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Global Environmental Change – Conceptualising The Challenge For Cities In Poor Countries

Susan Parnell, David Simon and Coleen Vogel

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Contact Information:

Michail Fragkias, Ph.D.
Executive Officer,
UGEC International Project Office
Arizona State University
PO Box 873211
Tempe, AZ 85287-3211
Tel: +1 (480) 727-7833
Fax: +1 (480) 727-9680
Email: fragkias@asu.edu
http://www.ugec.org

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GLOBAL ENVIRONMENTAL CHANGE – CONCEPTUALISING THE CHALLENGE FOR CITIES IN POOR COUNTRIES

Susan Parnell*, David Simon and Coleen Vogel*****

*Department of Environmental and Geographical Sciences,
University of Cape Town, Private Bag 3, RONDEBOSCH 7701, South Africa
Email: susan.parnell@uct.ac.za

**CEDAR, Dept of Geography, Royal Holloway,
University of London, EGHAM, Surrey TW20 0EX, UK
Email: d.simon@rhul.ac.uk (corresponding author)

***School of Geography, Archaeology and Environmental Studies,
University of the Witwatersrand, 1 Jan Smuts Avenue,
JOHANNESBURG 2001, South Africa
Email: vogelc@geoarch.wits.ac.za

Abstract

Ongoing urbanisation makes cities a key focus for global environmental change (GEC) research, creating an imperative for a new, city-scale, research agenda. The vulnerability of urban populations to the multiple stresses of GEC lies at the core of overlapping domains of knowledge that could be better integrated in advancing research. The urban development, global change and disasters literatures are fragmented and reveal fundamental cleavages over the role that government could play in mitigating vulnerability to multiple threats and challenges. Important empirical gaps exist, especially on cities of the South. While there are significant knowledge gaps and numerous tensions within and between schools of thought, this overview suggests useful entry points for framing an invigorated research agenda on urban GEC.

Key words Urbanization, cities, global environmental change, risk, vulnerability, urban livelihoods, urban planning, global South

Introduction

Many large cities and conurbations in the global South occupy low-lying, often flood-prone, coastal locations and lack adequate protection from both extreme events (including floods and hurricanes) and insidious, 'every day' risks. Similarly, the horrific impact of the December 2004 tsunami could only be imagined if its reach had included one or more of the South or Southeast Asian megacities. The human impact of such so-called 'natural' disasters has refocused academic and policy attention on the vulnerability of the large, disproportionately poor and chronically vulnerable human settlements of the global South, highlighting the need for a deeper examination of the root causes of such disasters, as opposed to only a technocratic response (see for example, Parker and Mitchell 1995; Mitchell 1999; Steinberg 2000; Wisner 2005/6; Cutter 2006; Schipper and Pelling 2006). Addressing the challenges of the evolving twenty first-century human settlement patterns, however, demands a clear understanding of the vulnerabilities to such extreme events but also those factors that 'drive' everyday or 'chronic' environmental stresses in the context of widespread urban poverty (e.g. Few 2003; Tannerfelt and Ljung 2006; UN-HABITAT 2006). Importantly, there is a growing realization that more needs to be understood about how vulnerabilities – and their impacts – are configured by a range of causal mechanisms and how risks are shifted across the landscape. Such differential shifts of risk between groups of cities and between groups within individual cities, become key focal points for systematic analysis. One imperative is to move beyond the tragic headlines of disasters to uncover the underlying structural relationships between urban settlements and global environmental change. Secondly, there is an urgent need to raise the awareness and policy response capacities of cities to address the increase in extreme events and other more localized, insidious changes that may accompany climate change, climate variability and/or other long-term changes.

The starting point for action is the imperative of addressing the structural and chronic vulnerability to GEC of cities everywhere, but especially in the global South, where data availability, the research base and resources for coping are generally most inadequate. This entails engaging GEC issues at a city scale and acknowledging the rich, if incomplete, urban scholarship that pertains to managing city vulnerabilities. Against these imperatives, the overarching purpose of this paper is to call for far greater academic engagement in issues of GEC and cities. More specifically, the paper notes that there are multiple existing literatures providing useful entry points for urban GEC research. Because urban GEC research has important practical applications, it is

important for scholars to make explicit their disparate conceptual points of departure as these may provide conflicting messages for implementation. Sitting as it does at the confluence of natural and social scientific approaches and methods, urban GEC research is likely to emerge as a critical site of both theoretical and applied innovation.

Debate over urban GEC has, however, been slow to start. Despite overtures from the scientific community to engage social scientists (e.g. Earth System's Science Partnership, www.essp.org), there is a dearth of strong guidance on how, especially at the urban scale, the issue of global environmental change should be approached. This gap indeed provides the rationale and departure point for the current International Human Dimensions Programme on Global Environmental Change's (IHDP's) research initiative on urbanization and GEC (Sánchez-Rodríguez *et al.* 2005). Closer reading of the various pertinent literatures reveals emerging discourses and practices on 'adaptation to climate change and variability' within urban studies, and urban expressions of the 'development and disaster risk-reduction' literature (e.g. Paul 2006) that often operate in isolation from each other. What they have in common is usually a restricted understanding of the implications of GEC for cities.

Moreover, very few national environmental policies in any part of the world include urban vulnerability assessments, city disaster-risk assessments or inventories in their plans, let alone systematic GEC responses such as mainstreaming sustainable regulatory frameworks and codes into daily urban management practices. Yet vulnerability to disaster and to the impacts of gradual GEC erodes the rights and opportunities of the urban poor. In this context it is noteworthy that UN-HABITAT's latest *State of the World's Cities* report (2006: 134-141) now includes a section on the impact of conflict and natural disaster on cities in recognition of the importance of the associated risk and vulnerability issues. The prominent coverage of Hurricane Katrina highlights that New Orleans' poorest residents suffered the deepest impacts. However, GEC and associated issues are equally conspicuous by their absence: GEC does not even appear in the index, while greenhouse gas emissions are mentioned just once in the entire report. Even leading urban environmental donors like SIDA omit GEC information from their otherwise comprehensive overview of urban development and management (Tannerfelt and Ljung 2006).

Yahmin, Rahman and Huq (2005) have called for the systematic inclusion of climate vulnerability analysis into the three main policy frameworks relevant for adaptation: development, disaster relief and climate change. We suggest

that such integration, if undertaken at the urban scale, offers opportunities for a comprehensive approach to reducing risks from a variety of stresses – economic, social and environmental. There is clearly a danger that this downscaling of risk reduction to the local or city scale (e.g. Few 2003; Pelling 2003a) will feed into the unfunded responsibilities of local governments associated with the move to decentralization, and possibly further enable Northern and some Southern countries to step back from the various Kyoto agreements, leaving responsibilities with the already overstretched urban local authorities of the South. However, cities present a crucial arena in the context of GEC, and it is in uncovering the bi-directional relationships between urban settlement and GEC that both risk reduction and greater sustainability lie. While the impact of cities and urban processes on GEC is also an important and directly related research focus (Sánchez-Rodríguez *et al.* 2005), we restrict our attention here principally to the vulnerability of cities to the effects of GEC.

All large cities, even the most wealthy, are vulnerable to the various components of GEC, namely the increasing frequency and severity of extreme, rapid events, gradually changing environmental conditions and varying response and adaptive capacities. While cities anywhere can – and do sometimes – experience disasters, those in poorer countries usually suffer more when their losses are measured either as a proportion of GDP or in terms of access to safety nets including insurance (Schipper and Pelling 2006). Notwithstanding the enormous difficulties of accurately measuring and calculating disaster losses, there are additional reasons why cities of the South should form a principal focus of a reinvigorated GEC agenda. At the heart of current concerns – now also being recognized by development agencies (e.g. DFID 2006) – are the interlocking vulnerabilities of particular people and places:

> *… connections between globalization and local urban form are changing the vulnerability of people and places within metropolitan regions [and other scales of urban settlement] … An important area for future … urbanization and global environmental change research will be to examine how the physical tightening of globalization processes further transforms the spatial form of cities and, how these changes, in turn, affect the vulnerability to all types of global environmental change hazards* (Leichenko and Solecki 2006, 12).

With this as contextual background, the remainder of this paper begins by asserting the overall significance of the relative shift in the geography of the world's population to urban areas both within and between the global North and South. It then underscores problems associated with this demographic shift because of the underlying economic and political vulnerability of cities across Africa, Asia, Latin America and the Caribbean. It is not just that the urban poor, who are heavily concentrated in these continental regions, face elevated risks from increasing frequencies of extreme events and other environmental hazards because of where they live. Entire urban populations in the South are also at risk from more gradual global environmental changes. Such urban risk arises from both the macro-failures to address global and national inequality and the more localized failures to implement sustainable urban development (e.g. Wisner 2002, 2003, 2005/6).

The emerging field of urban GEC

While there are some commonalties between the disasters/risk literature and that emerging on GEC, it is also important to differentiate between them. Most 'natural' disasters – not all of which are directly related to GEC – are one-off extreme events of short duration (no more than a few minutes, hours or days), often striking with little warning (e.g. earthquakes, volcanoes, tsunamis). Droughts, however, are the principal slower-onset and longer-lasting exception. Following successive reports from the Intergovernmental Panel on Climate Change (IPCC), the increasingly clear prognosis is that such extreme events are likely to become more numerous (e.g. IPCC 2001, 2007). But the now substantial body of academic writing, from which, in part, the IPCC reports are derived, indicates that GEC comprises both the increasing frequency and severity of such single events and a series of slow-onset events (like sea-level rise and increasing ambient atmospheric temperatures) as well as a range of insidious, 'everyday risks' that are the product of a variety of stress mechanisms. These generally slow (but sometimes also very rapid) shifts in environmental conditions are likely, in some areas, to have long-term or permanent impacts on human settlement (e.g. inundation of low-lying coastal zones, reduction in water levels of river catchments, desiccation, and salinisation of the water table) which may be of greater significance for more people than merely the extreme events that the media commonly present as exemplifying climate change. Such slower changes may also exacerbate a suite of other changes occurring in the 'system' (e.g. inundation of low-lying coastal areas reinforcing stresses such as poor access to safe infrastructure and resources). Ultimately it is the interaction of these different components of GEC that poses the greatest hazard: increasingly frequent and severe extreme

events on a trend of rising sea level and atmospheric temperatures in degraded environmental contexts aggravated by a range of socio-economic pressures.

Fuelled by public concern, the research and policy response in relation to major disasters has assumed a new urgency. Disaster-risk assessment and response emphasize the identification of high-risk areas and the need to better understand those people most at risk to various changes (e.g. vulnerable populations) (e.g. Few 2003; Paul 2006; Pelling 2003a, 2003b). Interventions include early warning systems and prediction, the timely (and usually) temporary evacuation of vulnerable populations, post-disaster recovery as well as renewed efforts to reduce risks to disasters in advance of a crisis event, often referred to by those in the disaster-risk reduction community as mitigation (e.g. Hyogo Declaration 2005, e.g. ISDR 2005 and http://www.unisdr.org/eng/hfa/hfa.htm). Failure to implement effective mitigation will be very serious in a few contexts where disasters do strike, but in urban centres that are spared damaging extreme events, the absence of wider mitigation measures may go unnoticed even as cities, and especially their most vulnerable inhabitants, become increasingly exposed to the risks and impacts of slower-onset GECs.

From the GEC perspective, which assumes that some of the most damaging environmental shifts will be incremental and widespread, the failure to intervene in the *everyday planning and management* of settlements is certain to have deleterious consequences. The systematic roll-out of GEC mitigation and longer-term adaptive efforts therefore needs to expand beyond the narrow zone of known high-risk places and will need to ensure medium- to long-term intervention in standard practices of settlement management to reduce human vulnerability. As such, GEC mitigation, and especially adaptive, efforts imply structural changes in how urban societies are run and it is in this regard that the GEC community will be compelled to challenge urban disaster management practice as well as the wider wisdom on urban planning.

Whereas existing disaster management has tended to focus on flood barriers, for instance, such measures may well prove inadequate to cope with more frequent extreme events on top of sea level rise, since there is a limit to how high such barriers can be raised. Hence GEC responses might include the permanent relocation of vulnerable populations, the design and enforcement of appropriate built environment and public health standards and the institutionalisation of a range of social safety nets, including food security programmes and support for sustainable livelihoods among relocated people.

While these measures might seem fairly standard elements of governance in the well-resourced North, they are only aspirational capabilities in many cities of the South. Across the developing world, the transparent advantage of protecting the public good through effective planning and urban management has failed to motivate states, especially at the local government level, to make even limited investments in securing universal minimum rights or basic standards. As a result the majority of the world's population now lives under conditions (mainly urban) that are unlikely effectively to withstand the ravages of GEC. Against this threat it seems hardly controversial to propose that 'the city' become a priority object of analysis in the GEC arena.

Despite the obvious environmental turn in urban studies, there has not yet been any sustained focus on city-scale vulnerability to global environmental change. In part this lacuna might be attributed to a tendency of many social scientists to focus on individual neighbourhoods or sectoral urban issues. In contrast, the scientific community has experienced difficulty downscaling climate models to the urban scale and thus continues to focus largely on the regional and national scales. A change is, however, noticeable as the diverse disaster practitioners and humanitarian agencies are, through their focus on national and more place-based assessments, beginning to influence wider-scale assessments of vulnerability (see www.proventionconsortium.org for examples). Where disaggregation does occur, the emphasis is usually on the agricultural and natural resource sectors rather than the urban and industrial spheres. In policy terms, the silence is even more readily explained by government, business and donor unwillingness to target the resources required to roll out a massive GEC adaptation and mitigation effort to all cities. But even if there were political will to address city vulnerability, would we know where to start? Part of the difficulty is that approaching urban risk from a GEC perspective is complicated. It involves interpreting complex modelling in areas of improved but still uncertain science (e.g. climate change), engaging diverse stakeholders and challenging the fundamental assumptions held by people working in different disciplinary and institutional contexts. At first reading it would seem that we are poorly equipped to advance our understanding of cities within the changing global environmental system. Despite these problems, we posit that Southern cities are useful starting points for they represent cases where there is growing interest and recognizable activity in terms of both enhanced theoretical and applied work.

Shifting urban geographies of vulnerability

Urbanization processes today are highly diverse around the world, reflected in differing urban growth rates and urban systems. Globally the urbanization rate averages about 0.8 per cent annually (UNCHS 2001). Although most cities continue to grow in terms of absolute population, urban growth is often proportionately most rapid in intermediate cities of low and medium levels of human development. Many large cities in post-industrial countries have nearly stabilized or – like London – even lost populations over recent decades through suburbanization and counter-urbanisation, although augmented more recently by new waves of international immigration. Urbanization rates (but not levels) in the more urbanized Latin American countries have been falling since the 1950s or 1960s but the same is now true in parts of Africa, where some of the interrelationships between urbanization trends and prevailing economic conditions have been demonstrated (Simon 1997; Potts 1995, 2005). By contrast, reflecting the rapid growth of cities in the world's two most populous countries, China and India, aggregate data for Asia show an increasing rate of urbanization, although other countries are experiencing different trends. The most well-known Chinese examples of Beijing, Shanghai, Tianjin and Shenzhen are by no means unique. Globally, however, one of the most marked changes over the last thirty years has been the rise of megacities (usually defined as having populations exceeding 10 million) in poorer countries (Figure 1). Many of these now appear in the list of the world's largest cities (Figure 2), and this trend is expected to continue.

[Figures 1 and 2 approx here]

These demographic processes have important implications for GEC research and management. On the one hand, urban-based activities contribute substantially to GEC through industrial, power station and motor vehicle emissions; changing land cover and heat island effects; resource consumption and waste generation patterns. Conversely, GEC – understood as a combination of secular change (e.g. rising sea levels and atmospheric temperatures) and the increasing frequency and severity of extreme events – has profound implications for cities, especially those in coastal and other environmentally vulnerable zones. In particular, mega- and other fast-growing cities in poor countries lack infrastructure, services, resources and institutional capacity to cope with shocks such as the Boxing Day tsunami in 2004 or a severe hurricane as much as they are unable to ensure a regular, quality supply of water in periods of drought. Moreover, within such cities, it is overwhelmingly the poorest residents who are usually susceptible to these impacts in five complementary ways. First, their livelihoods are at risk because they lack the skills and resources (material and non-material) to cope at a

household level. Second, the poor often inhabit the most marginal and risky environments in low-lying or steeply-sloping areas, close to pollution sources, inadequately drained and serviced, and often at highest risk of fire. Third, the poor are disproportionately found in cities and countries where there are limited social safety nets in the form of health care, welfare or disaster support. Fourth, a disproportionately large number of poor households commonly have informal or illegal residential status and so may remain invisible to the state's social welfare apparatus. As a result it is difficult for governments or outside agencies to make planned disaster support or mitigation interventions including them. Finally, community-based organizations of the poor have all too rarely been able to influence the urban agenda beyond the neighbourhood scale or influence the roll-out of the technocratic processes of urban management that characterize large city government. Where governments are receptive, and/or popular pressure overwhelming, impressive results can sometimes be achieved with variants of participatory democracy. Several examples have been featured in the pages of *Environment and Urbanization* in recent years, while Gret and Sintomer's (2005) account from Porto Alegre in Brazil provides one of the most detailed case studies (see also Parnell *et al.* 2002 on South African local government restructuring and Uitto and Shaw (2006) on community-based adaptation experiments).

While the concentrations of vulnerable people in large poor-country cities highlight most starkly the urgency of appropriate research, policy and adaptive behaviour and urban management reform, those in intermediate and smaller urban settlements should not be ignored. A further factor underlining the importance of a specifically urban dimension to GEC research and interventions is that cities contribute disproportionately to national economic activity. Hence gross city product per capita is generally 10-30 per cent higher than gross national product per capita (UNCHS 2001, 83). As cities in poor countries become more economically productive, their impact on GEC escalates. Despite their relative poverty, such cities are home to large and growing middle classes. The impact on GEC of rising urban consumption, especially through motor vehicle emissions, cannot be underestimated, making the city/GEC nexus a critical research interface. The following sections provide possible pointers to how this challenge might be taken up, but also indicate that neither the current focus on urban governance nor the current 'livelihood/adaptation' agenda for climate change gives adequate direction in this respect.

Our argument, that a comprehensive response to GEC and urban management is essential, is founded on the dramatic demographic transitions associated with urbanisation, made more explicit in the science agenda of the IHDP, one of the main GEC research groups facilitating GEC research, to focus global change research on urbanization and cities (Sánchez-Rodríguez *et al.* 2005). In setting out an agenda for GEC at the city scale, we suggest in this paper that the emergent field of urban GEC vulnerability studies need not be considered as a theoretical *tabula rasa*. Rather, noting significant gaps in existing literatures, we nevertheless propose that the work on adaptation/mitigation and debates emanating from the global change community, and also those from the more conventional social scientific debates within urban development studies, might usefully inform the new urban GEC agenda.

GEC and development theory: livelihoods, neoliberalism and the state

Currently the most sophisticated research on 'cities and GEC' draws mainly from systems theory, but this largely empirical and descriptive approach does not permeate the intellectual worlds of progressive urbanists. Rather than forcing social scientists to engage with what they perceive as dated research theory and methods, we draw from current debates to highlight alternative entry points for GEC research that might engage the urban studies community.

In seeking to build an understanding of how to approach urban GEC that moves beyond positivism, neoliberalism and other discredited reference points within social science, we revisit the relevant development literature of the past two decades. Here two very different thrusts have emerged: those of the developmental local state and of livelihoods analysis. The latter has dominated poverty-environment debates, while the former has been more effectively deployed in mitigating structural inequalities at the city scale through redistributive action. Both, we suggest, have utility in understanding GEC and the city but may, by themselves, be insufficient for the breadth and scope of the emerging GEC research agenda.

Insofar as the implications of global environmental change for poorer cities are addressed by social scientists, it is largely through the livelihoods or vulnerability perspective (for a range of methodologies and research approaches, see www.proventionconsortium.org). In the absence of a systematic urban GEC mitigation and adaptation programme, there has been an increasing focus on the vulnerability of the urban poor to natural hazards, if

not global change. Just as the emphasis in the urban vulnerability literature is on once-off events not endemic change, the urban livelihoods literature tends to be directed at the neighborhood and household scales, not at the city as a whole. In practice, the livelihoods and vulnerability literatures merge because of their common focus on assets and capabilities of the poor. The sustainable livelihood approach (SLA), which grew out of the rural development agenda, is associated with an almost anti-statist emphasis on building the capacity and assets of the poor themselves to address their development needs and aspirations. The rise of this approach formed part of the reassertion of human agency over the overly structuralist approaches of earlier development literature, including that on the developmental state. Similarly, the sustainable livelihoods perspective is somehow reminiscent of campaigns in favour of self-help housing and informal sector entrepreneurship in the 1970s and early 1980s, which saw poor people's own efforts as a development panacea, especially when contrasted with the clumsy and misdirected interventions of government (Burgess 1985). Originally developed in a rural context, the SLA has now been applied to urban arenas as well (Rakodi with Lloyd-Jones 2002). In a parallel process, access to micro-credit to support livelihood activities in urban areas is improving, with Grameen-style rural banks now opening increasingly in peri-urban and urban areas; in addition, adaptations of traditional rotating credit schemes are flourishing in poorer communities. However, the difficulties of scaling up the SLA from the household or neighbourhood to the urban or metropolitan scale (other than through micro-credit institutions, for instance, and other social security transfer schemes) have generated frustration as the generally micro-level interventions that emphasise human agency at the expense of wider structures (such as the land market), institutions and practices (such as prescribed minimum standards or zoning schemes) that are inappropriate for city scale analysis (Beall, Crankshaw and Parnell 2002).

At the same time, the poststructural turn in the literature on cities over the last decade has done little to facilitate engagement between natural and social scientists of the kind that is essential to addressing urban vulnerabilities to GEC. It may also explain why global environmental change scholars, most of whom have natural scientific backgrounds, have themselves sought to ignite work on the human dimensions of global environmental change. Blaikie (1996) represents a very rare attempt to link aspects of poststructural theory with GEC, but not in a specifically urban context.

The dominance of livelihoods analysis and postcolonial theory has left the terrain of urban management wide open for the new liberal agenda which

flourished throughout the 1980s and 1990s. Only recently has dissatisfaction with neoliberal solutions, a shift to the left in many political contexts and the search for developmental solutions strengthened the case for an alternative to the dominant neoliberal urban agenda. There is now a growing emphasis on the pivotal developmental role of the state, especially the local state. This understanding focuses not only on economic growth but also on poverty reduction and sustainability. For scholars of GEC, a potentially helpful thrust within this new body of state-centred city development literature points to a reassertion of the notions of universalism through a rights-based approach, distributive justice and minimum urban standards (Parnell 2004). Drawing from the work of urban political economy, there is also the view that justice and equality should increasingly be coupled to the restricted consumption of natural resources by elite urban populations (through taxation, regulation etc) (Swyngedouw and Heynen 2003). The obvious limits to resource consumption (especially of oil, land and water) have seen 'the environment' feature ever more prominently in the city strategy literature and in a corpus of work on sustainable cities. For the first time, this has introduced opportunities to insert a longer-term environmental perspective into urban management and planning in relation to the cash-strapped, rapidly growing cities of the global South. However, tensions remain between the practical and political imperatives of addressing the immediate basic needs of the poor and the longer term concerns raised by the GEC challenge.

Central to the ability of the state, however, to undertake these precautionary functions are two fundamental prerequisites, effective capacity and resources. While their existence may be taken more or less for granted in wealthier countries, especially (but no longer exclusively) in the global North, the experience of Hurricane Katrina in August 2005 demonstrated just how vulnerable even the supposedly sophisticated disaster preparedness and relief capacity of the USA was when faced with a relatively localised extreme event of hitherto unusual severity. The post-disaster investigations are throwing up complex issues of how (in this case remarkably accurate) climate forecasts are interpreted and acted upon, how different local, state and federal agencies communicated and collaborated in an often contested political context of unequal power relations, and how inadequate the flood defences and their maintenance were for a disaster not 'off the scale' of anticipation and preparation. Hurricane Katrina also exposed the underlying political economy and ecology which left particular minority communities as the principal victims and displacees (see the diverse sources available at http://understandingkatrina.ssrc.org/Gilman; Burns and Thomas 2006; Comfort 2006; Dreier 2006).

Human dimensions of global environmental change: Mitigating risk or adaptation?

The nascent discussion about structure and agency in urban (development) studies reviewed in the previous section has many echoes in the human dimensions of global change debate about mitigation or adaptation to GEC. In this second part of our search to locate existing conceptual reference points for city vulnerability research, we assess this emerging controversy, which takes place closer to the margins of the scientific community engaged in GEC research. Our issue here is to probe the mitigation/adaptation debates of particular relevance for thinking about cities in the South.

Managing climate risks and reducing exposure to disasters (both human and natural) are key concerns of urban residents, political leaders and managers seeking to improve the sustainability of cities and urban environments. To this end, the scientific community has moved to make its research findings more relevant and applied and there is increasing emphasis on 'the human dimension' (see for example the work of core projects of IHDP, www.ihdp.org). Associated with the reconfiguration of GEC science is an acceptance that cities should be objects of analysis in view of the increasing prevalence of urban settlement and the significance of cities as agents of change within the global environment. Thus we have seen not only the scale of GEC research become more localised (e.g. in the numerous local, place-based assessments of vulnerability), but also the historically rural focus of the human dimensions of climate change research become more urban (Sánchez-Rodríguez *et al.* 2005; Leichenko and Solecki 2006; Grimmond 2007; Gueye et al. 2007; Kraas 2007; Simon 2007).

As observed above, most poor countries' and cities' priorities are very short term and hence relate principally to poverty reduction and development and usually not to the risks of long-term climate change (e.g. Adger *et al.* 2003; Davidson *et al.* 2003), which is only one of many stressors on both human and ecological systems (Burton 1997; Wilbanks 2003). There is no doubt, however, that climate is closely linked to economic development (Agrawala 2004) and adaptation needs to be mainstreamed into development activities in all sectors and at all scales (Davidson *et al.* 2003; Huq & Reid 2004; Swart *et al.* 2003). Thus Najam *et al.* (2003, 226) view climate responses and sustainable development as "two sides of the same coin".

Within the global change community, the discourse currently focuses on 'human dimensions', where people either cause GEC or are seen to be at risk from it unless preventative structural action is taken. Like the development literature, the human dimensions of global change research fraternity and products are internally divided. Despite obvious linkages, there are very clear disconnections between those approaching cities and urban change from a 'disaster-risk' perspective and those using an 'adaptation to climate change' approach. Without wishing to overstate the case, there is a conceptual gulf separating those who focus on floods in urban environments by calling for an emergency response or disaster risk-reduction focus and those who approach flooding from a climate change perspective by calling for wider climate adaptation. While ultimately focusing on the same goals of reducing risks and enhancing human resilience in the face of various environmental changes, the mitigation perspective is generally aimed at the meso-scale of the public or private sectors, while the adaptation literature implies that more systemic changes need to be undertaken to facilitate household agency in adapting to GEC. Both the tensions and possible emerging synergies are manifest in global institutional contexts such as the International Council for Local Environmental Initiatives (ICLEI) and the Intergovernmental Panel on Climate Change (IPCC).

The divisions evident in the very large international NGOs operating with a range of scientists, policy and practice communities often re-emerge at the local level in municipalities and practitioner communities since budget allocations are made in accordance with the differential conceptual positions of advisors. This is something of which responsible leaders are aware, as evident in informal email interchanges stimulated by the Linking Climate Adaptation (LCA) network in the UK (www.linkingclimateadaptation.org). Scientists and practitioners often have no common language for approaching cities and climate change (e.g., lca-discussion@lyris.ids.ac.uk) but are eager to share and debate issues that are central to their research endeavours.

The issue of urban GEC is gaining profile on the agenda of practitioners, often in advance of clear scientific direction. Much effort to promote implementation of climate change adaptation and mitigation has been harnessed through networks such as ICLEI's Cities for Climate Protection (CCP), with key foci on projects designed to reduce greenhouse gas emissions and efforts to improve air quality control. Relatively little attention is, however, given to more substantive issues of climate adaptation, such as the mass delivery of affordable renewable urban energy solutions or the development of capacity to manage sustainable urban settlements.

One perceived 'meeting ground' for those working in the disaster-risk reduction and climate change arenas is 'development', though, as we have seen, this is a far more complex sphere than GEC scientists generally presume, especially at the urban scale. The development turn in GEC research arises from recognition of the short- and long-term impacts accompanying disasters in urban contexts. Poor and inadequate development can also heighten the risk profile of many poorer urban communities while extreme events divert resources away from progressive urban improvements. For instance, the Honduran Prime Minister is reported to have remarked that the economic damage incurred by Hurricane Mitch in October 1998 would set his country's economic development back at least 20 years (IFRC and RCS 2002).

While we have highlighted the disparate if overlapping nature of the urban development and human dimensions work, these are not hermetically sealed literatures. Just as urbanists are increasingly concerned with GEC, so the impact of developmental thinking in GEC scholarship is increasingly evident. The role of 'complex institutions', 'governance' and 'social capital' are emerging as key themes in GEC literatures, providing forms of exchange or 'currency' as scientific communities begin to engage and share in a negotiated agenda around cities and GEC. Wisner (2001a and b), for example, has noted that neoliberalism and brittle and weak institutions are factors constraining recovery in vulnerable communities such as those in El Salvador: "business as usual will only reproduce the pre-conditions for yet more disasters" (Wisner 2001a, 1). Such links in academic terms are echoed in various policy responses, regimes and international negotiations, and are also now being articulated and debated better (e.g., the LCA Discussion Background Paper 2 on reducing disaster risk while adapting to climate change, www.linkingclimateadaptation.org). Furthermore, linkages between the impacts of globalization and vulnerability, for example, are also being examined in various urban contexts including those linked to what cities have increasingly become (e.g. nodes of consumerism and environmental amenities; places where the roles of marketization and hazard exposure are becoming more apparent) and also places where responses to GEC and urban problems are also clearly shown to be wanting (e.g. the role of decentralization and resource use efficiency - see further discussion on this by Leichenko and Solecki 2006). When these trends are located in the broader demographic context of the growth of cities in the global South and the associated rise of both urban poverty and middle class urban consumers, the overall importance of the urban GEC agenda becomes clear.

Conclusions

GEC is distinct from, and more enduring than, the increasingly frequent occurrence of extreme events because of underlying long-term changes. The steady urbanization of the world's population, especially in the global South, and the particular vulnerability of cities to the effects of GEC, is opening new avenues of inquiry. The emerging field of urban GEC research lies at the intersection of several different intellectual traditions. For scientists, urban environmental change involves the downscaling of climate and land use change models, whereas natural resource managers explore the impact of the urban system on river catchments, biodiversity and nutrient and energy flows. Increasingly these natural scientists are seeking to engage with social scientists with expertise in urban issues and processes. Social scientific debates about urban development and vulnerability are, however, fractured, making this a messy encounter. Multiple entry points exist and reflect diverse and sometimes contradictory disciplinary and conceptual points of departure. In that context, we have reviewed some of the interacting stresses that configure the risks of global environmental changes in cities and some of the bodies of literature and paradigmatic 'frames' of current discourse around cities and GEC.

In arguing that the urban focus of GEC is increasingly important and must incorporate analysis of the human dimensions, it is prudent to draw upon existing bodies of relevant research. To this end, we have reviewed fissures in two of the dominant social scientific approaches of the past two decades, namely urban development theory and vulnerability/disaster-risk reduction studies. From this, core concerns that emerge for the urban scale include a debate about the relative importance of the role of the state and residents. In development theory, this is constructed as a debate over the developmental state versus (sustainable) livelihoods and vulnerability. In vulnerability studies, similar cleavages are evident in relation to the mitigation and adaptation emphases. Despite clear divergences over the emphasis on structure versus agency, both literatures contribute directly to the understanding of the urban drivers and experiences of GEC in cities and appropriate policy responses.

As the scientific and policy communities and civil society seek to respond to the urban manifestations of GEC (some of which are driven by urban processes), how we think about the problems will be reflected in how new knowledge is generated and what actions are taken. Actions to anticipate, mitigate and reduce the effects of GEC should arguably be the responsibility of

all relevant stakeholders. However, individual households, companies and other private actors will generally show an interest and take action only in so far as they perceive an immediate and remediable threat to their own interests. Therefore strategic leadership and co-ordination, not least while the threats remain perhaps some way off (thus posing a less immediate danger), represent classic roles of the state. The precise balance between local, regional and national institutions, and whether sectoral departments or a specialized disaster/civil defence agency should take the lead, depends on country-specific institutional architecture and governance arrangements. One of the problems in mounting such pre-emptive action in the many cities in poor countries is that the state is often poorly constituted at the sub-national scale. Overcoming this governance dilemma is itself an important priority with respect to the GEC and other agendas.

More engagement, both across the sciences (e.g. between climate change scientists, engineers, planners and disaster risk reduction scientists) as well as a better understanding of urban governance is thus required. While we have highlighted the particular vulnerabilities to GEC of cities in poor countries (predominantly in the global South), we are not advocating that these should be researched *sui generis* but that they should constitute an important focus of urban GEC research in comparative terms and via global mutual learning networks of the kind exemplified above. There are numerous researchable topics for the GEC community engaged in urban research. These are both academically challenging – requiring the rigorous application of (social) scientific expertise – and of great practical or applied importance. However, as this paper has shown, this GEC agenda is not driven by the interests of one party alone. Hence a degree of tension between various knowledge groups and stakeholders is healthy. Growing recognition of the urgency of addressing GEC at the urban scale worldwide underscores the imperative of acknowledging different intellectual traditions and promoting global learning networks of cities in what is likely to become a key and expanding focus of pure and applied research.

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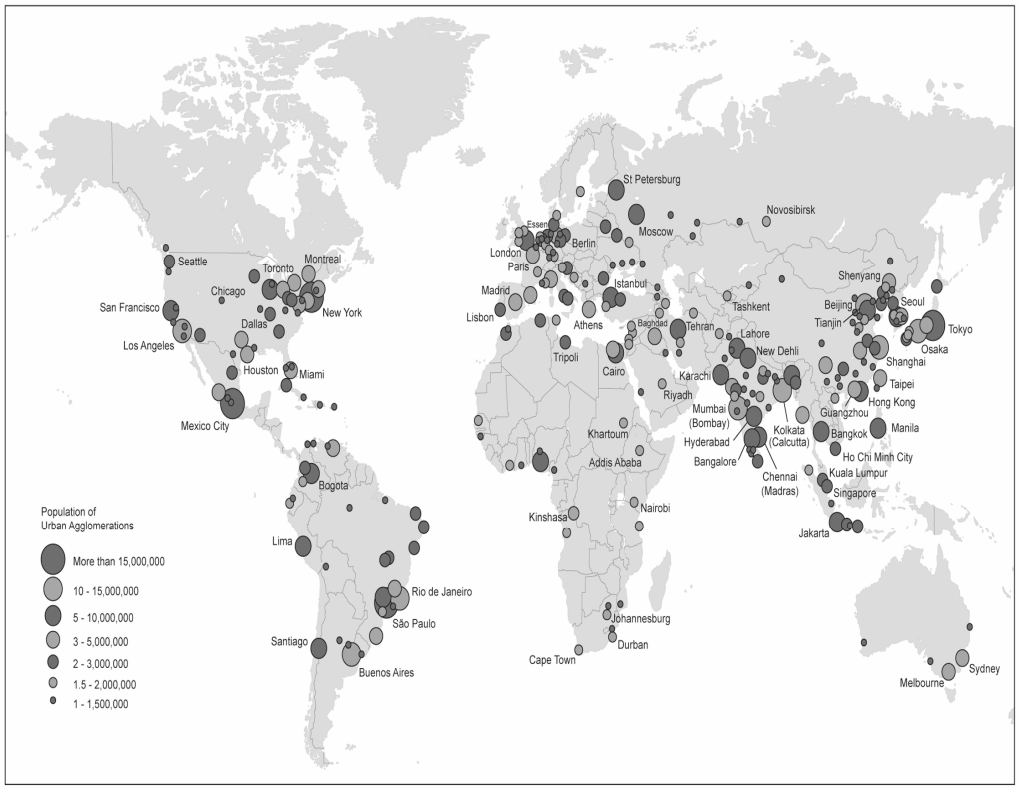
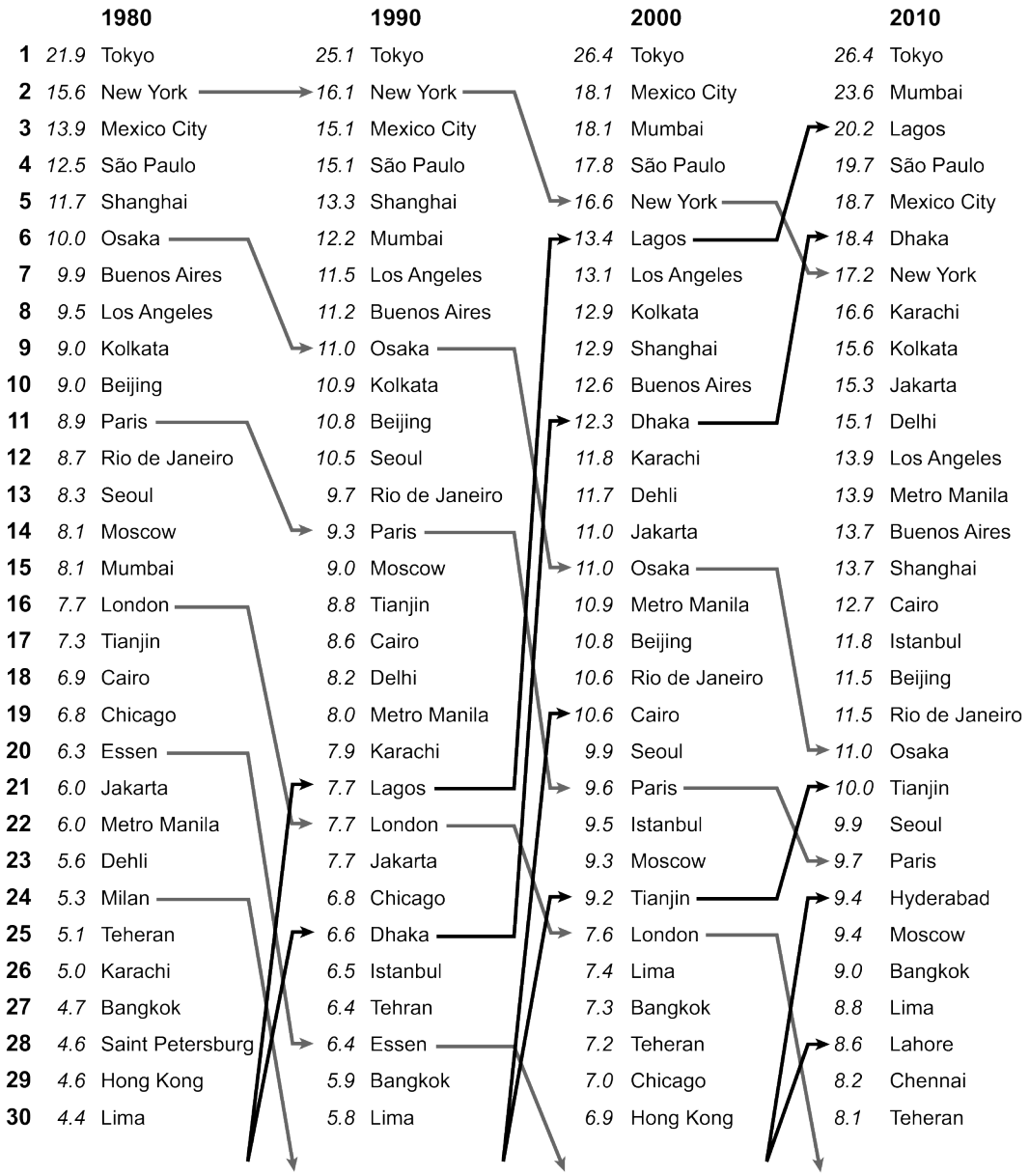
Figures

Figure 1: Cities with populations above one million



Source: adapted from Fellmann J, Getis A and Getis J 2003 *Human Geography -- Landscapes of Human Activities* 7th edn Wm C Brown Publishers, Dubuque Iowa

Figure 2: The world's thirty largest cities, 1980-2010



Source: adapted from www.unchs.org/istanbul+5/statereport.htm, 11