Ecosystem-based Flood Risk Management in Sub-Saharan Cities

Summary Paper

Global challenges related to urban flood management

Urban floods occur when the runoff of fluvial, pluvial, coastal or groundwater flows exceeds the capacity of the urban drainage system. While each of the cities has their very own political, social and cultural context, some of the key challenges which exacerbate flooding seem to appear in almost every city. Each of the cities in this study has been observing the adverse impacts of climate change such as an increase in heavy rainfall of precipitation extremes. Rapid urbanisation leads to an increase in impervious surfaces and infilling of natural areas. It also means cities have reduced ability to learn from mistakes and build adaptive capacity. Poor urban planning in response to high development needs leads to development and construction on floodplains and areas with a lack of solid waste management or insufficient drainage systems. People living in (informal) settlements located in flood prone areas are particularly vulnerable.

Ecosystem-based Adaptation (EbA) as a solution

There is a broad range of interventions and measures to reduce flood risk at different scales. These span from hard (grey) solutions to soft (nature-based) solutions. Even as cities have responded to flood risks predominantly through grey infrastructure solutions, the benefits of natural and ecosystem-based solutions are increasingly recognized. Measures to reduce urban flood risks can span from the city scale to looking at the whole catchment or watershed area, requiring interventions at different time scales.

Integrated Flood Risk Management (IFRM) describes a broad approach, entailing a combination of structural as well as non-structural elements. Structural elements aim to directly control the flow of water both outside and within urban settlements, and include hard-engineered structures such as flood defences and drainage channels, but also natural measures such as wetlands and natural buffers. IFRM also contains non-structural measures like better planning and management in urban development. These measures evolve around different purposes like emergency planning and management including warning systems and evacuation, increased preparedness via awareness campaigns; flood avoidance via land use planning and speeding up recovery as well as so-called “building back better” to improve resilience to future flood disasters.

Ecosystem-based adaptation (EbA) aims to restore and enhance the natural dynamics of ecosystems to buffer the adverse impacts of climate change. EbA are approaches that reduce the vulnerability and increase

KEY MESSAGES

Flooding poses a significant threat to cities in the Global South. **Urban floods are becoming more common as a result of increasing urbanization, climate change, and poor urban planning including the gap in service provision and limitations in effective solid waste management.** Rapid urbanisation means cities have reduced ability to learn from mistakes and build adaptive capacity.

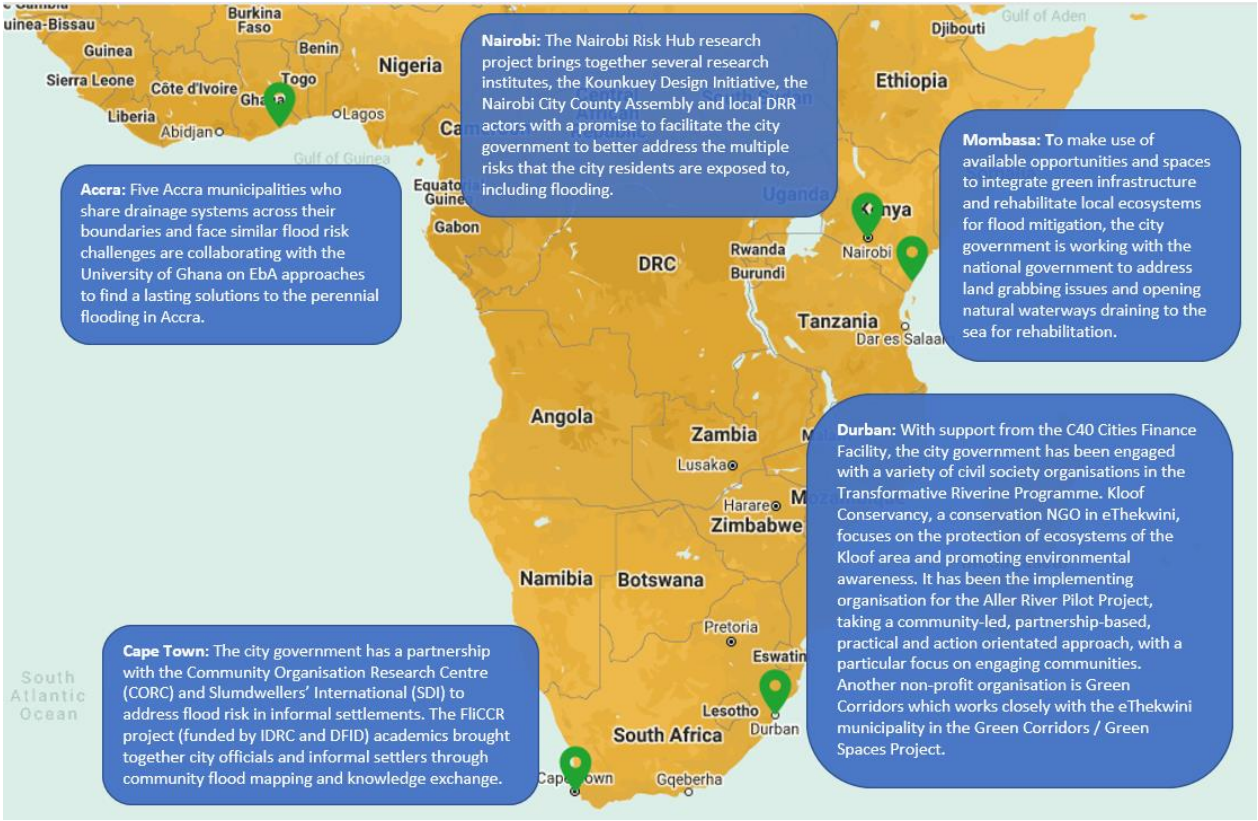
Urban flooding is a localised event, and is experienced unequally by residents of cities, based on their location in a city. In most cases, more exposed and vulnerable poor neighbourhoods, particularly in informal settlements, face greater impacts including disasters.

There is a broad range of interventions and measures to reduce flood risk at different scales. **This summary showcases good practices in flood management approaches in Accra, Cape Town, Durban, Nairobi and Mombasa.** These span from non-structural to hard structural solutions (grey infrastructure) and soft solutions (nature-based).

Examples of ecosystem or nature-based interventions include planting vegetation on slopes to prevent erosion(Accra), restoration of sand dunes (Cape Town), river rehabilitation projects (Durban), rehabilitation of wetlands (Nairobi) and rehabilitation of mangroves (Mombasa).

the resilience of socio-ecological systems to climatic and non-climatic risks, while also generating societal benefits. Considered a sub-set of the NBS portfolio, EbA is the use of biodiversity and ecosystem services for climate change adaptation and mitigation. While EbA and Ecosystem-based disaster risk reduction (Eco-DRR) are both recognised as part of the larger umbrella term of nature-based solutions (NbS), the terminology is still evolving. EbA can be used as a framework to guide natural flood management (NFM) strategies, which emphasize the restoration of innate hydrological pathways.

Flood and water governance need the engagement of a wide variety of stakeholders and institutions as well as intra- and cross-organizational collaboration, sometimes over a long period of time without the occurrence of a single flood event. Collaboration and engagement are required from municipalities, district, state and sometimes national governments, since the scale of a river basin or a water catchment area and therefore the impacts and measures often span beyond municipalities. Taking a nature-based approach to flood risk reduction requires an improved understanding of the dynamics of the hydrological system. Examples of multi-actor collaboration in urban flood risk management from the cases in this study can be found in the overview below.



Context of the study

The capital city of Ghana, Accra, and its peri-urban areas have always suffered from annual floods during the rainy seasons. Supported by CDKN, five Accra municipalities are working together with the University of Ghana to address flood risk with a special focus on the use of Ecosystem-based Adaptation (EbA) approaches to finding a lasting solution to the perennial flooding in Accra. In order to give recommendations to Accra officials based on the experiences of selected cities in South Africa and Kenya, the summary table below showcases good practices in flood management approaches by the cities of Accra, Cape Town, Durban, Nairobi and Mombasa to provide concise information on DRR practices, with a specific focus on EbA and NbS.

Information on the case study cities was gathered using literature review and guided by and expanded upon semi-structured interviews. These were conducted with representatives of city authorities, national governments, public benefit organisations whose work touched on flood resilience, community organisations and research institutions.

Flood Risk Management in Accra, Cape Town, Durban, Nairobi and Mombasa

City	Flood Risk	Non-structural solutions	Soft structural solutions (nature-based)	Hard structural solutions (grey)
Accra, Ghana (2.5 million inhabitants, 5 million in metropolitan area)	- High flood risk along coast and drainage basins of the Odaw catchment and Densu river - Insufficient drainage infrastructure and solid waste management services	- Educating citizens on responsible waste disposal to prevent clogging of drains - Self-help and rescue with locally manufactured boats during floods - Waste clearing by households from respective drains - Demolition of houses built on waterways	- Planting vegetation on slopes to prevent erosion and around water bodies that serve as drainage systems for communities - Requirement for homeowners to plant three trees to be granted building permit - Turning ponds into fish farms	- Building culverts and stormwater drains in flood hotspots - Community raised foundation of buildings and used sandbags to prevent flood waters from entering house
Cape Town, South Africa (4.5 million inhabitants)	- Flooding of low-lying, poorly-drained areas, - Annual flooding events, even during drought years - Lack of solid waste management services - Sea level rise (along the coasts)	- FliCCR flood risk research to understand and strengthen governance systems Progressive storm water management approaches - Including local knowledge and organisations in the process of managing flood risks (e.g. through reblocking) - Vulnerability mapping to flood risk within the Masiphumelele settlement (with local participation)	- Restoration of sand dunes, protection of kelp beds and Ramsar-designated wetlands to reduce coastal flooding and dissipate tidal energy - *Source to the Sea project:* maintenance of natural infrastructure in the Zandvlei catchment to store water and protect against flooding. - Khayelitsa Open Space Upgrading to make multifunctional use of a detention pond as a safe social space	- Sea walls along the coastline - Gravel platforms under residential dwellings to reduce flood exposure in Green Parks settlement - Installation of flush toilets and water traps to improve quality of life and contain negative health impacts of floods
Durban, South Africa (3.4 million inhabitants)	- Pluvial floods - Flood risk in informal settlements next to rivers - Blockages due to alien species and littering along water bodies - Embankments fall due to land degradation	- City-wide climate-related planning as early as 2004, through its Municipal Climate Protection Programme (MCPP) - Participatory climate risk mapping as part of the Palmiet River Project Forecast Early warning system - Urban Agriculture in the form of small-scale farming along the urban rivers	- Cleaning of waterways and restoring river parts i.e. the removal of waste and invasive species as part of several projects *(i) Sihlanzimvelo Stream Cleaning Project*; *(ii) Aller River Pilot Project;* *(iii) Green Corridors;* *and (iv) Palmiet River Rehabilitation Project* - Many projects create jobs for local communities	- Installation of groynes in order to redirect water flow in streams and rivers as part of several projects
Nairobi, Kenya (4.4 million inhabitants)	- Pluvial floods - Settlement and development on flood plains - Ineffective solid waste management - Deteriorated or inappropriate drainage systems	- Evictions of illegal settlements from riparian areas and flood plains to restore natural drainage pathways (eviction programmes are not always successful). - With support of KDI, Kibera Informal Settlement community is implementing Community-responsive adaptation to flooding through actions such as river bank stabilization, drainage improvement and solid waste management	- Incorporation of green infrastructure particularly in the riparian areas of Nairobi River and increase of green spaces; - Restoration of wetlands to improve flood water storage capacity; - Plan by Architectural Association of Kenya (AAK) to host a convention in August to for the FRIENDS OF NAIROBI RIVER to reclaim nature in the city e.g., by actualizing the planned integrated Nairobi metropolitan trunk road/bio-corridor/ linear park along Nairobi River	- Rehabilitation of city drainage system; - **Low-cost household level structural flood resilience and adaptation measures (supported by KDI)** improved drainage in and around the household; raised foundation levels. Community-level actions include: local grading to improve drainage; drainage clearance and expansion
Mombasa, Kenya (1.2 million inhabitants, 3.5 million in metropolitan area)	- Pluvial floods and risk of coastal flooding due to sea level rise and marine geological events e.g., Tsunamis - Settlement and development on flood plains		- Greening programmes are being integrated particularly in transport infrastructure and public spaces; - Rehabilitation of Mangroves in Tudor Creek - Improvement of trunk drainage systems and integration of greening option - The Mombasa gate city master plan targets 10% green infrastructure by 2040	- Rehabilitation of city drainage system; - Mombasa Gate City Master plan has provisions for integration of green infrastructure with grey engineered solutions for flood management

PRACTICES IDENTIFIED AS PART OF A SUITE OF FLOOD MANAGEMENT APPROACHES

1) **National policies** which provide the legislative framework for local planning and financial allocations towards state-led flood management approaches.

2) **Local policies, plans and engagement forums** that facilitate the implementation of local government-led flood management practices.

3) **Ecosystem or nature-based interventions,** such as restoration of sand dunes(Cape Town), rehabilitation of wetlands (Nairobi) and rehabilitation of mangroves (Mombasa).

4) **Planning interventions** such as creating a buffer zone along a river and estuarine system (Source to Sea project, Cape Town), Master plan with provisions for green infrastructure (Mombasa).

5) **Engineered and built- environment solutions** such as storm-water drains and culverts (Accra), placement of groynes as part of river flow management (Durban).

6) **Community-based approaches** can present locally-led adaptation strategies that deliver on social and environmental benefits simultaneously.

7) **Urban agriculture** increases the food security among communities, while absorbing floodwaters, protecting natural resources and benefiting local communities.

8) **Knowledge-based partnerships** to conduct evidence generation and groundwork for planning and awareness-building among citizens.

9) **Partnerships with relevant national and provincial departments and engagement forums** active in the region in sectors such as water management, sanitation and conservation (e.g. Catchment forums in KwazuluNatal).

Recommendations and lessons learned

While each city responds to its particular circumstances with a combination of structural as well as non-structural measures, it appears that effectiveness stems from collaborative modes of governance that embrace a whole-of-society perspective. Flood and water governance needs the involvement of a wide range of stakeholders and institutions as well as intra- and cross-organizational collaboration. There is value for practitioners and officials in becoming informants to the process of knowledge production. The role of NGOs working with communities is also imperative to understand flood management from a local perspective. Ecosystem-based approaches such as restoration of rivers, mangroves and sand dunes, and protection of kelp beds and wetlands show to have wider benefits to communities through improvements to public health, the protection of livelihoods and creation of new income-generating opportunities.

While South African cities have demonstrated maturity in their response to climate change across policy, planning and action frameworks, it is clear that the cities of Mombasa and Nairobi in Kenya are in the process of climate-proofing their urban planning, particularly for flood management. The research findings, particularly interviews with Kenyan city officials, demonstrate strong traditional thinking and urban planning practices with a large bias towards grey approaches to flood management. Research and learning collaborations between city authorities and non-state actors are however instrumental in the emerging ideas for mainstreaming of NbS ideas in urban planning for both cities. As was seen in the case of South Africa, a strong guiding role of the national government might help local governments take ownership of translating national policies like EbA into local mandates on DRR and climate protection. The challenge for the local government to fully respond to flooding remains, due to land ownership issues which means some areas are beyond their mandate.

As some of the cases showed, ecosystem- and community-based approaches offer a vehicle to address multiple challenges faced within informal settlements. Getting stakeholders on board, by identifying champions and communication of the co-benefits of EbA, through for example, improved health (by linking disaster risk management and climate protection departments) has proved beneficial. Furthermore, given the vulnerability of particular social groups, incorporation of social principles in the design and implementation of EbA for flood management is highly recommended to reduce the impacts of climate-exacerbated urban floods.

The insights of this summary paper are derived from the Scoping Study „Ecosystem-based Flood Management – a comparative study report of the cities of Cape Town and Durban (South Africa), Nairobi and Mombasa (Kenya)“ which can be accessed here: www.plan-adapt.org/projects

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Berlin, 2021