Toward Integrated Flood Management in Kampala, Uganda

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Abstract

Many cities are taking initiatives to increase their resilience in the face of climate change. Despite considerable uncertainty about the nature, speed, and location of specific climate change variables municipalities need to be thinking about possible scenarios and developing strategies to mitigate climate change effects. In relatively poor cities, such as the Ugandan capital, Kampala, these are not trivial issues, as many resource constraints exist. The approach that is being developed for a new UN-HABITAT project on integrated flood management in Kampala under the Cities and Climate Change Initiative is described in this paper. Flooding is a major problem in Kampala that already has substantial effects on all aspects of urban life, and greatly affects the quality of life of the city's urban poor who are particularly vulnerable to flooding and related problems. A two pronged approach is adopted that deals with the vulnerability issues of specific communities as well as city wide flood risk assessment. The two levels of analysis provide insights that can be used for strategic planning and the identification of strategic interventions to enhance Kampala's resilience to flooding.

1. Introduction

Urban flooding may be fluvial (caused by rivers bursting their banks), coastal (due to tidal waves and storm surges), pluvial (due to overland flows caused by runoff rates that exceed the capacity of natural and artificial drainage systems), ground water floods, and artificial system failures. The causes of flooding are usually a complex combination of natural, technical and human factors but are often the result of an inability to satisfactorily deal with the concentration, transportation and discharge of surface water runoff (Jha et al., 2012). As severe or frequent flooding may have high and long lasting impacts and costs the adoption of good practices for sound surface water management to minimize flood risk is a critical component of urban sustainability. Moreover, it is becoming more important in those cities where climate change is associated with increasing amounts of rainfall and or increasing rainfall intensity.

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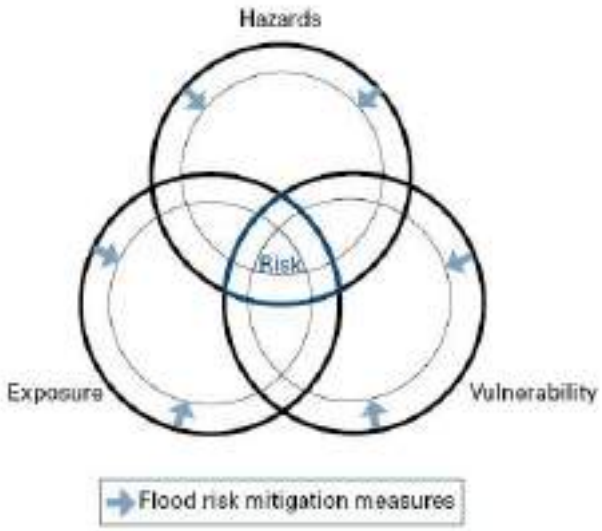
This paper examines on-going work to identify strategies to contend with flash flooding in Kampala, Uganda. Flash flooding, a form of pluvial flooding, is a widespread phenomenon in cities where extensive and intensive rainfall events that exceed the drainage capacity commonly occur. Severe storms that are occur in tropical cities are therefore likely to be problematic, especially in cities such as Kampala with relatively few technical, financial and human resources and a high degree of poverty and informal development.

Traditionally surface water management was seen primarily as an engineering problem. The classic response to flooding by civil engineers (and physical planners) was therefore to increase the capacity of artificial drainage systems to remove the surplus water as quickly as possible from the city and the affected neighbourhoods. Such approaches have though become the focus of increasingly critical discussion for several reasons. Engineering solutions are expensive to build, operate and maintain and are not easily adapted to higher rainfall regimes expected under climate change; the rapid discharge of massive amounts of water can create flooding problems downstream; ground water levels in urban areas may be depleted over time due to reduced infiltration as a result of increasing imperviousness, in combined storm water/sewer systems untreated sewerage may be discharged into natural streams causing pollution.

2. Integrated flood management

The integrated flood management (IFM) approach takes a more holistic view of flood management than the traditional engineering perspective. IFM is distinguished by its shifting of the focus from a reactive to a proactive response to flooding i.e. from flood control to flood management (APFM, 2006). In doing so it aims to develop an integrated package of instruments that target one of the three main components in any disaster event: the hazard itself, the degree of exposure or the degree of vulnerability (see figure 1). The management and hopefully reduction of flood risk therefore becomes a concern for all societal actors and not just the city engineers, though their expertise is certainly an essential element that should not be disregarded. Experience has shown that actors from all segments of society play various roles throughout the entire disaster management cycle with its three main phases: response, recovery and preparedness (Figure 2). Central to the approach is the distinction between structural and non-structural measures for flood management. Structural measures alter the physical characteristics of the flood phenomenon through water storage, upstream catchment management, channel modifications, levees and the operation of various hydraulic works and are typically the domain of engineers and physical planners who base their activities on the concept of Sustainable Urban Drainage Systems (De Bruin, 2006, Ellis et al., 2002) . Non-structural measures on the other hand are more directed at reducing exposure and vulnerability. For example by improved land use planning and development control in flood plains, better flood forecasting and early warning systems, stimulating flood

proofing measures by affected populations and businesses and offering other forms



of socio-economic assistance.

Figure 1: Construct of flood risk management and its reduction ((APFM, 2006)

Figure 2: Risk Management Cycle (APFM, 2008)

Spatial scale is a key issue in the IFM approach. Even if the main focus is a specific city's flooding problems (Figure 3), the nature of flood management is such that information will almost certainly be required for a much larger region covering an entire water basin. In some cases the water basin may require international cooperation, but almost certainly multiple administrative jurisdictions will be involved. Complex institutional settings may therefore complicate both the analysis of the problem as well as the search for affordable solutions.

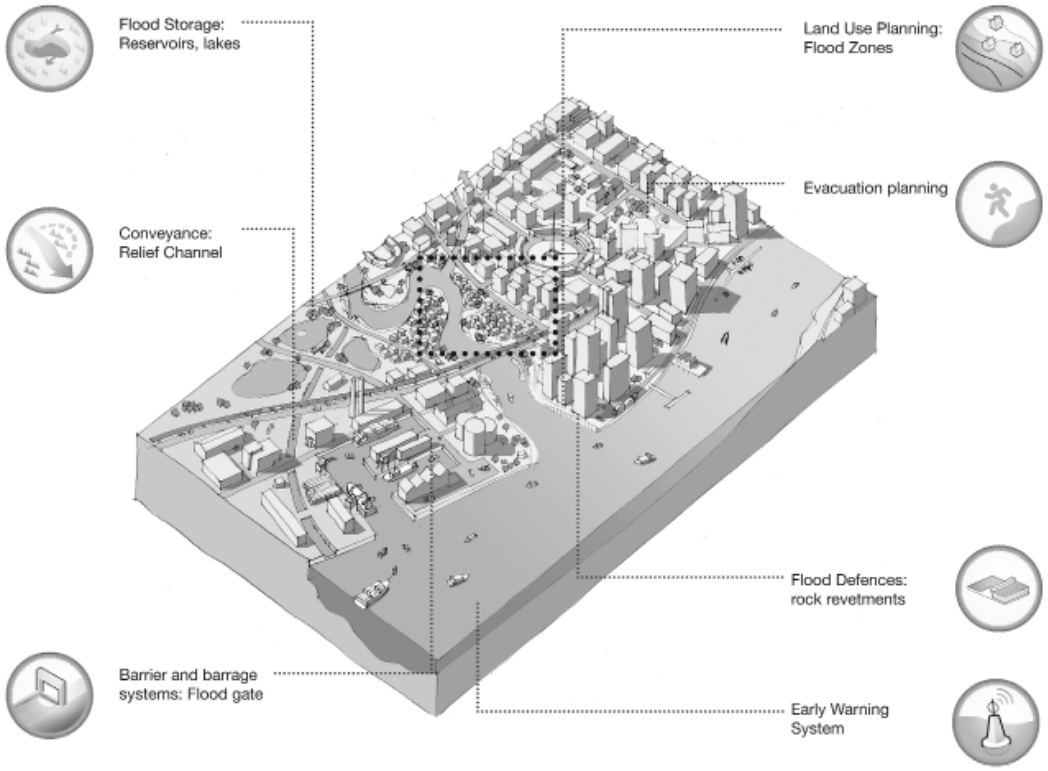


Figure 3: Overview of flood risk management measures at city scale (Jha et al., 2012)

3. Integrated flood management in Kampala

This section describes the specific setting in Kampala and explores some of the specific characteristics, the current status of the work there and some initial ideas for how an IFM approach might be implemented there.

3.1 Kampala and its flooding issues

The city of Kampala, Uganda's Capital, has been chosen as a pilot city for developing and demonstrating the use of IFM tools under UN-HABITAT's Cities and Climate Change Initiative. The city is located on the shores of Lake Victoria on terrain which is characterised by a series of hills that are separated by wetlands, some of which drain directly into Lake Victoria. Most of the original development of the city was concentrated on these hills which were interconnected through roads and

rail links crossing the wetlands at strategic places. The wetlands were also the natural urban drainage system. As urban development has proceeded the limits of natural drainage capacity have been exceeded and flooding problems have become more frequent and more severe. Currently the city faces regular flash flooding events in several locations around the city. Important contributing factors to flash floods are: significant increases in impervious surfaces leading to increased run-off rates, the lack of sufficient drainage systems (many primary drains located in the wetland areas are insufficiently maintained and under-dimensioned and secondary and tertiary drains are next to non-existent), an increasing amount of development has been allowed to take place in former wetland areas (this includes both planned and unplanned development as well as the recent construction of a major urban ring road and a new sewerage treatment works), the nature of the tropical climate with intense rainfall events which are expected to become more frequent and sever under the effect of climate change.

There are no major rivers passing through the city but flash floods occur regularly. These events are usually not of particularly long duration but they do cause significant disruption of social and economic life in the city, loss or damage to property and stock and in some cases life (Figure 4). Indirect effects include disruption of school attendance and health impacts related to the spread of feacal and other waste in flood affected neighbourhoods that rely on pit latrines for sanitation.

Figure 4: Flash floods in Kampala (source unkown).

3.2 Project approach

The project aims to develop strategies for introducing an IFM approach in Kampala at two spatial scales. The highest scale encompasses the entire administrative areas of the city supplemented by a detailed case study for one of the city's neighbourhoods known to have significant flooding problems. The whole process includes 4 main tasks (inception, data collection, flood modelling and analysis and strategy development) and will take about 15 months. The consultant team consists of a combination of Dutch and German experts with backgrounds in urban planning and hydraulic engineering and two local experts in spatial planning and climate change issues and flood modelling. During the kick-off mission the importance of

establishing a steering committee to ensure ownership and commitment from local bodies was realised. This committee includes senior staff from KCCA's planning and engineering departments, a local UN-HABITAT representative, a senior staff member of the Department of Disaster Preparedness, Relief and Management, Prime Minister's Office, a representative from the National Slum Dwellers Federation (NSDF) who provides a direct channel to the local low income communities in Kampala. Further, we have a representative from the Buganda Land Commission which is important because land rights over much of the wet lands in Kampala are held by the King of Buganda under the *mailo* tenure system, and although much of these lands are flood prone they have been allocated and settled for various uses. It is therefore evident that any actions to address current flooding problems and to prevent future development in flash flood prone areas must involve the Buganda King.

3.3 Current status of work

The team's initial focus has been on identifying the nature and extent of flooding problems, establishing institutional linkages and a project steering committee, identifying and obtaining access to useful spatial and other data for the two study areas, and undertaking some initial analyses on the basis of available data to test some assumptions about flood risk and possible IFM strategies.

Although the IFM envisages a multi-stakeholder approach in which technical expertise and analyses are combined with local perspectives and more qualitative analyses, flood modelling methods are required to provide a solid basis for dialogue throughout the project. High quality spatial data and non-spatial data is therefore required. Through the KCCA offices and other local actors it has been possible to quite quickly assemble a rich set of data for flood modelling and risk assessment. Particularly important sources of data are the Kampala Drainage Master Plan (KDMP) of 2002 and the work of the on-going Greater Kampala Physical Development Plan (KPDP) project. Initial euphoria has however been somewhat tempered by the realization that much of the available data is not available in GIS formats or has not been properly geo-referenced or is otherwise poorly documented. Although such deficiencies can usually be rectified they reflect a lack of concern for information management strategies within KCCA and other organizations, an issue which has been identified as a key success factor for GIS adoption by local government (Campbell and Masser, 1995, Masser and Sliuzas, 1999). Despite this concern, almost all agencies contacted thus far have demonstrated a readiness to share their data with the team and this is a very encouraging signal that data ownership is unlikely to become a barrier to progress.

The project will use a combination of quantitative and qualitative methods for data analysis. Rainfall run-off and flood modelling are data intensive activities that require a variety of inputs: the intensity and duration of typical rainfall events; current land cover and the built environment; terrain elevation; natural and artificial

drainage channels, etc. Much of the existing data will be updated using very high resolution colour orthophotos of the city and fieldwork. This work will be conducted together with students of Makerere University as part of an internship required in their study. In this way survey costs can be managed and combined with capacity development activities. A serious concern is the lack of high quality meteorological data for Kampala. Official meteorological data is outdated or only sporadically available. To compensate for this we have installed one low cost digital weather station at Makerere University and have started a programme of daily/nightly rainfall measurement with locally assembled rain gauges via local primary schools in flood affected areas. As many schools are in flood prone areas they are willing to assist our efforts and at the same time the collected data can be used by the schools for their own environmental education activities. The latest reading received showed that 3.8 cm of rainfall within 1.5 hours resulting in flood depth of 50 cm with waters remaining on the school for about 12 hours. The situation in nearby, more low lying areas was almost certainly significantly worse.

Stakeholder participation is a critical factor for the success of the project and any ensuing strategies. In the IFM approach stakeholders are more than victims of floods. Their behaviour is likely to be a significant factor in the level of exposure. Improper solid waste disposal for example is known to be a contributing factor in blocking drainage systems and therefore increases flood risk. Stakeholders also possess local knowledge about flood events, flood coping strategies and possible adaptation measures which could be replicated and disseminated throughout the city. Through workshops, focus groups and training activities the project will seek to engage affected communities and stakeholders in problem analysis, strategy development and implementation. Achieving and maintaining a high level of engagement will not be easy as the bonds between KCCA, Government agencies and low income communities are often fragile and easily broken. The NSDF is aligned with the International NGO Shack/Slum Dwellers International (www.sdinet.org) which promotes inclusive cities and high levels of emancipation and self-determination for low income communities. It is not yet clear to what extent the ambitions of NSDF will match with the ideas of KCCA and other project partners, but governance aspects will almost certainly be crucial to success.

Legal frameworks are another aspect of IFM activities to be addressed. Spatial planning law and development regulations for example set standard and conditions for development control and guidance. Typically such regulations adopt a one-size fits all normative approach to set backs form drainage channels for example. Restricting development within 30 or 60 metres of rivers and streams is certainly inappropriate and a gross simplification of reality. Determination of the extent of flood prone areas require a tailor made hazard assessment for each water basin, but will almost certainly generate resistance from those land owners who’s development rights and property values may be affected. Building and planning regulations too will be examined to identify opportunities for increasing rain water harvesting and infiltration options which will help to reduce the amount and speed of run-off, for example.

4. Future prospects

Although this project is in its initial stages the contours of the challenges to be addressed and some of the possible strategies are already beginning to emerge. The search for the *right mix* of options for the specific situation in Kampala will require a clear and open project governance approach. A range of IFM strategies have been identified and applied elsewhere (Schultz, 2006, Van Alphen and Lodder, 2006, van Duivendijk, 2006) and these and others can be valuable resources in the search of for approaches that are well suited to the Kampala case. Project governance will need to consider, manage and reconcile the interests of many stakeholders in the process. Given the limited technical and financial resources of KCCA and other partners, for example as indicated by the long lead time for the implementation for the KDMP, cost in terms of time and money will almost certainly be key elements of the strategy development and selection process.

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