Global Environmental Change xxx (2011) xxx–xxx

Contents lists available at SciVerse ScienceDirect

Global Environmental Change

journal homepage: www.elsevier.com/locate/gloenvcha

Sub-Saharan African urbanisation and global environmental change☆

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ARTICLE INFO

Article history:
Received 13 June 2011
Received in revised form 8 September 2011
Accepted 13 September 2011
Available online xxx

Keywords:
Urban growth
Urbanisation
Africa
Migration
Displacement
Down-scaled climate models

ABSTRACT

Scientific evidence for global environmental change in Africa presents a prima facia case for increased human migration and displacement. Closer scrutiny of the evidence on demographic change, however, suggests that migration and displacement are less important variables in explaining the human dimensions of global environmental change on the continent than is commonly projected. Natural population growth in cities is a more important dynamic in the evolving system of human settlement in Africa and this significant shift in where people live, both now and in the future is overlooked by the emphasis on the potential impact of environmentally induced migration. Even without any movement from the countryside, cities represent the fastest growing sector of the sub-Saharan African population. The existing vulnerability of African cities, with their fast growing populations and weak management means any environmental change is likely to have significant consequences for cities. Taking the sub-Saharan African demographic evidence seriously means that the scholarly and policy emphasis currently directed to GEC migration and displacement might be more effectively redirected to questions of the interface between global environmental change and urban areas.

1. Introduction

Simplistic notions of push and pull models of migration and urbanisation belie the great complexity of human movement and settlement in Africa, no more so than under present and predicted conditions of global environmental change (GEC). Understanding the interface of African migration and urbanisation in relation to shifting regimes of ecosystem services and increasing environmental hazards associated with climate change hinges on a clear unravelling of each of these dynamic processes and their interplay (Sanchez-Rodrıguez et al., 2005). The task is made complex because changes in urbanisation and environment are not linear, the data for Africa are poor (Potts and Bowyer-Bower, 2003; Potts, 2010; UN-HABITAT, 2009) and, in the case of urbanisation, the process is deeply politically charged (Jones and Corbridge, 2010; McGranahan et al., 2009; Parnell and Simon, 2010; Pieterse, 2008). Already there has been a very pubic spat over Myers (2005) predictions of up to 700,000 climate migrants, the majority from Africa (Brown, 2008; Dodson, 2011; Parry et al., 2007). There are weak indications, where the hypothesis of mass GEC induced migration is likely to hold true, but this assessment of African urbanisation suggests that there are also other, often more salient, conclusions about the impact of GEC that put the focus on the natural expansion of African urban populations and not just displacement and migration. This shifts the emphasis over why, where and how GECs will impact Africa, making migration a less substantive issue and cities more critical sites of significant GEC impact. The overall argument of this paper thus concurs with that of Warner (2010) that the impacts of GEC in sub-Saharan Africa are likely to drive further migration, some circular in character, but much of it permanently to African cities. The argument presented here further suggests that Africa's rapidly expanding and very fragile urban areas (many of them coastal) are likely to be the major locus of the impact of GEC over the next thirty to fifty years because of their fast rate of population growth and weak state capacity to manage GEC induced urbanisation and GEC at the city scale.

The paper is structured in three parts; the first provides a brief summary of the patterns and forecasts for sub-Saharan Africa's biophysical experience of GEC, establishing that there is indeed a *prima facia* case that predicted environmental change might precipitate new and different forms of human movement in Africa, but also highlights the gap in knowledge about downscaled or city regional climate predictions and the vulnerability of settlements. The next section reviews continental trends in urban growth,

☆ This research was supported financially by the United Kingdom Government Office for Science through the Foresight project on environmental migration. The Foresight lead experts and project team are thanked for their suggestions and support throughout this project. This article benefited from suggestions made by two anonymous reviewers of an earlier report from this study, and from comments by participants at a Foresight workshop.

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0959-3780/$ – see front matter © 2011 Published by Elsevier Ltd.
doi:10.1016/j.gloenvcha.2011.09.014

urbanisation, migration and the shifting urban system in Africa over the last century. Contrary to the view that suggests that GEC is a likely driver of migration, we show that there is little consensus on what drives (or draws) people into sub-Saharan African cities. The final section, mindful of the inconclusive nature of the literature on urbanisation and migration, takes us to a speculative assessment of drivers and impacts of GEC linked migration in Africa. To do this we follow Black et al. (2011) in arguing that we need to understand the foundational drivers of urbanisation, exploring its linkages with GEC, rather than looking for how GEC is an isolated driver of urban growth and urbanisation.

2. Global environmental change – trends and predictions for Africa

Africa is a continent that experiences a variety of climates across a range of regions, from humid tropics to the very arid Sahara (Christensen et al., 2007). What is clear from the data is that climate changes are of sufficient magnitude, if not predictability, to trigger altered human responses that include shifts in agricultural production and forced migrations in response to natural disasters (IOM, 2009). However there is insufficient detail to make local scale predictions of how or where GEC might drive migratory movements. Studies of observed temperature show a warming trend that is consistent over the continent, but not uniform. Decadal warming rates in the tropical forests, for example, are 0.29 °C (Malhi and Wright, 2004) while in South Africa they are between 0.1 °C and 0.3 °C (Kruger and Shongwe, 2004). New et al. (2006) show an increase in the number of warm spells over southern and western Africa between 1961 and 2000, and a decrease in the number of extreme cold days. Decreasing temperature trends have also been observed in the eastern African weather station records located close to the coast and major inland lakes (King'uyu et al., 2000). Local impacts of global sea level rises are only beginning to be modeled for African locations (Brundit, 2008, 2009).

The precipitation pattern across the continent is not only complicated, with spatial and temporal variability, but inter-annual variability remains high over most areas. Recent regional specific precipitation studies show a number of trends including decreases in West Africa (Chappell and Agnew, 2004; Dai et al., 2004; Nicholson et al., 2000) and in the North and South of Congo (Malhi and Wright, 2004). Increases in the annual rainfall along the Guinea coast have been noted during the last 30 years (Nicholson et al., 2000). Studies in southern Africa show no detectable, long-term trend, but inter-annual variability has increased in the post-1970 period with higher rainfall anomalies and more intense and widespread droughts (e.g. Fauchereau et al., 2003; Richard et al., 2001). A change in seasonality and extremes has also been noted in this region (New et al., 2006; Tadross et al., 2005a).

As with other regions, there are complex mechanisms governing these patterns and their changes. Our understanding of these has improved over the years but more research is needed in order to improve our ability to assess the impact that climate change may have on the continent and at the city region scale. Africa remains as one of the most vulnerable continents to climate change (Boko et al., 2007) and yet there are still very few regional to sub-regional climate change scenarios using regional climate models or empirical downscaling constructed in Africa. A summary of key future vulnerabilities for the continent as noted in the Fourth Assessment Report (Boko et al., 2007) is provided in Tables 1 and 2 below, with further more specific reading indicated in the last column.

The impacts that any of these changes listed in Tables 1 and 2 can have on cities are many and complex. Major cities situated along the coast for example, as it is with most of the major cities in sub-Saharan Africa, are likely to be affected by sea level rise through increased storm flooding and damage, inundation, coastal erosion, increased salinity in estuaries and coastal aquifers, rising coastal water tables and obstructed drainage. Displacement of people, destruction of property and loss of livelihoods are also the impacts that may be associated with this. Similarly, cities are vulnerable to extreme heat events, flooding and landslides as a result of possible future climatic changes. Some of the impacts on cities as a result, may be infrastructure damage, transportation, water and sanitation systems damage, economic and tourism impacts (UN-HABITAT, 2009). It is therefore very important that with the growth of cities in sub-Saharan Africa, potential impacts

Table 1
Future trends for GEC in Africa by climate variable.

Climatic variable	Future projections	Specifications of relevant study	Source/further reading
Air temperature	An increase in the mean annual air temperature of between 3 °C and 4 °C degrees is shown compared with the 1980–1999 period	Medium high SRES A1B used with 20 General Circulation Models (GCMs)	Christensen et al. (2007)
	Up to 9 °C warming in North African mediterranean coast in June to August and up to 7 °C for the southern African region in September to November	GCM scenario based on the A1F1 emission scenario, for the period 2070–2099	Ruosteenoja et al. (2003)
	A 3.7 °C increase in summer and 4 °C increase in winter southern Africa in the 2080s	Regional Climate model (RCM) HadRM3H using the A2 emission scenario	Hudson and Jones (2002)
	Cooling of 0.8 °C/year in the global tropics. Primarily due to increase in vegetation density		Bounoua et al. (2000)
Precipitation	Decreases along the Mediterranean coast by 20% – extending to northern Sahara and along the west coast.	SRES A1B and A2 emission scenarios for 2080–2099	Christensen et al. (2007)
	Likely increases of around 7% in the topical and eastern Africa.		Hudson and Jones (2002)
	High probability that winter rainfall in southern Africa will decrease, especially in the extreme west, by between 30%- 40%		
	South Africa indicated increase summer rainfall over convective region of the central and eastern plateau and the Drakensberg mountains	Empirically downscaled projections	Hewitson and Crane (2006)
	Decrease early summer rainfall and increase in late summer over eastern parts of southern Africa	RCM based projections	Tadross et al. (2005b)
	Sahel – number of extreme dry and wet years to increase	Using data from four GCMs simulations	Huntingford et al. (2005)
	Drying for northern Africa and wetting in central Africa	Global drought simulation for 21st century under A2 scenario	Burke et al. (2006)
Extreme events	Increase of between 10–20% in cyclone intensity with a 2–4° SST rise		Lal (2001)
Tropical storms	More frequent and intense storms over Indian Ocean		McDonald et al. (2005)

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Table 2
Future trends for GEC in Africa by sector.

Sector predictions	Future projections	Specifications of relevant study	Source/further reading
Water sector	Quergha watershed in Morocco is likely to change for 2000-2020. A 1 °C increase in temperature can change runoff in the order of 10%-assuming there is no change in precipitation. The impact in the area is equivalent to the loss of one large dam per year.		Agoumi (2003)
Streamflow	Africa wide the range in 2050 is from a decrease of 15% to an increase of 5% above 1961-1990 baseline. For 2100 the range is a decrease of 19% to an increase of 14%. For southern Africa, all countries except South Africa will experience a significant decrease. For South Africa increases under high emissions scenarios are under 10%	Using 10 scenarios by five GCM models – CSIRO2, HadCM3, CGCM2, ECHAM and PCM	Strzepek and McCluskey (2006)
Ecosystems	Changes in species range and changes in tree productivity – may add stress on forest systems.		UNEP (2004)
	Grassland changes to be expected due to changes in CO_2 levels and average temperature.		Muriuki et al. (2005); Levy (2006)
	One of the major ecosystems in Africa –mangroves and coral reefs are likely to be affected. Some of the endangered species include manatees, marine turtles and migratory birds. A rise in sea level may also allow mangroves to recolonise coastal lagoons.		Boko et al. (2007)
	Coral bleeching due to ocean warming on reefs. Loss of low lying corals and losses of biodiversity. Proliferation of algae and dinoflagellates may affect more people due to consumption of food sources. In South Africa changes in estuaries due to reductions in river runoff and inundation of salt marshes due to rising sea level.		Lough (2000); Muhando (2001); Obura (2001); Boko et al. (2007); Clark (2006)
	Assuming no migration, 10–15% species fall within IUCN critically endangered or extinct category by 2050, increasing to 25–40% by 2080. Less extreme when free migration allowed-10% to 20% at 2080	Using SRES A2 and B2 scenarios in sub-Saharan Africa in 141 national parks, with HadCM3 GCM for 2050 and 2080	
	Within the mammal population a westward range shift in equatorial transitional zone in central Africa and eastward shift in southern Africa is expected.	Shift due to latitudinal aridity gradients	
HOT SPOTS	Critical 'unstable' area identified for east-west band from Senegal to Sudan, separating dry Sahara from wet Central Africa	Based on 6 GCMs and a composite ensemble of African precipitation modeled for period 2070–2099 derived from 21 coupled ocean-atmospheric GCMs	deWit and Stankiewicz (2006)
	Okavango River basin could be negatively impacted by CC (greater than human activity)		e.g. Biggs et al. (2004); Anderssen et al. (2006)
	Mega cities along the coast vulnerable due to potential sea level rise and high risk of flooding		Nicholls and Tol (2006); Awuor et al. (2008)

and vulnerabilities to changes as a result of GEC needs to be studied in greater detail.

3. Defining and deciphering African urbanisation and migration

Understanding the future impact of GEC (Tables 1 and 2) on migration presupposes that there is consensus on the current drivers of human settlement, something that is more than usually difficult to establish for Africa where data is out of date, census figures are not always accurate and the important data is not always in the public domain. Despite the fact that recently there have been a number of high profile international publications providing a synthesis of urbanisation trends in Africa (UN-HABITAT, 2009; World Bank, 2009), there are no uniform official definition of 'urban' or 'rural' used across the continent, some countries do not even have a definition (Montgomery et al., 2003; Potts, 2005, 2010). This definitional omission helps to explain some of the variation in estimates across sources and acts as a general warning to treat the data presented here with some caution. It also reflects real ambiguity among scholars over what is understood by migration and urban life in Africa (c.f. contrasting accounts in IOM, 2009; Myers, 2003; Crankshaw et al., 1992; Simone, 2004 or Potts, 2010). The position adopted in this paper is that it is critical to understand the sub-Saharan African experience of both urban growth and urban migration as the platform for reflecting the possible GEC impacts, though these are of course interlinked dynamics in what, in global terms, is a very late urban transition (Montgomery, 2008; Montgomery et al., 2003) (Fig. 1). Sub-Saharan Africa's 'urban turn', that is widely understood to be distinctive because urbanisation and industrialisation have been uncoupled (O'Conner, 1983; Rakodi, 1997; Todaro, 2009; World Bank, 2009), may also prove uniquely destructive because of the temporal coincidence of inadequate urban management, rapid urbanisation and the escalation of those impacts of GEC, such as increased intensity in precipitation, that could drive migration to cities (Annez et al., 2010) and/or cause havoc in cities (Bicknell et al., 2009).

The academic literature on sub-Saharan Africa has long highlighted the importance of fluid human movement across the continent, with circular migration, rural to rural and urban to urban migration as well as the urban absorption of traditionally peri-urban or traditional settlements by the physical expansion of cities (Freund, 2007; McGregor et al., 2006; Potts, 2010). Until recently African cities were, with notable exceptions (Cairo, Lagos, Johannesburg) were generally small, low in density and without significant economic muscle (O'Connor, 1983; Simon, 2007). The fast growing character of African urban areas has, however, long been a source of concern (Rakodi, 1997; Stren and White, 1989), just as the looming size of the megacities of Lagos or Cairo draws

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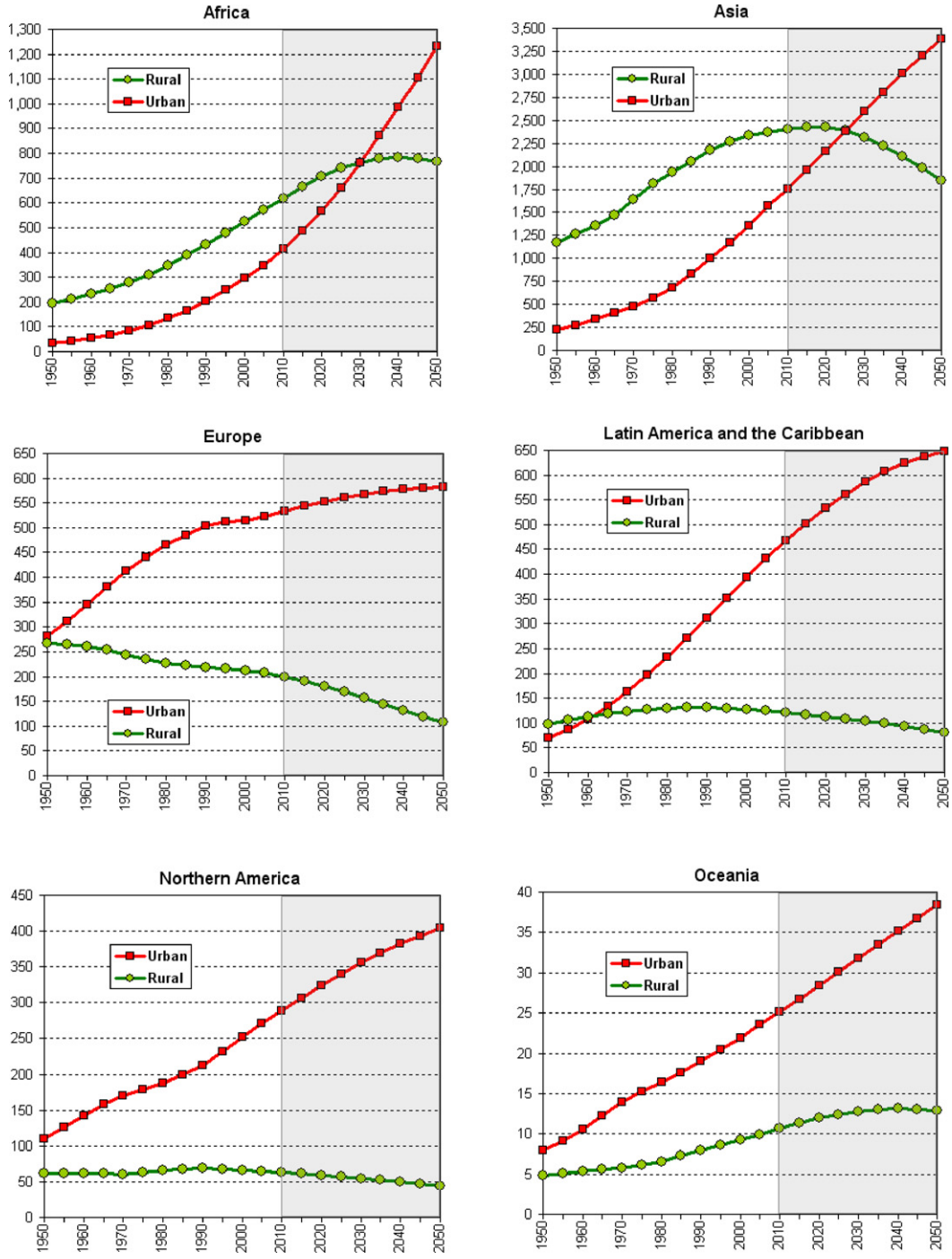

Fig. 1. The urban transition by major region (in million).

attention, not least in respect of their exposure to disaster (Wisner, 2003; Monitor, 2009). The absence of sub-Saharan African cities from any world city listings, with the possible exception of Johannesburg (Gugler, 2006), compounds the tendency to depict Africa as a vast, underdeveloped and essentially rural continent (Pieterse, 2010). As a consequence the emergence of a huge number of smaller and medium sized urban centres in Africa have been largely overlooked and Africa's silent urban transition is going almost unnoticed (Satterthwaite, 2009; Simone, 2010).

Failure by GEC scientists to counter the pervasive treatment of Africa as 'the rural continent' poses a danger that 'migration' rather than the more inclusive 'urbanisation' will be the dominant or sole lens through which the continent's settlement future and its experience of GEC is examined (c.f. IOM, 2009). To counter any possibility of 'anti-urban bias' the paper begins with an overview of African urbanisation, highlighting the importance of taking the African city as a site of GEC as seriously as the prospect of rural out migration, and then drills down to explore more specific issue of migration and its interface with GECs.

3.1. Urban growth

Africa's population is large. Being 965 million in 2007 (World Bank, 2009), its population is almost as large as those of India or China. How, when and why population shifts in Africa matters; not least because urbanisation is changing everything about twenty-first

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century African livelihoods and settlement forms. Even though Africa is currently the least urbanised continent but by 2050,it will have a higher number of people living in cities (1.2 bn) than Europe, Latin America or North America (CAP, 2010). Only Asia will have the greater number of urban residents (Fig. 1). Not withstanding its already large urban population, Africa is still more rural than it is urban and thus, even without the additional drivers of GEC, it is not unreasonable to predict that there will be high rates of rural out migration over the next three to five decades. Indeed at current rates of movement more than 50 million people are predicted to leave African rural areas for African cities over the next ten years. In that same time period, however, African cities will grow twice as fast (by 100 million) just through the natural increase in the existing urban population. In total, the cities of Africa will expand by 150 million people between now and 2020 (Fig. 1). Even if the currently low average consumption rates of African urbanites (Satterthwaite, 2008), the sheer scale of infrastructure construction associated with the emerging cities of Africa, like those of Asia, must be factored into projected carbon emission escalations (World Bank, 2010). This kind of increase in the urban population is itself identified as a driver of GEC (Parnell et al., 2007).

Exceptionally rapid urban growth, layered onto the weak urban management structures and under-capacitated local and national state that are found across the global South, but especially in Africa (UN-HABITAT, 2009), sets up particular dynamics for GEC induced urbanisation and urban growth (Kraaus, 2007; Simon and Leck, 2010). The challenge is not to assert which will be the more serious: the governance, economic or environmental dimensions of the urban crisis, but to understand what each of the additional challenges GEC will bring for migrating populations and for growing cities. Before returning to distilling the differential impacts of GEC, it is essential to get some sense of the scale and pace of urban change in Africa, for it is this very rapid, under-managed and under-funded, urban transformation that really sets the sub-Saharan African experience of GEC apart from Asia, where the huge number of urban residents, land scarcity and the density of cities in vulnerable ecological regions also makes GEC an intrinsically urban question (Sanchez-Rodrıguez et al., 2005, Seto, 2010).

3.2. Urbanisation in Africa

There is an unambiguous trend of rural to urban migration and an associated increase in the proportion of the African population living in cities and towns (Figs. 1 and 2). Confusingly, both processes are referred to as urbanisation. In fact the English term 'urbanisation' has at least two related meanings. First, urbanisation refers to the movement of people from the countryside to town. Second, urbanisation measures the proportion of the national population who live in urban rather than rural areas. Some but not all countries have official definitions of these terms, although there is no uniform international classification (see World Bank, 2009 for a full discussion on classification). Clearly, the proportion of people living in urban areas will rise not only due to migration, but also due to the natural growth of the existing urban population (Montgomery et al., 2003; Potts, 2005). In the African context urbanisation levels will also increase because of the reclassification of settlements from rural to urban. In some cases this is merely a bureaucratic task but, especially in Africa, cities do expand through encroachment as former peri-urban areas are incorporated into the town or urban jurisdiction (McGregor et al., 2006). Some estimates suggest that between 1950 and 1980 as much as 26% of the increase in the overall rate of African urbanisation could be attributed to such definitional changes (McGranahan et al., 2009). The net effect of all these contributing factors (growth, migration, reclassification) is a very high average rate of 3.3% per annum of

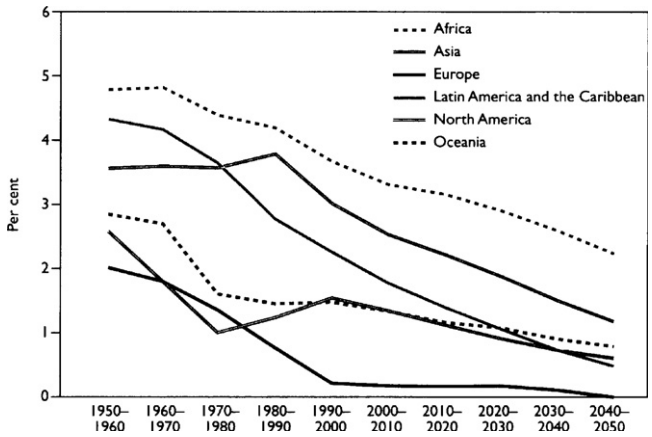

Fig. 2. Comparative rates of urbanisation (UN-HABITAT, 2009, p.24).

urbanisation in Africa (Fig. 2), though of course there are important regional differences (Potts, 2009; World Bank, 2009). As a result of high growth rate and rapid in-migration to cities, Africa shifts from having an urbanisation rate of just 35% in 1950 to 48% in 2030 and 60% in 2050 (UN-HABITAT, 2009).

Lest the impact of GEC induced migration on cities be misread or overstated and/or all urbanisation be attributed to new environmental forces, it is important to single out which component of urbanisation (migration and/or natural growth) drives the expansion of towns and the changing pattern of African settlement. At the moment only a one-third of Africa's city growth is caused by in migration. In any one of the countries or regions there is natural population growth but in Africa, where the fertility rate is higher than average (3.3% per annum in versus 2.2% globally) (Demeny and McNicoll, 2003; Montgomery, 2008), natural growth is more important than in other continents (UN, 2010). The shifting distribution of people in a country or continent also stems from the in or out migration resulting from local economic, environmental or even political forces. As a result of these varied demographic trends the proportion of urban or rural people across Africa varies (Fig. 3), reminding us that predicted GEC is just one of many factors driving the change in the sub-Saharan African settlement system.

Assessing the migration impact of GEC is made more complex by the fact that urbanisation is not linear and Africa has a long tradition of return migration, oscillating migration and circular migration – making it very difficult to detect or measure patterns of population settlement change over time (Potts, 2005, 2010). Indeed, so important is this strategy of moving between places as a means of securing a viable livelihood, that the literature on migration in Africa is far richer than that on urban settlement or

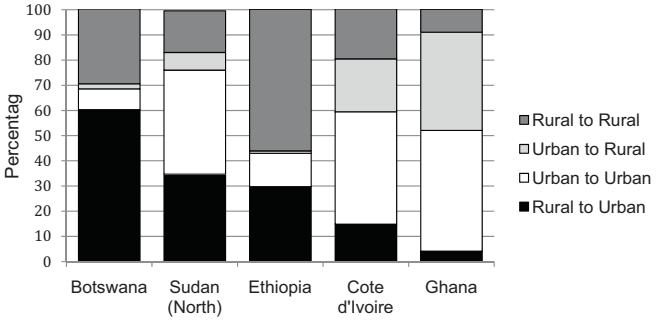

Fig. 3. Comparative migration patterns in selected African countries (adapted from Todaro, 2009, p. 344 using data prepared for WDR, 1999).

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natural urban growth. Recently the relationship between migration and GEC in Africa was fairly comprehensively reviewed (IOM, 2009) while the link between GEC and the African city is only just beginning to be substantively tackled, even in primary academic publications (Bicknell et al., 2009; Simon and Leck, 2010).

At a continental scale McGranahan et al.'s (2009) work on urban transitions provides the most comprehensive assessment of the relative importance of migration versus natural population growth as a driver of the distribution of population. Their work, when set in comparative perspective, is especially important because it highlights sub-Saharan Africa's unique demographic profile, based on high fertility rates, demonstrates that natural population increase is a far bigger (and more enduring) contributor to overall growth than is the case in either Latin America or Asia. Moreover, they show that natural population growth is predicted to outstrip migration as a driver of the level of urbanisation in sub-Saharan Africa throughout the period until 2050.

The data presented thus far reveals why it is unwise to look only at that proportion of the population that migrates while investigating the demographic and settlement impacts of GEC. To put it bluntly, even without the anticipated increase in droughts, floods, famines, and other climate-induced rural to urban migrations, the bulk (60%) of future population growth of cities will come from the offspring of current urban residents (Montgomery, 2008). This is true even in Africa, a continent with low levels of urbanisation. The rapid growth of sub-Saharan African cities is caused less by rapid migration than by the high rates of natural urban population growth. Using UN Habitat figures, McGranahan et al. (2009) suggest that Africa's urban population is the combined outcome of an overall natural urban population at a growth rate of 2.2% a year and an in-migration rate of 1.1% a year (making up a total growth of 3.3%). Poor education, inadequate health care (lack of access to contraception and abortions) plus the dominance of patriarchal values are cited to explain the high fertility rates in Africa that are driving the above average rates of urban population growth (Beauchemin and Bocquier, 2004; World Bank, 2009; UN-HABITAT, 2009).

Growth of the urban population is important because cities place enormous demands on ecosystem services like water, air, food, biodiversity and construction materials and there is such a paucity of capacity (institutional, human or financial) to deal with the pressures that urban growth implies (UN-HABITAT, 2009). In other words, urban settlements in Africa are fragile even before potentially increased migration associated with GEC is taken into account. That is why it is said, any GEC linked migration would inevitably increase the movement within and between African countries, further expanding cities and towns (IOM, 2009). It seems reasonable to suggest that GEC will generate an increase in migration driving further urban population growth, possibly making in-migration rather than natural urban population growth a more important driver of city expansion, with important policy implications. The specific issue of rural to urban migration in Africa should therefore be considered independently and it is to this issue we now turn.

3.3. Migration and GEC in Africa

Migration, forced and voluntary, is a well-established response to economic pressure (Mc Donald, 2000) and environmental crises in Africa (IOM, 2009). Relocation or movement (often temporary) has long been depicted as a positive adaptive response to economic livelihood insecurity (Rakodi and Lloyd-Jones, 2002) and is now also cited as a positive response to climate change and disaster risk exposure (Wisner, 2003). But not all African migration is voluntary. The continent already has 20% of all refugees globally and 45% of all internally displaced people (IDP) are found in Africa (Internal Displacement Monitoring Centre, 2008). There are millions of Africans displaced by war and conflict each year, a fact not unrelated to ecological crisis, especially water shortages (IOM, 2009). In other words, even without GEC, there is already a pattern of environmentally-induced migration in Africa, some of it voluntary and some forced; some of it temporary, some permanent; some of it to town and some between rural areas.

If, as seems inevitable based on climate scientists' predictions (Tables 1 and 2), GEC shifts the patterns and pace of migration streams that exist in Africa – possibly feeding urban in migration and/or reinforcing circular migrations, it seems reasonable to judge the scale of future impacts against current migration patterns. Unfortunately, the academic literature offers a very confused view over the causes, dynamics and patterns of migration in Africa (Table 3) and thus it is unclear exactly what adding GEC into the mix might imply for sub-Saharan Africa's migration future. Working through the multiple drivers of African in and out migration identified in Table 3 (push factors, pull factors, push-pull dynamics and other explanations for human movement) it is difficult to assess the migration trajectories of new (or intensified) GEG-induced migration streams. This problem of classification and overlapping causes should not lead to a rejection of the notion of GEC-induced migrations. Rather, especially given the fragility of African rural and urban livelihoods, it is imperative to highlight that GEC may be a catalyst for human movement or act as one of many drivers of settlement change (IOM, 2009).

The diversity of academic explanations for population movement in Africa that is presented in Table 3 reflects not only varied intellectual positions, but also the complex migratory movements that are typical across Africa. One difficulty with using the recently published scholarship on migration to illuminate the dynamics of GEC-induced movement is that it is dominated by the argument for 'African exceptionalism' with respect to circular migration (Potts, 2010). The argument for circular migration was first presented to counter earlier, simplistic modernisation narratives of the projected permanent urban migration that would accompany industrialization (see Mabin, 1990 for an African perspective on the literature). The most common argument now made by migration scholars, across Africa, is that economic and or environmental stress creates an imperative to ensure that poor people hold a base in both town and countryside (IOM, 2009). In many respects the migration literature implies African's preference for circular migration as a livelihood strategy, suggesting that life in town is undesirable and/or as soon as it is possible to return to rural areas this is what African people do, negating the evidence of extensive permanent movement to urban areas by rural people. There are remarkably few longitudinal studies tracking if and when migrants cease to move between town and countryside and settle permanently in town in response to either increasingly environmentally hostile rural conditions or more favorable urban conditions. McGranahan et al. (2009) do point out that the decision to cease circular migration hinges as much on what cities can offer as it does on the GEC-induced stressors of degraded and uncertain rural livelihoods:

> *It is likely that as a consequence of climate change this movement will increase and intensify, and possibly become more permanent. . . .What transpires will depend largely on the capacity of local governments to provide basic infrastructure and services, with the support of national and regional government* (McGranahan et al., 2009, p. 12).

Assuming, as McGranahan et al. (2009) and Annez et al. (2010) do point out, that GEC will put further pressure on Africa's rural areas (Table 3 column 1, bold text) and that this will encourage more permanent urban migration, GEC is likely to compound rates of urban growth – increasing pressure on already vulnerable

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Table 3
Explanations for migration in sub-Saharan Africa that might be amplified or muted by GEC.

1. Push – the decline of rural areas	2. Pull – the attraction of urban areas	3. Push and pull – circular and oscillating migration	4. Other drivers of settlement change
Urban bias in subsidies privileges the built and social environment of cities but creates rural wastelands and causes people to migrate to cities (Lipton, 1977).		Informal networks of migrants across city regions and country boundaries link migrants in an unsettled system of perpetual motion, precluding Africans assuming full urban citizenship of any one city (Simone, 2010).	
Drought and famine, which have been pervasive across Africa, permanently push the poor off the land and into town (O'Connor, 1983).	Although globalisation ignores African urban economies and creates a decline in agricultural labour leaving poor cities, but an even poorer countryside; so urbanisation is a product of relative contemporary advantage (Simon, 1992).	Circular migration is rationale response to inadequate rural and urban livelihoods, especially under conditions of urban poverty associated with structural adjustment (Potts and Mutimbira) or state repression (Potts, 2010).	War causes urban outmigration as in the case of Somalia, where Mogadishu has had huge population with deaths in the city and massive in and out migration (Marchad, 2006).
Land degradation and agricultural mechanisation destroys rural jobs and causes rural out migration (Pieterse, 2008).	Cities grow because they offer social and economic advantage (CAP, 2010).	Food shortages and crop failure see temporary relocation to towns (Cross at al 2006; Crush et al., 2011).	Traditional land tenure supports a peasantry and enables people to avoid the shift to cities (Shakelton et al., 2001)
Rural poverty and conflict drive people out of rural areas (Bryceson and Potts, 2006).	Cities are the economic engines of countries and will attract people (Todaro, 2009; World Bank, 2009).	Unsustainable rural subsidies fail to offer safety nets, feed costly circular migration and only delay inevitable urbanisation (Parnell and Crankshaw, 1996).	
High levels of dependence on agriculture that is not irrigated creates an African weakness to climate variability, causing people to move to town (Barrios et al., 2006; Annez et al., 2010)	Service delivery (such as subsidised housing) and some low skilled jobs absorbs some but not all migrants to the city, creating urban opportunities (c.f. Beall et al., 2006)	Forced migration creates temporary single migrants and splits households between town and (mining) settlements (Crush et al., 1991).	
	Urbanisation has been associated with economic growth, even where this growth is not sufficient to absorb all labour (Kessides, 2005)	Much cross border migration is temporary and circular (Potts, 2009; Cross et al., 2006).	Incorporation of peri urban areas into African cities is a key driver of urbanisation (McGranahan et al., 2009).

African cities and towns. It is, however, also possible that GEC pressures in badly managed cities that are exposed to increasing GEC risk may encourage poor households to maintain rural linkages. As yet there are no documented cases of urban-based GEC risk exposure driving urban out migration or circular migration, but Bicknell et al. (2009) have begun to document the toll that climate change is taking on the poor of Africa's cities, many of whom are migrants. Unless a city is at major risk from GEC (as in the case of Cairo or Lagos (Seto, 2010) it is likely that Africa's urban areas, despite high unemployment and inadequately secured infrastructure, will be a better place for GEC refugees/migrants. Cities are where the very poorest may be able to access food and other aid and, as many migrants know, this is where the economy is strongest.

Predictions of increasing frequency of drought and flood have created understandable concerns that the numbers of internally displaced people (IDP) in Africa will escalate as the impacts of GEC become ever more visible (IOM, 2009). Initial concern was that these IDPs would leave Africa and seek refuge in the Global North, raising fears of the costs of a legally binding refugee response and calling into question the definition of an environmental refugee (IOM, 2009). In fact, it appears that the migratory responses to environmental disasters such as drought have spawned national or cross border migrations within Africa (Cross et al., 2006), and that the movement has been from inland rural districts to African cities and coasts rather than trans-continental migrations to Europe or North America (Annez et al., 2010). The burden of climate-induced refugee absorption is thus, like the impact of climate change (IPCC, 2001), almost certainly going to be felt most harshly in sub-Saharan African cities.

4. Conclusion: growth, mobility and displacement under conditions of environmental change

The fact that only very recently has there been any significant attention to the possible impacts of GEC on sub-Saharan African migration and urban change makes it difficult to use the peer reviewed academic scholarship as a basis for predicting a singular impact of GEC on urbanisation and migration. In addition the absence of detailed forecasts of GEC for Africa and its major city regions, the lack of consensus about the drivers of migration and urbanisation, plus the reticence of politicians to put migration and urbanisation onto the developmental agenda makes it very difficult to offer any robust views on how GEC might be interpreted at the continental, let alone a more local scale.

What the discussion thus far suggests is that predicted GEC adds a further variable into an already unstable context and that as a result sub-Saharan African migration and urbanisation, already rapid, could well escalate. Black et al. (2011) in responding to the alarmist projections of environmental change on migration develop a framework that links the direct and indirect impacts of environmental change to the more traditional political, economic and demographic drivers of migration, rather than seeing migration as a response to GEC. The embedding of the impacts of environmental change in the wider migration decision-making process provides a useful device for reflecting that whether people move voluntarily or are forcibly displaced, opening the way for more appropriate policy and political responses to GEC induced migration. If, using the evidence presented in this paper, we augment their logic on the interplay of GEC with the multiple drivers of migration to include the links between urban growth and urbanisation we gain insight into the city scale dynamics of GEC.

When the GEC challenge is considered with respect to urban growth very specific technical and managerial responses can be identified. The scale of natural population growth in cities creates an imperative for national and local capacity to ensure that urban ecological resilience is maintained and that basic environmental health and human rights are upheld across the city. Creating sound urban management practices in rapidly growing urban areas may require specialised interventions in coastal cities, for mega cities and city regions. Not all responses to the GEC impacts on cities can be reduced to technical responses – and there is a very real politics

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that must be taken into account. The growth of the urban population in a location that is either ecologically sensitive or is subjected to significant environmental change impacts could trigger political challenges. Especially in megacity regions it is possible that there will be an internal displacement of a portion of the urban population exposed to environmental hazard and that these numbers could be sufficiently large in national terms, or that the affected population will have sufficient political power, that the intra-urban migration associated with environmental change will need to be considered as a driver of political change.

The thrust of this paper has been to show that the focus of scholarly literature on GEC impacts on Africa has hitherto been on mobility and displacement, rather than urban growth. Migration and displacement will almost certainly escalate over the next decades in the light of predicted GEC, but these are not necessarily the most critical issues shaping Africa's development. Understanding migration and displacement is not sufficient preparation for responding to predicted GEC impacts. In Africa, the burden of settlement change is likely to be in cities, which is not only growing rapidly because of endogenous growth but cities and towns are also potential (neglected) sites of GEC. A closer understanding of the demographic dynamics of the African continent, as demonstrated in this paper, shifts the emphasis for GEC scholars from issues migration and displacement to include the nature of permanent African urbanisation and the consequences of urban growth under conditions of global environmental change.

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