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AfricaInteract: Enabling research-to-policy dialogue for adaptation to climate change in Africa

Review of Research and Policies for Climate Change Adaptation in Urban Areas in East Africa

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Acronyms and abbreviations

CCAA	Climate Change Adaptation in Africa
DFID	UK Department for International Development
EAC	East African Community
GHEA	Great Horn of East Africa
IDRC	International Development Research Centre
IRA	Institute of Resource Assessment
NAPA	National Adaptation Programme of Action
NEPAD	New Partnership for Africa's Development
NGO	Non-Governmental Organisation
START	Global Change SysTem for Analysis, Research and Training
TMA	Tanzania Meteorological Agency
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

Executive summary

There is growing research interest in and support for adaptation to climate change in Africa. It is thus imperative that the findings emerging from relevant research are applied and used to inform policymaking concerning climate change adaptation. It is critical that sector policies be appropriately informed by the existing body of knowledge on climate change and climate variability generated from scientific research. The overall objective of this review is to enhance the knowledge base and to support research-based policy formulation for climate change adaptation in urban areas in East Africa.

Methodology and scope of the review

This review is a desk study of literature that is synthesised by thematic areas. The review covers countries in East Africa, with particular policy focus on Kenya, Tanzania and Uganda. It aims to review research and to identify gaps in research and policy, as well as barriers and opportunities for adaptation. The report is based on peer-reviewed articles; governmental, non-governmental and agency reports; and other grey literature. The write-up was guided by a number of questions on the role of climate change challenges in the context of the multiple challenges and opportunities, the current state of knowledge on urban adaptation and the current state of knowledge on whether and how research findings are integrated in urban area policies. More questions are on the major gaps in research on urban adaptation to climate change; how research findings can be better integrated into urban area policies; and the current state of knowledge on the stakeholders involved with research and policy on the subject.

Overview of key findings, conclusions and recommendations

The trends of temperature and rainfall in East Africa strongly support the general view that the global climate is indeed changing. There is need for researchers to provide further evidence based on climate science on the likely future climate patterns, particularly with respect to rainfall and temperature, to help governments in the region plan a suitable response. As a whole, the East African region has experienced increased temperatures since the 1980s. In particular, seasonal mean temperatures in Kenya and Uganda are projected to rise more than 2°C by the end of the twenty-first century. Possible impacts of climate change include increased urban heat and heat islands; global sea level rise that could affect the seaport cities which are major commerce and administration nerve centres; and severe flooding and coastal erosion. Inland flooding has also been observed and projected for East African urban areas. Many urban residents in the region are already faced with multiple stressors, including poor awareness of climate change phenomena as well as limited capacity to respond to climate change challenges. Others include high unemployment levels; poor housing; inadequate sanitation and waste management facilities; and inadequate and congested infrastructure.

Adaptation efforts in the region's urban areas take place at various levels, including the individual household, community, local government, national and regional levels. At the local level, urban agriculture has become a significant adaptation strategy for food and income generation across the region, both in times of shocks and as a long term mechanism to deal with food shortages. Various ways of adapting to climate change contribute to building resilience in the event of future shocks. For instance in Nairobi, urban agriculture can at times provide earnings estimated to be up to five times higher than the national per-capita income, just as in Maputo and Dakar. There may be need to integrate controlled urban agriculture into the policy framework at national and regional levels and provide a favourable environment for urban communities to supplement their livelihood as well as to decentralise and empower local authorities to manage urban agriculture through favourable by-laws. It will be important for communities to complement the current exclusively individual household adaptation strategies, such as shelter protection in times of floods, with self-mobilised community driven strategies, such as protecting their local facilities like streets and drainage systems and solid waste management, both as coping and adaptation measures.

So far little has been done to promote knowledge exchange for climate change adaptation, and there is currently a small community of professionals and researchers in the region. This limits analytical capacity to advance changes among key decision-makers. While there is significant knowledge on adaptation to climate change in the region's research communities and institutes, this knowledge still needs to be shared with policymakers for response and action. Scientists also need to be more proactive and have a shift of focus from mainly conducting research and presenting it in conferences, to also targeting policymakers by joining policymaker platforms where their research is more useful, and engaging donor agencies and urban authorities for community awareness campaigns.

Research gaps point to the need for researchers in the region to explore innovative, gender-responsive and cost effective ways of addressing the climate problem in urban areas. There remains a special need for research that focuses in-depth on the dynamics of migration and population growth at the national level, and there is hardly any focus on gender differentiation and climate change adaptation in urban areas in the region. The dearth of adaptation studies is more pronounced for inland cities than it is for coastal cities in the region, but in both cases there is need for gender disaggregated studies and possible opportunities or localised benefits from climate change. Scientists and gender specialists need to mobilise for resources to conduct further research that

targets the research gaps that have been identified for this region in order to present policymakers with concrete evidence on these issues so as to collaboratively develop robust pro-poor policies and strategies for climate change adaptation in urban areas. Donor agencies also need to commit substantial funding to cutting-edge research that targets the identified research gaps in the region.

In some cases, policymakers are not adequately informed by experts on facts regarding climate change and its implications for the urban poor. Experts need to make efforts to reliably inform policymakers on the true facts of climate change's implications. For example, there is entrenched thinking among policymakers that migration is a problem, yet it is important to have a shift of focus to the role of urban planning in supporting and accommodating mobility. In this respect, it is important to address the informal systems and inequalities in the region's urban areas. For this reason, the region needs a more robust institutional framework regarding urban planning that is more resourced and has expertise to implement a suite of strategies on climate change that are being developed in the region. There is also need for further decentralisation of city management of policies from the national level to ease the engagement process between science and policy, including improving on communication channels between these two parties.

Although there is little communication between policymakers and researchers, across the region, research institutes, universities and government departments have initiated process to engage in conducting research and linking up with policymakers. For instance in Uganda, significant climate change research on urban areas has been done through the Climate Change Unit that is located in the Meteorology Department of the Ministry of Water and Environment. Although much more still needs to be done, a major step some of these institutions have made is the engagement of communities, government departments and agencies right from the research design stage in participatory action research and in developing policies and strategies. This is important because public support and active participation, including decentralising the city management to municipalities, will improve stakeholder involvement. Urban authorities also need to be more proactive and engage with communities and other local stakeholders to improve living conditions for the urban slums, even in the absence of explicit national level policies and strategies.

1 Introduction

There is growing research interest in and support for adaptation to climate change in Africa. In addition, there is growing recognition of the need to focus on urban adaptation, including the problem of still limited knowledge base and policy attention. A stock-taking, synthesis and review of research results from relevant sources (peer-reviewed, theses, grey literature etc.) and the way they feed into and influence policies for climate change adaptation in the urban sectors is needed. This review can help to identify gaps in current climate change adaptation research and policies and measures needed to move from current practice to best practice.

The objective of this study is to enhance the knowledge base and to support research-based policy formulation for climate change adaptation in urban areas in sub-Saharan Africa.

The report was commissioned by the West and Central African Council for Agricultural Research and Development (CORAF/WECARD), which has established an International Development Research Centre (IDRC)-supported AfricaInteract platform for exchange between researchers and policymakers for adaptation to climate change in Africa. As part of this, studies have been commissioned to synthesise research related to climate change adaptation related to urban areas in each of the four sub-regions of sub-Saharan Africa: West, Central, East and Southern Africa. This report focuses on East Africa, comprising the five countries that make up the East African Community (EAC): Burundi, Kenya, Rwanda, Tanzania and Uganda. While this review makes reference to other countries in Africa in some cases, the major focus is on these EAC member countries.

This review is guided by a number of questions:

1. What is the role of climate change challenges in the context of the multiple challenges and opportunities facing urban areas in the region?

2. What is the current state of knowledge on adaptation to climate change in urban areas in the region?

3. What is the current state of knowledge on whether and how research findings are integrated in urban area policies in the region?

4. What are the major gaps in research on adaptation to climate change in urban areas?

5. What is needed to ensure that research findings are better integrated into urban area policies?

6. What is the current state of knowledge on the stakeholders involved with research and policy on adaptation to climate change in urban areas in the region, and how could stakeholder involvement be improved?

In addition to the number of issues raised as review guidelines in the preceding paragraph, the review also considers cross-cutting issues such as social differentiation and gender implications, implications for water resources, cross-scale interactions (national, sub-national, local) and energy usage and infrastructure in the urban areas.

This review is structured as follows. Section 1 presents the introduction to the review. Section 2 broadly outlines the background and methodology that was employed for the review. Section 3 focuses on the overview of the region's urbanisation profile. This section outlines key facts for urban areas in the region, the role of climate change challenges and state of knowledge on the implications of climate change for other key challenges (and opportunities) for urban areas in the region. Issues touched on in this chapter include the scope of the review, definition of terms (such as adaptation to climate change in urban areas) and the methodology, including limitations/challenges to the study and measures that the reviewer took to mitigate these limitations/challenges. The review presents research related to climate change adaptation in urban areas in section 4 and broadly outlines vulnerability and adaptation of people in urban areas in the region.

In section 5, the review presents policies related to urban issues with regards to climate change. More specifically, the focus is on the state of knowledge on policies and strategies for climate change adaptation in urban areas; review of key arguments for policies on adaptation to climate change in urban areas; and review of key policy actors and networks involved with adaptation to climate change in urban areas. Other areas of focus in this section are the state of knowledge on funding streams for policies and strategies on adaptation in urban areas at national and regional levels; and review of key barriers to uptake of research and implementation of policies by policymakers. Section 6 presents a synthesis of gaps in climate change adaptation research and policy in urban areas, mainly in research, policy and the research-policy nexus. Section 7 presents analysis of stakeholders and opportunities for collaboration by giving a synthesis of key institutional actors, a review of identified or inferred 'missing voices' in research and policy debates and lessons from efforts to promote research-policy dialogues on adaptation in urban areas. Conclusions and recommendations are presented in section 8 of the review.

2 Background and methodology

This section of the review presents the scope of the review as outlined in the Terms of Reference. The section also presents definitions of terms such as adaptation, resilience, coping and urban areas. Other sub-sections focus on limitations/challenges faced during the review process and how the Consultant dealt with these challenges.

2.1 Scope of the review

Based on the Terms of Reference, the focus of the review is to conduct a synthesis of research on climate change and urban areas in EAC member states. Specifically, the following list presents the guidelines and scope of the assignment:

1. Review climate change adaptation research and policy pertaining to the urban sector including the relationship with water resources and gender in the EAC.

2. Identify gaps in (a) climate change adaptation research and policy in the urban sector, and (b) the way research informs policymaking.

3. Identify key stakeholders and opportunities for improving climate change adaptation research-policy nexus in the urban sector.

4. Prepare an overall report comprising three sub-reports corresponding to each of the preceding 3 tasks.

2.2 Defining adaptation to climate change

Adaptation to climate change is defined as adjustments made in natural and human systems as a response to actual or anticipated climate stimuli or the effects of the stimuli (Adger et al. 2007). These adjustments moderate harm and take advantage of beneficial opportunities. This adaptation may be either planned or spontaneous. The former definition refers to deliberate policy decisions that seek to come up with ways of adjusting to observed and projected changes. The latter is triggered by changes in natural or human systems. Planned adaptation also entails proactive adaptation before impacts occur, while spontaneous adaptation is mainly reactive, that is, it is done after impacts are observed. Planned adaptation usually involves local and public or government actions, while spontaneous adaptation often involves private or non-governmental organisation (NGO) actions (IPCC 2007; Batterbury 1996).

Adaptive capacity reduces the vulnerability levels of human systems. Several studies highlight the importance of employing a vulnerability rather than an impacts approach in informing adaptation policy (Füssel and Klein 2006; Nkomo et al. 2006; Burton 2000). This is important since the vulnerability of a system depends on its adaptive capacity. Vulnerability is the 'ability or inability of individuals and social groupings to respond to, in the sense of cope with, recover from or adapt to, any external stress placed on their livelihoods and wellbeing' (Kelly and Adger 2000: 22). Vulnerability in the context of multiple stressors encompasses long term trends and short term shocks. The long term trends may include demographic trends and seasonal changes in employment, trade and production, while short term trends may include illness or natural disasters that slowly erode resilience (Gandure et al. 2007).

Resilience refers to the capability of a natural or human system to deal with disturbances without changing its basic structure and function, including transformation to a better state in some cases (Traerup 2012; IPCC 2007). This includes being able to self-organise and adapt to any long or short term stresses. In essence, how a system is able to adapt also hinges upon its resilience over a period of time (IPCC 2007). Resilience has more to do with ability to recover from an impact, whilst ensuring sound institutions and knowledge base (da Silva et al. 2012; UN DESA 2011). Resilience may not be only to climate change but economic change, conflict and other pressures, and can encompass transformation to better conditions (Satterthwaite et al. 2007).

2.3 Definition of 'urban areas'

The term 'urban area' varies by context in available literature. The United Nations describes an urban area as comprising a city or town in its proper terms. There is a lack of common definitions on urban areas due to national variations in characteristics that distinguish urban from rural; hence, no global basis exists for defining the term (UN 2012; 2006 FAO 2005). A number of terms are also used differently by different countries to define 'urban', among them 'urban centres', 'major cities', 'administrative centres' or 'municipalities', and country-specific criteria are set out to distinguish between 'rural' and 'urban'. Likewise, the definition of quantitative thresholds also varies by country, but virtually all countries define urban areas as having a minimum of 20,000 inhabitants (UN 2012; 2004). Urbanisation has to do with the physical growth of urban areas due to population growth. Urbanisation can also refer to the level of urban relative to overall population, or the rate at which the urban proportion is increasing.

2.4 Methodology used for review

In the first stage of the review, the Consultant did a search for a representative sample of the wide range of sources on climate change and urban areas, followed by a search of relevant sources which entailed focusing on literature on climate change or urban areas as distinct concepts, as opposed to the climate change and urban

nexus. The Consultant identified key literature through the ScienceDirect search engine, and then acquired this literature through:

- Emails and telephone calls to ask for reports and papers from individuals and organisations who have done similar work, including Global Change SysTem for Analysis, Research and Training (START), United Nations Environment Programme (UNEP), government departments and policy and university institutions in the region;
- Organisations such as the World Bank and United Nations Development Programme (UNDP), among others, through their reports available on their websites and elsewhere online;
- Online search through open access and subscribed files and reports through journals and databases online; and
- Use of the local library in the Institute of Resource Assessment (IRA) at the University of Dar es Salaam for work done by local and external researchers in relation to the subject.

By the end of this literature gathering process, the Consultant had gathered a total of 800 journal papers, reports and theses, among other reading material. Not all this literature was relevant to the process, so the Consultant then assessed the compiled literature for quality and categorised it by type (journal, grey, book chapters etc.) and then relevance by themes according to the scope of the review (see section 2.1). Of these, 78 were specifically on East Africa. This write-up mainly concentrates on the most scientifically reliable studies (peer reviewed materials) which were available. The main focus is on studies relevant to the region, but some studies from other countries are included as appropriate. The write-up also makes reference to grey literature that backs up assertions in the scientific work. In the process, the Consultant paid attention to:

- Synthesising research carried out to date;
- Stock taking of research conducted to date;
- Analysis of research results;
- Mapping out climate adaptation change policy processes; and
- Identifying key gaps in research.

2.5 Limitations to the study and measures to mitigate them

Locating and retrieving relevant literature is challenging, yet crucial to the success of a systematic review. For this reason, the Consultant employed the above detailed systematic strategy of conducting the synthesis. A major challenge was in locating general identified articles, and to mitigate this, intensive and extensive contact with networks was used to source the important literature. The START Secretariat provided the bulk of literature for this synthesis. Peer-reviewed literature for Rwanda and Burundi on climate change in urban areas is minimal and sparse, and this posed a major challenge in compiling this synthesis. It was difficult to get access to published peer reviewed literature on these countries. For this reason, the synthesis draws extensively on reports and policy documents for these member states. Locating current literature was a daunting task as there is a dearth of and gaps in country specific peer reviewed research evidence, including lack of consistency on an issue between studies.

3 Overview of the region's urbanisation profile

This section presents current trends and variations on key indicators for urbanisation in the region; the role of climate change challenges; state of knowledge on the implications of climate change; and the implications that these trends have for policy and general livelihoods and well-being of city dwellers.

3.1 Background to urban areas in East Africa

By 2008 more than half the world's population was living in urban centres, and this proportion is growing. Statistics on global urbanisation indicate that these trends will continue to rise up to 2050 as the global urban population is expected to soar (Buhaug and Urdal 2013; UN 2012; UN DESA 2011; 2010; 2008). In this period, most of this projected urban growth is anticipated to happen in less developed regions, and annual growth rates further indicate that Africa is the world's most rapidly growing region, with this trend expected to be sustained up to mid-century (UN DESA 2011; Rockefeller Foundation 2010; UN-Habitat 2008a; Cohen 2006; UN 2006; Chamie 2005).

The rate of urbanisation in the EAC countries is consistent with that of global urbanisation. The Great Horn of East Africa (GHEA), where the five countries

Table 1: Urbanisation trends for EAC cities from 2005 to 2010 and from 2006 to 2020		
Global Rank	**City/urban areas**	**Average annual growth (%)**
Between 2005 and 2010		
1	Kigali, Rwanda	7.73
16	Kampala, Uganda	4.02
18	Dar es Salaam, Tanzania	3.95
23	Nairobi, Kenya	3.64
28	Mombasa, Kenya	3.53
Between 2006 and 2020		
6	Dar es Salaam, Tanzania	4.39
13	Kampala, Uganda	4.03
18	Nairobi, Kenya	3.87

Adapted from Pocket World in Figures (2008) in Rockefeller Foundation 2010

under review are located, is the region with the most rapid urbanisation rate in Africa (Rockefeller Foundation 2010). Nine of the 30 fastest growing cities in the world between 2005 and 2010, and among the projected 100 fastest growing up to 2020 (Table 1), are in the GHEA, although the onset of Rwanda's urbanisation came later than other countries (Rockefeller Foundation 2010; Mirzaie et al. 2007; UN 2006; UNDP 2006). Projections show that Nairobi, Dar es Salaam and Kampala are likely to grow faster than they did between 2005 and 2010. Even though Kampala is also rapidly urbanising (Table 1), by 2002 the overall rate of urbanisation was at 20 percent and 22 percent respectively for Kenya and Tanzania but only 12 percent for Uganda. For Uganda, urbanisation is projected to reach 21 percent by 2030 (Cities Alliance 2010; Muzzini and Lindeboom 2008; UNFPA 2007). Even though the rate of urbanisation for Burundi is growing fast at 4.9 percent per year, urbanisation in this country is currently at only 11 percent (CIA World Factbook 2012), and the country is the least urbanised in the region (Kolmannskog 2010). By 2005, there was evidence to show that urban areas in Rwanda, Tanzania, Uganda and Kenya had experienced remarkable changes in sex ratio with a subsequent female excess (UN 2006; UNDP 2006).

This rapid urbanisation for the EAC countries, as in most other developing countries, is not necessarily commensurate with economic development in the region, but rather a consequence of uneven development between rural and urban areas (Brückner 2012; Poelhekke 2011; Mirzaie et al. 2007; Barrios et al. 2006; Fay and Opal 2000). This is contrary to the initial World Bank and other studies' positive correlation of urbanisation with economic development (UN-Habitat 2010; Todaro 1995). While this assertion might be true for developed country cities, the same does not apply to low and middle income countries at present (UN 2012). Essentially, the linkage between urbanisation and economic development remains unclear and generally manifests itself in different ways in various contexts. For instance, while in Rwanda rural poverty is five times that of urban areas, in Burundi the gap is small, with poverty widespread in both rural and urban areas (UN-Habitat 2010).

3.2 Climate change challenges

3.2.1 Observed and projected climate change

While observed climate change trends across Africa record an increase in temperature of 0.5°C, projected trends show a further temperature increase above the global average in the context of a 1-4°C global temperature increase (James and Washington 2012; Grab and Craparo 2011; Hoffman et al. 2011). Similarly, East Africa has experienced increased temperatures since the 1980s, particularly seasonal mean temperatures in Kenya and Uganda, and mean temperatures are projected to rise more than 2°C by the end of the century (Anyah and Qiu 2012; Funk et al. 2012). Mean annual temperatures are likely to increase in Tanzania, Kenya and Burundi (Watkiss et al. 2011; Christy et al. 2009; Government of Burundi 2007). Observed precipitation trends in East Africa show a decrease in precipitation in the 'long rain' season (March to May/June) and similar trends in the monsoon rains (June to September) throughout the GHEA over a period of 60 years, including a general variability in rainfall (Funk et al. 2012; Williams and Funk 2010; IPCC 2007). However, these trends are inconsistent with the projected changes of increases in precipitation in East Africa, and there are studies that show that East Africa has in the past years suffered excessive and anomalously strong rains which have been linked to the El Niño episode (Doherty et al. 2010; Hastenrath et al. 2007; IPCC 2007; 2001). This implies that there is still uncertainty regarding the projections for precipitation across Africa, as opposed to those for temperature.

3.2.2 Overview of possible impacts of climate change in urban areas

Strong evidence on the actual risk and impacts of climate change on urban areas in Africa in general and specifically in East Africa is limited (Omondi et al. 2012; Kithiia 2010; Dodman 2009; Huq et al. 2007; IPCC 2007). However, Kithiia (2010) asserts that this literature is indeed growing. Studies indicate that the cities of East Africa are crowded and in sub-standard physical conditions as

city authorities fail to match infrastructural development with their growing populations (Archambault et al., 2012; Brown 2012;PASS et al. 2011; Yuen and Kumssa 2011; UN-Habitat 2008b; 2005; 2003; Majale 2008; Nkurunziza 2007; Action Aid 2006). Generally, climate change in the region is likely to impact on economic systems, livelihoods, infrastructure and water, among other variables (Kithiia and Dowling 2010).

Possible impacts identified for the region's urban areas include high general urban heat and high noon temperatures, as well as sea level rise, flooding and coastal erosion that could affect the seaport cities of Dar es Salaam and Mombasa, both major commerce and administration nerve centres (Bunce et al. 2009; Kithiia 2010; McCarthy et al. 2010; Awuor et al. 2008; Shisanya and Khayesi 2007). Inland flooding has also been observed and projected for EAC urban areas. Case studies show that cities in Kenya, Rwanda, Uganda and Tanzania were heavily affected by floods in 2002 and remain prone to flooding due to climate change (Lwasa 2010; Douglas et al. 2008). Droughts have also been shown to affect urban centres such as Naivasha in Kenya in a number of ways, among them electricity blackouts and decline in agricultural yield (Simon 2010).

3.2.3 Overview of key causes of vulnerability in urban areas

Given this rapid urbanisation and population growth in Africa, it is not surprising that studies show the greater portion of the urban population in East Africa living on low incomes and in slum settlements (an average of 80 percent; 70 percent in Dar es Salaam, 60 percent in Kampala and up to 70 percent in Nairobi [Action Aid 2006]). Most rely on livelihoods from informal sectors (Archambault et al., 2012; Brown 2012; Yuen and Kumssa 2011; Majale 2008; UN-Habitat 2008a; 2005; 2003; Nkurunziza 2007; Action Aid 2006). Studies highlight challenges in the cities such as disruption of the social fabric, high rates of unemployment, congested transport systems and poor conditions in informal human settlements and slums (Hendricks 2010; Dodoo et al. 2007). The literature portrays a dichotomy within the cities of the region, which typically contain planned and orderly as well as unplanned and disorderly sections. Nairobi and Kigali, more than any other cities in the region, exude this kind of dichotomy, and show how it results in the marginalising of significant sections of society (Rockefeller Foundation 2010;). The majority of these marginalised people are women (UN-Habitat 2005).

Impacts from climate change in major urban areas in East Africa are likely to hit hardest the urban poor (women, children and the elderly, including people with underlying medical conditions) who live in informal settlements and lack adequate access to basic urban amenities (Kithiia 2011; Kithiia 2010; UN-Habitat 2010; Douglas et al. 2008; Moser and Satterthwaite 2008). These people are less mobile, and have limited income and assets (Moser and Satterthwaite 2008). Case studies of slum settlements such as Kibera in Kenya and Bonde la Mpunga in Dar es Salaam bear testimony to the vulnerability of residents who barely have access to basic sanitary facilities and who also rely on agriculture for food and income (Brückner 2012; Gichere et al. 2011; Simon 2010). In cases of both coastal (Dar es Salaam and Mombasa) and inland flooding (Kampala and other smaller towns such as Bwaise, Kinawataka, Natete, Ndeeba and Katwe), research shows that residents are at higher risk if they live in lowlands, which are usually host to the unplanned settlements. Little provision for drainage systems and rudimentary sanitary infrastructure in the cities further compounds the plight of these residents faced with flooding risks (Lwasa 2010; UN-Habitat 2010; Doornbos 2009; Lwasa et al. 2009; Awuor et al. 2008; Douglas et al. 2008). Research shows that the issue of climate change could be less problematic in cities that have adequate infrastructure and robust local governance systems (Kithiia 2011).

3.3 Climate change implications for key challenges in urban areas

Research highlights the high levels of vulnerability in urban areas in the region that have fast-growing populations, especially in the face of climate change impacts. Among the vulnerability determinants are limited capacity and awareness of climate change (Kithiia 2011; Simon 2010). High population growth rates are shown to culminate in increasing levels of urbanisation, and subsequently exposure to climate risk, particularly for the urban poor (Kithiia 2011; Kithiia 2010; UN-Habitat 2010; Douglas et al. 2008; Moser and Satterthwaite 2008). The rapid urbanisation in East Africa has been partly driven by the decline in rural development and a decrease in the value of agricultural livelihoods, which has subsequently triggered rural-urban migration in all of the countries under review (Brückner 2012; Rockefeller Foundation 2010; Mendel 2006; Todaro 1995). These studies are consistent with Barrios et al. (2006), who state that rainfall variability has driven rural-urban migration in sub-Saharan Africa.

However, some studies question this assertion and caution that in a number of cases in the region natural population growth accounts for the greater proportion of urban population growth; some also question the linkage between climate change and rural-urban migration (; Lall et al. 2009; Muzzini and Lindeboom 2008). For instance, while in Uganda migration contributes more to the urban population growth than natural population growth, in Tanzania migration contributes only 17 percent to the total urban population growth, against the world average of 25 percent. In Kenya each year an average of 250,000 people move to urban areas (Abuya 2012; Muzzini and Lindeboom 2008; Lall et al. 2009). Reasons for migration include the development of administration centres and ports; this is the case in Tanzania and Kenya for urban areas such as Kisumu and Arusha, among others (Rockefeller Foundation 2010). However, literature on the region and the rest of sub-Saharan Africa provides little support for the 'population growth as a problem' thesis,

instead asserting that inconsistent political institutions and economic shocks, lack of robust planning processes and macro-economic conditions, among other factors, are to blame for increasing levels of poverty (Buhaug and Urdal 2013; Mirzaie et al. 2007; Todaro 1995).

There is evidence of unemployment, poor housing and inadequate sanitation and waste management facilities making cities more exposed to climate impacts such as flooding, with evidence from documented research done for Kampala, Dar es Salaam, Mombasa, Kibera and other African cities (Poelhekke 2011; Lwasa 2010; Awuor et al. 2008; KCC 2008; Tenywa et al. 2008; Mendel 2006). Coastal cities in the region, such as Mombasa in 2006, are shown to be especially prone to flooding due to sea level rise, leading to a disruption in the economy from suppressed tourism activity and other disturbances (Awuor et al. 2008). Disruptions in water availability affect house water systems and trigger sanitation-related disease outbreaks; these, as well as disturbances in transport systems and electricity supply, are much more significant in informal settlements (Böhm et al. 2010; Lwasa 2010; Lwasa et al. 2009; Twinomugisha et al. 2008; Omumbo et al. 2005). Research further shows that saltwater intrusion and shortages of fuel wood, particularly in times of interrupted electricity supply, pose challenges for city-dwellers and EAC member states. Reductions in water levels can also increase energy costs by affecting hydro-electricity generation in Uganda, Tanzania and Kenya (Gichere et al. 2011).

4 Research related to climate change adaptation in urban areas

This section presents a synthesis of research carried out in the region on implications of climate change and vulnerability in a multi-stressor context; options for reducing vulnerability and strengthening adaptive capacity; and documented adaptation in urban areas. Other areas of focus in this section are key documented barriers to adaptation and lessons from adaptation projects and interventions in urban areas in the region.

4.1 Implications of climate change and vulnerability in a multi-stressor context

As alluded to in section 2.2 above, EAC member states, like many other countries in the world, have started to experience increases in extreme climatic events with severe impacts. These include excessive rains and heat waves, among others (Magezi 2011; Lwasa 2010) (see Box 1). In Uganda, the warming has been most significant in the western and south-western highlands, such as the Kabale Highlands, and in lower lying areas around Lake Victoria. Reports from Rwanda show similar trends in the south-western areas, which are experiencing some of the highest temperature increases in the world (Magezi 2011; Lwasa 2010). There is evidence of decadal variability in the inter-annual patterns of East Africa's rainfall (Omondi et al. 2012). Extreme weather events such as droughts have also intensified. Uganda experienced six droughts between 1991 and 2000. These drought incidences have led to increased forest fires that in turn affect slum dwellers whose makeshift structures are destroyed by the fires, as has happened in Nairobi and Kampala (Magezi 2011). Water scarcity in urban areas as a result of drought raises energy bills for residents of both affluent and low-end settlements, and disease incidence among the poor in slums (Gichere et al. 2011; Magezi 2011; Awuor et al. 2008; Mogaka et al. 2006). In turn, the high energy bills have led to massive forest degradation in urban areas such as Dar es Salaam and Kampala (which fell from 7.6 percent to 0.4 percent forested area between 1994 and 2004) as households engage in charcoal production for both household use and income generation (Magezi 2011; Ahrends et al. 2010).

In coastal areas of the EAC member states mean annual rainfall is expected to increase, which along with sea level rise will likely aggravate flooding. Episodes of flooding are mostly experienced in slums, such as Kibera in Nairobi, Bonde la Mpunga and Jangwani in Dar es Salaam and Kibuli and Katanga in Kampala, and in almost all cases lead to infrastructure destruction and human deaths (Gichere et al. 2011; Byakika 2009). Studies also link climate change to increased disease incidence in

Box 1: Impacts from floods

In 2002, heavy rains that were caused by unusually extremely high temperatures in the urban areas in East Africa caused 112 deaths. In Rwanda, Kenya, Burundi, Tanzania and Uganda, floods and mudslides displaced tens of thousands of people and Rwanda was the hardest hit by this disaster. In Rwanda, Kenya and Tanzania, 50 people died in 10 days, 46 people in two weeks and hundreds of families were displaced respectively. Four years later, more than 100 people died in Addis under similar circumstances after a river over-flow. Women and children are the most affected by these floods.

Source: Douglas et al. (2008)

urban areas in the region. There has been an increase in disease pathogens such as malaria-carrying mosquitoes and water borne diseases such as cholera, influenced by scarcity of water resources (Magezi 2011; Lwasa 2010; Byakika et al. 2009; Awuor et al. 2008; Mendel 2006; Wandiga et al. 2006).

Research on EAC member states outlines a number of factors that compound experiences of impacts from climate change in urban areas (see Box 2). There is a dominant view in climate change literature that asserts that local climate planning for cities is likely to succeed if climate change is considered within a framework of multiple stressors (Kithiia and Dowling 2010). Indeed, climate change has added a new dimension to already existing challenges in the region (Lwasa 2010; Awuor et al. 2008). For instance, studies show that the impacts of flooding in the cities in the regions would not be severe if the cities did not have solid surfaces that cause water run-off, and if they did not lack parks and green spaces to absorb water flows as well as sound drainage systems (Mendel 2006).

Studies on the region, as elsewhere in sub-Saharan Africa, highlight a number of other factors that heighten vulnerability for city-dwellers, among these general food insecurity and poverty, resource-based conflicts and over-reliance on rain-dependent systems (Marchiori et al. 2012; Omondi et al. 2012; Parnell and Walawege 2011). The poor, mostly female residents who are involved in marketing vegetables are further affected through disruptions in market prices and lower food production as populations in urban areas continue to grow and convert agricultural areas into non-food producing land uses (Dubbeling and Pasquini 2010). Many residents of unplanned settlements rely on urban agriculture and therefore tend to be affected when their crop is lost due to recurrent flooding (Gichere et al. 2011). Half of Nairobi's slum children are chronically malnourished, while 38.2 percent of Mombasa residents are poor. 60 percent of Kampalans are living in poverty, of whom 70 percent are women (FAO 2012; UN-Habitat 2012; Lwasa 2010; Awuor et al. 2008). These women typically multi-task and have fewer opportunities to engage in breadwinning activities than their male counterparts, which places them at a disadvantage and makes them less resilient (UN-Habitat 2012). In EAC member states, 44 percent of the population live below the US$1/day poverty line; of these, 55 percent live in cities. Burundi, just coming out of a war and considered one of the poorest countries in the world, is also among the most vulnerable (Gichere et al. 2011; Kolmannskog 2010; Awuor et al. 2008). Waste management becomes particularly critical in flood conditions. Yet waste management is shown to be a challenge for Mombasa, Dar es Salaam and Kampala, where the greater proportion of residents lack basic sanitary facilities (Gichere et al. 2011; Lwasa 2010; Doornbos 2009).

As alluded to in the preceding paragraphs, it is important to understand population trends with regards to climate change given the need for informed policy responses (Satterthwaite 2009). In Mombasa, Dar es Salaam, Nairobi and Kampala, research shows that population increases are associated with housing challenges and exposure and sensitivity to flood risk as residents construct makeshift housing structures that are built of weak and inadequate materials (Gichere et al. 2011; Kithiia and Lyth 2011; Lwasa 2010, Magezi 2011; Awuor et al. 2008). This population growth has led to the mushrooming of settlements in undesignated areas, which has compromised the improvement of infrastructure such as roads and drainage systems, making rescue operations difficult to implement in times of shocks (Awuor et al. 2008).

Another documented factor that heightens the vulnerability of EAC cities is the ad hoc and business-as-usual institutional and planning processes that are followed for the cities (Kithiia and Lyth 2011; Kithiia and Dowling 2010; Swan 2010; Awuor et al. 2008). Little deliberate effort has been put in place by local authorities to monitor informal slum growth and settlement of residents in undesignated areas, which has been shaped by years of lack of proper planning, ad hoc activities and unregulated urban development (Magezi 2011; Swan 2010; Douglas et al. 2008). Given the existence of such multiple stressors in the EAC, there is need to factor adaptation into a wide range of stressors in order to build urban resilience (Leichenko 2011).

Box 2: Impacts from droughts

In the EAC member states, there is evidence to show the impact of climate change on energy. While flooding is documented as a major problem in the regions, droughts are equally hazardous. Climate change is implicated for the drop in water levels in key lakes and rivers such as Lake Victoria (where water levels have dropped by 4m since 2004), the Nalubaale/Owen Falls and Kira Dams on the River Nile that are no longer able to produce adequate electricity for Uganda, with a drop of 260MW by 2005. The subsequent use of thermal power generation as an alternative raised tariffs by 20 cents in 2007, a move that mostly affected the urban poor and pushed them into relying on less clean and unsustainable energy use. Similarly, Kenya largely depends on hydropower; the country felt the pinch during the 1999/2000 drought with a drop of 1269.5GW in this period and a monthly cost of US$68m. Unemployment levels were as a result affected to an extent that the rural people lost remittances from the city.

Source: Gichere et al. (2011) and Mogaka et al. (2006)

4.2 Options for reducing vulnerability and strengthening adaptive capacity

Available research on adaptation to climate change in urban areas in East Africa highlights a number of options for reducing vulnerability and strengthening adaptive capacity to the identified current and future climate change and non-climate impacts. At the individual level, it is important to promote resilience for individual households, for instance by providing access to information on weather and any looming crises in time for households to make decisions regarding immediate responses (Gichere et al. 2011; Goulden et al. 2009; Douglas et al. 2008). It would be important to follow up on this information dissemination exercise to ensure that households engage in activities that make them more resilient in times of shock by possibly providing training and the necessary infrastructure (Archambault et al. 2012).

For local level adaptation, there is evidence of informed action at the local level through community management for localised flooding as highlighted in 4.1. Governments and civil society can play an important role in supporting this participatory process, which promises to be very effective, through training and capacity building activities. This option is considered to be especially effective for boosting both response and adaptive capacity by slum communities, considering that these communities are stakeholders in good drainage, rapid water removal and storage and good sanitation practices, among others (Gichere et al. 2011; Schouten and Mathenge 2010; Douglas et al. 2008; Majale 2008; ActionAid 2006).

In the same context, implementing by-laws on land use planning and disaster management needs to be accorded priority over management and oversight of planning for service provision when dealing with climate change impacts such as floods so as to sustain services and increase adaptive capacity (Douglas et al. 2008; ActionAid 2006). This is important given that impacts are mostly felt at the local level, and this is where adaptation needs to start (Kithiia and Dowling 2010). Authorities could also ensure that they implement by-laws by restricting and ensuring that there is no further construction of human settlements in the remaining existing swamps (Douglas et al. 2008; ActionAid 2006). A stark contrast of Kampala and Kigali portrays Kigali as a city where there is an attitude by government authorities that 'we go by the master plan', while in Kampala the attitude is 'everyone does whatever they want' (Goodfellow 2013: 89). As a result, the former have been able to deal with informal settlements more effectively than the latter.

While it would be prudent for local government to advocate for increased infrastructure budgets for the urban poor, it is important at this level to monitor costly expenses and replace them with alternatives, such as erecting public toilets in slum areas which can be used by many people rather than creating a toilet for each household (Douglas et al. 2008). Costly hard infrastructure development of seawalls and channelised drainage lines could be replaced by constructing cheaper but useful feeders and wider channels that can accommodate flood water (Kithiia and Lyth 2011; Douglas et al. 2008; Dossou and Gléhouenou-Dossou 2007). Some documented options for adaptation in cities such as Mombasa suggest a suite of adaptation strategies to enhance the economy through redesigning and reconstructing city ports and relocating some industries inland (Awuor et al. 2008). However, these adaptation options would be costly for the countries concerned (see Box 3). Studies in the region indeed concur that most of the suggested adaptation measures in the EAC are costly and mainly relate to 'hard engineering solutions' (Kithiia and Dowling 2010).

For this reason, Kithiia and Dowling (2010) suggest more emphasis be placed on 'soft engineering' solutions instead, as they are more cost effective, flexible and sustainable for the region. Among these are ecosystem based strategies and green spaces/infrastructure, including more robust land use planning. These would work better alongside the more expensive approaches to adaptation. Studies on community based adaptation strategies that could be employed by urban communities to both address poverty issues and impacts from climate change raise possibilities including domestic energy briquettes from wastes, greening and urban agriculture, household level rainwater harvesting and nutrient recycling from wastes (Lwasa 2010).

In the same context, and to emphasise a point already highlighted, it is important for EAC member states to come up with a robust information sharing system that reaches out to the local level in order to reduce slum dwellers' vulnerability. This system should be tailor-made for the specific context based on local information needs and proposes and uphold evacuation procedures to cushion affected residents (Douglas et al. 2008; ActionAid 2006). This process may enhance the preparedness of these slum communities for future disasters. Market gardens provide one opportunity to address the issue of lack of green spaces that are required for catchment in urban areas and cities. Local government could set aside areas of land that can serve the purpose of containing urban sprawl and maintaining green spaces. For instance, Kigali has reserved 15,000ha for agriculture and wetlands (FAO 2012).

At the macro level, when towns and cities are flooded by water from a river basin, it is important to deal with subsequent impacts and curtail future serious events by employing integrated management, which can be a tool for sustainable development and equitable empowerment (Kithiia and Dowling 2010; Douglas et al. 2008; ActionAid 2006). This process entails management at either a national or international level depending on the scale and extent of the river basin. Integrated river basin management is recommended for large African river basins such as Lake Victoria (UN-Habitat 2012). However, rather than employing strategies to drain the

Box 3: Options for reducing vulnerability and strengthening adaptive capacity in Mombasa, Kenya and Kampala, Uganda

Mombasa

- Enforcing the Physical Planning Act and city by-laws to ensure promotion of sound drainage and water supply
- Solving the problem of land ownership to encourage planned settlements for easy access to basic services
- Developing a strategic plan to guide future development of the coastal city
- Decongesting the city by encouraging settlement in the peripheries of the city
- Encouraging the building of structures that can accommodate future climatic occurrences
- Rehabilitating the city's water and sanitation infrastructure
- Promoting water reuse and recycling to improve availability and access to water
- Encouraging use of readily available renewable energy at both household and industrial levels
- Encouraging the disaster management committee to be more proactive than reactive
- Making use of existing community-based groups as an entry point for community collaborative adaptation activities

Kampala

- Conducting climate proofing and environmental impacts assessments especially in infrastructure development
- Enforcing use of renewable energy
- Replanning the road networks and creating satellite urban areas to reduce traffic congestion
- Building the capacity of urban planners
- Ensuring effective involvement and consultation of women and children, who are the most affected by challenges in the urban areas

Sources: Awuor et al. (2008) and Magezi (2011)

water away, the river basin management institutions may need to find ways of retaining the water.

In order to improve the adaptive capacity of the urban poor in the region, governments need to take the issue of urban production and distribution in these urban areas more seriously and integrate urban agriculture into sectoral policies and plans as well as link rural and urban areas for greater resilience (FAO 2012; Dubbeling and Pasquini 2010). In Kenya, food consumes up to 51 percent of the income of the urban poor (Mason et al. 2011). The current traditional and informal food distribution systems that characterise the urban areas in the region expose these poor farmers to serious disruptions of their income in the event of shocks such as floods and droughts. Local governments need to promote location of supermarkets strategically to take into account proximity to production areas and also foster involvement of supermarkets in vegetable distribution processes together with the farmers. In Kenya, supermarkets and seed companies are currently involved in the distribution of leafy vegetables in Nairobi. Traded volumes increased to 600t in a year from 31t, with an increase in income of US$136,000 per month (Dubbeling and Pasquini 2010). While the same is true for Kampala, there is evidence of hijacking of the process by foreign operators with larger networks in the country (Ssemwanga 2010).

Urban agriculture is very important in the region given that it has become a very important form of livelihood and income. For instance, in Nairobi urban agriculture can at times provide earnings estimated to be up to five times higher than the national per-capita income, as in Maputo and Dakar. However, limited access to water disadvantages urban farmers, depressing their income in cities such as Bujumbura where most of the cultivation takes place in the rainy season. This is also the period in which rural farmers intensify horticulture activities, creating competition for markets.

In Kigali farmers are disrupted by lack of secure tenure to land, and grow their crops in marshes which are usually contaminated by industrial effluents, sometimes with high concentrations of lead or cadmium. In Dar es Salaam urban agriculture has grown significantly, though it tends to be practiced on undesignated land and is therefore looked down upon by financers as 'backward' (FAO 2012).

4.3 Documented adaptation in urban areas

There have been significant local efforts to deal with the impacts of climate change in urban areas, as highlighted for EAC member states. Residents in the slums of Nairobi and Kampala employ coping and adaptation strategies when they are confronted with floods, as presented in Box 4. Analysis of these strategies indicates that they do not vary significantly across the cities. This synthesis classifies the strategies into 'coping' and 'adaptation'. Coping strategies are used immediately when there are floods, while adaptation strategies may also be used in the same period but remain to cushion households in future flood occurrence. Some of the strategies can easily be classified under both coping and adaptation.

The presented strategies (Box 5) are mainly employed at individual level, rarely as community-based initiatives or coordinated collective action to deal with floods, and with very little support from government (Douglas et al. 2008). In addition, a glance at the strategies suggests the need for strengthening adaptation as a sustainable way of dealing with climate change shocks.

The need to strengthen urban food systems through urban agriculture in the region is documented. Food production in the urban areas of the region has grown, not only for subsistence but also as a major form of income for the urban poor, especially women (Dubbeling and Pasquini 2010; Ayaga et. al. 2004). Livestock activities are increasing in the region due to the rising demand for animal protein at the household level. More importantly, it has become more and more necessary to link rural cattle producers with urban consumers given the growing demand in urban areas (FAO 2012). In Nairobi, the demand for affordable and nutritious animal protein is very high, yet there is limited livestock production due to issues such as animal waste pollution and urban livestock holding infrastructure, among others (FAO 2012). Adaptation at the community level is also presented in Box 6, and at all levels by EAC member states in Box 8. This not only addresses traditional and conventional challenges that exacerbate climate change impacts but also acts as a form of adaptation to climate change in the long term (Kithiia 2010). Research indicates that adaptation in urban areas rarely happens solely to deal with the impacts of climate change. Rather, there is significant overlap between climate change adaptation and conventional and traditional sustainable development practices (Gichere et al. 2011).

Lake Victoria supports Africa's largest inland fisheries and is critical to the livelihoods of the three riparian countries of Tanzania, Uganda and Kenya, and by extension Rwanda and Burundi (UN-Habitat 2012). Regional efforts to build adaptive capacity of small towns in the EAC member states have been initiated as a measure to reduce vulnerability for these towns and cities (Box 7) and contribute towards reducing the impacts from climate change.

Box 5: Coping and adapting to floods in the city slums of Nairobi and Kampala

Coping

- Protecting household assets
- Bailing water out of houses
- Constructing water barriers at doorsteps

- Protecting household members
- Placing children in higher and safer places for periods of time
- Relocating to secure areas of high elevation
- Relocating to lodges and mosques/churches
- Protecting houses and shelters

- Constructing temporary structures such as dykes and trenches around the house
- Using bags of sand to stop water from filtering into the house

Adaptation

- Protecting houses and shelters
- Digging trenches around houses before and during floods
- Using waterproof material that stops water from entering the house
- Making water outlets behind the house

Sources: ActionAid (2006) and Douglas et al. (2008)

Box 6: Adaptation linking poor rural and urban communities

Challenges such as severe droughts and climate change and limited entrepreneurial expertise to penetrate the urban market by rural pastoralists triggered the need to link poor rural livestock producers with poor urban consumers so that rural products are available for the urban poor at more affordable rates in a project supported by the United Nations Food and Agriculture Organization (FAO), Heifer Kenya, Heifer International and International Partners for Sustainable Agriculture (IPSA). A multi-stakeholder platform Sustainable Agriculture and Rural Development (SARD) Kenya Livestock Working Group (KLWG) was established in 2006, comprising Maasai pastoralists, local leaders, local slaughterhouse business people, NGOs and authorities. The slaughter business grew from 30 to 150 cattle per day between 2005 and 2007 and a biogas initiative was also developed for electricity generation to preserve meat products in a cold room and improve food safety standards.

Source: FAO (2007)

Box 7: EAC Water and Sanitation Initiative

The Water and Sanitation Initiative is a collaborative effort between UN-Habitat, Kenya, Tanzania, Uganda and the EAC. Up to 25 small towns are the target of the water and sanitation initiative that seeks to achieve the targeted Millennium Development Goals. The process involves rehabilitation of infrastructure and capacity building. The initial target is ten towns that have population ranging from 20,000 to 200,000 and specifically those that face challenges related to inadequate water supply. In the towns in the three countries, rapid urbanisation has not matched the improvement of solid waste management.

Source: UN-Habitat (2012)

Box 8: A summary of EAC member states' adaptation strategies in cities

- Addressing drivers of vulnerability such as poverty, limited capacity at all levels
- Building response capacity by addressing inadequate early warning systems and natural resource management
- Managing climate risk through disaster risk reduction and climate proofing of investment schemes
- Confronting climate change by relocating communities and building dykes against sea level rise
- Mainstreaming adaptation into existing plans, policies for infrastructural development and water resources management, among others
- Strengthening early warning systems and disaster preparedness
- Setting up special ministries for disaster preparedness e.g. Uganda
- Planning that integrates adaptation needs at individual, local, national and EAC levels

Source: Gichere et al. (2011)

4.4 Key barriers to adaptation in urban areas

Research documents a number of barriers to adaptation in the region, among others the general low adaptive capacity of the urban poor and limited climate change awareness to encourage early adaptation measures (Lwasa 2010).

In some cases, when these urban poor do receive support from NGOs and governments, there is top-down planned adaptation support that does not adequately foster adaptation for the urban poor (Ludi et al. 2012). This barrier extends beyond the lack of adaptation capacity of individual households to that of city authorities and institutions that lack adequate human and financial resources for effective implementation of adaptation activities (Kithiia 2010; Kithiia and Dowling 2010; Lwasa 2010; Prasad et al. 2009; ActionAid 2006). For instance, constructing a seawall for protecting the Dar es Salaam coastline would cost US$270bn, while coastal flooding-associated costs from sea level rise in Mombasa would cost US$7-58m per year in 2030 and increase to US$31-313m in a decade (SEI/IRA 2009; Government of Tanzania 2008). There is also a considerable cost associated with the upgrading of infrastructure such as drainage and sewerage. In Kampala, Dar es Salaam and Mombasa, for example, this infrastructure was developed between 1950 and 1970 and has undergone little upgrading since then (Dodman et al. 2009).

Moreover, city authorities do not take the issue of climate change seriously as a management problem that needs urgent attention for successful urban development and adaptation and lack the requisite expertise to deal with the issues it brings (Kithiia and Dowling 2010; Kithiia 2010; Awuor et al. 2008). However, studies concur that these city authorities in East African urban areas may not be entirely to blame given that there is limited downscaled data showing localised climate change trends and that they are hampered by limited availability of funds for acquiring downscaling equipment and infrastructure (Kithiia and Dowling 2010). Essentially, limited political will, funding and human capital hamper successful adaptation to climate change in the urban areas in the region (Awuor et al. 2008)

The pace at which municipal authorities in the region have developed requisite plans for effective climate change adaptation is also a limiting factor (Kithiia 2010). More successful adaptation plans are documented for Cape Town and Durban in South Africa (see OECD 2009; Roberts 2008; Muheibir and Ziervogel 2007). However, for EAC member states the need does not only rest with developing adaptation plans but also with a re-evaluation of city planning in general, with climate change adaptation in mind (Kithiia and Dowling 2010).

4.5 Opportunities derived from climate change impacts in urban areas

There does not appear to be significant focus on opportunities derived from climate change impacts at present. However, there is recognition that in coastal and tourist areas such as Zanzibar the disappearance of very wet periods and the recurrent dry spells that have been experienced in recent years have been viewed in a bad light, yet tourists themselves tend to classify these periods as 'ideal', 'pleasant' or 'blessed'. This weather is a

welcome development for some of these tourists who do not enjoy the torrential rains that are sometimes experienced in these tourist towns and sometimes force closure of hotels (Gossling et al. 2011).

In the process of adapting to climate change impacts, there are prospects and opportunities at the same time taking care of other development concerns that might not have initially been targeted. Among such opportunities are strengthening housing structures for slum dwellers, addressing energy issues through use of alternative sources of energy and strengthening partnerships for future engagements. Adaptation strategies also tend to build resilience and cushion individuals or authorities and reduce vulnerability against future climate shocks (Kithiia and Dowling 2010). There is evidence to show that urban residents in the region are acquiring resilience. In Dar es Salaam and Mombasa, resident groups have been able to self-organise to reforest degraded forest areas and provide a seawall and other benefits. In Nairobi, exchange visits in slum dwellings helped deal with a fire disaster. A suite of these capacities can be harnessed to build a strong foundation of resilience for the city dwellers (Kithiia 2010).

4.6 Lessons from adaptation projects and intervention in urban areas in the region

The preceding section on adaptation to climate change brings to light a number of lessons to be taken into account. These lessons include the fact that adaptation takes place at various levels, such as the individual, household, community, local government, national and regional, and that urban agriculture has become a significant adaptation strategy for food and income generation. In addition, adaptation rarely happens solely in the context of climate related events, but rather to address a host of other challenges that households, municipalities and nations face, yet adaptation to immediate climate change shocks also contributes to building resilience in the event of future shocks. Also important are the lessons that successful adaptation needs commitment of resources to the set activities; collaboration and partnerships are important in the adaptation process, and more so by engaging communities themselves; and that adaptation of infrastructure is key, particularly in the slum areas where most of the urban poor live.

5 Policies related to urban issues with regard to climate change

This section provides a breakdown of reviews on climate change considerations in national and regional urban area policies and strategies. The section also outlines regional policies with regards to climate change adaptation by drawing on a few country case studies and a review of policy trade-offs in mainstreaming climate change adaptation in urban areas. The section ends by outlining key arguments for policies of adaptation to climate change in urban areas and policy actors and networks involved with these processes. All of these reviews make specific reference to Kenya, Tanzania and Uganda.

5.1 Climate change considerations in regional urban area policies

In a number of regional policies and strategies reviewed, there is little mention of specific climate change considerations; these are rather an add-on to other sectoral issues. Adaptation efforts are not yet integrated into other national development programmes. While it is comforting to note that the New Partnership for Africa's Development (NEPAD) has put in place action plans and strategies to address urbanisation issues in Africa, it is still disheartening that there is little consideration of climate change in these. The programme does however make reference to the importance of provision of environmental services in cities through properly planned and managed public utilities; control of industrial pollution; sound management of coasts; adequate water and sanitation; and efficient waste management (NEPAD 2005). Seven African cities were selected for a NEPAD pilot Cities Programme, among them Nairobi. Although there is no strong commitment on climate change in the programme, it is remarkable that members of the NEPAD Cities Programme convened in Durban at the Seventeenth Conference of Parties (COP17) to the United Nations Framework Convention on Climate Change (UNFCCC) to share experiences regarding climate change adaptation activities in their cities for achieving local development sustainability.

The EAC member states are among the 14 countries that have initiated reviews of their land and urban policies and legislation under the Bamako Plan of Action Framework in the face of rapid urbanisation and to increase access to secure tenure and affordable housing. In more EAC focused strategies, UN-Habitat and UNEP launched a new initiative in June 2011, working with all EAC members states in promoting energy efficiency in buildings and updating city-level codes and standards that respond to regional realities. In both efforts and initiatives, there is little specific consideration of climate change in urban planning and development.

A review of the EAC policies and strategies shows that there is no standalone policy or strategy on urban planning and development. Instead, urban development issues are addressed in a number of strategies such as the Regional Strategy on Scaling-up Access to Modern Energy Services and the EAC Development Strategy (2011). There are important issues that relate to reducing the vulnerability of the urban poor in the region, such as providing access to reliable electricity, adequate water and sanitation and efficient waste management, but little mention of climate change. The EAC is partnering with UN-Habitat and World Health Organisation (WHO) in these efforts. The EAC Development Strategy does mention efforts to deal with global warming and environmental degradation, including institutionalising long term urban planning and supporting urban development and housing in the East African region. The EAC Industrialisation Policy also makes mention of undertaking to address general environmental issues and all forms of pollution from urban development and waste development, but is silent on climate change.

5.2 *Climate change considerations in national government urban area policies*

Kenya has operated without an urban policy for many years and has only just finalised the National Urban Development Policy (2011) that was developed following the National Constitution in 2010. The policy does recognise that climate change impacts are being experienced and focuses a section on land, environment and climate change. The Policy creates a framework for the planning, development and management of public open spaces, parks and recreational facilities, including creating structures for mainstreaming disaster risk management and climate change planning in urban planning and development (National Urban Development Policy 2011). Since the Policy is very recent, studies show that there have been no current or past local authority plans and regulations that have linked housing programs and infrastructural designs with changing climatic conditions (Kithiia and Dowling 2010). In fact, the Nairobi Environment Outlook (2007) emphasises development of a Master Plan and environmental governance in general without highlighting climate change impacts.

Unlike in Kenya and Nairobi, there is lack of explicit consideration for climate change in urban area planning in Tanzania and Dar es Salaam, although there is reference to environmental management and the gazetting of the swamps in the city as 'hazard lands'. The 1979 Dar es Salaam Master Plan recognised the significance of a robust drainage system for the city and designated areas that are vulnerable to flood hazard, such as Bonde la Mpunga. By 1995, the rate of encroachment on hazard lands had soared so much that the National Land Policy was put into place (Meshack et al. 2006). The thrust then shifted to rehabilitation and upgrading of these hazard lands that have been diverted for settlement and urban development. In 2000, the National Human Development Policy was put in place. This in principle sought to restrict construction in previously designated hazard lands by limiting the issuance of titles to developers, but did not do much in practice (Meshack et al. 2006).

Uganda does not have a national urban policy to guide its activities, despite the importance of the sector to the economy. The current climate change legislature draws its legitimacy from the Constitution of the Republic of Uganda (1995) and international conventions such as the UNFCCC, which Uganda ratified in 1994, and the Kyoto Protocol. A Physical Planning Act was recently passed in 2010 but there is need for an urban policy to put the Act into practice. The Town and Country Planning Act (1964) and the Public Health Act (1964) address some of the concerns that relate to climate change adaptation, albeit without making deliberate efforts for the same.

The Ugandan Local Government Act does make mention of environmental management in cities, as

Box 9: A summary of the Kenyan experience of urban planning policies and climate change

- Mayoral and municipal leadership for climate change is not discernible and climate change is not prioritised
- Climate change is not prioritised for the climate change discourse
- Limited governance capacity and dearth of quality of political actors at municipal level
- Differing interests and lack of clear mandates between technocrats and political actors
- Limited decentralisation of decision making from central government and bureaucracy is a challenge
- Slow mainstreaming of key stakeholders in the governance of climate change at national and local levels
- However, all is not lost as cities have the capacity to engage stakeholders in participatory initiative

Source: Bulkeley et al. (2009)

does the Environmental Management Act. However, climate change *per se* has not been fully integrated into these acts, and there is no direct link of the entire legal framework in the country's urban development with climate change (UN-Habitat 2009). Although there are no urban or climate change policies, and the Kampala City Council has not yet adopted climate change in its agenda, recent country level interventions and creation of the Climate Change Unit provide an entry point into developing an Urban Planning Policy, a process which is underway. Urban development in the country is guided by the Town and Country Planning Act (1964), The Public Health Act (1964) (which details building standards), the Local Governments Act (1997) and The National Environmental Act (CAP 153). Climate change is not explicitly integrated into any of these Acts.

5.3 Urban area considerations in climate change policies and strategies

Four of the EAC member states (barring Kenya) are classified as Least Developed Countries (LDCs), and along with other LDCs they have developed National Adaptation Programmes of Action (NAPAs) under UNFCCC processes to assess vulnerabilities and explore possible impacts and adaptation priorities (UNFCCC 2002). Kenya has developed a National Climate Change Strategy (Box 10) of its own, and more recently Tanzania has also published its National Climate Change Strategy, which identifies urban area vulnerability to climate change under the human settlements sub-title. Among the interventions identified are promotion of adaptive building standards, provision of insurance schemes and relocation from unplanned settlements. However, most of these national plans and policies give little consideration to urban adaptation to climate change, with a few exceptions where local-level authorities engage in specific disaster risk reduction to extreme weather events. The developed Local Action Plans are as a result also silent about urban areas, although there is general consensus on their importance in climate change adaptation (UN-Habitat 2009).

In Uganda no explicit climate change strategy has been developed, and the city councils are yet to formally adopt the climate change agenda. The nearest that urban authorities have come to dealing with and mainstreaming climate change is through assessments that are related to climate change, such as the Kampala Integrated Environmental Management Project, which however did not directly factor in climate change. Moreover, the Kampala City Council has participated in several projects that address aspects of climate change (Lwasa et al. 2009).

5.4 Policy trade-offs and barriers to mainstreaming climate change

There are significant inevitable trade-offs in policy implementation in the region. Among these are industrial production vs. pollution; and public vs. private interests in implementation. While member states have undertaken to address industrialisation in the region, and even though there is commitment to deal with the subsequent pollution and waste issues, it is likely that the states will be unable to manage these outcomes at a pace that matches industrialisation. The consequences in the long term may be insurmountable and irreversible. It is important to manage these trade-offs by putting in place adequate fiscal measures. Trade-offs between private, short term economic interests and long term public interests still need to be transparently and responsibly managed. However, weakened institutional capacity at central and decentralised levels remains a challenge in a number of these countries, such as Rwanda and Tanzania.

While all of the EAC member states have prepared NAPAs or national climate change strategies, every country is lacking in coordination of responses to climate change by sector in line with these documents and in conjunction with the UNFCCC. There is also little harmonisation of climate change adaptation efforts with disaster risk reduction into urban development plans in the region (Gichere et al. 2011). In the Nairobi Declaration, East African mayors, together with many others from 31 African cities, made an undertaking for efforts to integrate climate change into urban development; to date, however, very little deliberate and practical policies or programmes have been made (UN-Habitat 2010). For instance, Dar es Salaam and Victoria City in Seychelles are both expected to be severely affected by rises in sea level, although the capital of Seychelles is considered less vulnerable due to its proactive policies (UN-Habitat 2010). Studies have also shown that institutions in the Kampala region lack capacity in a number of areas that are key for climate change adaptation. These areas include advocacy, vulnerability assessment and climate-proofing of infrastructure, among others (Lwasa et al. 2009).

Box 10: Kenyan National Climate Change Strategy highlights on urban adaptation

Social amenities including human settlements: strengthening disaster preparedness; proper planning of urban settlements which takes into consideration the expected high growth rate of urban population due to climate-induced migration from rural areas to urban centres; and establishing insurance schemes to support preparedness in regions susceptible to climatic disasters.

Source: Government of Kenya (2010:14)

Box 11: Decentralisation, devolved lawmaking and political commitment

In Uganda, national policy is less supportive to urban agriculture than what currently is the case for local level policy and planning towards urban agriculture. The local authorities have reasonably effective frameworks and mechanisms that they have used to change national policy at the local level. Initially, the Kampala City Council officials saw no significance of Agricultural Extension Officers that they had been assigned in an urban context. However, following the 1997 Local Government Act, there were effective linkages between technical and political wings that effected policy change at this level. The availability of resources at that time and the political commitment enabled the facilitation of draft ordinances that have led to recognition of the importance of urban agriculture to food security in urban areas.

Source: FAO (2007)

5.5 Key policy actors and networks key to adaptation to climate change in urban areas

Local governments and city authorities are key actors in the planning of urban areas and therefore need to be mobilised for implementation of policies at the local level, where action matters most. This section presents a case study of Kampala. Although there is limited policy framework for consideration of climate change in the urban planning of Uganda, there is an opportunity for local level authorities to make commitments for the wellbeing of the residents since the law gives them sweeping powers to make by-laws. Moreover, they also have jurisdictional powers which they can use to build adaptive capacity at the local level (Kithiia and Dowling 2010). An example of when the Kampala local authorities enforced their jurisdictional powers in urban agriculture is presented in Box 11.

The realisation that there is a gap in adaptation efforts at planning and action has driven integrated efforts by external agencies in the region. Collaboration with external actors has provided an opportunity for the EAC member states to consider adaptation in their action plans regarding urban development. Among these initiatives are the Cities and Climate Change Initiative that UN-Habitat launched in 2009 in collaboration with Uganda and other agencies such as UNDP and UNEP. This initiative has created the Sustainable Urban Development Network in Kampala and provides urban authorities with expertise, policy advice and information to meet the daunting challenges of climate change (UN-Habitat 2010). A number of activities are underway and recommendations have been made to integrate national and local policies and establish a network of stakeholders dealing with climate change. Essentially, the whole process benefits from partnerships with city planners, NGOs, the government and the communities themselves to map flood risk areas, maintain urban stream channels, control building in flood channels and on floodplains and provide emergency assistance (Hendricks 2010; Majale 2008; ActionAid 2006).

5.6 Key arguments for policies on adaptation to climate change in urban areas

There is general recognition of the importance of explicit adaptation policies, but the emphasis lies with the less costly integration of climate change adaptation in municipal-level planning to build adaptive capacity (Kithiia and Dowling 2010). This process is important so as to guard against introducing climate change as an addition to already fragmented planning systems, and it can address the issue of limited resources that is found to cripple many of the city planning processes in Kenya and other countries in the region (Kithiia 2010). This could also drive infrastructural development that takes into account a range of risks, rather than just sea level rise as experienced in the coastal cities of the region, and ensure robust plans (Ibid).

The rapid rate of urbanisation and poverty in the EAC (Brückner 2012; Poelhekke 2011; Rockefeller Foundation 2010; Mirzaie et al. 2007; Barrios et al. 2006; Fay and Opal 2000) calls for robust and effective national and regional holistic policies (regional policies are more likely to bring about structural change) and planning that target urban inequalities in the urban areas of the region where the business elite dominate the urban space (UN-Habitat 2010). These policies are holistic in the sense of targeting waste management, infrastructural development, real estate, water and sanitation, among other issues. Another important factor to consider is that any form of planning done today will be a permanent decision for the long term for any city planning, hence the importance of ensuring that planning decisions are robust and sustainable and also reduce the vulnerability of the urban poor to the growing threats of climate change (UN-Habitat 2010). This is more important for some decisions than others, such as location of infrastructure and capacity of drainage systems, which allow little if any flexibility for change in the future.

5.7 Funding streams for policies and strategies on adaptation in urban areas

Funding for Tanzania operates at three levels: global funding streams, usually either from global funds or donor headquarters; local bilateral funding; and regional programmes. Some of the funding that has come from bilateral sources includes Norwegian funding for developing and implementation of the Reducing Emissions from Deforestation and Forest Degradation (REDD) Strategy in Tanzania, which has a specific component focusing on a peri-urban setup. While it appears that REDD is more skewed towards mitigation than adaptation, REDD still conforms to the principles of adaptation through monitoring of forests and related activities.

An example of a regional programme is Climate Change Adaptation in Africa (CCAA), funded by IDRC and the UK Department for International Development (DFID). This funding supported research conducted by the University of Dar es Salaam and Sokoine University of Agriculture. While the major component of the study focused on the adaptation in rural areas, the programme also funded a component on rural-urban linkages in Tanzania and Malawi. A number of studies that have a bearing on evidence-based policymaking have been funded by the World Bank, who also supported the development of the country's Climate Change Strategy.

In Kenya, the Action Planning process for urban adaptation to climate change is being supported by, among other donor agencies, DFID, the Climate and Development Knowledge Network (CDKN), the Common Market for Eastern and Southern Africa (COMESA), the Danish International Development Agency (DANIDA) through the Natural Resource Management Programme (NRMP) and the Africa Adaptation Programme (AAP) funded by Japan through UNDP (Government of Kenya 2010). The United Nations is financing demonstration projects (Bulkeley et al. 2012).

The Economic Commission has supported research on urban agriculture and climate change for Tanzania, Ethiopia and Uganda since 2009. This programme has also been supported by UNEP and the World Meteorological Organization (WMO) and implemented by START in collaboration with IRA. The project has been critical for policymaking on urban areas and other themes with regards to climate change by creating a science-policy platform in Tanzania, Burundi and Rwanda, where among other issues climate change and urban areas were discussed. This platform brought together academics, policymakers and practitioners among others to deliberate on the country specific issues and explore solutions to deal with climate risk.

5.8 Key barriers to successful uptake of research evidence and policy implementation for adaptation in urban areas

Current measures to deal with climate change adaptation are basic and piecemeal. As a result, they fail to adequately address climate disasters such as flooding and droughts (UN-Habitat 2010). Barriers that have been highlighted to managing these trade-offs by designing appropriate fiscal measures include limited resource allocation to the implementation process. For instance, in Tanzania the government allocates a flat rate fund to all ministries for the implementation of the Environmental Management Act without taking into account ministry priority and needs. This is coupled with inadequate capacity to implement and monitor policies and regulations, and lack of good governance.

Although the situation is expected to improve after the development of the new constitution and sector policies in Kenya in 2010, it is documented that the rudimentary and under-resourced institutional framework regarding urban planning was not conducive for implementing strong climate change policies. The major setback in this regard was the absence of explicit policies linking climate change and urban development (Kithiia 2010; Kithiia and Dowling 2010). Even where prospects for climate change policies exist, lack of implementation remains a major challenge. In Kenya, various sectors in urban development had at the time of review not factored climate change into their plans, since there was no mandate from the national level governance structures. In Tanzania, recommendations by Parliament that the government encourage alternative sources of energy and reduce dependence on climate-sensitive hydro-electric power in the energy sector have not yet been taken up (Kithiia and Dowling 2010; UN-Habitat 2010).

Implementation of NAPAs across the region has been hampered by inadequate funding for the proposed adaptation projects. In addition, there is a lack of adequate coordination by the Environmental Management Authorities who are tasked with the proposed multi-sectoral approaches (Gichere et al. 2011; Lwasa 2010). Meteorological stations across the region have made an undertaking to provide basic weather information and climatic data. However, there has not been optimal use of this information for urban development given that the information is mostly tailored for the aviation and agricultural sectors rather than urban managers (UN-Habitat 2010).

6 Gaps in climate change adaptation research in urban areas

This section presents gaps that this review has identified in research, in policy and in research-policy linkages. The section also presents the options and possible policy spaces and opportunities for improved uptake of research findings.

6.1 Key research gaps on climate change adaptation in urban areas

A number of research gaps emerged from the literature search. In general, studies on the region show that there is limited evidence of knowledge creation and a small community of professionals working on climate change adaptation in urban areas, not only in the region but in Africa in general (Kithiia 2010; Archer 2008).

There appear to be inconsistencies concerning the role of migration in population growth and in the attribution of challenges in the urban areas of the region. Migration has been considered by some studies as a major driving force of population growth, while other studies show that there is actually a balance between migration and natural population growth in the region's urban areas. To this end, there remains a special need for research that focuses in-depth on the dynamics of migration and its root causes in the context of cultural frameworks and natural population growth at national levels. There is concern that alarmist predictions of climate change-induced rural-urban migration may result in inappropriate policies that will do little to protect the rights of those most vulnerable to climate change (Satterthwaite 2009; Tacoli 2009). There may be need to consider the broader context of an ailing social order – one characterised by competition, violence, conflict and insecurity – all linked to the discourse of climate change adaptation, as opposed to just migration issues.

While there are some studies that have focused on local-level adaptation to climate change in the urban areas in the region, the available literature shows that still not much research has been devoted to exploring 'innovative and cost effective' ways of addressing the climate problem in urban areas (Kithiia 2010), especially as compared to similar studies on rural areas. This dearth of adaptation studies is more pronounced for inland cities than it is for coastal cities in the region (Lwasa 2010). These kinds of studies are important for recommending best practices across the region and for convincing policymakers about the importance of committing resources to climate change adaptation.

Among the studies that were reviewed for this synthesis, little research has been done on rural-urban linkages in terms of how one influences the other. The link between urban and rural areas in the region often appears thin, yet it is important to explore these two locations that tend to be presented as distinct entities, for the dichotomy between them is no longer a certain reality, as confirmed by studies done elsewhere in Africa and around the world (Torreggiani et al. 2012; Madaleno and Gurovich 2004). Exploring these linkages is important for understanding how urban functions can be brought into the countryside and improving the quality of rural settlements.

Very little research on climate change adaptation in urban areas in the region focuses on, or at least significantly interrogates findings for, any opportunities or localised benefits that may arise from climate change. There are no deliberate efforts by researchers to explore this dimension in terms of reducing vulnerability and building adaptive capacity for the urban poor. This presents a research gap that needs specific studies dedicated to understanding how the urban poor may also take advantage of climate change impacts, if at all.

In the literature reviewed there is hardly any focus on gender as a dimension of climate change adaptation in urban areas in the region. There is only cursory mention of women as part of the marginalised and most vulnerable sector to climate change impacts, but little dedicated research for deeper understanding of gender issues. This represents a very important area of research that needs to be conducted in order to inform policy across the region.

6.2 Key policy gaps with regard to climate change adaptation in urban areas in national policy frameworks

This review has highlighted the high rate at which urbanisation is taking place due to both rural-urban migration and natural population growth. It has however emerged that in East Africa, unlike in Southern Africa, rural-urban migration is not the major driver of population growth; it rather works in combination with limited planning and development to accommodate natural population growth. However, there is entrenched thinking among policymakers that migration is a problem (Tacoli 2009), which needs to be replaced by a shift of focus to the role of urban planning in supporting and accommodating mobility and addressing the informal systems and inequalities in the region's urban areas. However, this can only happen if experts make efforts to reliably inform policymakers on the true facts of population growth and climate change.

There remains a gap in the framework in African countries for estimating adaptation costs at national and city levels (Dellink et al. 2009), a task that needs immediate attention in the region. Adaptation funds at the global level do exist, and the EAC countries need to be prepared to access these.

Essentially, there is a key gap between national and local action plans. Effective adaptation strategies call for exploring linkages between national, regional and local policies and in turn linking activities at different scales, such as between rural and urban areas. There is little mention and coordination of policies and action on opportunities that may arise in slum upgrading as an adaptation strategy to climate change, among others employment creation for jobless youth, some of whom are qualified to undertake the requisite positions. Studies on the region highlight employment creation through participatory urban planning (Hendricks 2010; Majale 2008).

6.3 Key research-policy gaps

Successful strategies are likely to be founded on robust urban planning processes that seek to reduce the dichotomy between formal governing institutions and networks of actors that provide local capacities. In addition, national urbanisation policy frameworks will have to complement local strategies for the envisaged changes to be quicker and deeper, and this includes identifying various levers by which action can be triggered and sustained. These actions are likely to be enhanced if good science (including the use of new data, methodologies and models) is used to inform policy (Kithiia 2010), which is currently not the case in the region.

Limited knowledge exchange for climate change adaptation is evident in the small community of professionals and researchers in the region, but also in Africa as a whole (Kithiia 2010; Archer 2008). This limits analytical capacity to advance changes among key decision-makers (Kithiia 2010).

Researchers point out that knowledge on adaptation to climate change in Kampala (Lwasa 2010) and apparently in the rest of the region is available in research communities and institutes, but is less shared with policymakers for response and action. The implication is that good practices of adaptation go unnoticed when they could be useful for policy and decision-making across the region. It requires concrete evidence to convince policymakers and other adopters.

6.4 Options and possible policy spaces for improved uptake of research findings

Although a number of gaps have been identified in the mainstreaming of climate change and implementation of the policymaking process in the region, there has been significant collaboration so far between experts and policymakers and this presents an opportunity for a policy space that links stakeholders and policymakers. The significant role played by donor agencies in provision of resources and technical expertise also buttresses this assertion. The participatory processes highlighted for adaptation and decision-making also present an entry point, although a lot more still needs to be done. This is consistent with studies done elsewhere, which suggest that participatory decision-making is a vehicle of shared understanding among stakeholders (Brown 2012; Carmin et al. 2012). This process is beneficial in the long term, as is the case with Kampala City Council who are now engaged with scientists in conducting knowledge assessments and also in creating a favourable environment for the urban poor for food production.

7 Stakeholders and opportunities for collaboration

This section summarises stakeholders that are mainly involved in research, dissemination and policymaking on urban areas and climate change adaptation in the region. The section also reviews any identified 'missing voices' in research and policy debates and lessons from efforts to promote the science-policy linkage.

7.1 Key institutional actors in research and policymaking on climate change adaptation in urban areas

There are a number of institutions that are conducting research on the issue of urban areas and climate change, although this review identifies that there is still little research that is being done in the region as compared to adaptation in other sectors. Across the region, among these actors are research institutes, universities and government departments. In Tanzania, the Institute of Resource Assessment (IRA) at the University of Dar es Salaam has been involved in a CCAA-funded project on understanding rural-urban linkages in Tanzania (Exploring Urban-Rural Interdependence and the Impacts of Climate Change in Tanzania and Malawi). Another CCAA project addressed action in cities (Sub-Saharan African Cities: A Five-City Network to Pioneer Climate Adaptation through Participatory Research and Local Action in Cape Town, Dar es Salaam, Maputo, Windhoek, Port St. Louis), with Tanzania as one of the focus countries. This project was implemented by Stockholm Environment Institute for this region. The Tanzania Meteorological Agency (TMA) and Ardhi University also partner with IRA and other university departments to conduct research and to engage policymakers, for instance in a science-policy dialogue that was implemented in 2009. A major step these institutions have made is the engagement of communities, government departments and agencies right from the research design stage in participatory action research.

In Uganda, significant climate change research on urban areas has been done through the Climate Change Unit that is located in Meteorology Department of the Ministry of Water and Environment. Climate change scientists conduct research within this unit, and others also conduct research from Makerere University.

Associations such as the Uganda Association of Impact Assessment and the business community have also increasingly become involved in climate change debates and research. Participating institutions that have taken a lead in climate change issues include the Carbon Credit Bureau by implementing the Clean Development Mechanism (CDM) in the country (Lwasa et al. 2009).

In terms of policymaking, the three countries in question usually set up a task force for this process, which is made up of central governments with representatives from appropriate ministries. Among these are ministries of agriculture, livestock development, local government, public health and social services. These ministries usually work in consultation with interest groups and major research institutes such as the Kenya Agricultural Research Institute (KARI), Mazingira Institute, Nairobi and Environs Food Security, Agriculture and Livestock Forum (NEFSALF), Nairobi City Council and Provincial Department of Agriculture in Kenya. A case in point is during the development of the Urban and Peri-Urban Agriculture and Livestock Policy (2010).

7.2 Missing voices in research and policy debates

The missing voices identified in research and policymaking for climate change adaptation in urban areas include the urban poor, among them women and children. For instance, urban poor farmers in Tanzania are under-represented in the policies in place and do not in most cases benefit from policy measures (Foeken 2008). Policies are usually inconsistent and can be applied differently in different settings given that Local Government authorities usually develop by-laws that are sometimes inconsistent as they are based on a number of legal instruments that are fragmented and uncoordinated. For instance, in Kenya local urban authorities can variously forbid, restrict, control or promote agricultural activities based on which line they follow in the by-laws and ordinances they make (Foeken 2006). If the minimum interests and rights of the poor in the city are not considered, then the challenge for building sustainable urban areas is huge (Dubbeling and Pasquini 2010; UN-Habitat 2010). This borders on rights to food and participation in the process of public policymaking.

7.3 Lessons from efforts to promote research-policy dialogue

It is important to have more demand-driven research on climate change and urban areas in the EAC member states, which should then be systematically shared with a critical mass of policy- and decision-makers who can be engaged through the various climate change fora in the cities. Therefore, it is important to strengthen communication at the science-policy interface by having periodic dialogues to discuss climate change and development matters in urban areas attended by

Table 2: Assessment of city stakeholders and their contribution to climate responsive integrated planning in Mombasa

Stakeholder	Contribution	Example in Mombasa
Urban federations of various interest groups (resource users, micro-entrepreneurs, enterprising poor, etc.)	Help address the systematic exclusion of urban poor/slum dwellers from the formal economy; implement indigenous practices for sustainable resource use and coping mechanisms; use their experience to influence local groups and secure their co-operation.	Mombasa/Kilindini Urban Forest Association; fishing associations consisting of various Beach Management Units
NGOs, big businesses, corporations	NGOs work directly with vulnerable communities; reduce bureaucracy in project implementation; achieve faster mobilisation of resources. Businesses/corporations employ a majority of urban poor and middle class; must guard their financial basis; avail financial resources and expertise.	Coast NGO Forum, World Wide Fund for Nature (WWF), La Farge Ecosystems, Coral Reef Degradation in the Indian Ocean (CORDIO), chambers of commerce and industry, Kenya Ports Authority/airports/oil refinery (have support initiatives aimed at building adaptive capacity)
Government departments, research institutions	Provide technical expertise, policy guidelines and government agenda; guide implementation, monitoring and evaluation, research, current information and resource allocation.	All climate sensitive sectors (housing, land, infrastructural sectors), Kenya Marine and Fisheries Research Institute
International agencies, regimes and transnational networks	Share learning from best practices; establish frameworks of action; provide financial resources.	UNFCCC, Cities for Climate Change

Source: Kithiia and Dowling (2010)

a critical mass of decision-makers (Swan 2010). Issues aimed at generating political will, policy reforms and funding streams necessary to address climate change adaptation at the national and regional levels need to be teased out in these fora, and if possible, agreement reached on implementation.

Sound policy actions will be difficult to enforce in the absence of public support and active participation. The difficult task of linking science to practice largely depends on the nature of partnerships that are forged at all levels, including a convergence of interest in climate change adaptation and vulnerability reduction (Vogel et al. 2007). The availability of resources for science-led policymaking processes and integration of climate change policies and plans with other sectoral policies are crucial to the process.

Decentralising the city management to municipalities is important in the engagement of science and policy. Kampala provides a good example of a city council that has embraced the drive to implement locally constituted by-laws that give them legitimacy as a standalone entity, sometimes in contrast with national stipulations. In addition to mobilising support for urban agriculture, this has also enabled them to reach out and engage with scientists in research in a number of projects. Since local government and municipalities are the locus of city development, this eases the engagement process for the science-policy interface. The opposite is true in Tanzania, where the national political and legal context is broadly favourable to urban agriculture, yet municipal by-laws make it effectively illegal to farm in most of the built-up areas in Dar es Salaam (Foeken 2005) – although in practice, the exercise has continued to mushroom.

Essentially, city authorities can become a conduit for successful partnerships in science-policy processes for climate change adaptation in cities, as evidenced by the Mombasa case study. This also curtails creation of a dichotomy between formal governing institutions and the networks of local actors. The engagement into partnerships of communities and local authorities leverages these communities to help develop policy and solutions that directly address local challenges (see Table 2).

8 Conclusions

This section highlights major findings from this synthesis in response to the six guiding questions presented in section 1. The section also summarises major research gaps in the region, issues on policy integration and finally provides a suite of recommendations for research and policy on climate change adaptation in urban areas in the region.

8.1 Major research findings

1. What is the role of climate change challenges in the context of the multiple challenges and opportunities facing urban areas in the region?

   This review has demonstrated that climate change trends across East Africa show current and projected increases in temperatures and a current decrease in precipitation, including a general variability in rainfall, with greater certainty on the latter. East Africa has experienced increased temperatures since the 1980s, particularly seasonal mean temperatures in Kenya and Uganda, and a rise of more than 2°C is projected by the end of the century. High general urban heat and high noon temperatures, global sea level rise, droughts, heavy climate change-linked coastal and inland flooding and coastal erosion could exacerbate the plight of the vulnerable urban poor. East Africa has in the past years suffered excessive and anomalously strong rains, which have been linked to the El Niño episode. **Climate change impacts have exacerbated the challenges for urban residents, particularly amongst the poor. Some of these challenges include limited capacity and awareness of climate change; high unemployment levels; poor housing; inadequate sanitation and waste management facilities; and inadequate and congested infrastructure.**

2. What is the current state of knowledge on adaptation to climate change in urban areas in the region?

   Adaptation takes place at various levels, including the individual household, community, local government, national and regional levels. In Kenya supermarkets and seed companies are currently involved in the distribution of leafy vegetables in Nairobi to deal with food shortages that usually come after droughts and floods. Traded volumes increased 600t in a year from 31t, with an increase in income of US$136,000 per month. However, social capital for the urban communities in the region has not yet developed to a point where they self-mobilise for activities to reduce their vulnerability. Urban agriculture has become a significant adaptation strategy for food and income generation across the region and various ways of adapting to climate change contribute to building resilience in the event of future shocks. For instance, in Nairobi urban agriculture can at times provide earnings estimated to be up to five times higher than the national per-capita income, just as in Maputo and Dakar. **Research shows that collaboration and partnerships are key in the adaptation process, more so by engaging communities themselves**

and committing resources to assist the process. More importantly for the urban poor, adaptation of infrastructure is key, particularly in the slum areas where most live.

3. What is the current state of knowledge on whether and how research findings are integrated in urban area policies in the region?

   There are currently limited efforts towards knowledge exchange for climate change adaptation and a small community of professionals and researchers in the region. This limits analytical capacity to advance changes among key decision-makers. **While there is significant knowledge on adaptation to climate change in the region's research communities and institutes, this knowledge is less shared with policymakers for response and action. There is negligible promotion of socioeconomic and gender dynamics within the science-policy linkage.**

4. What is needed to ensure that research findings are better integrated into urban area policies?

   There is entrenched thinking among policymakers that migration is a problem, yet it is important to have a shift of focus to the role of urban planning in supporting and accommodating mobility and addressing the informal systems and inequalities in the region's urban areas. However, this can only happen if experts make efforts to reliably inform policymakers on the true facts and implications of climate change. The region needs a more robust institutional framework regarding urban planning that is better resourced and has the expertise to implement a suite of strategies on climate change that are being developed in the region. **There is also need for further decentralisation of city management of policies from the national level to ease the engagement process between science and policy, including improving on communication channels between these two parties.**

5. What is the current state of knowledge on the stakeholders involved with research and policy on adaptation to climate change in urban areas in the region, and how could stakeholder involvement be improved?

   Across the region, research institutes, university and government departments have been engaged with conducting research and linking up with policymakers. In Uganda, significant climate change research on urban areas has been done through the Climate Change Unit that is located in Meteorology Department of the Ministry of Water and Environment. **A major step some of these institutions have made is the engagement of communities, government departments and agencies right from the research design stage in participatory action research and in developing policies and strategies.** TMA and Ardhi University also partner with IRA and other university departments to conduct research and to engage policymakers, for instance in a science-policy dialogue that was implemented in 2009. This is important because public support and active participation, including decentralising the city management to municipalities, will improve stakeholder involvement.

8.2 Major research and policy gaps

Research gaps point to the need for researchers in the region to explore innovative and cost-effective ways of addressing climate change impacts in urban areas. There remains a special need for research that focuses in-depth on the dynamics of migration and natural population growth at national levels. It is also important to further explore rural-urban linkages in order to understand how urban functions can be brought into the countryside and improve the quality of rural settlements. There is hardly any focus on gender and climate change adaptation in urban areas in the region. **The dearth of adaptation studies is more pronounced for inland cities than it is for coastal cities in the region, and in both cases there is need for gender disaggregated studies across socioeconomic backgrounds.** Very little research on climate change adaptation in urban areas in the region focuses on, or at least significantly interrogates findings for, any opportunities or localised benefits that may arise from climate change.

In some cases, policymakers are not adequately informed by experts on facts regarding climate change and its implications for the urban poor. This is important if policymakers are to make informed decisions on climate change adaptation. There is currently no framework for assessing adaptation costs in the region, yet this is important for city plans. Furthermore, there is a key gap between some national and local action plans. For instance, there is little mention and coordination of policies and action on opportunities that may arise in slum upgrading as an adaptation strategy to climate change.

9 Recommendations

9.1 Scientists/researchers

There is need for research scientists to provide scenarios for future climate changes, particularly on rainfall trends both at local and national levels. Such rainfall trends for East Africa still need further research and understanding. Scientists also need to be more proactive and shift focus from mainly conducting research and presenting it in conferences, to also targeting policy and policymakers by finding ways to join policymaker platforms where their research is more useful, and engaging donor agencies and urban authorities for community awareness campaigns. It is also important that scientists mobilise

for resources to conduct further research that targets the gaps that have been identified for this region in order to present policymakers with concrete evidence on these issues so as to collaboratively develop robust pro-poor policies and strategies for climate change adaptation in urban areas. Researchers from East African countries could take advantage of the emerging opportunities for collaboration and strengthening of networks within and without the region, among them the World Urban Forum and the Africa Centre for Cities. In their own countries and region, the national parliamentary forums for climate change and the East Africa Parliamentary Forum for Climate Change respectively can be invaluable to the cause.

9.2 National and regional level policymakers

Governments need to commit resources for the procurement of downscaling equipment and building capacity that can improve the quality of forecasts and scenarios. There is also need to integrate controlled urban agriculture into the policy framework at national and regional levels and provide a favourable environment for urban communities to supplement their livelihood as well as to decentralise and empower local authorities (where economically possible) to manage urban agriculture through favourable by-laws. There may be need for holistic regional planning and investment to decongest the region's crowded cities by decentralising government departments away from their capital cities and relocating them gradually to other areas outside the capitals to the extent possible. This move will reduce the vulnerability of cities to the impacts of future climate change. In addition, governments will need to invest resources in building the capacity of urban authorities in a number of areas such as fiscal management and monitoring and evaluation of climate related plans and strategies, and national level policymaking should heavily consult and involve all stakeholders in the process. To regulate trade-offs in policymaking, national policies should be aligned to international conventions such as the UNFCCC.

9.3 Urban authorities

Urban authorities need to be more proactive and engage with communities and other local stakeholders to improve living conditions for urban slums, even in the absence of explicit national level policies and strategies. Urban authorities also need to be proactive in engaging meteorological departments in an effort to improve early warning systems, and also mobilise for concerted disaster risk reduction efforts, from the communities to the private sector and donor agencies. In addition, urban authorities need to partner with scientists and gender specialists and run awareness campaigns for climate change adaptation for the urban poor.

9.4 Urban Communities

It will be important for communities to shift from the current exclusively individual household adaptation strategies, such as shelter protection in times of floods, to self-mobilise community driven strategies such as protecting local facilities, streets, drainage systems and solid waste management, both as coping and adaptation measures.

9.5 Donor agencies

There is need to mobilise resources and support national and local level efforts to foster active involvement of public and private stakeholders, including the urban poor, in urban agriculture and building the capacity of urban authorities in policy monitoring and implementation, including general policymaking for the region, given that urban agriculture has emerged as a key strategy for enhancement of livelihood options in a number of cities. Donor agencies also need to commit substantial funding into cutting edge research that targets the identified research gaps in the region.

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