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Urbanization and Global  
Environmental Change  
AN IHDP CORE PROJECT

International Working  
Paper Series  
ISSN 1935-9160

WORKING PAPER 08-01  
JULY 2008

When Do You See It? The Challenges of Global  
Environmental Change for Urban Africa

David Simon

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## UGEC International Working Paper Series

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### Series Editors:

Roberto Sánchez-Rodríguez, Professor of Environmental Sciences, UC Riverside  
Michail Fragkias, UGEC Executive Officer, Arizona State University

The UGEC project is a Core Project of the International Human Dimensions Programme on Global Environmental Change (IHDP) and is hosted by the Global Institute of Sustainability (GIOS) at Arizona State University (ASU)

### Contact Information:

Michail Fragkias, Ph.D.  
Executive Officer,  
UGEC International Project Office  
Arizona State University  
PO Box 875402  
Tempe, AZ 85287-5402  
Tel: +1 (480) 727-7833  
Fax: +1 (480) 727-9680  
Email: [fragkias@asu.edu](mailto:fragkias@asu.edu)  
<http://www.ugec.org>



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*Revised version of the paper prepared for the UNU-WIDER Workshop,  
Beyond the Tipping Point: African Development in an Urban World,  
Cape Town, 26-28 June 2008*

## Introduction

This paper surveys the still little understood phenomenon of global environmental change (GEC) and its implications for cities and urban populations in Africa. Today, GEC or the narrower concept of climate change is fast becoming a buzzword 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. GEC appears to be following a well-trodden path of becoming an international and development mantra, just as poverty has done in recent years, sustainable development did during the 1990s, structural adjustment in the 1980s and basic needs in the 1970s. This may be a mixed blessing, as experience with the (new) poverty agenda has recently demonstrated.

Poverty issues now truly occupy centre stage in development discourse of international agencies, national and subnational governments and NGOs. As with all such mainstreamed development foci, there is an inevitable tension. The underlying good intentions gain credibility – and hence hopefully greater levels of resourcing – through this process but, simultaneously, become the new orthodoxy and lose important elements of originality, vitality, flexibility and ‘critical purchase’ through the process of bureaucratic institutionalisation. In the case of poverty reduction efforts, this process has occurred through the adoption or implementation (often with associated conditionalities) of the Highly Indebted Poor Country (HIPC) Initiative, Poverty Reduction Strategy Papers (PRSPs), the Millennium Development Goals (MDGs) and some objectives of the Jubilee 2000 campaign.

One of the unfortunate side effects of such bureaucratisation is that the accompanying international comparative statistics and rankings are inevitably undertaken using highly aggregated national-scale data that mask often important regional, urban-rural, age or gender differences. This has often been true of poverty data, as so clearly revealed when the UNDP began publishing national *Human Development Reports*, in which a wide range of variables and indicators, such as the Human Poverty Index, were disaggregated geographically and socially. Such efforts, along with successive issues of the UN-Habitat’s *State of the World’s Cities*, have demonstrated that where we live does matter and that urban poverty has often been underestimated in the past. The 2006/7 report (UN-Habitat

2006) actually links urban poverty and substandard shelter to the relevant MDGs and the quest for more sustainable urban development.

Longitudinal data, such as Human Development Index trends since 1975, tend to show overall improvements in quality of life over time in the majority of countries not beset by debilitating conflicts or suffering other ongoing calamity (UNDP annual). Hence, the proportion of people who are poor (by whichever yardstick is used) appears to have fallen, although – as a result of population growth – more people may now be classified as poor on that variable than in the past. However, the positive trend is not inevitable, and can be quickly reversed, as evidenced by data on war-torn countries like Afghanistan, the Democratic Republic of Congo, Iraq, Somalia and, until very recently, Angola. The same is true of those countries most severely affected by the HIV/AIDS pandemic in central and southern Africa, where life expectancy has shortened to 35-40 years, dependency ratios and poverty levels have risen alarmingly, and vulnerability to disease or unforeseen mishap is high.

We are currently faced with a different but no less dramatic example. Many more people worldwide are rapidly being drawn into poverty as a result of the mutually reinforcing steep increases in the prices of fuel and food over recent months. These have been driven by a complex web of contributory factors, including droughts and floods in key producer areas. While possibly due to ‘normal’ cyclical climatic conditions, GEC is increasingly being implicated. As with all politico-economic dynamics, the impact of the price rises is highly unequal, with the poorest being the most vulnerable. In this case, on account of their greater reliance on fossil fuel consumption (both directly and indirectly) and on food purchases through formal or informal marketing channels, the urban poor are being particularly severely affected. Hence, in scenes grimly reminiscent of the savage cuts in price subsidies during the 1980s as structural adjustment programmes were implemented, there have already (as of 2 June) been food riots in no fewer than 37 countries – principally by the existing and new urban poor. In Africa, such protests have occurred to date in Somalia, Kenya, Cameroon and Senegal, following a near doubling of the price of basic staples like maize, wheat and rice over the last year. In Kenya, the annualised inflation rate rose from 21.8% in March 2008 to 26.6% in April, mainly as a reflection of fuel and food price increases (BBC News 31/5/08).

As already exemplified, severe setbacks 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 petrochemical 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) but 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), poor access to the corridors of power (political capital). The disasters literature has shown decisively 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 (e.g. Douglas et al 2008). This awareness is now increasingly being taken up in policy and development agency circles (e.g. Commission for Africa 2005; Sachs 2005; DFID 2006).

Over the last 10-15 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 UN Decade of Natural Disaster Reduction – a major global initiative in this field. For the first time, the latest 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 global environmental change (GEC) was unfortunately missed. This is now due to be remedied in the 2008/9 edition to be launched at the Fourth World Urban Forum in Nanjing, China, in early November 2008. Incidentally, there will, for the first time, be parallel continental state of the cities reports, including one on Africa that will provide a welcome break from the traditionally bland and descriptive coverage of such documents, and hopefully also introduce GEC and disaster vulnerability.

### **Understanding GEC**

GEC is commonly misunderstood as being little different from, or – indeed – merely a variety of – 'natural' disasters. Hence the 'disasters community',

political leaders and civil servants (at all scales of government) alike have assumed until very recently that their accumulated expertise was appropriate to the task of addressing GEC and its impacts. Yet the difference is important. As indicated above, 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.

#### Distinguishing Mitigation from Adaptation

Actions to address GEC fall into two categories. Mitigation comprises efforts to reduce the impact of, and vulnerability to, the various dimensions of GEC. Examples include strengthening coastal sea defences, rehabilitating mangroves or reedbeds along shorelines and riverbanks, increasing the capacity of urban stormwater drainage, strengthening and protecting vulnerable buildings and infrastructure such as electricity pylons and substations, promoting energy efficiency and savings (e.g. through improved insulation of buildings, 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 winning, brickmaking, fuelwood and reed harvesting, groundwater abstraction) do not increase vulnerability. This includes both industrial/commercial-scale operations and ‘informal’ activities (themselves now often commoditised and commercialised) by the urban poor. In essence, therefore, mitigation refers to enhancing or modifying current activities to reduce their impact or reduce vulnerability. 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 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 promoting walking, cycling and a shift from private motor vehicles to public transport; 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 multi-functional landuse; 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). Clearly, 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.

GEC science has long been controversial, not so much on account of the science per se but because of its implications. Hence those, like the oil industry and politicians linked to them, with strong vested interests in current lifestyles and consumption patterns have sought to discredit the research as inaccurate and GEC ‘proponents’ as biased. However, the increasing sophistication of global climatic models and other research has progressively enabled more accurate forecasts with narrower variance and standard errors. Publication of the Intergovernmental Panel on Climate Change’s (IPCC) Fourth Assessment Report (AR4) (IPCC 2007, 2008a, 2008b) marked something of a watershed as the climate sceptics and deniers have, in effect, now lost credibility. Even President Bush of the USA has now acknowledged the reality of GEC, even if still reluctant to accept the scale or extent of measures that will be needed to tackle it. Importantly, the IPCC AR4 added to the debate fostered by the Stern Review Report on the Economics of Climate Change (Stern 2006), which argued 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 is real and unavoidable and the longer appropriate

mitigation and adaptation are delayed, the more costly such actions would become. On the basis of preliminary IPCC data and other evidence, the report also indicated the substantial scale of greenhouse gas emissions required but pointed optimistically to these challenges as tremendous economic and innovative opportunities.

### 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 on 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 (e.g. Bulkeley and Betsill 2003). Disasters and vulnerability thinking (e.g. 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 deliberately rather than cities in order to ensure that intermediate and smaller urban areas are included, since no size category is immune from the impacts of GEC. The bias of size is already evident in two respects. First, research has, perhaps inevitably, 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.

Of course, urban areas are not islands but 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. Globalisation 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 policy-making 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) have recently sought to set an agenda for debating and conceptualising the urban GEC challenge in poor countries. They see it very much as part of broader development challenges. Indeed, 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, recognising that states do need effective capacity and an ability to intervene. However, such capacity should be nuanced and avoid previous mistakes. To that end, we advocate linking developmentalism to a political ecological awareness and people-centred approaches such as livelihoods analysis that seek to integrate an analysis of the structural processes and forces driving the political economy and its environmental ramifications with an understanding of the diverse and multiple livelihoods strategies undertaken by individual families and households to make ends meet. These strategies may be partially or entirely vulnerable to the impacts of GEC (Parnell, Simon and Vogel 2007).

As 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 (e.g. emissions levels, waste production and fossil fuel-derived energy utilisation) and to move towards a low carbon economy. Such private sector initiatives may also have significant social benefits and should be leveraged to maximise 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 marginalised groups. Furthermore, formal processes and regulations may everywhere be bypassed through corruption, patronage/clientilism 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.

### **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.

#### Raising awareness: initiatives and networks

Initiatives to address these challenges have recently been launched through a variety of organisations, including the United Nations, 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) ([www.ugec.org](http://www.ugec.org)) 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 is currently gearing up its own role in respect of cities and climate change,

following an expert group meeting on the subject in Nairobi in November 2007. It is establishing its own global network, SUDNET ([www.sudnet.org](http://www.sudnet.org)), to promote sustainable urban development through Habitat Agenda partners at global and local levels. GEC will form one element of its focus. SUDNET will be launched in Oslo on World Habitat Day, 6<sup>th</sup> October 2008. The 2008/9 edition of UN-Habitat's *State of the World's Cities* will also include some coverage of climate change.

The South African Cities Network ([www.sacities.net](http://www.sacities.net)), a well-resourced and quite efficient resource for city managers and officials, is keeping a watching brief and exchanging relevant information, only now really beginning to engage seriously on climate change. Indeed, the *State of the Cities Report 2006* (SACN 2006) fails to mention GEC or climate change, despite 3 of the 10 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. 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 emphasised the need for advice on practical policies ([http://www.sacities.net/2008/may26\\_jozisummit.stm](http://www.sacities.net/2008/may26_jozisummit.stm)).

Along with Addis Ababa, Cairo and Lagos, Johannesburg is also a member of the C40 network of the world's largest cities ([www.c40cities.org](http://www.c40cities.org)). Originally known as the C18, it initiated biennial climate summits in 2005 (London) and 2007 (New York), bringing together mayors, senior officials and business leaders to promote the exchange of ideas on best practice and collaborative efforts. The next will be in Seoul in 2009. In 2006, the C40 established a partnership with the new Clinton Climate Initiative, dubbed the climate leadership group, in order to progress its agenda of promoting energy efficiency and reducing carbon emissions more effectively.

At a broader level, The Commonwealth is now also prioritising 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 Commonwealth Secretariat, Commonwealth Foundation, Commonwealth Association of Planners (CAP), Commonwealth Human Ecology Council, Commonwealth Local Government Forum, Homeless International, UN-Habitat and the UK's Dept for International Development (DFID)

([www.comhabitat.org](http://www.comhabitat.org)). 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, is being prepared under the auspices of the CAP, using a set of case studies as the basis for a comprehensive review. Ongoing urbanisation 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 percent 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 (Commonwealth Foundation Briefing Meeting on Cities and Climate Change, London, 23/4/08).

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; <http://www.iclei.org/index.php?id=629>), Under this programme. 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.

I am not aware that any substantive evaluation of these initiatives and actions has been undertaken, so 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 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 mainstreaming implementational capacity to promote sustainable development, does represent an appropriate framework for tackling GEC.

The differences between disasters and GEC are also still often poorly understood. Importantly, too, 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 late 2006 to protect government offices, luxury hotels and residences from storm surges. However, its design was not bolstered to cater for the likely level of sea level rise or increased magnitude of storm events linked to GEC.

#### The situation on the ground<sup>1</sup>

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, 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 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 masterplan developed elsewhere should be avoided. While much mutual learning is clearly possible, especially in terms of identifying the most important principles

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<sup>1</sup> Figures 1-6 referred to in the city case studies, are not included in this version of the paper to keep a reasonable file size and avoid reproduction difficulties.

and elements of successful action elsewhere, there can be no simple or universal strategy to reduce urban footprints. Local conditions (biophysical, structural, socio-economic 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 18<sup>th</sup> in 1980, 17<sup>th</sup> in 1990, 19<sup>th</sup> in 2000 and was expected to be 16<sup>th</sup> in 2010. By contrast, Lagos entered this league at 21<sup>st</sup> in 1980, before rising to 6<sup>th</sup> in 2000 and an anticipated 3<sup>rd</sup> 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 megacity 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 30cm 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 represent acute risks. Inland urban areas, both within littoral and landlocked Commonwealth African countries, face diverse risks, ranging from floods to desiccation, rising temperatures and desertification to water, food and fuelwood supply.

Kano, Bulawayo,<sup>2</sup> 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 southwestern Zimbabwe, Bulawayo has already been beset by chronic water shortages for years (Gwebu 2002; Musemwa 2006; *Business Report* 2007), although 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 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 fisherfolk adversely. Lagos has suffered as much as anywhere in this respect (Simon 2007).

### Case Study: Lagos<sup>3</sup>

In such contexts, it is easy to appreciate the likely impact of sea level rise, which, as indicated above, is already occurring. Table 1 provides data for

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<sup>2</sup> Pres. Mugabe withdrew Zimbabwe from the Commonwealth in 2003 but a new government would be very likely to rejoin.

<sup>3</sup> This example is drawn from Simon (2007).

likely increases in Cotonou, not far from Lagos and therefore a useful illustration of what can be expected. Even the extreme level is well below the upper end of the IPCC global average predictions.

The most likely effects include accelerated coastal erosion and the inundation of low-lying areas. Even beyond the upper limit of such impacts, increased salinisation of coastal groundwater and estuaries, lagoons, rivers and lakes that survive inundation will dramatically affect human water supply, natural vegetation and agriculture in some of the region's areas of highest population density and resource consumption.

Table 1 Predicted sea level rise scenarios, Cotonou, Benin

End dates	Sea level rise (cm)	
	2050	2100
Average scenario	20	49
Extreme scenario	39	59
Basic scenario	7	20

Source: First National Communication (Benin), 2001, cited in Dossou and Glehouenou-Dossou (2007).

The precise extent and permanence of such damage will depend on local conditions but – as indicated earlier – this is a very different prospect from localised subsidence or a one-off flood, from which one can begin to recover and rebuild almost immediately.

These impacts will destroy or adversely affect numerous livelihoods. It is also important to remember that coastal urban areas are important concentrations not just of commercial, industrial and service activity but also of fishing and agriculture. Some 15,000 people depend on fishing and ancillary activities in Cotonou, a city of one million (Dossou and Glehouenou-Dossou, 2007). In Cape Coast, Ghana, the fishing community live right on the beach, behind the castle, and thus stand to lose both livelihoods and homes. This is not an uncommon situation. Much low-lying urban land, especially along watercourses and in swampy areas, is utilised for urban and peri-urban agriculture, providing both subsistence production but also a significant source of commercial food for the cities. The peri-urban and nearby rural areas, many of which are also low-lying, are often cultivated intensively by smallholders and larger scale commercial farmers supplying the urban market for food and industrial inputs. Employment statistics for any town or city with vaguely reliable



data reveal that agriculture, forestry and fishing typically employ between 10 and 25% of the urban labour force.

The precise proportions of different cities likely to be submerged under the rising seawater will vary, as it will over time in a single city. In extreme cases, entire towns and cities may disappear. Lagos, probably the second largest metropolis in Africa, has a population of about 15 million although the Lagos State Government (2005) projected 16.9 million for 2006. A high proportion of these people are poor, living more or less from hand to mouth, in informal, irregular and/or overcrowded shelter. They certainly lack the resources to cope alone and hence must be deemed vulnerable.

Elite and upper middle income housing, along with office and service activities (including tourist development), now dominate parts of the most desirable coastal frontage, e.g. on Victoria Island, Ikoyi on Lagos Island and Moroko (from where some 500,000 largely poor residents were evicted under the military government in 1990). The recently completed anti-erosion work and promenade may help to protect part of Victoria Island. However, in many other areas, abutting older industrial and commercial zones along with newer lagoonside locations where conditions are poor and existing environmental hazards sometimes considerable, poor people are concentrated. The southernmost part of Ajegunle and others of Lagos's 200-odd slum areas, including parts of Mushin as well as Ojota abutting the Ogun River floodplain and new shantytowns along the Lekki Peninsula which are home to large numbers of Liberian and Sierra Leonean refugees (Gandy 2005), are also very vulnerable. Parts of Bariga and Makoko actually stand over the water, with houses built on stilts; many early residents were fishers; now they struggle to catch any fish at all as a result of urban pollution. The numerous sawmills along the shoreline are also very vulnerable.

Superimposing altitude contours on such a map will provide a graphic illustration of the areas – and people – most vulnerable to inundation (Figs 1, 2 and 3). According to UN-Habitat's (2006: 41) global scorecard on slums – produced in relation to the Millennium Development Goal 7, target 11, on shelter provision – Nigeria is well off-target, with slum populations growing at 5% p.a. 1990-2005. Although the proportion of slums declined from 80 to 71.9 over that period, the absolute number of slum dwellers increased from 24 to over 46 million in 2005.

Lagos's northward expansion is increasingly encroaching on the Ogun River floodplain which, along with the grassy mudflats and swamps along the northern lagoon, is particularly vulnerable to sea level rise, as is the area of coastal sand ridges and shallow depressions to the west of the city

that stretches well beyond Badagri. Behind that zone lies another area of flat, often waterlogged area (Adeniyi 1981; Braimoh and Onishi 2007; Gandy 2005, 2006) – a good example of a zone vulnerable to salinisation if not direct inundation.

#### 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 3 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 (Republique du Senegal, ONU-Habitat et Cities Alliance 2007).

As in Lagos, 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 land-use and 1m sea level rise maps (Figs 4 & 5). Indeed, the mayor of Rufisque described vividly at the UGEC/UN-Habitat workshop in February 2008 how the sea has encroached progressively to the point where it is 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 the rainy season. Some retrofitting of service infrastructure has occurred in these areas, conveying de facto legitimacy to the residents but the rate of growth is far outstripping the city's planning and implementational capacity. Extensive illegal sandwinning on the beach for urban construction is increasing vulnerability to storm surges and coastal inundation. Despite its coastal location, Dakar is 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.

#### Case Study: Cape Town

At over 350 years, Cape Town is South Africa's oldest city. Hence its urban fabric, political ecology and diverse population and resource use patterns provide a distinctive degree of historical 'embeddedness'. The city's status as a declared ecological hotspot provides additional salience to the considerable GEC threats. As one of South Africa's most important industrial, commercial and tourist centres, Cape Town possesses many world-class facilities juxtaposed to extensive poverty and deprivation, making it a particularly unequal city.

The proportion of households below the Household Subsistence Level (HSL) increased from 25% to 32% between 1996 and 2001 (Boulle and Parnell 2005; De Swardt *et al.* 2005). Most of the urban poor – often relatively recent African migrants from the Eastern Cape as well as long-term residents adversely affected in the past by apartheid urban management – inhabit the low-lying and sandy Cape Flats (Turok 2001; Watson 2002), often in flimsy shacks, and are thus particularly vulnerable to fires and regular winter floods. These are some of the most vulnerable areas in terms of GEC impacts, highlighting again the way in which vulnerable people commonly inhabit the most vulnerable localities. Key industrial and communications infrastructure (airport, railways, marshalling yards, arterial 'national' roads, power stations) also occupy parts of this vulnerable land. Attention to environmental and social justice, as well as issues of service privatisation, are important in terms of post-apartheid planning regulation and practices (McDonald 2002), even before the likely impacts of GEC are factored in.

Examination of the land-use and 1m sea level rise maps (Figs 6, 7 & 8) indicates the vulnerability of some coastal areas and also those in parts of the Cape Flats, underscoring the need not only for carefully co-ordinated mitigation programmes but a coherent adaptation strategy in the longer term. Sea level rise and inundation from increasingly frequent and severe storm surges are but one dimension of the challenge. These events will increase salinisation of, and ingress of industrial and sewage pollution into, the Cape Flats water table, including potentially the important subterranean aquifers. In turn, this will affect part of the city's water supply and the intensive, high-value market gardening area of Philippi.

As indicated in a more general context above, there have been commitments to meeting the challenges of GEC in high level policy statements by both the City Council and the Province (City of Cape Town 2005; Western Cape 2006). Nevertheless, translating a general awareness of the threats of GEC into urban policies and programmes that anticipate the challenges of GEC requires resources, skill and innovation as well as technical capacity across diverse sectors including land use planning, energy and other ecosystem-based services (Bulkeley & Betsill 2003; Wilson 2006). Before institutional changes are implemented to meet the MDG and Johannesburg Plan of Action deadlines adopted at the 2002 World Summit on Sustainable Development, a more robust investigation is needed on what can be done to mitigate and adapt to GEC at the city scale (Parnell, Simon and Vogel 2007).

## **Conclusions**

Having explained the key dimensions of GEC as they are increasingly affecting urban areas, this paper surveyed the state of the art with respect to African cities. 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, and particularly in the case studies of Lagos, Dakar and Cape Town, 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 to appropriate actions in situations where distant and less certain impacts pale into insignificance against 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 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 salinisation 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. Crucially, 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 will ultimately need 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 or adaptation as conflicting with other interventions aimed at promoting social equity, environmental justice or urban sustainability. Put bluntly, without viable GEC strategies, the others risk being eclipsed by a rising tide of change. Generic decision-support tools may be helpful but must be adapted and tested for local conditions.

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Paper DS 28June08.doc