Flood Risk Adaptation Among Poorer Households in Lusaka, Zambia

Wilma S. Nchito
University of Zambia
wnchito@unza.zm

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Keywords	Urban flooding, waste, unplanned settlements, adaptation
City Population	3,079,964
City Area (Metropolitan)	360 km^2
City GDP (per capita)	2,200 USD
Climate Zone	Cwa (monsoon humid subtropical climate)
ARC3.3 Linkage	Equity, Development, and Informality Element

Figure 1: *Flooding in an unplanned settlement in Lusaka Photo by Wilma Nchito (2017)*

Introduction. The city of Lusaka has a history of flooding. The increase in the number of unplanned settlements compounded with the effects of climate change has caused a rise in the number of affected households. It is known that the poor tend to settle in precarious and hazardous zones in and around cities because this is what they can afford (Hamstead and Quinn, 2005). This case study presents an analysis of the various adaptive measures residents in Kanyama and Kalikiliki settlements in Lusaka undertake to cope with frequent flooding. Some of these measures are changes in the architectural styles of houses, unblocking drainages, and adapting informal businesses to suit flood conditions. It is such proactive measures that enable people to continue living in conditions that are considered harsh, unhealthy, and stressful. The case highlights resident's perceptions of the roles they can play in mitigating floods. Residents felt they could unblock drains and dispose of waste properly as a way of reducing flooding. It is often assumed that communities cannot participate in preventing floods and the responsibility falls on government institutions and NGOs which often do not take into consideration the efforts of individuals and communities. The case study advocates for the improvement and replication of some of these community efforts.

The case presents lessons on: 1. Reducing and mitigating flood risks among poorer households 2. Community responses to flooding; 3. Reliance on local knowledge, solutions, and strategies 4. The need for the development of urban early-warning climate systems.

Brief History and Context. The city of Lusaka in Zambia has experienced incidences of flooding during periods of heavy rainfall since the founding of the settlement 100 years ago. This is mainly due to the geology and topography of the city. Lusaka, the capital city of Zambia, is located in the center of the country at 1217 metres ASL. The city has sprawled outwards in all directions and this, compounded with the massive infilling of formerly vacant lots, has led to some residents living on marshlands that have not been drained (Nchito, 2019). In some cases, the constriction of existing streams causes flooding for residents who live downstream.

It is projected that the city and country as a whole will experience more frequent extreme weather events such as heavy rainfall and this will continue to cause flooding if no interventions are taken. The city experiences flash floods after prolonged downpours. In the more recent past the city has been experiencing prolonged dry spells and short periods of intense rainfall. This has resulted in the mushrooming of settlements both formal and informal in areas prone to flooding. The geology of Lusaka consists mainly of karstified marbles interlaid with a thin sub-horizon of schists and quartzites. This has allowed the development of a system of conduits and solution channels creating an easily accessible aquifer for water supply (Nkhuwa, 2001).

Lusaka's climate is described as warm and temperate, with less rain in winter than in the summer months. The average annual temperature is 20.3° C and the average annual rainfall is 831 mm. The city of Lusaka is getting warmer and drier due to climate variations. Spatial and seasonal variability is being felt in the longer and hotter dry periods. Climate scientists predict that temperatures in Lusaka are likely to increase by 1° C or 2° C in the next 10 years (FRACTAL, 2018). This scenario will be compounded by reduced rainfall and extreme weather events. The city normally experiences minimum temperatures of around 7.8° C in the cool months and maximum temperatures of 31.7 C in the warmer months (Chitumbo & Nchito, 2023).

Lusaka is unique in that, unlike coastal cities that have a visible and ever-present threat from the sea/ocean, the risk of flooding for Lusaka is the groundwater upon which the city lies. The rapid filling of aquifers means that the water table rises quickly and the thin top soils saturate causing flooding. This is exacerbated by the low-lying flat terrain with a gradient of 2%. The absence of natural drainage causes annual flooding as the artificial drainage system is unable to efficiently drain the water from the seasonal tropical storms.

The Department of Geography and Environmental Studies at the University of Zambia undertook a study of flooding and its causes in the City of Lusaka in 2017. The project, funded by SysTems for Analysis, Research and Training (START) was titled "Understanding interactions between urban floods, municipal solid waste and urban planning in the Lusaka city-region" (Nchito et al., 2018). The project surveyed two unplanned settlements that experience flooding and these are Kalikiliki and Kanyama settlements. The results presented are from the survey carried out in these two unplanned settlements in Lusaka.

Proactice Community Responses to Flooding. Residents of Kalikiliki and Kanyama reported carrying out several activities in order to reduce the impact of floods on their households and within their communities. Literature shows that community involvement in environmental planning and implementation produces sustainable results (Hampstead and Quinn, 2005; Frediani et al., 2016). The impacts of the annual floods that are experienced in the two settlements can be mitigated if infrastructure were to be inspected by council staff and advice on structural reinforcement were to be given in advance. In the absence of such advice and forewarning, residents are left to their own devices. It is not clear how much these additions cost households. In some instances, the study found that homes become uninhabitable and households lose incomes due to lost rentals. In other cases, households have to move out of their properties and look for rented accommodation which is an additional cost.

Drainage Unblocking. When asked what they did to reduce flooding 30.7 % of residents responded that the community could do more if there was more community cooperation. Different mechanisms were used by the community to mitigate the impact of flooding. Improvements in drainage and compacting and raising and building barriers presented the largest responses but these actions are done with no technical assistance and guidance. Improvements to the measures taken by the community could enhance the longevity of these remedies, reducing the costs to these communities since these actions are repeated yearly.

Architectural/Structural Flood Measures. The study found that most residents in areas prone to flooding had taken precautionary measures during the construction of their homes. The prominent action was the raising of the foundation, requiring a step or two to get into the house. This is obviously an additional cost that is borne by homeowners but in the long run, it saves them from enduring the destructive effects of floods. Most homes in the study area still used pit latrines and again, most of these were built on raised platforms to avoid flooding.

It is clear that homeowners construct their houses with the knowledge of the terrain they are dealing with and yet, literature often presents such people as lacking background information that will result in them bearing the brunt of disasters. The raised steps that were found during the study are an indication of this.

Half of the population surveyed did not utilize early warning climate information. This provides an opportunity for cities to ensure that climate information is disseminated more broadly using various formats, for instance the use of short messaging on mobile phones, which most residents own. The weather forecasts on television are the highest source of information even though they may not contain accurate or relevant information. Civic leaders and indigenous knowledge also provide opportunities for exploration.

Table 1: Assessment of Responses Undertaken during 2016/2017 Flooding

	Measures taken to respond to floods	Effectiveness	Narration
1	Sandbags (household)	Yes	Stopped individual households from flooding
2	Moved out	Yes	Households avoided adverse impacts of floods
3	Early Warning	No	Not everyone adhered to the warning
5	Drains were de-silted	Yes	Flooding was eased or avoided
6	Secondary drains were dug	Yes	Flooding was eased or avoided
7	Removal of constrictions along stream channel	Yes	Flooding was eased or avoided
8	Water pumped out	Yes	Flooding was eased or avoided, and reduce water lopped
9	Individuals/ community members pumping out water	No	Less capacity

Source: Nchito et al., 2018

Recommendations. The following are the recommendations for the prevention and mitigation of flooding in the city of Lusaka:

- Reclaim natural drains/streams where people have settled through joint activities with the community.
- Re-design the drainages to take more stormwater during peak rainfall season.

- Co-produce and integrate the development plans of the city with other institutions and the community involved or affected.
- High water table to be pumped down and artificially recharged into boreholes or dams/storage tanks.
- Behavioural change and sensitization program on indiscriminate dumping to reduce drainage blockages and flooding in communities.
- Create a by-law and enforce the sorting of solid waste beginning at the household level up to the dump site.

The Lusaka City Council (LCC) was closely involved in the START Project and are aware of these recommendations. It is expected that the local authority will act on them in collaboration with communities and other stakeholders in the city. Sensitization on waste disposal is being undertaken by the Lusaka Water Security Initiative (LuWSI) in collaboration with the local authority.

Figure 2. *Abandoned housing due to flooding Photo by Wilma Nchito (2017)*

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Additional Data

- **Population Density:** 100 people/km^2
- **Gross National Income (GNI):** 4,870 USD (Lower-Middle Income)
- **Gini Coefficient:** 51.5
- **Human Development Index (HDI):** 0.615 (Medium)
- **Type of Climate Intervention:** Adaptation
