URAdapt

Managing Water at the Urban-Rural Interface: The key to climate change resilient cities

CLIMATE CHANGE AND POPULATION CONFERENCE ON AFRICA

Symposium
Managing Water at the Urban-Rural Interface: The key to climate change resilient cities

MEETING REPORT

Tuesday, 3rd July, 2012

University of Ghana, Accra

Symposium 1:
Managing Water at the Urban-Rural Interface: The key to climate change resilient cities

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University of Ghana, Accra
10:30 a.m. – 12:00 p.m.

Introduction	10:30 a.m. – 10:35 a.m.	**Welcome remarks**
Presentations	10:35 a.m. – 10:45 a.m.	**Factoring Climate Change into urban water management – conceptual framework for adaptation** *Raschid-Sally Liqa*
	10:45 a.m. – 10:55 a.m.	**Impact of Climate Change on the existing and future drainage infrastructures of Addis Ababa City, Ethiopia** *Semu Ayalew Moges*
	10:55 a.m. – 11:05 a.m.	**Impacts of expansion of built environment on the flooding regime of Addis Ababa City and its implication to the developing cities in Africa** Semu Ayalew *Moges*
	11:05 a.m. – 11: 25 a.m.	**Questions and Discussions**
	11:25 a.m. – 11:35 a.m	**Climate downscaling over Densu basin, Ghana, using RegCM4** *Kasei Raymond*
	11:35 a.m. – 11:45 a.m.	**Water supply–demand management for Accra in the light of climatic and non-climatic drivers** *Amisigo Barnabas Akurigo*
	11:45 a.m. – 12:55 a.m.	**Flood vulnerability: methods of adaptation and health risks.** *Amoah Philip*
	11:55 a.m. – 12:00 a.m.	**Questions and Discussions**
		Wrap Up and Closure

SYNOPSIS

The symposium was organized around the findings of a multidisciplinary research project on urban adaptation to water mediated impacts of climate change that is being implemented in two African cities, Accra, Ghana and Addis Ababa, Ethiopia. The project was designed for policy influence and uptake of research, through a process of continuous stakeholder engagement. It is nearing completion, with findings that suggest a paradigm shift in thinking around integrated urban water resources management for adaptation to climate change. The research has produced a rich evidence base that is in the public domain, and our motivation is to share this knowledge with a wider audience.

Introduction

The purpose of the symposium was to present the findings from an IDRC project which was part of the Climate Change in Africa Adaptation (CCAA) Program. This project titled "Managing water in the urban-rural interface: the key to climate resilient cities (URADAPT) had the purpose of working in two African cities, namely Accra, Ghana and Addis Abeba, Ethiopia, to come up with adaptation strategies to make the cities more resilient to the water mediated impacts of climate change. In her introduction to the session Dr. Liqa Raschid-Sally presented an overview of the project, touching upon the objectives, the challenges faced, the conceptual framework utilised, the processes and research studies undertaken and the outcomes achieved. As an opening remark, she queried "do we have to wait till the cows come home before we factor climate change into urban water management?" The reference to cows was further explained by the poisoning of livestock due to unexpected rainfall events linked to climate change in Addis Abeba, causing flooding of farmland and resulting in pollution from industries being washed into the river. Crop and livestock losses are two consequences faced by the farmers downstream of the city. She confirmed that cities in Africa were expanding rapidly using the changing faces of Accra and Addis Abeba cities as examples of what is happening elsewhere in Africa. The purpose of the project was to understand the challenges that cities face in relation to climate change impacts on the urban water cycle and how these can be addressed. The innovation in the research was that a systems perspective was applied to the urban water cycle, looking at it holistically. It was hypothesised that the city location within a basin and its linkages with rural areas through an analysis of the upstream downstream interactions, played a key role in understanding how cities could address the impacts of climate change on the urban water cycle.

In the processes of developing a strategic agenda to make cities resilient, Liqa discussed challenges encountered to include:

- *Vulnerable groups*- In the study processes, the vulnerable groups which fall into policy and institutional vacuums were likely to be left out and efforts were made to have all vulnerable groups covered by the study.
- *Selection of stakeholders* – this could be a challenge under the *f*ragmented institutional context of most cities. Smooth functioning of multi-stakeholder platforms is usually faced with challenges due to a common platform of diverse disciplines. A good understanding of the political and institutional set-up is necessary to identify the key players. There is also the challenge of avoiding 'platform fatigue' and using the right participatory tools the right way.
- *Policy makers* - Developing a strategic agenda to make cities resilient requires that policy actors are in the driving seat right from the start, in order to move from research to implementation.
- *Data and Data Processing*- Africa generally has challenges in obtaining and processing data, and decision processes are not always clear and the policy processes are sometimes heavy.

Vulnerability was central to the notion of adapting to climate change. She presented a conceptual framework for addressing urban vulnerability as related to the water cycle. This analyses vulnerability in terms of, pathways and media through which impacts may be felt, the various users who may enter into conflict and whose needs have to be accommodated, the various levels

at which vulnerability should be addressed (as for instance the community level, and/or the city as a whole reflecting institutional vulnerability); and accounting for the different groups/categories within communities (those described by formal statistics, and those excluded like informal settlements, those currently at risk, but also new at-risk groups), and finally; accounting for the different spaces/scale at which these analyses should take place (eg: river basin/watershed, and the urban-rural interface). In Accra, the project worked within the Volta and Densu Basins whilst in Addis, the Awash and Akaki basins were critical. Both climatic and non-climatic drivers were used to describe various scenarios, which allowed to accommodate uncertainty. The analyses in the two cities have allowed for comparing and contrasting the two situations which provide generic lessons for other cities. For instance the extent of impact of climate change on water availability and downstream water quality, can be explained using various factors like the positioning of a city within a basin, the degree of autonomy of cities and the level of decentralisation of decisions, the types of regulations in place and the degree of implementation, etc. She explained the type of questions which the research studies were designed to answer, and described the stakeholder engagement processes in the two cities for moving from research to uptake of recommendations. Finally she presented some of the project achievements to date based on a recent process evaluation study of the project.

Presentations

Impact of Climate Change on the existing and future drainage infrastructures of Addis Ababa City, Ethiopia (Semu Ayalew Moges)

An introduction to a presentation on the impact of climate change on the existing and future drainage infrastructures of Addis Ababa city consisted of summaries on evidence from historical records on climate change and how the future climate change will affect cities in Africa. Hydrological models were employed in the study. He confirmed that whilst observed average rainfall data did not show a decreasing trend, 30 year data on flood of highest rainfall events did show an increasing trend. In terms of change in river flow from rainfall changes, an 8% increase was observed in the period 1930-1990, but this will increase to a projected 13% change in the 1990 to 2090 period.

According to the study, on average the flood extremes will likely increase by 37 % in 2030s and 15 % in 2090s. Conclusions of the study infer that, in Addis Ababa, impact of climate likely increases risk of flooding in an already exacerbated situation (due to expansion of built environment) and causes regular inundation of streets, putting existing drainage infrastructure at risk, whilst aggravating flood risks to vulnerable communities. Whilst regular maintenance of infrastructure for older system is essential to minimize the damages, re-evaluation of the design for new drainage infrastructure is critical. From an institutional perspective, flood management has to be prioritized with a separate unit within the municipality, responsible for dealing with it.

Impacts of expansion of built environment on the flooding regime of Addis Ababa City and its implication to the developing cities in Africa (Semu Ayalew Moges)

The aim of the study was to identify the impacts of expansion of built environment on the flooding regime of Addis Ababa city and its implication for other developing cities in Africa. Changes in the hydrograph due to urbanisation have been shown by previous authors when comparing forested watersheds with urban watersheds. This approach was used to analyse the case of Addis city, on the basis of increase in the built environment from 1984 to 2002 since later datasets were not available. The maps were digitised and the expansion in built areas was correlated to the runoff from impervious areas. In 1984 the percentage runoff volume increase was only 8% whereas in 2002 it was 62%. The impact on peak floods was also analysed. Conclusions drawn from the study show that rapid expansion of impervious surfaces (built environment) has created city flooding in Addis Ababa and enormously increased street flooding and overflow from urban drainage structures. This is likely to hold for many expanding cities in developing countries. The situation of flooding is exacerbated by likely increase of extreme rainfall events due to climate change impact.

Climate downscaling over Densu basin, Ghana, using RegCM4 (Kasei Raymond)

Introducing the presentation on climate downscaling over Densu basin, trends of rainfall were discussed. There is a general decrease in annual rainfall amounts over the entire basin and depending on the scenario considered, reductions will be between 11 and 16 % by 2050. The objectives of the study were to nest fine-grid Accra area atmosperic model within GCM's coarse-grid global model, use current-generation physics and numerics, simplify the task of climatic input data for modellers and generate outputs flexible across platforms. Reg CM3-4 downscaling models were used. Process activities of the study consisted of obtaining historical climate data orography of Accra and Akosombo areas, setting land surface model, sea surface temperature, and atmospheric-land interaction, preprocessing data for Initial and lateral boundary conditions and stimulating with projections. MM5, and Reg CM simulated results were compared with observed data. The results of the study using the SPI classification index show that for the project areas, the occurrence of normal moderately dry years will decrease significantly, and the severely to extremely dry will increase significantly. The occurrence of extremely to severely wet years will remain the same. Also the intensity of rainfall within shorter durations is likely to increase in future.

Water supply-demand management for Accra in the light of climatic and non-climatic drivers (Amisigo Barnabas Akurigo)

The popular response to water supply demand gap has been the introduction of domestic and commercial storage systems to provide a buffer strategy during days without water supply. Such a buffer could provide a minimal resilience to a city if utilized effectively. For Accra a calculation of the buffer storage available is in the order of one day's production from the Weija scheme. The study's objectives were to evaluate the water supply-demand gap for Accra under current conditions and plausible future scenarios, model the impact of climate change on surface water availability in the Densu Basin and determine the implications for bridging the water supply-

demand gap of GAMA. The city water supply-demand modelling was done using VENSIM, a simple input-output simulation model for various growth scenarios which accommodated mainly the non-climate drivers of population and economic growth. The HEC-HMS hydrological model was coupled with downscaled climate data, to understand the implications for water availability in the Densu Basin, one of the main sources of water supply to the city. Results show that there will be a slightly decreasing trend in water availability. Currently the water abstraction in the lower Densu is 34% of the estimated basin runoff. Further future extraction for water supply at Weija would put the basin into water stress situation, conflicting with future upstream water uses. With respect to the water supply-demand gap, even at the lowest water demand scenario (based on a 80 litres per capita per day consumption and a 3.1% population growth rate, the requirements will not be met unless future proposed additions to the supply are effected. Even under these conditions, by 2021 the demand will not be met for the lowest water demand scenario. The higher water use scenarios cannot even be envisaged. The study concluded that the municipal water supply-demand gap for GAMA will continue well into the future. New water supply developments will be needed to bridge the gap. Climate change impacts would contribute to reducing the water availability in the Densu, and given the current context of water extraction, it is recommended that an integrated approach coupling the Densu and Volta basins, and balancing upstream water abstractions in the Densu is applied to manage water in the basin.

Flood vulnerability: methods of adaptation and health risks (Philip Amoah)

The presentation on flood vulnerability in relation to methods of adaptation and health risks, discussed how health risks could be aggravated due to climate change, using Gbegbeyise as the study site. This site was selected based on a risk analysis to identify flooding hotspots. Drinking water and soil samples taken from demarcated zones for analysis showed that pathogen contamination increased after flooding incidents. Obtained results also showed that bacteria contamination levels in the stream Gbegbe, increased after floods, and stream and flood water quality is mainly worsened. Health risk to inhabitants in flood prone locations with poor water supply and sanitation services is very high. In terms of adaptation, inhabitants in Gbegbeyise use various measures, like building barriers and increasing floor heights to prevent flood water from entering homes, building flood diversion trenches, and other such measures, to reduce the impacts of flooding in their living spaces.

Question and discussions – 1st set

- Which hydrological model was used? Was city plan and expansion taken into account?
- Getting cooperation from vulnerable populations in a study is an efficient way of stating a case. How did you involve the vulnerable population?
- Advising policy makers on recommendations from a study using a single model is not convincing. It is recommended that more than one model is used and it is likely to justify what is likely to happen and give policy makers room to make decisions

Semu agreed that it is advisable to use more than one model in climate analyses as there are always queries about downscaled results. However in Addis a lot of reflection has gone into the selection of the model, and he is confident that the results are valid and useful to policy makers. In

Addis Ababa, a lot of learning has gone on which could be adapted for other situations. Master plans for cities have to be consulted when available to project built area expansion. Liqa added there was an issue of resources to do the study in terms of time, human and financial resources, and hence the study had to prioritise and be selective in the analyses.

Questions, comments, and discussions – 2nd set

- What are scientists doing about the situation in Gbegbeyise? EPA now called EPC was created in 1964 where the first annual report on sanitation was published. There is enough evidence on poor sanitation now and scientists are being unfair. In an era of environmental education, what are we doing about this?
- What lessons have been learnt from Accra and Addis Abeba.
- Mr Boanuh agreed with the results from the study of the Densu River. He explained water in the Densu, few years back was perennial but it has deteriorated to being seasonal. Recommendations from previous studies led to public education on pollution, farming on water courses and growing of tree seedlings and it was effective. Hence, he suggested findings of studies should be accompanied by practical activities for NGOs conducting public education.
- In comparison to Ghana, Mr. Ajadi stated in Nigeria, short raining durations occur with higher intensity and rains over a short duration rather cause devastating flood.

Answering the questions, Philip stated the purpose of the study was to quantify microbial risk using QMRA which is a first step to discussing issues raised and setting targets. Liqa added that the purpose was to generate evidence, based on which decisions can be made on how the issues can be addressed.

In reference to the observation by Mr. Boanuh, Barnabas queried about who takes care of the trees when they are grown and if the people knew why trees are grown. To address such issues, he explained the Water Resources Commission develops buffer zones and that a more holistic way of managing water resources is necessary. Raymond responding to Mr Ajadi, commented saying in climate downscaling, regional modelling is necessary and in the study, past data was used. Further studies could look at specifics from Lagos which would have been difficult for the study. The results presented pertain to Accra and the team is very certain of its conclusions.

Wrap up and closure

In her concluding remarks, Liqa stated two cities (Accra and Addis Ababa) were used as pilots to understand what would make them resilient. Selection of these cities was not based on climatic conditions only but development parameters and political stimulators. The core of the project is the development of a strategic agenda based on the findings of the studies, translated into recommendations. Continuous engagement with those who will implement them was also part of the project approach. In 2 months, key players would be invited to a round table discussion, on how to move the agenda forward.

Liqa highlighted that “Cities need to respond to water needs whether climate change hits us or not. Adapting to these non-climatic drivers is already a critical issue. What happens when climate change hits us?”

Finally in relation to financing some of the recommended solutions, which were part of the strategic agendas, it was important to consider how climate financing could be accessed for this purpose. Most adaptation measures are partly in response to development drivers and partly in response to climate change, and it’s difficult to distinguish between the two, let alone separate the costs. How then does one justify that a project merits climate financing? This problem has been clearly brought to light through the evidence that the project has generated, by using climate and non-climate drivers to describe current urban water problems; and it is urgent to address this issue.