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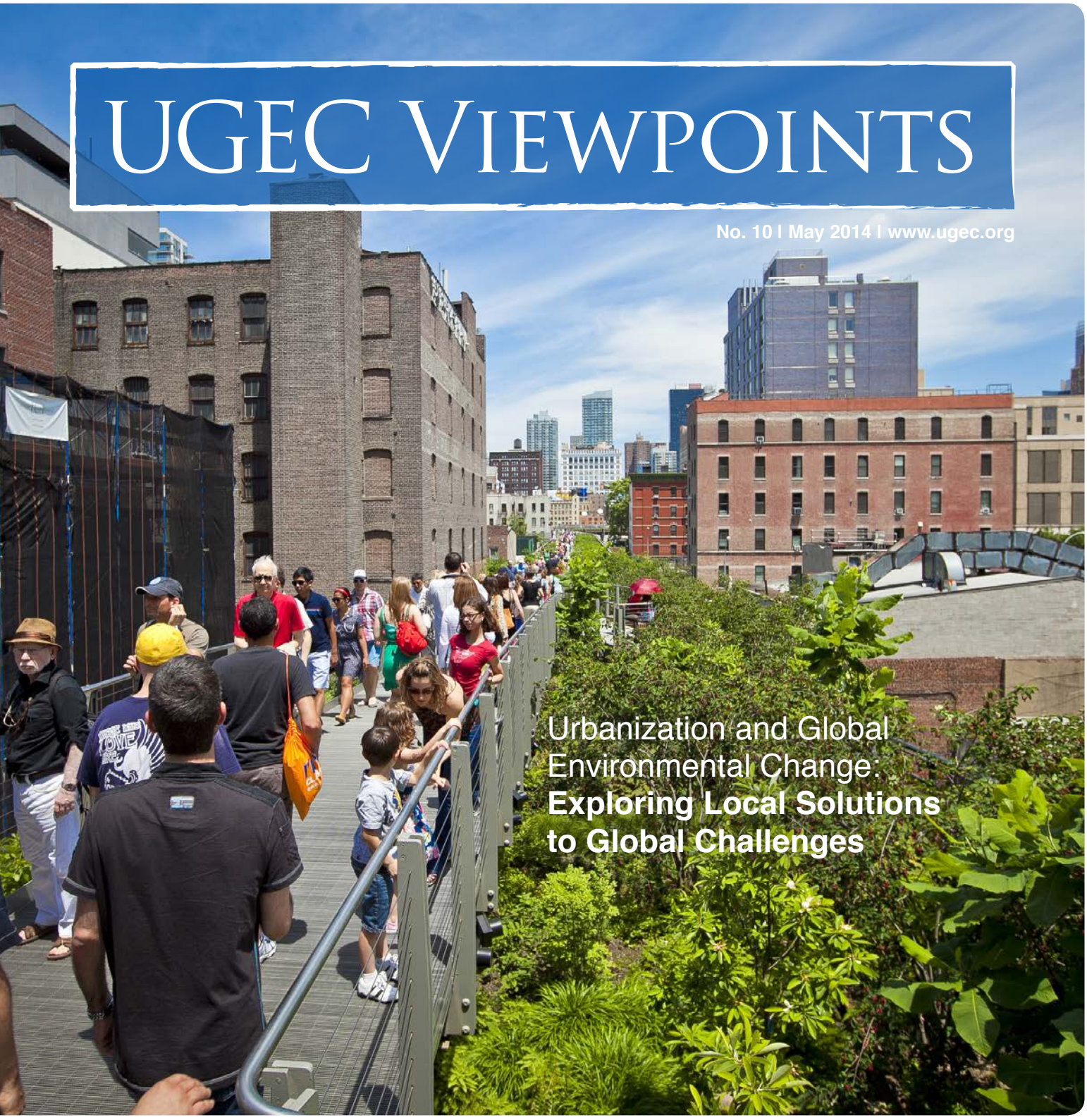

Urbanization and Global Environmental Change: **Exploring Local Solutions to Global Challenges**

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Editorial

Dear UGEC friends and colleagues,

We are happy to share with you this tenth issue of *UGEC Viewpoints*! This issue offers a diversity of articles representing research across urban Sub-Saharan Africa, India, Vietnam and the EU with authorship along the spectrum from PhD and early career researchers to seasoned scholars. The title of this issue is a theme found to be a common thread throughout the contributions: How can global challenges be successfully addressed through local actions? This notion is not new, but continues to be heard as an important challenge within the Global Environmental Change community. Cities, although small in terms of percentage of the Earth's surface (3%), have profound influences beyond their boundaries — e.g., with respect to GHG emissions, natural resources, ecosystems, markets and economies, information flows, etc. How we influence development and urbanization over the next few decades will thus be critical for human well-being and the global environment. The articles in this issue remind us that we cannot overlook the resources, institutions, knowledge and expertise that exist in many urban areas, and that there are lessons to be learned, shared and adapted to other local contexts.

Moving from the local to global, we'd like to share with you some exciting activities that are taking place at this scale within the UGEC project. As many of you are aware, the 10-year international research initiative Future Earth (www.futureearth.info/) is taking shape and robustly moving forward. This last February in an effort to think about a broader and more interdisciplinary initiative within the Future Earth framework, UGEC hosted a Scoping Meeting at Royal Holloway, University of London, UK. The meeting began a conversation among a range of urban researchers and practitioners as to what a new urban research initiative would look like in terms of key research questions, mission, and organizational structure. We found it to be incredibly successful and promise to share more information about this meeting to the wider community in the very near future for input as well as other opportunities to become involved and help shape this important process. Accordingly, we would like to encourage you to attend the UGEC Synthesis Conference, 'Urban Transitions and Transformations, Science Synthesis and Policy,' November 6-8, 2014 in Taipei, Taiwan. The conference planning is steadily underway and the Call for Abstracts remains open. This conference will not only address what we've come to know as a community over the last eight years, but it will also be very forward thinking, as the title suggests, in terms of where urban research needs go and how to accomplish this in the years ahead. We are working towards a more innovative conference structure that we hope will be exciting, interactive and more conducive to discussion and knowledge sharing. The themes of the conference are: 1. Urbanization patterns and processes; 2. Urban responses to climate change: adaptation, mitigation and transformation; 3. Global environmental change, urban health and well-being; and, 4. Equity and environmental justice in urban areas. Please visit the conference website (www.ugec2014.org) for more information.

We hope you will enjoy reading this issue of *UGEC Viewpoints* and hope to see you later this year in Taipei!

Best regards,

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Governance and Urban Resilience in Africa: Lessons from START's GEC Scoping Workshops

Senay Habtezion and Clark Seipt

The global environmental change (GEC)-cities nexus has been one of START's primary thematic focus areas for knowledge development in recent years, especially in Asia. In 2013, our prioritized ramping up its knowledge development initiatives in African urban systems. In March and September 2013, we conducted a pair of scoping workshops that investigated knowledge and capacity needs on governance facets of GEC in Africa. This article provides context for START's strategic focus on the governance-vulnerability-resilience interface, makes the case for prioritizing knowledge generation in governance dimensions of urban vulnerability and resilience in Africa, and summarizes related research priorities that emerged from these workshops.

GEC and cities: complex interlinkages

As hubs of most of the world's economic and industrial activity, cities are responsible for the majority of global greenhouse gas emissions as well as the innovations in science and technology that are needed to address mitigation of said emissions. High concentrations of population and economic development also means that cities often suffer the brunt of damage from extreme events and natural hazards, including those induced by climate variability and change (Rosenzweig, 2012; Dickinson et al., 2012; Satterthwaite et al., 2007; Baker, 2012).

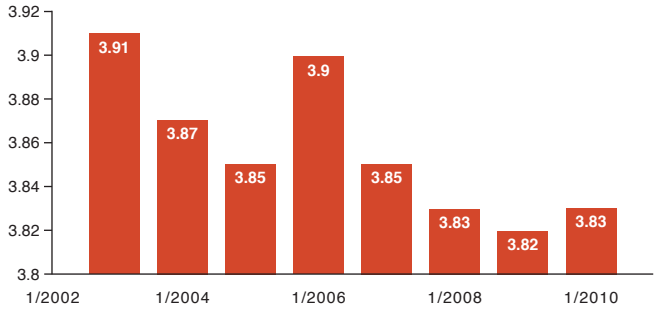
The ways in which cities develop will, in many ways, determine the extent to which humanity succeeds or fails in tackling the climate challenge – "the (q)uest for sustainability will be increasingly won or lost in our urban areas" (UN-HABITAT, 2010). Yet, the ways in which urban dynamics interact with and influence vulnerability to climate change impacts and resilience remains woefully understudied. This is particularly evident in African cities where, in many cases, even basic 'Millennium Development Goals (MDGs)'-type data on health, poverty, and demographic trends are not available (START, 2013). Better understanding of the complex dynamics that underpin the drivers and impacts of GEC in African cities is necessary for the design of meaningful mitigative and adaptive responses.

Governance, climate change and the African urban context

By 2050, there will be 2 billion Africans, and 60% of them will live in cities (UNHABITAT, 2010). This pace of urban growth

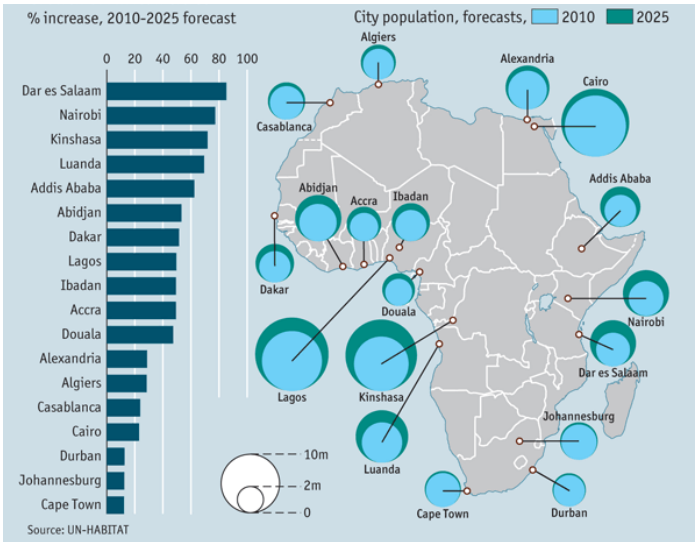
(currently 3.83% annually – see Figure 1) is quite remarkable; in 1960, the urban population of Africa was only 15% of the total population. By 2010, this figure had risen to 40% (Figure 2 provides a graphic representation of expected urban growth by 2025). This significant upsurge in urban (and demographic) growth may benefit the continent in terms of reducing its rural poverty (Ravallion et al., 2007) and catalyzing its economic growth (Freire, 2013). However, urban growth in Africa is taking place against the backdrop of distressing deficits in infrastructure, public services and governance. Combined with climate change and other drivers of GEC, such growth exposes many cities in Africa to potential risks (START, 2013). Evidence of the impacts of current climate change suggests that poor countries in Asia and sub-Saharan Africa have already witnessed ruinous impacts on their economies (see Dell et al., 2008). Africa's climate predicament is a product of not only biophysical changes but also 'multiple stresses' that exacerbate the continent's vulnerability to climate change. These include endemic poverty, poor infrastructure and governance failures (Boko et al., 2007).

Figure 1 | Sub Saharan Africa urban population growth (1967 – 2013)



Source: World Bank

Figure 2 | Growth of African cities



Source: UNHABITAT

At present, one third of Africa's urban population lives in 36 large cities of more than one million inhabitants. Much of the remainder is spread across 230 intermediate cities (World Bank, 2010) of between 100,000 and one million inhabitants, with many of these living in peri-urban areas (UN-Habitat, 2010). As Africa's urban population expands, the cumulative effect of population density, urban poverty and climate change poses a significant risk to the lives and livelihoods of millions. This is especially the case in informal settlements where infrastructure, water, sanitation, energy and other public services are scarce – at present 72% of African urbanites live in such settlements (Wisner and Pelling, 2008; Lwasa, 2010; See Figure 3).

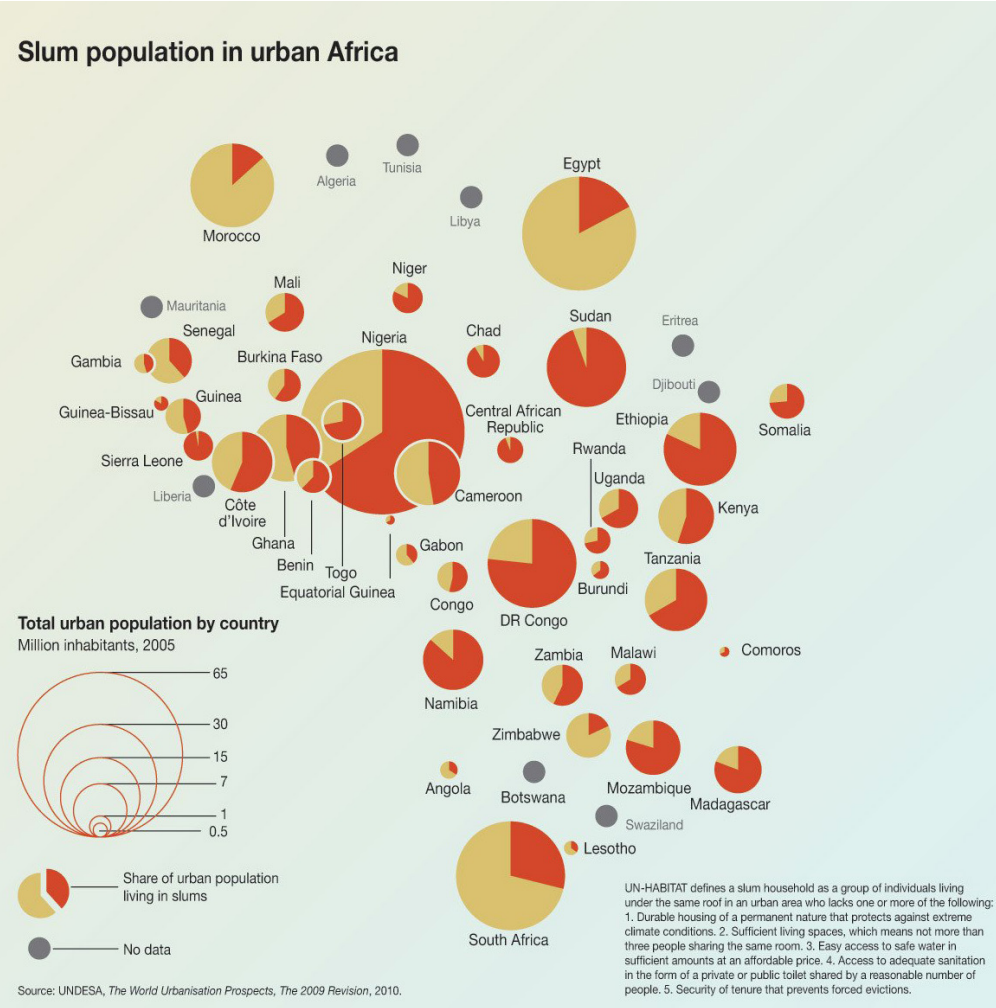
Urban slums are usually situated in marginal areas (such as steep hillsides, flood plains, coastal zones, or near hazardous waste), putting residents at higher risk from flash floods, landslides and heavy downpours and other similar hazards (see Baker, 2012; Satterthwaite, et al., 2007; Dickson, et al., 2012). It is therefore likely that Africa's cities will be the face of future climate change impacts on the continent.

Governance, GEC and African cities: the need for knowledge development

"Good local governance" is key to urban sustainability (Satterthwaite et al., 2007). Deficits in good governance (such as political suppression and corruption) are likely to impede development of much needed adaptive capacities and resilience at all levels of government (see UNHABITAT, 2010; Brown et al., 2010; Lockwood, 2013; Bond et al., 2009). For instance, comparative research on the human toll of Indian Ocean cyclones of Nargis (2008) and Sidr (2007) suggests that the absence of good governance in Myanmar may have heightened the mortality rate in the country as a result of cyclone Nargis (IPCC, 2012). Similar place-based research is critically needed to assess the relationship between governance systems and processes, and climate change risk management and adaptation efforts across cities in Africa.

Thus far, response to climate change in Africa has been largely short-term and reactive. For example, as part of the

Figure 3 | Share of African slum population (red)



UNFCCC National Adaptation Programmes of Action (NAPAs) process, 33 African Least Developed Countries (LDCs) and the republic of Cape Verde[1] have devised priority projects that span different sectors and levels, some at the city scale[2]. However, these projects tend to focus more on short-term fixes to current sectoral needs and concerns. The more systemic and underlying problems of context and governance paired with the need for future-focused perspectives have been, by and large, deemphasized in program and project design and execution (see Lockwood, 2013). This is a cause for concern, given that any adaptation and/or resilience-related programming in Africa that eschews governance impediments evident in many parts of the region will likely be futile. What is worse, some adaptive efforts that fail to take into account governance failures may have unintended negative impacts. As an example, climate finance that goes to fund 'adaptation' projects and programs may have the reverse effect of sustaining and strengthening illegitimate institutions that repress adaptive capacities of communities (Lockwood, 2013; see Transparency International, 2011). Seen in this light, one cannot overstate the criticality of the governance context in Africa, as its urban spaces become increasingly relevant for understanding GEC impacts and devising appropriate responses.

In acknowledgment of the fact that the governance and the institutional and political context of climate vulnerability, adaptation and resilience in Africa is underexamined, two START scoping workshops were held in 2013 to explore the associated knowledge gaps and needs — both called for sustained knowledge development to address the complex interlinkages among vulnerability and governance.

Linkages between urban resilience and good governance: Cities at Risk Workshop — Africa

START, in collaboration with the ICSU Regional Office for Africa and the eThekwini Municipality of South Africa, convened a four-day scoping workshop entitled, "Cities at Risk – Africa", held on March 25-28, in Durban. Those in attendance included scientists, municipal leaders, and representatives from African universities and research centers. The event assessed knowledge and capacity needs regarding vulnerability and risk in the urban sector and shared knowledge, insights and experiences on pathways for effective climate change adaptation and resilience in African cities and urban systems. Figuring

1 The Republic of Cape Verde graduated from LDC status in 2007.

2 See UNFCCC NAPA Priorities data base: http://unfccc.int/files/cooperation_support/least_developed_countries_portal/napa_priorities_database/application/pdf/napa_index_by_sector.pdf (last visited Oct 15 2013)

3 For full workshop report see http://start.org/download/2013/durban/car-workshop-report.pdf

Figure 4 | Cities at Risk Workshop – Africa participants

Figure 5 | Good governance necessary for urban resilience — schema developed by participants in the Durban workshop (START, 2013)

prominently in workshop recommendations[3] was an emphasis on the need for good governance to enable and ensure long-term building of adaptive capacities and resilience in urban areas. Workshop participants underscored the following in this respect:

- There is a need for transformative change in the quality of governance of African cities. This will require participatory, transparent, efficient and climate-conscious local governments (LGs) that are well-resourced and ready to work with other cities to address urban challenges under a changing climate. In this regard, it is important to generate and share knowledge (e.g. through case studies) on how other cities are managing climate variability and change.
- There is a clear relationship between good governance, urban adaptation and resilience. Greater resilience is likely to be achieved where there is effective, transparent and democratic governance with a robust vision and plan for adaptation (See Figure 5).

Attributes of good governance that were identified as necessary to promote urban resilience in African cities included:

- Transparent, consultative, and democratic LGs that operate within the principle of the rule of law.
- LGs that are efficient in the execution of programs and projects that build adaptive capacities and foster resilience.
- LGs that are adaptive to new science and circumstances as well as approaches to governance.
- Resourcefulness of LGs in terms of technical, financial and institutional capabilities and knowhow.

These attributes of good governance are very broad. It is important to examine their application within the context of urban vulnerability and resilience. In this regard, it is worthwhile to note that many African cities have "very little actual power" or influence under existing national constitutional and governance regimes in the region (UN-HABITAT, 2010). It is therefore crucial to understand the national governance context as well.

The broader context of GEC and governance: Climate Change & Governance Workshop — Africa

In collaboration with the Earth System Governance Project and the Institute for Environment and Sanitation Studies of the University of Ghana, START organized the "Climate Change & Good Governance Workshop – Africa", held September 23-24, 2013 in Accra, Ghana. The event brought together an interdisciplinary team of experts from African universities and research centers to exchange experiences, views and insights on knowledge and capacity needs related to governance dimensions of GEC. Participants collaborated on developing a draft strategy paper on knowledge, capacity and networking needs in governance dimensions of GEC in Africa.

While the workshop had a broader scope (global to local), its recommendations are applicable at the LG level:

- Because traditional authority is still respected in Africa – especially with regards to environmental issues, natural resource allocation and conflict resolution there is a critical need to examine the roles of such institutions in promoting or undermining resilience.
- There is a need to improve effectiveness of national and local governments in adaptation programming as well as their capacity in management and financing of such programs and projects. More comparative research on experiences of local governments is needed to empirically understand the relationship between attributes of good governance, vulnerability and resilience.

Figure 6 | Climate Change & Good Governance — Africa Participants

- There is a need to better understand the extent to which democratic (or non-democratic processes) affect vulnerability to GEC – for example: how does political suppression influence vulnerability?
- There is need for institutions themselves to be adaptive to changing circumstances. The degree to which African institutions at all scales of governance, including LGs, are adaptive is an important subject of inquiry.
- Allocation of, and access to, environmental resources should be founded on the basis of well-enunciated rights and obligations. Appropriate systems of management are key for ensuring the functional aspects of 'allocation' and 'access'.

Concluding remarks

Combined with poverty, rapid demographic and urban growth, and climate change, governance impediments could create a perfect storm for urban Africa. While a great deal has been written and talked about on governance impediments in sub-Saharan Africa, this angle is underexamined in the context of current adaptive efforts in the region. There is a critical need to encourage knowledge generation to bridge this knowledge gap.

The two workshops in Durban and Accra have identified areas for knowledge development in the governance-urban vulnerability-resilience nexus – more effort needs to be exerted. Beside its research value, such knowledge would be immensely useful in the devise of meaningful adaptation and mitigation interventions in the region.

For more information on START's portfolio of projects and activities related to Cities at Risk and Urban Futures, please visit www.start.org.

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Water kiosk in Kisumu, Kenya

Rapid Urbanization, the GEC and the Challenge of Water Provision to the Poor: Lessons From Utility-Community Partnership Models in Kenya

Daniel M. Nzengya and Rimjhim Aggarwal

A relative latecomer to the path of urbanization, Sub-Saharan Africa (SSA) is currently experiencing the fastest rate of urbanization globally, driven by endogenous growth as well as migration due to climatic extremes and global environmental change (GEC) (Parnell and Walawege, 2011). Africa is generally regarded as one of the most vulnerable continents to climate change (Boko et al., 2007) yet there are very few regional to sub-regional climate change scenarios using regional climate models or empirical downscaling (Parnell and Walawege, 2011). This makes it difficult to predict how climatic trends, together with other drivers of urbanization, are likely to influence the trajectory of urban growth in SSA. With urban population currently growing by around 5% per annum, it is predicted that more than half of the population of Africa is likely to reside in urban areas by 2030 (UN Habitat, 2005).

The uniqueness of the SSA urbanization experience derives not only from its rapid pace, but more importantly, from the decoupling of this urban transition from the process of industrialization that was witnessed in other parts of the world during their transition. Much of the urban growth is being absorbed within the informal services sector, which is associated with lower incomes and greater vulnerability to risks. This has deepened the cycle of poverty in the region. The population living in slums is estimated to double every 15 years while the overall population doubles every 26 years (UN Habitat, 2005). Recent research has documented how the evolving dynamics of human settlements is leading to shifts in ecosystem regimes (e.g., eutrophication of lakes), further exacerbating the cycle of rapid urbanization, poverty, and environmental degradation (Odada et al., 2009).

The rapid pace of growth has also overwhelmed the capacity of the already weak states in SSA to develop infrastructure for provision of basic services, such as water and sanitation. Given

the lack of public infrastructure, many urban residents turn to informal water services, such as small-scale water vendors and bottled water delivery, for their drinking water. Studies show that more than 50% of urban residents in Africa, largely the poor, depend on the informal water sector (Solo, 1999) and end up paying a much higher price for water of uncertain quality than those with piped water connections (Gulyani et al., 2005).

The window of opportunity

While these challenges associated with rapid urbanization are getting increasing attention, the role of public infrastructure in providing basic services and mediating the interaction between urbanization and environmental change has not been well recognized. Government and donor agencies are currently investing heavily in new water infrastructure projects to meet the Millennium Development Goal (MDG) of halving the number of people without access to safe drinking water. This offers us a window of opportunity in terms of thinking about how to leapfrog current development approaches and instead design infrastructure projects that not only meet the needs of the population today but are also robust enough to withstand future shocks.

The role of infrastructure design is critical in leveraging the links between urbanization and GEC because the useful life of large water infrastructure is often around 100 years or longer, and thus investments that are made today are likely to still be operating under the new climates of the next century. The issue of appropriate design relates to not only the physical infrastructure but also to its "fit" with the design of the institutional dimensions which relate to the rules regarding provision, cost sharing, access, pricing, everyday management and maintenance (Anderies et al., 2004). This is important because of the legacies associated with institutional design that are also long enduring and often resistant to change.

> Rather than including slum settlements as an after-thought, the challenge is to design infrastructure that explicitly recognizes the rather unique needs of slum communities.

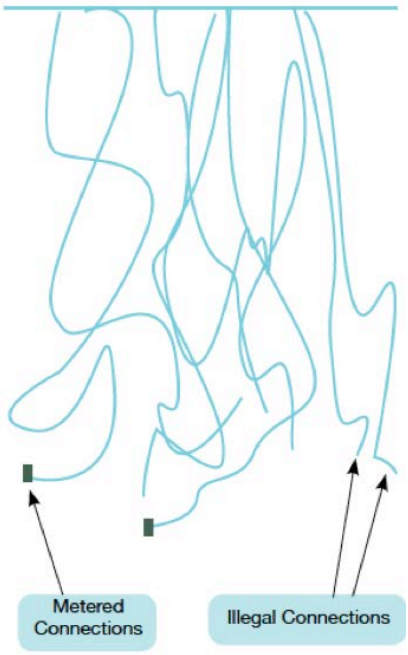
The design solutions that are proposed need to be rooted in the bio-physical and socio-economic realities of today's cities. Here an important factor to consider is the dominant presence of slum settlements in cities of SSA, as discussed before. Rather than including slum settlements as an after-thought, the challenge is to design infrastructure that explicitly recognizes the rather unique needs of slum communities (Nzengya and Aggarwal, 2013a). This is often difficult because policies regarding provision of basic services to slum communities are highly politically charged and entail complex legal issues (Aggarwal and Haglund, 2013). In this article, we discuss one solution that has been attempted in Kisumu city, Kenya, to engage slum communities in partnership with pubic utility to provide affordable and safe water.

Innovative solution: example of partnership model

In Kenya, around 70% of urban dwellers live in informal settlements (WHO/UNICEF, 2008). Most slum housing is either illegally occupied or subdivided, and does not comply with the country's building and planning regulations. This presents difficulties for utilities because there is no official, registered owner to whom water service providers can offer services. Kisumu is the largest city on Lake Victoria with a population of around one million. Its population grew by 80% in the previous decade, making it one of the fastest growing cities in Kenya. In 2007, around 60% of Kisumu's residents lived in informal settlements and only 36% of the entire city's population had service coverage (Schwartz and Sanga, 2010). The Kisumu Integrated Water and Sewerage Company (KIAWSCO), a semi-private company and municipal water provider, reported in 2007 that the water demand was nearly three times greater than its production capacity (KIWASCO, 2007). Kisumu's main source of water is Lake Victoria. Rapid urbanization and poor sanitation make Kisumu one of the leading polluters of Lake Victoria.

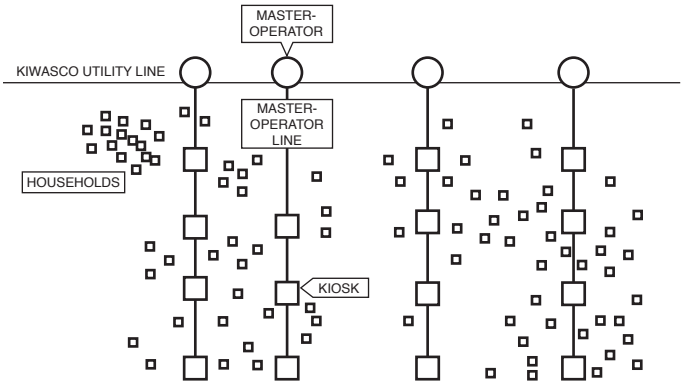
Nyalenda is the largest informal settlement in Kisumu with a population of about 50,000 inhabitants (WSP, 2009). Prior to the development of the partnership model, described below, water supply in Nyalenda was mainly provided by one main line

Figure 1 | Prior situation — spaghetti network of legal and illegal connections



Source: WSP 2009

Figure 2 | Water infrastructure layout for Delegated Management Model



Schematic of Kisumu partnership model to extend water service to informal urban settlements.

from the utility through a spaghetti network of legal and illegal connections (see Figure 1). KIWASCO had limited monitoring and control over the water supply, and was losing a lot of revenue in the form of "unaccounted for water" due to the theft and resale of water by informal service providers (WSP, 2009). Coverage level for safe water was only 36% in 2003. The poor, who could not afford to pay the high connection fees, were largely serviced by informal providers and were found to pay a much higher price for water than those with piped connection.

In 2004, KIWASCO co-financed a pilot project in Nyalenda, with technical assistance provided by the Water and Sanitation Program of Africa. In the first phase of the project, investments were made to convert the rather haphazard structure of connection lines (Figure 1) to a structured system of parallel secondary lines connected to the main line (Figure 2). To match with this new physical design, a new institutional structure of Delegated Management Model (DMM) was designed. Under the DMM, the water utility, KIWASCO, provides a single water-supply line from which master operators (MOs) are licensed to run additional supply lines into the settlements, collect revenue, and perform minor maintenance in a given area. MOs may be individuals or formally registered community groups. The MOs, in turn, enter into agreements with individuals or community-based operators (CBOs) to set up and operate water kiosks and provide water to the slum dwellers. Currently there are eight metered MOs in Nyalenda, of whom five are CBOs and three are private individuals. Through delegating in this way, it is expected that the utility reduces administrative costs and brings services closer to the customer.

In summer 2013, we collected data on the functioning and impacts of this model using interviews with 216 households and 73 kiosk operators out of a total of 266 in Nyalenda. For a rigorous impact evaluation we also collected data from a neighboring settlement, Manyatta, which has a similar socio-economic and demographic profile but has not implemented the DMM (Nzengya and Aggarwal, 2013b). Our results show that in the settlement with DMM (Nyalenda) prices are significantly lower (around 17%), there is greater responsiveness to consumer needs (in the form of more flexible payment schedules), and significantly greater level of consumer satisfaction. Our analysis also shows that kiosk operators in Nyalenda are significantly more likely to come from poor households, are less educated, and more likely to be women. This suggests that the DMM has improved accessibility and provided greater employment opportunities for the poor and marginalized sections of the population.

Households reported reliability of service provision as the most important problem they face with kiosk services. A majority of respondents attributed this to utility rationing of the water supply, especially during periods of prolonged drought. Some respondents attributed reliability problems to pipe bursts and long repair times, specifically under the DMM, due to the low level of technical skills of kiosk operators. Building the technical and financial capacity of kiosk operators under the DMM remains a challenge. When kiosk operators were asked about

what plans they had for the future, adaptation measures to ensure service provision and income during the period of utility service disruption were mentioned most often. Adaptation strategies included purchasing a water storage tank and/or ensuring they have access to supplemental water sources (such as bore wells). Around 4% of kiosk operators in our sample were observed to have implemented some such adaptation strategy.

Lessons for the future from an urbanization and GEC perspective

Partnership models, such as the DMM presented above, are being held up as examples of how to design institutional strategies to meet the MDG challenge of providing safe and affordable water, specifically to slum communities. However, so far the assessment of service delivery models, such as this, have been based primarily on current indicators of prices, costs, demand, coverage, and participation rates. As we discussed before, given the long physical life of water infrastructure and the associated institutional legacies, there is also need for assessing how robust these different models (DMM versus centralized) are to future shocks associated with economic growth, shifting demographic and urbanization patterns, and environmental change at global, regional and local scales. This is a complex task because changes in urbanization and the environment are not linear; they interact in complex ways that we are only now beginning to understand.

Both the centralized and decentralized systems are vulnerable in somewhat different ways to the climatic and other risks mentioned above; understanding what the trade-offs are between these sets of vulnerabilities and how to navigate them given highly contested societal preferences remains a challenge. The centralized model offers the benefits of greater coordination and control over the multiple sources of future uncertainties and greater capacity to cope with changes at larger scales, such as long-term droughts. The decentralized model, on the other hand, is likely to be associated with better knowledge of and responsiveness to the needs of local residents. The decentralized model, however, poses a huge challenge in terms of building financial and technical capacity at the various levels and social capital (in the form of long-term relationships and trust) among the different partners. Future research will need to take up these issues related to the co-design of physical and institutional dimensions of infrastructure for the future.

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Local market in Kampala

The Role of Civil Society Organizations in Shaping Adaptation Capacities of the Urban Poor in Kampala, Uganda

Peter Kasaija and Shuaib Lwasa

Understanding the current and future impacts of climate change is one of the key issues dominating international policy discussions across the globe. There is now substantial consensus on the influence of human activity and potential impacts (Oreskes, 2005). Unprecedented levels of population growth and increased urbanisation, coupled with unsustainable consumption and waste generation patterns, have in turn led to uncontrolled exploitation of critical resources such as water and forests to meet human demands. The short and long term implications of climate change on our world at a global scale are enormous, and therefore require immediate attention. However, there is an equally urgent need to pay as much attention to its emerging dimensions at local levels. Accordingly, governance or decision-making processes must be examined if any meaningful interventions to address the different challenges associated with the effects of climate change in developing cities, like Kampala, are to be made. Recognizing the importance of these processes is vital in understanding how communities adapt in this highly dynamic world (Jones et al., 2010).

Kampala is experiencing rapid population growth. It has increased steadily from about 1,189,142 in 2002 to 1,659,600 in 2011 (UBOS, 2010). Of the total population, more than 60% reside in slums, which is one of the highest figures in the region (Goodfellow, 2010). These slums are highly susceptible to flooding, caused by increased intense rainfall, one of the many effects of climate change (Action Aid International, 2006; Lwasa, 2010). Communities living in slums are deprived of decent livelihoods, as they are left exposed and vulnerable, unable to effectively meet their own basic needs. In order to fill the gap created by weak public institutions, civil society organizations (CSOs) have come to play an increasingly important role in helping these communities deal with the numerous challenges they face (Mercer, 2006). These organizations offer material and financial assistance to help communities build more resilient mechanisms/capacity to deal with the development challenges

exacerbated by climate change. This article summarizes research which examines the decision-making governance model guided by three objectives:

a) Analyse the current decision-making model of governance and assess its performance in enhancing the adaptive capacity of the urban poor;

b) Examine the effectiveness of current strategies adopted by the CSOs to enhance the capacity of the urban poor to adapt to climate change; and,

c) Assess the responsiveness of the urban poor to interventions of CSOs to enhance their adaptive capacity to climate change in Kampala City.

Figure 1 | Map of Kampala showing informal settlements affected by annual seasonal floods

Source: Ellen Byagaba KCC GIS UNIT

Framing and approach

The administration and management of Kampala is based on a decentralised governance framework, a primarily two-tier system composed of democratically-elected and appointed technical officers who are charged with representing the wishes of the populace and also provide basic social services. Within this model, aside from state actors like the Kampala Capital City Authority (KCCA), various non-state actors like CSOs are playing an increasingly important role in meeting the needs of communities. In order to examine this governance model, this study utilized key-informant interviews with officials from the KCCA and two CSOs, as well as focus group discussions with selected households located in informal settlements in Kampala. Literature reviews and field observations were used to acquire valuable information about climate change adaptation, especially as it pertained to informal settlements.

Governance and management in Kampala

The governance model upon which Kampala is managed is based on a decentralised framework meant to provide greater autonomy at the lower levels of government. This model addresses many issues of development and infrastructure, but has yet to mainstream vulnerabilities of the urban poor to flooding in Kampala. The decentralised framework and participation of communities at the local level was designed to minimise bureaucracy, political stalemates, and exclusion of the marginalised in implementing policies and programmes (Tanner et al., 2009).

Realizing these changes has proven difficult in Uganda, as it has in other low-income countries as pointed out by Helmsing (2002). Influence peddling by the ruling elite (Goodfellow, 2010), cronyism, misappropriation of public funds, and unprofessionalism among other problems have contributed to the relative failure of this governance model. Corruption is still endemic in public offices. This is illustrated by the lack of transparency in the award of tenders, and the lack of accountability in expenditure of public funds. Health facilities are inadequate, making affordable healthcare inaccessible to the majority of residents, while public infrastructure like roads are in poor condition. The city's drainage system can no longer cope with the increasing demands of a rapidly growing population. This has resulted in persistent flooding across the city. Sanitation and solid waste management are still generally poor, presenting the threat of disease outbreaks. The new administrative and management structure established in 2010 is highly polarised due to on-going conflicts between the two main tiers of government (civil & political). Stalemates over contentious regulatory, administrative and financial decisions are now typical of proceedings in the KCCA.

Through this study, a quick assessment was made of the city's current governance model based on capability, accountability and responsiveness to citizens' needs (Rhodes, 1996). Interviews and

discussions were held with officials from KCCA, ACTogether, Sustainable Settlement Alternatives (SSA:UHSNET), and poor communities living in informal settlements. Through these interactions, it was revealed that the city's management and administration remains largely unable to deliver on its obligations (basic social service delivery, traffic management, maintenance and expansion of social and economic infrastructure and planning). In the context of this article, the KCCA has yet to design and install infrastructure with consideration of climate risks. Flooding has increased and communities are unable to cope with the frequency of the disasters. Local level participation has not enabled governance of the critical urban infrastructure of drainage systems that accommodate the runoff from intense rainfall events.

However, the KCCA has made significant improvements in service delivery over the last three years. It has been able to decongest city streets, increase revenue, improve solid waste collection, and promote some level of transparency in its actions. There is still room for improvement, as the impacts of climate change continue to disrupt the livelihoods of the most vulnerable. Meaningful dialogue on climate change policy, especially at the lower levels of government, is limited because they still lack political autonomy to address such matters. The piecemeal improvements that have been made in service delivery pale in contrast with the larger challenges awaiting a rapidly sprawling and vulnerable city. Unless radical changes are made to address the underlying issues plaguing the current governance model, it will be difficult to make any significant improvements to the ability of the city's urban poor to adapt to increased flooding.

Aside from the KCCA as the main state actor in the city's governance framework, non-state actors including CSOs have become important in wider decision-making processes, especially with regard to climate change adaptation of the urban poor. ACTogether is a support organisation for the National Slum Dwellers Federation of Uganda (NSDFU) primarily set up to promote policies and practices to help the poor in Uganda's urban development arena (Figure 1). It continues to be actively involved in flood-response initiatives in settlements like Bwaiise, Kalerwe, Kasubi, Kawaala and Kisenyi within Kampala City. It has been involved in mobilising poor communities to improve drainage within their neighbourhoods in response to flooding. It has also helped to support local government initiatives to construct and maintain drainage channels in areas that are highly prone to flooding. However, policy-wise, it has not yet devised definitive

strategies to specifically tackle climate change-related issues. Their focus remains on helping poor communities to access better housing through slum upgrades and ensuring greater access to clean water and sanitation (SDI et al., 2013).

Sustainable Settlements Alternatives (SSA:UHSNET) on the other hand, is a network of civil society organisations and other stakeholders primarily involved in lobbying and advocating for better policies towards sustainable improvement of human settlements in the country (SSA:UHSNET, 2011). Although SSA UHSNET has progressively expanded the range of issues in relation to its mandate, climate change issues are yet to be considered as a priority, with land, housing, gender, environment and HIV/AIDS still their key focal areas.

The areas to which the KCCA and CSOs like ACTogether and SSA UHSNET are currently channelling their resources are among the most critical if any positive impact is to be made on the lives of the marginalised. However, their approach needs to be re-examined. Rather than tackling the challenge presented by flooding from an engineering perspective, they need to view it in a more holistic manner. This approach requires different actors to employ engineering methods, coupled with socio-economic interventions to improve the livelihoods of those most affected by flooding. Equally important to highlight is the lack of coordination between and among CSOs and other important stakeholders. The lack of a coherently coordinated effort has rendered past initiatives ineffective, such as the duplication of responses to flooding, leading to a loss of scarce resources. All these failures point to an urgent need by CSOs to revisit their approach in addressing the issue. The different actors need to make genuine and deliberate efforts to scale back on investing valuable resources in dealing with flooding as just another urban

development challenge (such as sanitation, clean water provision, solid waste management, etc.) Similarly, strategies to improve the adaptive capacity of marginalised communities in Kampala need not be adopted as add-ons to other development challenges. It is essential that the CSOs, together with KCCA and other relevant actors, develop a more integrated and holistic policy towards the principal challenge of climate change if they are to make a greater impact improving the flood adaptive capacity of poor communities in Kampala.

The lack of an integrated policy approach toward flooding by relevant actors at the city level has left loopholes in their approaches to help poor communities adapt to flooding in Kampala. Discussions with local community leaders and several households in flood-affected settlements revealed that there was a general receptiveness to more sustainable strategies to help them adapt to the effects of climate change. However, their receptiveness was dependent on key issues like the magnitude/scale, scope and the timing of the strategies. Other equally critical factors like community involvement/participation and the identification of resources (human and financial) for implementing flood adaptation strategies emerged as important determinants in helping them build more resilient livelihoods against climate change.

Conclusion and ways forward

The decentralisation model under which Kampala is managed must be deepened for a more responsive approach to climate change and its impacts. Non-state actors should be more than passive participants in the decision-making process. Climate change adaptation must be incorporated into the wider sustainable development agenda if key actors in the sphere of urban development are to make a positive impact on the lives of the poor. The KCCA and CSOs need to mainstream climate change issues within their policy frameworks if they are to be effective. There is also a need for both state and non-state actors to build capacity within their ranks as well as creating networks with other development actors like government ministries and departments, especially on climate change issues. Information management, knowledge dissemination and constructive feed-back among the different actors are also other critical areas that require attention. Effective participation, sensitisation, education and training of affected communities could also be quite useful in building local capacity and resilience against the impacts of climate change. Set in a transparent and flexible framework, this governance model could help to ensure greater responsiveness, awareness and participation of the most affected communities in strategies towards improved adaptation to the effects of climate change over the long term. This study has highlighted several key issues in relation to governance. As a result, it should be followed up by substantive efforts to conceptualise and develop an alternative governance model better suited to improving the capacities of the urban poor to withstand the increasingly recurrent challenges presented by climate change.

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How Prepared are UK Cities for Addressing Climate Change Adaptation and Mitigation?

Oliver Heidrich, Richard J. Dawson, Diana Reckien and Claire L. Walsh

Cities are increasingly aware of the need to mitigate greenhouse gas (GHG) emissions and adapt to changes in weather patterns, resulting in the production of urban climate change plans to coordinate interventions across multiple urban sectors (ARUP, 2011; Carbon Disclosure Project, 2011; Carmin et al., 2012; Hunt and Watkiss, 2011). Typically, multi-city studies have used questionnaires to gather evidence of urban climate preparedness, whereas this research has compiled and assessed approved and published climate change plans (Figure 1) by 30 cities in the UK (representing ~28% of the UK's population).

This analysis characterizes progress against (i) Assessment, (ii) Planning, (iii) Action, and (iv) Monitoring, for both adaptation and mitigation using an Urban Climate Change Preparedness Score (Heidrich et al., 2013). This allows for a quantitative comparison of climate change strategies across cities and makes possible the comparison of national and international urban areas by way of their climate change adaptation and mitigation plans.

Cities and data analysis

To ensure this analysis captured cities/urban areas of a range of population sizes and locations, we used 30 cities (Heidrich et al., 2013) previously identified by the European Urban Audit database[1]. The Urban Audit methodology aims to provide a balanced and representative sample of cities from European countries (Eurostat, 2010). Only officially published or approved climate initiatives and documents were analysed.

Preparedness scores for urban areas

Evaluation procedures were derived to evaluate the measures from the evidence provided by the authorities. We characterised the following four key stages of adaptation and mitigation preparedness (Heidrich et al., 2013). Each stage (see Figure 2) is scored from 0 to 3 on the following stages of adaptation:

- *Assessment of current and future climate risks* — Availability and quality of Local Climate Impacts Profile[2] (UKCIP, 2009), climate change risk analysis and accounting of adaptation;

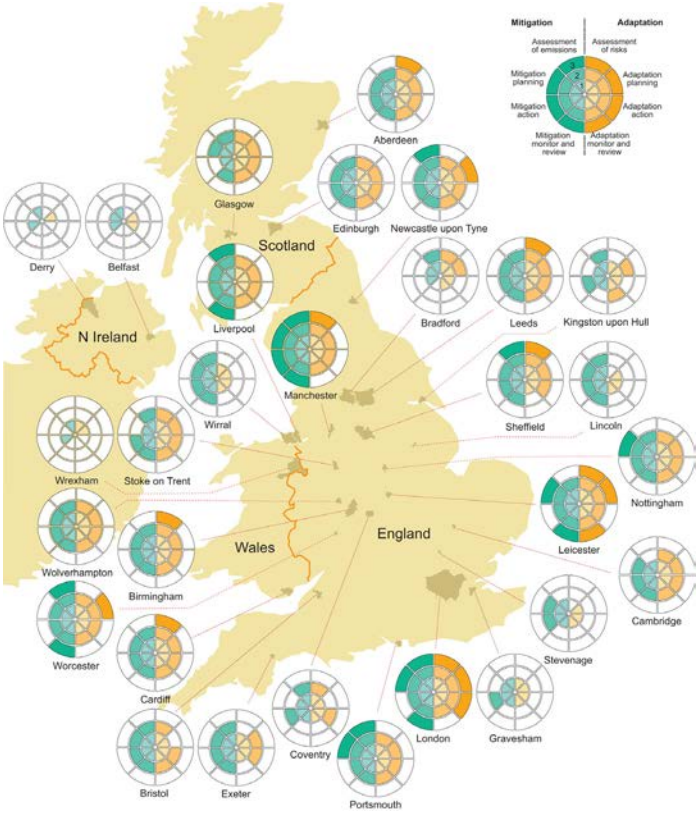
1 Following the European Regional and Urban Statistics Reference Guide (Eurostat, 2010), a city is generally defined as the administrative town/city (e.g., the central municipality), which is responsible for local government and considers four levels (Core City, Larger Urban Zone, Kernel and Sub-City District).

2 This tool is used to assess the exposure to weather and climate by highlighting a locality's vulnerability to severe weather events and assesses how these events affect local communities as well as local Authority assets, infrastructure and service delivery capacity.

Figure 1 | Selection of climate change strategies and commitments analyzed

Source: Authors

Figure 2 | Urban areas and their climate change preparedness scores — 3 being most advanced (Heidrich et al., 2013)



- *Adaptation planning* — Breadth and depth of adaptation strategy, existing standardised management system;
- *Adaptation action* — Quality of adaptation action plans and implemented projects;
- *Adaptation monitoring and review* — Signatory of Covenant of Mayors[3], level of senior management commitment and formalised procedures (e.g., annual reviews).

Each stage is scored using an assessment criteria outlined in the Supplementary Information in Heidrich et al. (2013). For illustrative purposes we only describe the 'assessment of current and future climate risk' stage here. In the case that no evidence is provided, a score of 0 is given. If some anecdotal evidence is found, i.e., the Authority acknowledges climate change risk and there is some evidence from either websites or discussion with members of staff (i.e., not published), a score of 1 is given. If we found some published evidence i.e., an adaptation risk assessment report or something similar, but it did not use a standardised method, it was scored a 2. If published evidence and standardised methods were used, it scored a 3, i.e., the Authority has published a local climate impact profile or similar assessment of risks, conducts detailed risk assessments and is active in regional climate change risk assessments using standardised methodologies.

The following stages of mitigation preparedness were also scored from 0 to 3:

- *Assessment of GHG and/or carbon emissions* — Status of carbon management programmes and other GHG accounting methods;
- *Mitigation planning* — Availability and quality of mitigation strategies, plans and existing management systems to manage the process;
- *Mitigation action* — Quality of mitigation action plans and implemented projects;
- *Mitigation monitoring and review* — Covenant of Mayors signatory, level of senior management commitment and formalised procedures (e.g., annual reviews).

Results and discussion

Signatories of national and international agreements

The cities investigated represent a population of around 17.3 million. By far the largest urban area is London, with a population of 7.6 million and the smallest is Stevenage with 81,000 inhabitants.

3 The Covenant of Mayors is the mainstream European movement involving local and regional authorities, voluntarily committing to increasing energy efficiency and use of renewable energy sources on their territories. By their commitment, Covenant signatories aim to meet and exceed the European Union 20% CO_2 reduction objective by 2020. For more information: http://www.covenantofmayors.eu

Forty-three percent (13) of the cities signed the Covenant of Mayors' agreement. Additionally, from the 23 English areas, 22 signed the Nottingham Declaration[4]. The Scottish Declaration[5] is signed by all Scottish areas, whereas the cities from Wales and Northern Ireland did not sign such Declarations.

Scope of initiatives

Twenty-eight of the 30 urban areas have published climate initiatives outlining how they will tackle climate change adaptation and mitigation. Derry (Northern Ireland) and Wrexham (Wales) are at the start of this process and had not published an official decision or document tackling climate change. The majority of cities (25 of 30) developed one strategy addressing both mitigation and adaptation in one document. Leicester, London and Nottingham provide one strategy for adaptation and one for mitigation. Strategies covered activities across the authorities' geography i.e., including households, industry and businesses. Some authorities, such as Coventry and Edinburgh, also provided strategies covering activities directly controlled by the Authority (operations).

Technologies and techniques for mitigation

Of the 52 documents, 49 address mitigation specifically and all cities plan energy saving and efficiency improvements, e.g., buildings, housing, resources and street lighting, which perhaps reflects the other perceived benefits of economic and energy security. Figure 3 shows the range of proposed mitigation measures from general ones, e.g., energy efficiency and savings, to measures that named specific technologies for transport, heating from renewables and renewable energies like wind, biomass, energy from waste and tidal power. Where possible urban areas build on existing infrastructure, for example, Coventry and Sheffield may build upon existing waste-to-energy plant operations.

In UK cities there is little agriculture so it should not be surprising that only 14% of urban areas included agriculture as a mitigation issue. Transport is a priority for 93% of urban areas through a wide range of activities from providing green travel for staff, introducing flexible working hours and low carbon initiatives to developing new infrastructure such as the Bristol Rapid Transit Project. Provision of supporting infrastructure for electric transport or new electric vehicles was proposed by 46% of areas. Waste management, although recognised by 96% of the areas as a component of mitigation, is mainly restricted to activities such as raising awareness and recycling.

Figure 3 | Percentage of 28 urban areas considering climate change mitigation measures (lighter shaded bars show sub-categories of the upper darkly shaded bar – for example, three main sub-categories were identified for heating from renewable energies) (Heidrich et al., 2013)

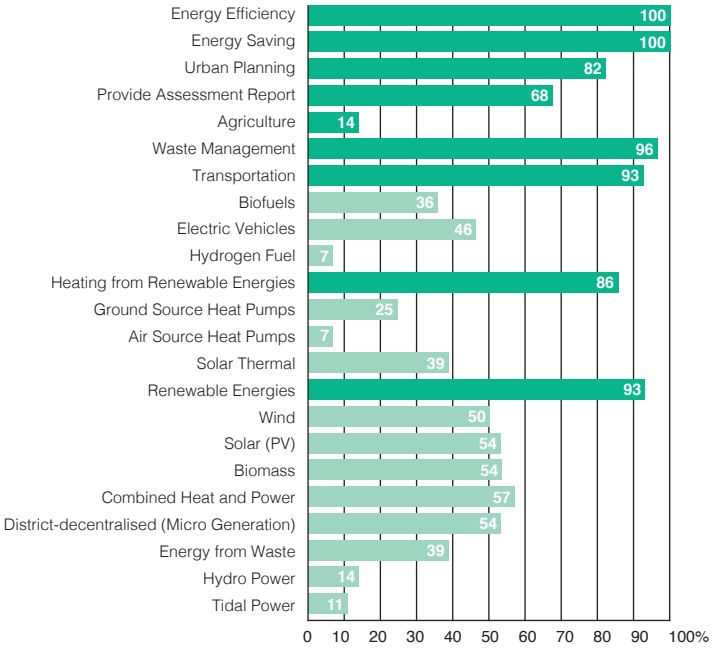
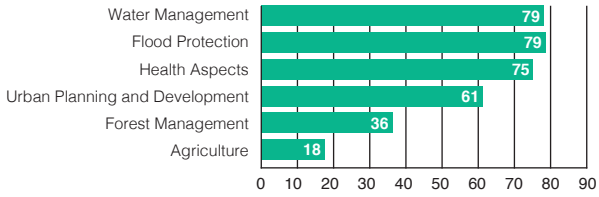


Figure 4 | Percentage of 28 urban areas considering climate change adaptation measures (Heidrich et al., 2013)



Technologies and techniques for adaptation

From the 52 documents analysed, 36 covered adaptation. Floods and droughts are regular occurrences in the UK and 79% of urban areas highlight flood protection and water management as priorities (Figure 4). Urban areas that consider 'urban planning and development' identify cross-sectorial benefits and overlaps of adaptation measures, such as urban green space and shaded areas to ameliorate urban heat and increase levels of physical activity and hence health.

Preparedness scores for each city

The Preparedness Scores of the 30 urban areas in terms of their progress against assessing, planning, implementing and monitoring of both adaptation and mitigation have been created

4 By signing the Nottingham Declaration on climate change, councils in England acknowledge that evidence shows that climate change is occurring and that it has wide ranging effects; that councils should lead responses at the local level, and they make various commitments such as reducing emissions and publish plans and monitor progress.

5 Signatories of the Scottish Declaration (councils in Scotland) make similar commitments and acknowledgements as the Nottingham Declaration.

The strength of our Urban Climate Change Preparedness Score is that it is more informative than a single number. It captures both quality and progress, recognizes adaptation and mitigation processes, and is easily utilized and visualized.

and depicted in Figure 2. Overall, the highest scoring urban areas are Leicester and London, both of which provide separate plans for adaptation and mitigation, assimilate these with the core strategy, and provide regular reports on carbon footprints. Some cities provide other plans such as the 'Climate Change Risk Assessment and Management Plan' in Cambridge or 'Adapting to Climate Change Creating Natural Resistance' in London.

Aberdeen, for example, scores a 3 (the highest rank), for adaptation assessment, and although their adaptation plan is a decade old, the Council completed a Local Climate Impact Profile in 2008. Across other categories, Aberdeen scores a 2, as the council provides Carbon Programs and have signed the Scotland's Climate Change Declaration and the Covenant of Mayors' initiative, thus providing annual progress reviews. However, it is unclear if they have a standardised process or state of the art monitoring and reviewing.

Concluding remarks

The strength of our Urban Climate Change Preparedness Score is that it is more informative than a single number. It captures both quality and progress, recognizes adaptation and mitigation processes, and is easily utilized and visualized. It could therefore be undertaken at regular intervals to determine progress and provide a national overview to central government. The potential weakness of any such scoring system is that it may overly standardize strategies and their contents thereby reducing the potential for local innovation. Despite following assessment criteria, a degree of subjectivity is inevitable.

Whilst governance structures and institutional capacity have an influence, areas obliged (whether by regulations, self-imposed, or as a prerequisite for membership of another body) to report on their progress appear more advanced in adaptating and mitigating — highlighting the important benefits that regulation and incentives can have. The methodology presented in this article helps to assess and rate efforts made by cities and makes a national and international comparison consistent, transparent and easy.

This analysis has shown that UK cities of all sizes acknowledge the threat of climate change. There is a considerable spread of mitigation and adaptation measures under consideration, whilst their degree of implementation varied across the UK. Given the importance of urban areas and spatial planning to manage climate impacts and reduce GHG emissions, it is essential to embed adaptation and mitigation within the urban planning framework and the organisations responsible for delivering local infrastructure and services. This must be supported through local, national and international initiatives to stimulate and, where necessary, enforce appropriate action, monitoring and review.

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Air cooling by tree shadow and recreation activities within an urban park in Berlin, Germany

Ecosystem Services in Urban Landscapes: Practical Applications and Governance Implications – The URBES Approach

Dagmar Haase, Timon McPhearson, Niki Frantzeskaki and Anna Kaczorowska

Urban landscapes are the everyday environment for the majority of the global population — some 52%, with nearly 80% of European and U.S. citizens living in cities and urban regions (UN World Population Prospects, 2011). More than 90% of the global GDP is produced in cities (Seto et al., 2012). The continuous growth in the number and size of most urban areas comes with an increasing demand for resources and energy, which poses great challenges for ensuring human welfare while preventing further loss of biodiversity at local, regional, and global scales (Breuste et al., 2013). Deepening our understanding of how urban ecosystems function under the combined pressures of dense populations, changing climates, and the intense growth of infrastructure as well as how they provide goods and services for urban dwellers, is critical to improving our ability to govern local and global ecosystem change for the benefit of all species. Additionally, knowledge of how ecosystem services change over time and what enhances and limits their performance is critical to managing urban ecosystems so that the supply of services meets demand in a rapidly urbanizing world (Elmqvist et al., 2013; Gomez-Baggathun et al., 2013).

This article introduces research and workshops conducted by the European BiodivERsA project — Urban Biodiversity and Ecosystem Services (URBES). This group was created to help bridge the knowledge gap between urbanization and the demand, creation and provisioning of ecosystem services in urban regions as well as their relationship to environmental justice, urban governance and planning. URBES is a three-year research project funded by BiodivERsA from 2012 through 2014. The project's research builds on case studies of eight city regions in Europe and the US: Berlin, Rotterdam, Salzburg, Stockholm, Helsinki, Lódz, Barcelona and New York City. The research consortium consists of eleven world-leading research institutes on social-ecological studies of urban areas based mostly in Europe with one in the United States.

URBES research

Ecosystem services in European cities

A set of indicators representing important urban ecosystem goods and services, including local climate regulation, air cooling potential and recreation, was tested using spatial data along an urban–rural gradient for many of the cities. The results of this study show that there is neither a typical urban-rural gradient in terms of urban ecosystem service provisioning nor a uniform urban spatial pattern of service provisioning that can serve as a generic model for cities (Larondelle & Haase, 2013). We can, however, provide evidence that (1) core cities do not necessarily provide fewer ecosystem services compared to their regions, and (2) there were no patches found within the four case study cities where all of the indicators report very high performance values. A key finding of this study is that a high degree of soil imperviousness does not necessarily translate to low ecosystem service provisioning, especially if urban infrastructure contains a considerable amount of mature trees, which support carbon storage and biodiversity.

The benefits of green space on human health and quality of life

Biodiversity is one of the primary foundations for human physical and psychological health and wellbeing. The benefits which biodiversity can bring to people are numerous and occur at many levels. Not only is biodiversity fundamental to life with the provision and cleaning of air, water and other essential resources, it also contributes to the regulation of air temperature and moisture and thus provides people with suitable living space (Kabisch & Haase, 2012). The services supported by biodiversity and ecosystems also include the provision of resources for curing and preventing human diseases. Not least, nature is a source of inspiration and relaxation for people with positive impact on mental health. Other frequently mentioned benefits of urban green space and biodiversity are an improved air quality and reduction of pollution, asthma reduction, allergy prevention and immunity increase, regulation of air temperature and reduction of the urban heat island effect, regulation of the water cycle, stress and crime reduction.

Conserving and improving the supply of ecosystem services can help to reduce cities' budget expenditures while generating economic benefits for cities and their dwellers.

Figure 1 | Annual change rates (%) of urban green spaces for 1990 – 2000 and 2000 – 2006. Data: GISCO — Eurostat (European Commission) (C) EuroGeographics for the administrative boundaries (Kabisch & Haase, 2012)

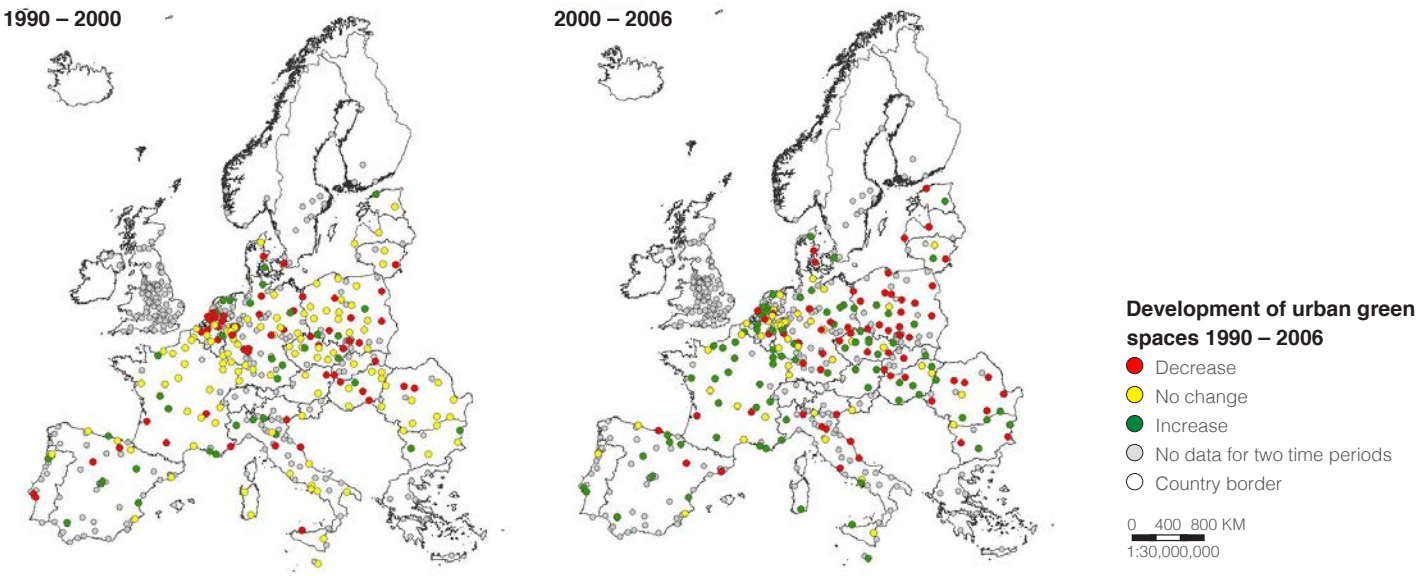
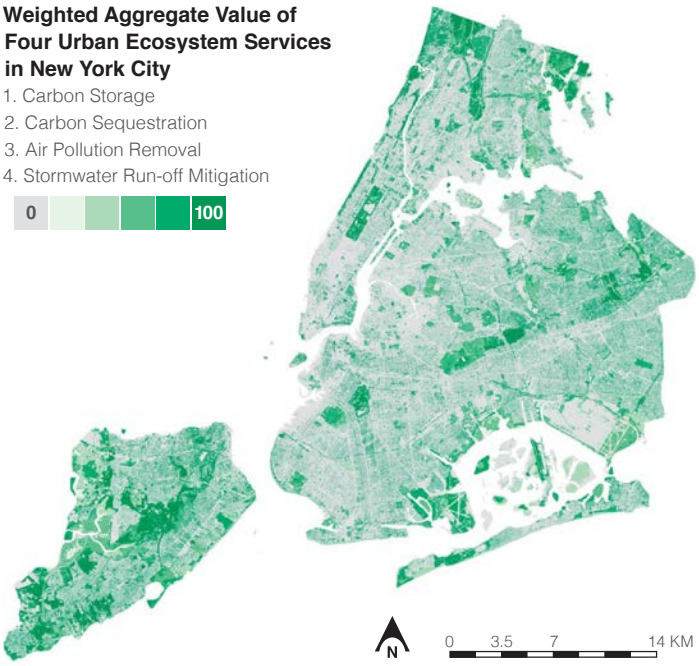


Figure 2 | Weighted aggregate values of four ecosystem services in New York City: Results show a high spatial variation in the non-monetary value of the four selected ecosystem services. The quality and quantity of urban green infrastructure (e.g. bare soil, herbs, shrubs, trees) determine the total value of urban ecosystem services (Image: Peleg Kremer)



Trees, parks, gardens, ponds, and other natural areas make up the green infrastructure of cities and towns (Breuste et al., 2012). This infrastructure hosts and protects biodiversity and is the source of much needed ecosystem services. An URBES study of 202 European cities found an overall increase in urban green spaces from 2000 to 2006, while the data reported nearly no change between 1990 and 2000 (Figure 1). This increase was mainly found in cities in Western and Southern Europe. In contrast, most Eastern European cities experienced a decline in green space accompanied by a decrease in population. In addition, urban residential areas continued to increase in area regardless of population growth or decline. We show that a decrease in population does not automatically lead to a decline in residential areas and a subsequent increase in urban green space on a large scale. On a small-scale, however, demolition of houses, desealing of soils and brownfield re-use all represent novel opportunities for the increase of urban green spaces in shrinking cities (Kabisch & Haase, 2012).

There is evidence that trees in urban areas help remove air pollution and improve urban air quality. A study in 55 U.S. cities showed that air quality improvement due to trees is relatively low (<1%), but that the actual magnitude of pollution removal can be significant (Nowak et al., 2006). URBES researchers also studied climate regulation functions of green infrastructure in four case study cities (Larondelle & Haase, 2012) and results confirm the impact which green infrastructure can have in reducing urban heat.

Urban ecosystems valuation for planning and governance

Policy makers and practitioners often demand economic and non-economic valuation information on urban ecosystems in order to inform and guide decisions in urban planning (Gomez-Baggethun et al., 2013). Numerous studies have demonstrated that investing in ecosystems makes economic sense because safeguarding urban ecosystems strengthens the ability of cities to adapt to climate change and transition to a more healthy and sustainable future (Bowler et al., 2010). Conserving and improving the supply of ecosystem services can help to reduce cities' budget expenditures while generating economic benefits for cities and their dwellers. However, the value of ecosystem services is not always taken into account in market transactions or adequately quantified in economic terms. Ways in which valuation can inform urban planning and management include raising awareness for ecosystem-provided benefits, economic accounting, priority-setting, incentive design, and litigation (Gomez-Baggethun et al., 2013), thus broadly reflecting the objectives of "recognizing, demonstrating, and capturing value" as suggested in The Economics of Ecosystems and Biodiversity report (TEEB 2010). URBES research is generating new frameworks, methods, and knowledge improving cities' ability to capture the economic and non-economic value of urban ecosystems (McPhearson et al., 2013; Figure 2), including both the quantitative monetary valuation as well as the qualitative dimension of urban ecosystem services.

URBES scenario workshops

The URBES project works to communicate research outcomes by bringing together leading research institutes from various European countries together with key local governmental stakeholders, such as city planners and decision-makers. A series of participatory scenario workshops were held in the cities of Stockholm, Berlin and Rotterdam. In-depth interviews with stakeholders in Stockholm, Rotterdam and Berlin revealed that although urban green infrastructure had been managed

successfully in the city, the concept of ecosystem services was not widely known amongst planners. These workshops were aimed at investigating the different ways with which ecosystem-based approaches could be applied and/or integrated into urban planning. For each city's scenario process, a methodology was designed and customized to the city's socio-cultural context and to diagnosed policy needs. Developing scenarios in these three cities demonstrates the potential use and requirements for governance of urban ecosystem services.

Rotterdam

The scenario workshops produced a new integrated vision for a future resilient city in which the green and bluescapes are considered as inter-dependent and benefiting urban residents. This integrated vision created the basis for proposing strategies to safeguard and promote the provision of urban ecosystem services and closing material and nutrient flows at the same time. The strategies proposed are summarized as: (a) build on the knowledge gained from successful pilots and initiatives such as roof gardens, greening the river banks and urban agriculture, (b) incentivize community initiatives for greening neighbourhoods and schoolyards, and (c) create a synergy space between local government and citizens to help them understand how to co-develop green infrastructure projects and to create new knowledge about urban ecosystems and their management in the city. The scenario process in Rotterdam helped planners from different departments to share their knowledge of the city's ecosystems and assets, create a new discourse around ecosystem services and formulate an agenda for short-term and medium-term action for enhancing the city's potential to restore urban ecosystems and become resilient.

Stakeholder workshops in Berlin (top photo) and Rotterdam (bottom photo): Stakeholders and scientists discussed the results of the interviews on implementation of the ecosystem services approach and respective scenario maps of future land use change to optimize the benefits from ecosystem services.

Local stakeholders in New York City planting trees to improve neighbourhood cooling, air pollution removal, stormwater absorption, and provide new habitat for biodiversity and recreation

Stockholm

Locally, the benefits of urban green areas are still not widely known. Two scenarios created for 'Stockholm 2050', a vision of a resilient Stockholm created by the URBES scientists, entitled 'Utopian Green Capital' and 'Vibrant City' brought complex material linking long-term strategy and land use planning to the demand and supply of urban ecosystem services. They show how different opportunities and challenges can be balanced within the future land use changes reflected in urban densification and shrinking green areas. In particular, they provide evidence on how ecosystem services promotion may either conflict or work in partnership with other urban development needs. They also helped to understand how urban policy-making, planning and strategy-making can contribute to urban environments that can better meet the needs of the local population. The future governance challenges identified for Stockholm are to improve

urban conditions and to plan land use changes that ensure the resilience of ecosystem services.

Berlin

The city of Berlin is expected to face a population growth of about 250,000 new inhabitants per year until 2030, along with hotter and drier summers. Scenarios involving the implementation of green roofs, walls and of converting brownfields into parks or park-like green spaces were discussed. An approach of implementing solar energy on suitable roof space was positively evaluated by stakeholders, although it only peripherally touches the pure ecosystem services concept.

Overall, scenario workshops revealed that cities are different from open landscapes and there are many more opportunities to use bio-physical ecosystem processes provided by built spaces such as roofs, walls, balconies, fountains, etc.

Concluding remarks

In the face of future population growth, urban expansion and densification, there is a need for effective mechanisms for the planning and governance of biodiversity and ecosystem services in and around cities. As demonstrated in results of URBES research, such mechanisms can improve human well-being and strengthen the capacity of cities to adapt to social-ecological change. Local governments, supported by scientific research, can benefit from taking the leadership role in the effective integration of biodiversity and ecosystem services into land use planning, policymaking and management responses. Future research should focus on disseminating current knowledge via open communication between stakeholder groups and through easily accessible tools. Facing global changes in climate and demography, new field studies/experiments are needed to confirm existing data on ecosystem benefits for urban people and to uncover new facts, particularly in terms of a co-evolution of ecosystem and technological development in cities. For more information about the URBES project, visit our website: http://www.urbesproject.org

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Market area, Tiruchirappalli, India

Understanding Drivers of Urban Expansion: Exploratory Case Studies of Three Indian Cities

Shriya Anand and Kavita Wankhade

The spatial structure of cities has implications for socio-economic development and environmental sustainability. It affects a city's social characteristics, economic efficiency, and potential for sustainability. Understanding and influencing city shape and expansion is an important dimension of the challenge to create sustainable, economically vibrant, and socially inclusive cities. However, the urban policy and planning framework in India has traditionally focused only on aspects such as population and economic output, while neglecting implications of spatial patterns and growth. Given that there has been limited research done on the dynamics of cities' spatial growth in India, our study aims to close this gap through a set of three exploratory case studies of medium-sized cities in India.

Through these case studies, we examine how factors such as infrastructure investments, urban planning, land markets, and other historical and natural features affect urban expansion. For the purpose of this study, we restrict our attention to a fairly narrow aspect of city morphology, which is the overall shape of the city as defined by the boundaries and clustering of the built-up area i.e., radial, linear, and scattered[1] (Angel et al., 2005). The goal is that these case studies and careful contextual analysis will help develop more specific hypotheses about drivers of spatial growth in urban areas that would contribute to contemporary discussions on inclusive and sustainable urbanization.

Methods of research and analysis

We analysed the spatial structure of 36 medium-sized cities (population ranging from 70,000 to 140,000) to classify them into various typologies based on their morphology. As stated earlier, the cities were classified based their overall shape and clustering of built up area[2] (Galster et al., 2001). The cities were selected to represent three of the most commonly occurring typologies in Indian cities: scattered and radial, scattered and

1 This definition matches most closely with the work of Angel (2005), in which he studies urban expansion in a global sample of 200 cities. This study attempts a more granular understanding of urban form in Indian cities keeping local context in mind.

2 The spatial classification was based on the work of Galster et al., (2001). We adapted the typologies in response to our specific set. The final set of typologies were: (i) compact, (ii) scattered, (iii) linear, (iv) polynucleated, and (v) radial. We also found that most cities exhibited more than one type e.g., scattered and radial.

poly-nucleated, and compact. After controlling for population and population growth rates over the past decade, **Gwalior** in Madhya Pradesh, **Tiruchirappalli** (also called **Trichy**) in Tamil Nadu and **Solapur** in Maharashtra were selected as representative of each of these spatial typologies (Figure 1). Maps showing the built-up structure of the three cities are presented in Figure 2. The maps on the left depict the administrative boundaries of the cities as well as major road networks, while the maps on the right depict the expansion in built-up area from 2001 to 2011. The spatial typology is evident in these maps, with Gwalior showing a scattered and poly-nucleated form, Trichy showing a scattered and radial form, and Solapur showing a compact form. Trichy and Gwalior have witnessed a significant expansion in built-up area over the past decade.

Figure 1 | Location of study cities

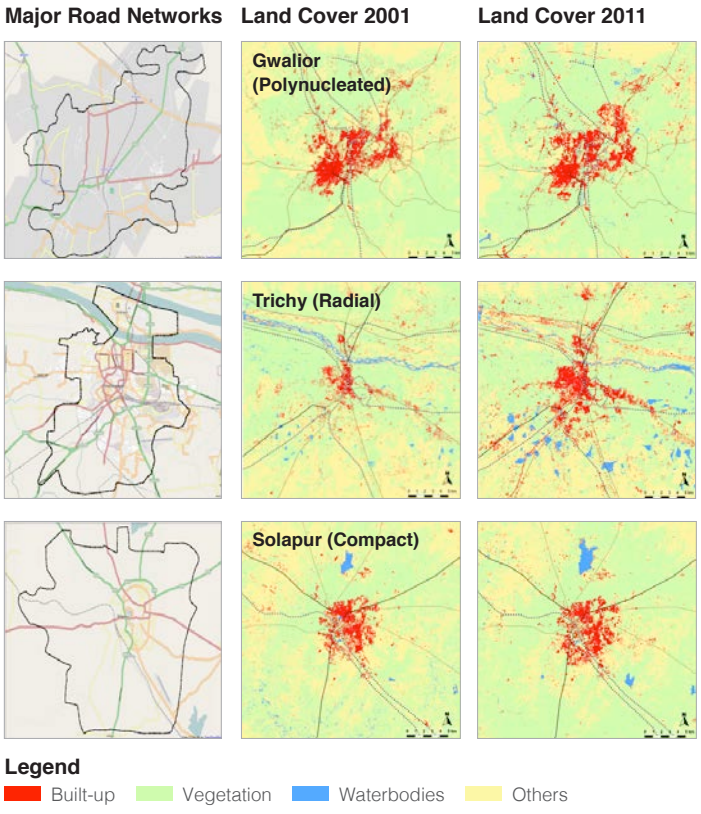
In addition to the secondary analysis, between April and August 2012 semi-structured interviews with a range of respondents were conducted. Interviewees included city officials, planners, local leaders, real estate developers, members of industry, journalists, academics, civil society leaders and other relevant stakeholders in our three study cities.

While each group of interviewees was asked slightly different sets of questions, the focus of the interviews was similar. Prior to the interviews, we identified areas of growth/densification in the city over the past two decades. In the interviews we first validated these findings and then asked a series open ended questions around drivers of spatial growth. Once the respondents had identified a few critical factors for spatial growth and pattern, we probed deeper into these specific factors. These factors were then cross verified and substantiated in the following interviews. We interviewed additional respondents if a particular factor emerged as important. For example, in case of Trichy, a huge public sector undertaking (Bharat Heavy Electricals Limited, or BHEL) was considered a major influence in the city, and therefore interviewed BHEL officials to understand its historical development.

Drivers of spatial growth and pattern

Due to the variety of our interviews, we have been able to understand the perceptions of various changes in the built environment, and were able to triangulate a set of narratives that led us to hypotheses for explaining certain observed phenomena. In some cases, these hypotheses were testable using existing datasets or methods; however, in several cases, we found interesting counter-intuitive dynamics that we will utilize as questions for further research and exploration. As

Figure 2 | Major road networks, land cover 2001, and land cover 2011. Black lines and dotted lines represent highways and railway networks respectively.



stated earlier, this was an exploratory study, and we present the factors below as areas for further attention in order to gain a more nuanced understanding of the dynamics of Indian cities.

Land markets and land use conversion

Fieldwork in all three cities highlighted that legal regimes of land use conversion and the land economy of the city and surrounding areas have an influence on expansion of urban areas. Urban spatial growth appears to be determined by relative land prices between city and surrounding areas as well as by the profitability of agriculture in surrounding areas.

In all three cases, peri-urban areas were first converted into residential areas, and then post-facto included within urban jurisdiction. Broadly, developers in all three cities were responding to growing demand for property, hence developing areas on the periphery. The legal conversion process was largely seen as a hurdle to be crossed, rather than a significant decision making factor affecting whether or where to build. Land use conversion laws do not seem to promote urban expansion, but the absence of firm prohibitive mechanisms means that urban growth is made possible. The jurisdiction of the local authorities is often limited either to municipal boundaries, or sometimes to a larger planning area, which often does not include the surrounding rural or agricultural areas.

Infrastructure and planning

Different infrastructure and impacts

Our field work revealed that only certain kinds of infrastructure, notably trunk infrastructure like highways, has a significant influence on urban form. These findings are in line with economic geography literature, which demonstrates that a city's proximity to international ports and highways has a far more significant impact on city competitiveness than local infrastructure services such as municipal roads and water supply (Lall, Wang and Deichmann, 2010). In Trichy, the radial shape of the city appears to be linked directly to investments in upgrading the national highways leading out of the city. In Gwalior, the city appears to be growing towards the national highway bypass in the east. The lack of municipal services in Trichy, like neighbourhood roads or water supply, does not seem to hinder its growth in certain directions. Residential colonies have developed in areas which were lacking in water supply and roads.

Nagar Nigam Tank, Gwalior, India

> Land use conversion laws do not seem to promote urban expansion, but the absence of firm prohibitive mechanisms means that urban growth is made possible.

Industrial and public sector investments

One of the surprising common threads across all three cities is the absence of a vibrant or diverse economic base. In the absence of this base, it seems public sector investments, particularly in industry, are one of the major drivers of urban growth for these medium-sized cities both historically and presently. In all three cities, these investments were primarily in public sector industrial units or infrastructure to attract industrial investment with the aim of balanced regional development. For example: approximately two decades ago, Trichy had developed towards the east side of the city due to the presence of a large BHEL factory. Similarly, one can see the beginnings of development in the direction of the proposed National Thermal Power Corporation plant in Solapur. Also, it appears that in the absence

Market area, Solapur, India

of public sector incentives, these locations might not be favorable or attractive for private capital. While this might seem obvious in hindsight, it is not clear whether planning frameworks at the city level recognize the primacy of such investment, and its multiplier impacts in driving urban form.

Lack of integrated metropolitan planning

While various plans and policies have obviously given direction to city shape, the cities also seem to be driven by absence of metropolitan/integrated planning frameworks. Particularly, the cities are driven by factors outside the influence of the municipal authorities who are responsible for service provisioning. The most obvious example is the growth of built up area outside the official municipal limits. In all cities, we observed that agricultural land was first converted to residential use to varying degrees. Once an area was 'urbanised' i.e., once there was sufficient built up area, the municipal boundaries were subsequently expanded to include these areas.

Another example of fragmented planning is evident in Gwalior, where the Counter Magnet to NCR scheme was developed to absorb additional migration from Delhi[3]. Under the scheme, a large tract of land was acquired for development towards the west of the city. For over a decade, there has been no development in this area. The scheme did not fulfil its objectives of attracting jobs and people into Gwalior, and it has had the perverse effect of freezing up this land. Therefore, this policy has had an unexpected impact on urban form. The local authority does not have any control on these decisions, and is unable to free the land for development.

Location

Interviews reveal that the location of the cities matter, particularly with respect to political and administrative boundaries. Trichy's location in the geographic centre of Tamil Nadu and its proximity to large urban settlements like Chennai, Madurai, Coimbatore, and smaller urban centers in all four directions was perceived as an important factor in its development. The city has seen increased tourism due to a presence of an international airport and its central location in the state. In Solapur, interviewees perceived that its proximity to Maharashtra-Karnataka border has affected its growth in multiple ways. While its proximity to another state may have led to its emergence as a transport hub for goods traveling between the two, it has also led to lack of investment. Several projects such as an international cargo airport, a textiles park, etc., have been announced in the past, but many of the interviewees said that these have been delayed or stalled due to uncertainty created by an on-going border conflict.

Other factors

Socio-cultural dynamics

While the literature refers to the role of socio-cultural dynamics and politics in shaping urban form, this plays out differently in each city. In Gwalior, a number of our respondents referred to the role of caste in influencing the desirability of Gwalior as a location for industrial investment. Caste conflict was also identified as a reason for violence and the presence of gangs and armed robbers in the region. Over the last decade or two, the city has expanded but has also seen a great deal of densification in the city centre. This was facilitated by the construction of a ring road, but Gwalior city residents do not want to move to the outskirts of the city because of a perception of crime — Gwalior is part of an area associated with robbers and gangs involved in kidnappings and other petty crimes.

Political economy of land/ land politics nexus

Another set of dynamics that emerged through interviews was the politics-land nexus: how politicians used information about future development in particular areas to drive up the value of land that they owned. We repeatedly heard this was

3 This scheme was established in 1989 to stem migration to the National Capital Region of Delhi by investing in several locations around Delhi in different geographical directions. http://ncrgwalior.nic.in/

a factor driving city expansion and real estate investment in Solapur, but did not hear of this much in either Trichy or Gwalior. This is an inherently difficult problem to study, but the variation in the apparent importance of the politics-land nexus is an interesting political economy question.

Policy implications and further research questions

It is clear from the study that each city evolves due to a combination of factors, some of which are common across cities and some unique. It is thus not possible to make general predictions regarding spatial growth of cities. However, this study does highlight certain concerns, and indicates further research areas.

The biggest concern emerging from the study is that there are several dynamics influencing urban form that are not adequately understood or factored into the current planning and policy frame. For example, land markets and industrial investments have a high degree of influence; and while there are mechanisms for regulating the above, these do not necessarily find a space in the spatial planning framework. The urban and regional planning framework does need to respond to these processes. Conversely, infrastructure and industrial location are determined by number of factors, and cannot be dictated by their impact on urban form. However, the planning and decision matrix for both infrastructure and industry could take cognizance of the impacts on urban areas.

It is increasingly apparent that the authorities responsible for the development of cities have little control over how the city grows. This is most apparent in the issue of land conversion. Since the authorities only have control in areas within municipal limits, and not surrounding areas, growth in peri-urban areas is often ad-hoc. This has tremendous implications on sustainability as this means that there is no means to ensure optimal densities. Also, services extended to these unplanned areas tend to be sub-optimal. Similarly, local authorities have little say over decisions regarding large public investment projects such as highways, which are often made at higher levels of government.

This study thus indicates further areas of research. First, it is necessary to understand through detailed case studies some of the critical factors affecting urban growth. We believe it is especially important to understand rural/urban dynamics and the linkages between economic development and spatial planning. Further, it is important to understand existing planning/policy frameworks that govern urban planning and land dynamics and explore different models of integrated planning.

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Low-quality post-disaster housing is common in Central Vietnam

Developing Resilient Housing for Disaster-prone Regions in Central Vietnam

Tran Tuan Anh

In Vietnam, residents consider housing to be not only their most valuable, but also most vulnerable possession. The national government recognizes housing infrastructure as one of four sectors that will be most affected by climate change (others include agriculture and food security, water resources, and human health) (MONRE, 2008), with poor and low-income groups most exposed to climate risks (Tinh et al., 2010). Recent debates have raised concerns about the role of post-disaster housing reconstruction in building disaster resilience. This PhD research explores the linkage between housing and disaster recovery with the aim of developing resilient housing solutions in Central Vietnam, the most disaster prone region of the country (Tinh et al., 2010). Three case studies are examined within the region that involve organizations such as Vietnam's Red Cross, Save the Children UK, and Development Workshop France. At-risk communities, built-environment professionals (particularly architects and engineers), and housing providers (e.g., donors and developers) are the key groups of this research. Findings from these case studies provide an in-depth understanding of the meaning of resilience in Central Vietnam and the potential contributions of post-disaster housing reconstruction towards achieving resilience.[1] Two important factors to this process are highlighted in this article: (i) community consultation and (ii) the role of built-environment professionals.

Building resilience via post-disaster housing reconstruction

Climate change is an ongoing process that is associated with the increased frequency and intensity of extreme weather events (e.g., floods and typhoons). Withstanding the ongoing impacts of climate change involves more than simply recovering from individual events (Morecroft et al., 2012). There is widespread

1 Resilience of an individual or a system is its ability to absorb the impacts of an event without critical changes of its basic functions (ISET, 2012; UNISDR, 2009; Amaratunga and Haigh, 2011)

agreement in the literature that post-disaster housing reconstruction plays a key role in disaster risk reduction and must be included in the process of development in both pre- and post-disaster periods (Archer and Boonyabancha, 2011; Lyons et al., 2010; Davis, 2011). Housing reconstruction standards should therefore include guidelines for building resilience to future hazards posed by a changing climate (Schilderman and Lyons, 2011). Post-disaster housing reconstruction must be framed historically rather than simply the one-time action of rebuilding damaged structures (Archer and Boonyabancha, 2011; Schilderman and Lyons, 2010).

In practice, however, housing reconstruction is narrowly conceptualized (Anh et al., 2013) as projects that have attempted to provide aesthetically pleasing shelters with the presence of some structural reinforcement (e.g., beams, posts, roof supports), but that frequently lack sensitivity to the local socio-economic and cultural norms. For example, after the 1999 and 2000 floods, in a project undertaken by the International Federation of Red Cross and Red Crescent Societies and Vietnam's Red Cross spanning eleven provinces of Central Vietnam[2], flood-resistant houses constructed with steel were deemed culturally inappropriate. The use of steel restricted potential spatial expansion and did not effectively replicate the local architectural style (IFRC and VNRC, 2002).

In the coastal cities of Hue and Da Nang, where floods and storms are concentrated, the limitations of local construction practices such as insufficient local resources and capacity, and socio-economic constraints are the main obstacles to the construction of disaster-resilient housing. Conditions are even more severe in the peri-urban and hazard-prone areas of these cities, where exposure to climate risks is greater and technical assistance is absent (Anh et al., 2013). In addition, communication and consultation between at-risk groups and professionals is still limited and contributes little to the success of disaster-resilient housing. In particular, up-to-date information and knowledge of disaster risks and measures for risk reduction is out of reach of susceptible groups, whose needs are addressed limitedly by the professionals involved (usually architects and engineers).

Community consultation: a valuable resource

During the 4th Session of the Global Platform for Disaster Risk Reduction in May 2013, community engagement was highlighted as one of the most important principles to help achieve resilience (UNISDR, 2013). Innes and Booher (2004) argue that community consultation is more than one-way communication from project implementers (donors or professionals) to end-users (beneficiary households) where local needs are quickly captured and narrowly addressed in housing solutions. Instead, community consultation should promote interactions where all participants and stakeholders thoroughly understand each other's perspectives before reaching an agreement on an appropriate course of action (Innes and Booher, 2004; ISET, 2012). Four key purposes of community consultation include: (i) discovering public preferences so these can play a part in decisions; (ii) improving decisions by including citizen's local knowledge; (iii) achieving fairness and justice; and, (iv) gaining legitimacy for public decisions.

A post-disaster house (white) next to an older model in a peri-urban area of Da Nang City, Central Vietnam

Findings from these case studies show that a narrow definition of *community*, the limited capacity of facilitators, and the limited use of community feedback in project implementation are the most common barriers to successful post-disaster housing reconstruction. So-called 'community-based' approaches have been commonly understood by local

2 Quang Binh, Quang Tri, Thua Thien Hue, Da Nang, Quang Nam, Quang Ngai, Binh Dinh, Phu Yen, Khanh Hoa, Ninh Thuan and Binh Thuan

authorities, community-based organisations and implementing agencies as the participation of disaster victims in some stages of reconstruction, with most consultations organised for this group. From on-site observations and focus group discussions, we found that the persons responsible for facilitating consultations often do not have experience working in the field. They range from social workers and information disseminators to office and technical staff of reconstruction projects. In some cases, untrained volunteers are also utilized for this role. The use of inexperienced facilitators reveals how agencies in charge of post-disaster housing projects underestimate the role of community consultation.For example, one interviewee who was provided a home after typhoon Xangsane (2006) commented:

> **Community consultation was often focused on general themes related to the socio-economic situation while technical details of safe housing, such as, housing forms, building structure, hazard-mitigation measures and appropriate functional and spatial layouts were less considered and discussed in meetings.**

Literature on community post-disaster housing consultation in Vietnam is limited. In practice, public meetings and individual household discussions regarding housing design and construction were only found in donor-built post-disaster housing, with no such forms of communication existing in housing constructed by the homeowners (Anh et al., 2013). Research findings show that, in the donor-built group, two common forms of consultation are used: *community meetings* and *household consultations*. Community meetings were organised at the beginning of the project with the participation of project staff and local authorities as well as those communities and families who were beneficiaries of the project. The main purpose of these meetings was to inform the public about the project. Information disseminated at these meetings included project objectives, time scale of the project and those who would be affected. Input and agreement was sought from

From on-site observations and focus group discussions, we found that the persons responsible for facilitating consultations often do not have experience working in the field.

Household consultation to capture family needs and capacity before construction

attendees on how to proceed with further consultation.. Next, individual household visits and discussions were conducted to assess needs and capacities of each family for reconstruction before finalising housing designs and construction methods. As the information collected from these consultations is mainly used for the design and construction of post-disaster housing, built-environment professionals are more appropriate as consultation facilitators in order to adequately capture the needs and capacity of at-risk groups and effectively translate them into functional solutions both spatially and technically (Lizarralde et al., 2010).

3 Governmental and non-governmental organisations

The role of built-environment professionals in community consultation

Built-Environment Professionals (BEP) involved in disaster risk reduction can usually be divided into four groups: architects, engineers, planners, and surveyors (SKAT and IFRC, 2012; Max Lock Centre, 2009). Their engagement is critical to the success of reconstruction projects (Lizarralde et al., 2010). However, in existing literature, few studies discuss the role of BEPs in detail, except that they have an essential role (Max Lock Centre, 2009; Davidson et al., 2007; Haigh and Amaratunga, 2010).

Very little research has been done in this field with respect to our case study areas and, in practice, few agencies employ BEPs in project implementation. Based on the interviews of in-field experts and local representatives, BEPs usually do not take part in housing reconstruction projects at the same time. Furthermore, architects and engineers tend to dominate the professional contribution whereas planners and surveyors are frequently absent.

Research findings also show that architects and engineers focus more on central urban areas that typically include residents of middle to high socio-economic status, while little attention is given to the peri-urban areas where low-income communities predominantly reside. According to key informant interviews, almost all architecture and construction firms are located in central urban districts, whereas very few are found in peri-urban areas. In an interview with a local architect, he stated that people from low-income areas are not his targeted clientele as they are unable to afford his services:

> **People here, due to their economic constraints, cannot afford a hire of architect for housing design. What they do is hire a group of local masons, about 3-5 persons, to build their house following their needs without technical drawings and, of course, often lack safety-related measures.**

BEP's expertise and skills are crucial for post-disaster housing reconstruction and can strengthen the transfer of needs and capacities of at-risk communities into appropriate solutions. Their involvement is valuable not only for the physical improvements of settlements, but also for the enhancement of local construction policies and regulations, and increasing local awareness of disaster risk reduction and resilience. Haigh and Amaratunga (2010) identify three key roles for BEPs: (i) to collect and process data, (ii) to facilitate decision-making processes, and (iii) to disseminate experiences and knowledge of disaster risk reduction. In the very few cases where BEPs have participated, their role was greatly appreciated given the success of community consultation and development outcomes. For example, in Kobe, Japan, BEPs, particularly architects, delivered effective design options for resilient housing owing to the conduct of appropriate community consultation (Petal et al., 2008). The reconstructed buildings were widely adopted by the local people, as such houses offered a strong sense of ownership given the high regard to local tastes, lifestyles and the freedom for residents to select housing-design options (Petal et al., 2008). From this perspective, the involvement of BEPs is significant on many fronts, from designing resilient structures to facilitating community consultations and building local capacities.

Additionally, this research has revealed that the limited contribution of BEPs to the development of disaster-resilient housing is linked to the lack of mandated building permits for civil construction. Without building permits, local administrative

A post-disaster house built after typhoon Xangsane (2006) in Central Vietnam

bodies are unable to mandate safe construction principles, and must resort to either encouraging or convincing those involved in construction practices to adhere. In reality, many do not put safety as a high priority for their housing construction/renovation (ADPC, 2007). This is echoed in the interview with an engineer from the district government of Lien Chieu (Da Nang), who lamented that one of the main reasons for increased housing exposure to climate hazards is the absence of zoning criteria and building permits for local construction that could minimize unsafe practices.

Ways forward

The development of a resilient housing system is crucial to address future risks posed by the impacts of climate change. This research has revealed that in Central Vietnam, particularly in peri-urban areas, housing vulnerability is exacerbated due to the lack of consultation between at-risk groups and built-environment professionals. City and district governments, along with other public sector groups, should work to promote programs and policies to bridge this gap and to intensify local governance for disaster risk reduction through the application of zoning criteria and building permits for local construction. Further research is needed into guidelines for community consultation by built-environment professionals in disaster risk reduction for the hazard-prone peri-urban areas of Central Vietnam.

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Coastal defences in South Mumbai

Local Water Issues Reframe Responses to Environmental Change

Cat Button

'Think global, act local' is a popular tagline that can be traced back almost a century to the Scottish town planner Patrick Geddes (1915). However, we seem to have lost sight of the second part of this agenda, and allowed global structural forces to frame climate change responses. This article attempts to rebalance the tables in favour of local issues as the framing concept, arguing that these often revolve around water. Thus the logic here is that instead of focussing on a specific type of response we should revisit local issues and responses grown from the grass roots. Mumbai is used as a case study to explore how responding to local environmental issues means putting water at the centre of the agenda.

This piece was developed from an investigation of urban climate change responses through housing in Mumbai, India. Qualitative data were collected over nine months during two visits between November 2009 and March 2011. Interviews were conducted with professionals (including municipal officers, architects, developers, NGO staff and rainwater harvesting consultants) as well as local residents. The research also included over twenty site visits to residential buildings that were facing environmental pressures. It was through this fieldwork that water emerged as the key environmental issue in Mumbai.

Local issues, not global methods

There are two standard methods that frame urban responses to climate change: mitigation of the causes and adaptation to the impacts. There is evidence to suggest that combining the two approaches can be beneficial (Klein et al., 2007) but this article goes further to suggest that dividing and labelling responses by their methods is unhelpful. Using the framing of adaptation or mitigation as the starting point, before considering local site-specific issues, is often a response to larger scale political agendas and funding pressures. Thus they should not be separated in the first place and not used to define responses.

Governing responses by encouraging a mitigation or adaptation pathway separates different actors and pushes them towards certain topics as foci of response. For example, mitigation as a framing concept centred on energy and low carbon discourses defined by political and financial rewards can restrict responses

to pathways of innovation, with passive and low-tech solutions not promoted so forcefully (Liddell, 2008). The template formed by institutions to frame responses in terms of mitigation or adaptation thus restricts not only the current response but also future pathways of innovation. With many countries reluctant to sign up to binding carbon targets, it is time to move beyond the stalled and slow negotiations and begin action with response to local needs. This does not mean the exclusion of global aims and large organisations, but a structural change to the framing of response.

Water, not 'carbon emissions'

Water is an urgent environmental concern for many urban populations (e.g., sea level rise, drought, water shortage, flooding, unpredictable precipitation patterns, cyclones, etc.), especially large coastal cities in the global South (Timmerman & White, 1997; Yeung, 2001). The case study of Mumbai is used here to explore how water-based responses are manifesting in a coastal city in the global South and the potential this has for creating appropriate systems.

Mumbai's coastal edge

> Using the framing of adaptation or mitigation as the starting point, before considering local site-specific issues, is often a response to larger scale political agendas and funding pressures.

There are several reasons for the positioning of water at the heart of environmental change discourses and responses in a city such as Mumbai. Firstly, there is a chronic shortage of mains water supply in Mumbai and the municipality is struggling to update the infrastructure (Gandy, 2008). Secondly, the coastal position of Mumbai and its high-density built-up area combined with the monsoonal climate, make it particularly susceptible to flooding and water shortages (Timmerman & White, 1997; Yeung, 2001). Thirdly, it was found during fieldwork that the changing climate is a contributing factor in the increased acuteness of both these issues.

There has been a great deal of research into urban water supplies from many angles (Gandy, 2008; Bakker, 2007), but fewer that consider water as a key component of responses to environmental change (with some notable exceptions, such as Swyngedouw, Kaika & Castro, 2002). This culmination of climate pressures and infrastructural failings have led to water shortages and flooding. Rainwater harvesting has emerged as a popular response to water shortage experiences as the mains falter and wells dry up. Rainwater harvesting has the additional effects of reducing pressure on the centralised system (freeing up potential water supplies), reducing the amount of water needed to be treated to potable standard and reducing localized flooding.

"Down, down, down, level is going down. So that's why we have done now 700 feet borewells. 600 feet, 700 feet in the area of Powai – Andheri/Powai area. We have done [a] 700 foot borewell but it didn't get water. There is no single drop of water."

Rainwater harvesting consultant 1 (Mumbai, 24/01/2011)

Rainwater harvesting is mandatory for all newly constructed domestic buildings with a plot area of over 1,000m^2 since October 2002 and over 300m^2 since June 2007 (Municipal Coorporation of Greater Mumbai, 2003 and 2008). This legislation is one of the first major environmental policy tools in the city and has been successful because it eases the pressure of water shortages and solves the problem of dried up wells.

"Actually we are only drawing water; we are not giving water [by using basic borewells or municipal supplied water]. So by this [rainwater harvesting] we are doing recharging so it also being drainage will come and the trees will get the water. It's good that we are doing one kind of nature protection, helping the natures to grow. Greenery."

Rainwater harvesting consultant 2 (Mumbai, 24/01/2011)

Another effect of rainwater harvesting is that green spaces become possible, which can have many benefits including cleaner air and reduced urban heat island effects. This policy of mandatory rainwater harvesting for new residential properties sits between water, environment, housing and planning legislation by changing the nature of water provision and controlling development. It is also becoming popular to retrofit systems in middle class residential building. This legislation was brought in to address concerns over water shortages in Mumbai and has been retrospectively presented as an environmental policy when the 'environment' moved up the political agenda. This demonstrates that responding to local issues can also be environmentally beneficial without being framed and labelled as such.

Appropriate local responses

The Ministry of New and Renewable Energy in India began research into solar energies in the 1980s but it was never further developed. This is attributed to a lack of interest in environmental issues until recently; renewable electricity technologies may not address the key local issues; and solutions were perhaps at the wrong scale and expensive.

"India needs technologies that are cheap, small and rectified for the needs of society. Simple, small things. Every house has an 'Aqua Guard' [water filter] can this be solar powered? Most people have a balcony, can they have solar lighting? Cheap and simple. Need some crisis to make everyone take notice."

Municipal Corporation of Greater Mumbai (MCGM) officer (Mumbai 14/02/2010)

Appropriate technologies that address not just the requirements of the population, but also the capacities and culture, are required. The global North emphasis on large-scale centralised energy infrastructure may not be appropriate, but in Mumbai de-centralised water responses are taking centre stage in environmental initiatives and policy. Thus South-South technology transfer can yield better results, with due attention given to site specificities when the technologies are appropriate and cost-effective, such as rainwater harvesting as a response to water shortage and flooding. When a problem is successfully addressed it sets a precedent that can be used to implement further technology interventions and legislations.

"To start with this building. We went for rainwater harvesting […] Then I started solar energy in the building, this is solar working now [points at lights] all our communal area lighting is solar now […] We also started vermiculture within the society."

Co-operative secretary in a middle class residential building in Mumbai's Western Suburbs (Mumbai, 09/01/2010)

Following on from the success of a rainwater harvesting retrofit, one building's residents have installed solar water heating onto the terrace, which provides hot water to all the apartments. This was subsequently followed by photovoltaic cells (solar panels), which power the communal lighting and composting biodegradable waste. Solar water heating legislation is being pursued at a city scale to address energy usage at peak times, again following the success of rainwater harvesting.

Reframing responses to climate change

An issues-based approach to tackling climate change in cities across the world has implications for how negotiations are undertaken and how funding streams are managed. However it might be possible to make this a legitimate local agenda for urban areas, without disrupting national and international policies and further negotiations. This would require political and popular public support and funding in the same way as all successful responses to environmental change.

Water – having too little or too much in the wrong place – is a major threat to urban populations that is being exacerbated by climate change and urbanisation. Therefore, this research found that water underlies local environmental and climate change concerns in Mumbai, and is likely to be a major concern for other large coastal cities in the global South. Responding to these popular issues can then lead to a rise in profile of environmental issues, and to other policies and initiatives.

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Jose Edgardo Abaya Gomez, Jr.

Congratulations to Jose Edgardo Abaya Gomez, Jr., an attendee at the Urban Responses to Climate Change in Asia: Understanding Mitigation and Adaptation Strategies workshop in 2011. His article "The limitations of climate change donor intervention as deus ex machina: evidence from Sorsogon, the Philippines" was published last year in *International Development Planning Review*.

Abstract

This study reviews the empirical context of a relatively recent UN-sponsored infusion of climate change-related knowledge and skills for local development in Sorsogon City, in the Bicol region of the Philippines. While recognising the significant positive impacts of such targeted, pro-poor international aid, it points out that the diffusion of benefits is gradual at best, owing to the limitations of sociocultural context, administrative structures and the confounding influence of endemic practices of resilience. Enthusiasm for such developmental aid, often coveted by impoverished localities in the Global South, should be tempered by scholarly realisations on both sides that such grants, especially if they try to localise a phenomenon as complex as global environmental change, are fleeting over the long run, and therefore their advantages must be capitalised on quickly and learned well if these are to be passed on and multiplied at the grassroots.

Link to Full Article

http://liverpool.metapress.com/content/y7470338k6850772/?genre=article&id=doi%3a10.3828%2fidpr.2013.26

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