up its own role in respect of cities and climate change. It has established its own global network, SUD-NET,[2] to promote sustainable urban development through Habitat Agenda partners at global and local levels. GEC will form one element of its focus. A central element of SUD-NET is the Cities and Climate Change Initiative (CCCI), launched in Oslo in March 2009; two African capitals, Maputo and Kampala, are among the first four pilot cities (UN-HABITAT 2009).

The South African Cities Network,[3] a well resourced and quite efficient clearing house for city managers and officials, fulfils a monitoring, information-exchanging and networking role. It has only very recently really begun to engage seriously on climate change. Indeed, the *State of the Cities Report 2006* (SACN 2006) fails to mention GEC or climate change, despite three of the report's ten concluding challenges addressing different aspects of sustainability directly. This reflects the dominant South African urban management focus on post-apartheid restructuring and the attendant social, economic and environmental justice agendas (McDonald 2002). Johannesburg hosted the first substantive countrywide South African local government engagement with GEC issues in a national conference on 2-3 June 2008 under the rubric of 'All hands on deck: towards a low carbon economy'. This event was linked to World Environment Day. The hosts emphasized the need for advice on practical policies.[4]

Along with Addis Ababa, Cairo and Lagos, Johannesburg is also a member of the C40 network of the world's largest cities.[5] Originally known as the C18, it initiated biennial climate summits in 2005 (London), 2007 (New York) and 2009 (Seoul), bringing together mayors, senior officials and business leader to promote the exchange of ideas on best practice and collaborative efforts. In 2006, the C40 established a partnership with the new Clinton Climate Initiative, dubbed the climate leadership group, in order to

1 www.ugec.org.

2 www.sudnet.org.

3 www.sacities.net.

4 See www.sacities.net/2008/may26_jozisummit.stm.

5 www.c40cities.org.

further its agenda of promoting energy efficiency and reducing carbon emissions more effectively.

At a broader level, the Commonwealth is now also prioritizing climate change, with a particular focus on cities. The Commonwealth Consultative Group on Human Settlements (CCGHS), an intergovernmental group comprising the national ministers responsible for implementing the Habitat Agenda in their own countries, has existed since 1998. ComHabitat, established in 2004, is a partnership between CCGHS and the Commonwealth Secretariat, Commonwealth Foundation, Commonwealth Association of Planners (CAP), Commonwealth Human Ecology Council, Commonwealth Local Government Forum, Homeless International, UN-HABITAT and the British government's Department for International Development (DFID).[6] The Commonwealth People's Forum that preceded the 2007 Commonwealth Heads of Government Meeting (CHOGM) in Kampala requested the production by ComHabitat of a State of Commonwealth Cities report for the 2009 CHOGM meeting. This document, styled after the UN-HABITAT reports referred to above, was prepared under the auspices of the CAP, using a set of case studies as the basis for a comprehensive review. Ongoing urbanization means that 38 per cent of Commonwealth citizens are now classified as urban; in the 32 small-state members, the average is slightly higher, at 39 per cent. Forty per cent of cities in the Commonwealth are situated on the coast or in estuaries; many of these, especially on small islands or low-lying coastal margins, are particularly vulnerable to the effects of GEC.[7]

The International Council for Local Environmental Initiatives (ICLEI) is the body charged with overseeing and promoting Local Agenda 21 formulation and implementation by city governments in the wake of the World Conference on Environment and Development (the Earth Summit) in 1992 in pursuit of sustainable urban development. Under the aegis of its Cities for Climate Protection (CCP) Campaign established in 1993, and of which South Africa has the only African membership (Betsill and Bulkeley 2004),[8] the ICLEI has promoted various actions in South African cities to reduce greenhouse gas emissions, air pollution and waste, such as the replacement of conventional street lights with energy-efficient bulbs.

In the absence of any substantive evaluation of these initiatives and actions, it is difficult to assess the efficiency of their implementation or their effectiveness in relation to their objectives. My subjective judgement, based on ad hoc observation, conversations and examination of documents in several large African cities from Cape Town to Lagos and Nairobi to Dakar, is that implementation has been variable. Individual actions generally remain just that, rather than being linked and integrated into coherent programmes. Moreover, some individual officials and elected representatives are reasonably aware and well informed but this has yet to translate into substantive widespread awareness or to become embedded within institutional culture and practice. Similarly, the Commonwealth's Development Framework for Human Settlements (CCGHS 1999), formulated in 1999 just after the establishment of the CCGHS, does not even mention GEC or climate change. This needs updating. However, the Habitat Agenda's concern with Local Agenda 21, which is in essence a mechanism for

6 www.comhabitat.org.

7 Commonwealth Foundation Briefing Meeting on Cities and Climate Change, London, 23 April 2008.

8 See also http://www.iclei.org/index.php?id=629.

mainstreaming implementational capacity to promote sustainable development, does represent an appropriate framework for tackling GEC.

The great majority of all the interventions undertaken to date lie at the 'easy' end of the spectrum of mitigation actions. For all the reasons outlined above, more costly, complex and logistically difficult mitigation actions have not yet been planned, let alone attempted. More fundamental adaptive actions remain even further away. Commonly, too, golden opportunities are simply missed. For instance, a new breakwater/promenade was completed on the southern shore of Victoria Island in Lagos in late 2006 to protect government offices, luxury hotels and residences from storm surges. However, its design was not bolstered to cater for expected sea level rise or the increased magnitude of storm events linked to GEC.

3.2 The situation on the ground

The following examples demonstrate that the urban risks from GEC are both far more imminent and more substantial than often perceived. They also have fundamental implications for all other aspects of urban management, planning and governance. Raising awareness and *demonstrating the importance of integrating mitigation and adaptive strategies into all spheres of existing practice, rather than regarding them as separate activities in competition for scarce funds and staff resources*, are therefore crucial tasks. The inability of even a relatively wealthy and well protected city such as New Orleans in the USA to withstand Hurricane Katrina has helped focus attention on the vulnerability of cities that are less protected. Imagine for a moment what the effects of the December 2004 Indian Ocean tsunami would have been if metropolitan Jakarta, Bangkok, Dhaka or Kolkata had been in its path rather than Banda Aceh and numerous small coastal towns and villages. Coastal cities and towns from Dakar via Lagos, Cape Town, Maputo and Mombasa to Djibouti contain many low-lying areas, often accommodating concentrations of poor residents, strategic infrastructure and economic production. However, different combinations of challenges (most conspicuously heat islands, desiccation, fresh water supply, diseases and food security) will affect many inland urban centres as well.

Tackling GEC successfully will require more than enhanced disaster preparedness. Action to address unsustainable aspects of everyday life and current corporate and institutional activity will be necessary. However, the inevitable temptation to search for a template or master plan developed elsewhere should be avoided. While much mutual learning is clearly possible, especially in terms of identifying the most important principles and elements of successful action elsewhere, there can be no simple or universal strategy to reduce urban footprints. Local conditions (biophysical, structural, socioeconomic and cultural) produce specific constraints and opportunities in each context. Even where certain effects, such as urban heat islands, are known to occur everywhere, their impact varies according to environmental and climatic conditions, urban size, layout, the proportion of urban space devoted to buildings, roads and other hard surfaces as opposed to green open space, rivers and other natural features, the average height of buildings and construction and roofing materials (Grimmond 2007). It is also vital to clarify the important distinctions between (predominantly 'natural') urban disasters/vulnerability and urban GEC issues.

The African continent boasts only two of the world's thirty largest cities, Cairo and Lagos. The former was ranked 18th in 1980, 17th in 1990, and 19th in 2000 and was

expected to be 16th in 2010. By contrast, Lagos entered this league at 21st in 1980, before rising to 6th in 2000 and an anticipated 3rd in 2010 (UNCHS 2001). However, the statistical basis of this definition is complex and may not correspond to de facto built-up or functional urban areas. For instance, metropolitan Johannesburg fills most of Gauteng province, which certainly has an aggregate population qualifying it for inclusion in the list of 30 largest cities. A similar situation pertains to Kinshasa.

Although many of the Commonwealth's GEC urban hotspots are in South Asia and the Indian and Pacific Oceans, Lagos is a key Commonwealth mega-city with great vulnerability (see below). Coastal cities from Monrovia in Liberia and Freetown in Sierra Leone, Sekondi-Takoradi and Tema in Ghana via Walvis Bay in Namibia to Cape Town, Port Elizabeth, Buffalo City, Durban and Richards Bay in South Africa, Maputo and Beira in Mozambique, Dar es Salaam in Tanzania and Mombasa, Malindi and Lamu in Kenya contain key economic facilities and infrastructure, not to mention often substantial vulnerable populations. Mombasa is already subject to regular damaging floods from rivers after heavy rains. A sea level rise of 30 cm would inundate some 17 per cent of the city's area and affect key functions and livelihoods dependent on tourism and agriculture (Awuor, Orindi and Adwera 2008). More generally, there are numerous smaller coastal towns and villages, often dependent on artisanal fishing and/or tourism, for which the combination of sea level rise, increased storminess and changed inshore marine conditions affecting fish harvests represents acute risks. Inland urban areas, within both littoral and landlocked Commonwealth African countries, face diverse risks, ranging from floods and desiccation, rising temperatures and desertification to threats to the security of water, food and fuel wood supplies.

Kano, Bulawayo,[9] Dodoma and Naivasha are prominent examples already at the margins of sustainability in terms particularly of water supply; GEC is very likely to exacerbate their problems. In Kano's case, any further modest southward shift in the transition zone from the Sahara Desert to well watered intensive agriculture will imperil the city's food security and water supply. Located in the semi-arid zone of south-western Zimbabwe, Bulawayo has already been beset by chronic water shortages for years (*Business Report* 2007; Gwebu 2002; Musemwa 2006), although this is at least partly due to political factors that have delayed investment in new supplies. Dodoma, Tanzania's new capital city, is also situated on a semi-arid escarpment and if the city grows as intended once the all-but-stalled government relocation is complete, it will face similar problems. Naivasha's location on the southern shore of Lake Naivasha, one of the few Rift Valley lakes with potable water, has been fundamental to the rise of its intensive horticulture industry since the promotion of high-value, non-traditional exports under neoliberal economic diversification policies. The lake's water level has fallen to critical levels, while the water table in the surrounding farmland is also dropping. Various conservation measures have yet to have a significant impact or prove enforceable.

Much of the Gulf of Guinea coastline is alluvial in nature and low-lying, with coastal dunes and other formations that are vulnerable to erosion. This has already been problematic for some considerable time as a result of storms and human activity, which has already affected local weather conditions. Several coastal capital cities, such as

9 President Mugabe withdrew Zimbabwe from the Commonwealth in 2003, but the new government is likely to seek readmission soon.

Lagos, Cotonou and Accra, are situated in natural harbours afforded by lagoons, estuaries or artificial links to coastal lakes. Significant parts of the lagoon shores and hinterlands actually lie at or below mean sea level. These coastal environments now suffer heavy pollution from industry, sewage and indiscriminate refuse dumping. The destruction of mangrove swamps, which are among the most efficient breakwaters and silt traps, as well as vital breeding grounds for diverse fish and arthropod species, has contributed to the problem in such areas, as well as affecting the livelihoods of artisanal fisher folk adversely. Lagos has suffered as much as anywhere in this respect (Simon 2007).

3.3 Case study: Dakar

Dakar's location on a peninsula jutting into the Atlantic, coupled with variations in elevation and a rapidly growing metropolitan population of over three million (equating to half the country's urban population and over a quarter of the national population), creates multiple vulnerabilities. Many of the new domestic migrants hail from the interior, where rainfall variability, exacerbated by climate change, has reduced farming livelihood opportunities. However, there are also extensive international migration and circulation patterns centred on the city, and much of the new peripheral urban development is financed by remittances and investment in profitable real estate by expatriate Senegalese (Guèye, Fall and Tall 2007). Dakar is a strongly primate city, containing a disproportionate share of national economic activity and gross geographical product. In terms of GEC coping strategies, the absence of an overarching metropolitan planning agency to link the 53 separate local authorities is a major impediment (République du Senegal et al. 2007).

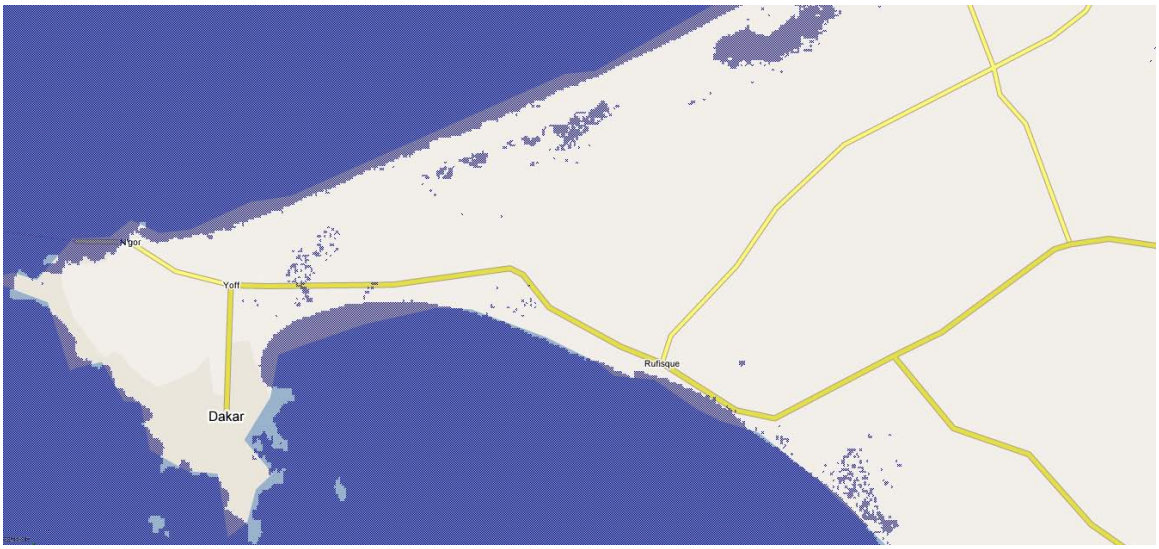
Data for Cotonou (Benin) provide a reasonable estimate of the likely magnitudes of sea level rise in the region: the average and extreme scenarios suggest 20 and 39 cm, respectively, by 2050 and 49 and 59 cm, respectively, by 2100 (Dossou and Glenhouenou-Dossou 2007); in the light of the most recent scientific estimates of accelerated polar ice cap melting, the extreme figures are more likely to be accurate than when these data were produced. Many of the poorest and most vulnerable people occupy areas most at risk from flooding and sea level rise. This is immediately evident from the comparison of the satellite photo of Dakar's built-up area (Figure 1) and the map showing the areas prone to inundation and to periodic storm flooding (in blue-grey and pale blue respectively) (Figure 2). Indeed, the mayor of Rufisque (see Figure 2) described vividly at the UGEC/UN-HABITAT workshop in February 2008 how the sea had encroached progressively to the point where it was now literally within a few metres of the nearest homes. Along the coast to the north, irregular settlement just beyond the beach is creating major environmental and sanitation problems, contributing to health hazards and the risk of flooding during severe storms as in 2005 or the rainy season. Some retrofitting of service infrastructure has occurred in these areas, conveying de facto legitimacy on the residents, but the rate of growth is far outstripping the city's planning and implementational capacity. Extensive illegal sand extraction on the beach for urban construction is increasing vulnerability to storm surges and coastal inundation. Despite its coastal location, Dakar lies in a semi-arid zone, where water supply and provisioning represent major challenges to the growing city. Guèye, Fall and Tall (2007: 90-92) also attribute one dimension of internal migration, and the large-scale departures of migrants in unseaworthy vessels heading for the Canary Islands and ultimately a better life in Europe, to the impact of industrial overfishing and changing

marine conditions as a result of climate change, which have greatly reduced the availability of fish stocks to these coastal artisanal fishing communities.

Figure 1
Google Earth image of the built-up area of metropolitan Dakar

Source: © Google Earth

Figure 2:
Google Map showing area of metropolitan Dakar that would be flooded
(pale blue) by a sea level rise of 1 m



Source: © Google Earth

Conclusions

This paper has surveyed the challenges of coping with GEC in urban Africa. Various international, regional and national agencies and city networks engage with GEC to differing extents, some of them just now beginning to incorporate it into their activities.

Up to now, ‘sustainable development’ in various guises has been the nearest point of contact, but this has tended to remain principally concerned with the Habitat Agenda and implementation of Local Agenda 21s. The more detailed examination of existing conditions and vulnerabilities to GEC impacts in urban areas across Africa demonstrated the potential scale of the problems. Some of these are already demonstrably being experienced, often with unintended consequences, but others are still some way off.

One of the key challenges is therefore ensuring appropriate levels of awareness by African urban planners and managers of the urgency of GEC threats, and then converting this awareness into appropriate actions in situations where distant and less certain impacts pale into insignificance in relation to immediate basic needs and other demands on the public exchequer. Delays will prove costly, even though African cities still contribute little to global emissions, because of the cumulative impacts and often substantial investment lags. Such actions as have been undertaken in a few cities to date aim straightforwardly at mitigation, while there is little evidence of adaptive planning or implementation.

Analysis of the urban impacts and governance implications of GEC means addressing resource availability (water and sanitation services; electricity; woody biomass for low-income residents unable to use electricity; sand, gravel and other construction materials), resource consumption (incentives and re-/constraints on land, water and energy use) and the impacts of resource use choice (atmospheric pollution; watercourse and groundwater contamination or salinization through rising seawater penetration of coastal water tables; land degradation and loss of vegetative ground cover), and also urban preparedness, anticipatory planning, regulation and state and civil society hazard response capability. Research is required in different contexts to expose how these initiatives can be targeted variously at rich and poor people and the neighbourhoods which they inhabit. Evidence-led planning and management for GEC mitigation and adaptation may be a remote possibility at present in most African urban areas, but it will become increasingly important. GEC thinking ultimately needs to be embedded within all forms of research, planning and action. This requires a strategic, medium- to long-term perspective that avoids seeing GEC mitigation and adaptation as conflicting with other interventions aimed at promoting social equity, environmental justice or urban sustainability. Put bluntly, without viable GEC strategies, the other interventions risk being eclipsed by a rising tide of change.

References

Adger, W. N., S. Huq, K. Brown, D. Conway, and M. Hulme (2003). ‘Adaptation to Climate Change in the Developing World’. *Progress in Development Studies,* 3 (3): 179-95.

Awuor, C. B., V. A. Orindi, and A. O. Adwera (2008). ‘Climate Change and Coastal Cities: The Case of Mombasa, Kenya’. *Environment and Urbanization,* 20 (1): 231-42.

Betsill, M., and H. Bulkeley (2004). 'Transnational Networks and Global Environmental Governance: The Cities for Climate Protection Program'. *International Studies Quarterly*, 48 (2): 471-93.

Bulkeley, H., and H. Betsill (2003). *Cities and Climate Change*. London and New York: Routledge.

Business Report (2007). 'Bulawayo Runs Dry'. *Business Report*, 1 August. Available at: www.busrep.co.za/index.php?fArticleId=5019055.

Commission for Africa (2005). *Our Common Interest: An Argument*. London: Penguin.

DFID (Department for International Development) (2006). 'Reducing the Risk of Disasters—Helping to Achieve Sustainable Poverty Reduction in a Vulnerable World'. DFID Policy Paper. London: DFID.

CCGHS (Commonwealth Consultative Group on Human Settlements) (1999). *Focus on the Habitat Agenda: Commonwealth Development Framework for Human Settlements*. London: DPU for CCGHS and CHEF. Available at: www.ucl.ac.uk/dpu-projects/drivers_urb_change/official_docs/Focus_on_the_Habitat_Agenda.pdf.

Dossou, K., and B. Glenhouenou-Dossou (2007). 'The Vulnerability to Climate Change of Cotonou (Benin): The Rise in Sea Level'. *Environment and Urbanization*, 19 (1): 65-79.

Douglas, I., K. Alam, M. Maghenda, Y. Mcdonnell, L. Mclean, and J. Campbell (2008). 'Unjust Waters: Climate Change, Flooding and the Urban Poor in Africa'. *Environment and Urbanization*, 20 (1): 187-205.

Grimmond, S. (2007). 'Urbanization and Global Environmental Change: Local Effects of Urban Warming'. *Geographical Journal*, 173 (1): 83-8.

Guèye, C., A. S. Fall, and S. A. Tall (2007). 'Climate Perturbation and Urbanization in Senegal'. *Geographical Journal*, 173 (1): 88-92.

Gwebu, T. D. (2002). 'Urban Water Scarcity Management: Civic vs. State Response'. *Habitat International*, 26 (3): 417-31.

IPCC (Intergovernmental Panel on Climate Change) (2007). *Climate Change 2007: The Physical Science Basis*. Cambridge: Cambridge University Press. Available at: www.ipcc.ch/ipccreports/ar4-wg1.htm.

IPCC (2008a). *Climate Change 2007: Mitigation of Climate Change*. Cambridge: Cambridge University Press. Available at: www.ipcc.ch/ipccreports/ar4-wg3.htm.

IPCC (2008b). *Climate Change 2007: Impacts, Adaptation, Vulnerability*. Cambridge: Cambridge University Press. Available at: www.ipcc.ch/ipccreports/ar4-wg2.htm.

Leichenko, R. M., and W. D. Solecki (2006). *Global Cities and Local Vulnerabilities*. IHDP Update 2.2006. Available at: www.ihdp.org.

McDonald, D. (ed.) (2002). *Environmental Justice in South Africa*. Cape Town and Athens, OH: University of Cape Town Press and Ohio University Press.

Musemwa, M. (2006). 'Disciplining a "Dissident" City: Hydropolitics in the City of Bulawayo, Matabeleland, Zimbabwe, 1980-1994'. *Journal of Southern African Studies*, 32 (2): 239-54.

Parker, D., and J. Mitchell (1995). 'Disaster Vulnerability of Megacities: An Expanding Problem that Requires Rethinking and Innovative Responses'. *GeoJournal*, 37 (3), 295-301.

Parnell, S., D. Simon, and C. Vogel (2007). 'Global Environmental Change: Conceptualizing the Growing Challenge for Cities in Poor Countries'. *Area*, 39 (3): 357-69.

Pelling, M. (2003). *The Vulnerability of Cities: Social Resilience and Natural Disaster*. London: Earthscan.

République du Senegal, ONU-HABITAT & Cities Alliance (2007). 'Diagnostic Territorial de l'Agglomération Dakaroise (Résumè executif)'. Dakar: Projet Strategie de Developpement Urbain du Grand Dakar. Juin.

Sachs, J. (2005). *The End of Poverty: How We Can Make It Happen In Our Lifetime*. London: Penguin.

Sánchez-Rodríguez, R., K. Seto, D. Simon, W. Solecki, F. Kraas, and G. Laumann (2005). 'Science Plan: Urbanization and Global Environmental Change'. IHDP Report 15. Bonn: International Human Dimensions Programme on Global Environmental Change. Available at: www.ugec.org.

Simon, D. (2007). 'Global Change and Urban Risk: The Challenge for African Cities'. *The Constitution*, 7 (1): 3.22.

South African Cities Network (2006). *State of the Cities Report*. 'Johannesburg: South African Cities Network'. Available at: www.sacities.net/2006/pdfs/cities_2006.pdf.

Stern, N. (2006). *The Economics of Climate Change: The Stern Review*. Cambridge: Cambridge University Press.

UGEC (2008) *Short Workshop Report: Climate Change Resilience in an Urbanizing West Africa*. Ile de Gorée, Dakar, 22 February. Available at: www.ugec.org/docs/WorkshopReport_Short_English_CCResilienceUrbWestAfrica_v3.pdf.

UNCHS (United Nations Centre for Human Settlements) (2001). *The State of the World's Cities Report 2001*. Nairobi: UNCHS. Available at: www.unchs.org/istanbul+5/statereport.htm.

UN-HABITAT (2006). *State of the World's Cities 2006/7*. London and Sterling, VA: Earthscan.

UN-HABITAT (2008). *State of the World's Cities 2008/9*. London and Sterling, VA: Earthscan.

UN-HABITAT (2009). 'Cities and Climate Change Initiative: Launch and Conference Report'. 17 March. Nairobi: UN-HABITAT.

Wilson, E. (2006). 'Adapting to Climate Change at the Local Level: The Spatial Planning Response'. *Local Environment*, 11 (6): 609-25.