Emerging issues in urban flooding in African cities - The Case of Accra, Ghana

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ABSTRACT
Urban floods have become a critical development challenge for both developed and developing countries. They are particularly problematic in Africa, the world's fastest urbanizing region. This paper explores the impacts on and readiness of African cities in dealing with urban flooding using Accra, the capital of Ghana - a West African country - as a case study. Accra is a rapidly growing coastal city affected by perennial flood hazards, and with rising sea levels, flooding may become an even greater problem. Flood events have been attributed to overflow of rivers within the city's catchment, uncontrolled growth, poor waste disposal and rapid urbanization. Climate variability and/or change have also been cited as a cause of urban flooding. Using documentary review and institutional data, the study presents key issues in urban flood risk management and suggests the way forward for planning urban resilience to flood events.

Key Words*: urbanization, urban flood risk, vulnerability, adaptation and resilience*

INTRODUCTION

Urban flooding is a serious and growing phenomenon affecting both developed and developing countries. In the face of rapid urbanization, climate variability and change and their corresponding changes in urban hydrology, urban flood events appear to be on the ascendency. This paper reviews relevant literature on the key themes of urban flooding in Africa to unearth the key issues in current scholarship. It further presents a wide range of issues associated with urban flooding in Ghana and particularly Accra, while highlighting their implications for flood risk management in the city. This approach was complemented by analysis of institutional data collected from relevant institutions and a review of newspaper articles and editorials in Accra, Ghana.

URBAN FLOODING: A CURRENT GLOBAL DEVELOPMENT ISSUE

Data available shows an increasing trend in reported flood events around the globe, as well as water-related natural disasters (Adikari and Yoshitani, 2009, Jha et al., 2011b) (See Figure 1 and 2).

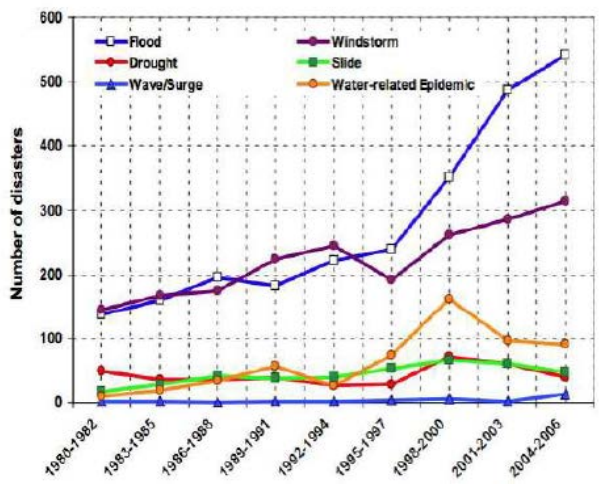

Figure 1: Reported Cases of water-related disasters
Source: Adikari and Yoshitani, 2009

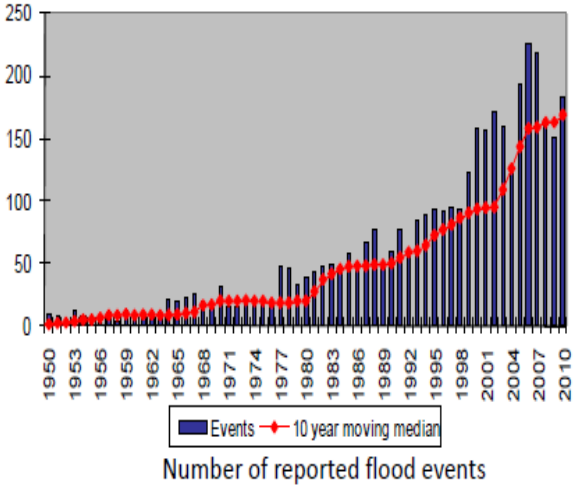

Figure 2: Globally reported flood cases
Source: Jha et al.,2011b

Figures 1 and 2 present a steadily increasing trend in disasters caused by flooding and other water related events, an indication that flooding has been increasing since the last half century**.** The increasing trend has been attributed to rapid and uncontrolled urbanisation that produces changes in local hydrology and places urban inhabitants in vulnerable locations as well as climate variability and change (Jha et al., 2011a, UN Habitat, 2011, IPCC, 2012).

URBAN FLOODING IN AFRICA

Flooding has become an increasingly severe and more frequent problem in most African cities, with adverse repercussions for the urban poor and vulnerable (Douglas et al, 2008). The continent ranks second hardest hit by flooding after Asia (Tschakert et al., 2010) in terms of number of events, damage and deaths. However in the last decade, the number of flood events recorded in Africa is higher than the rest of the world (Jha et al. 2011b). The trends are shown in Figure 3.

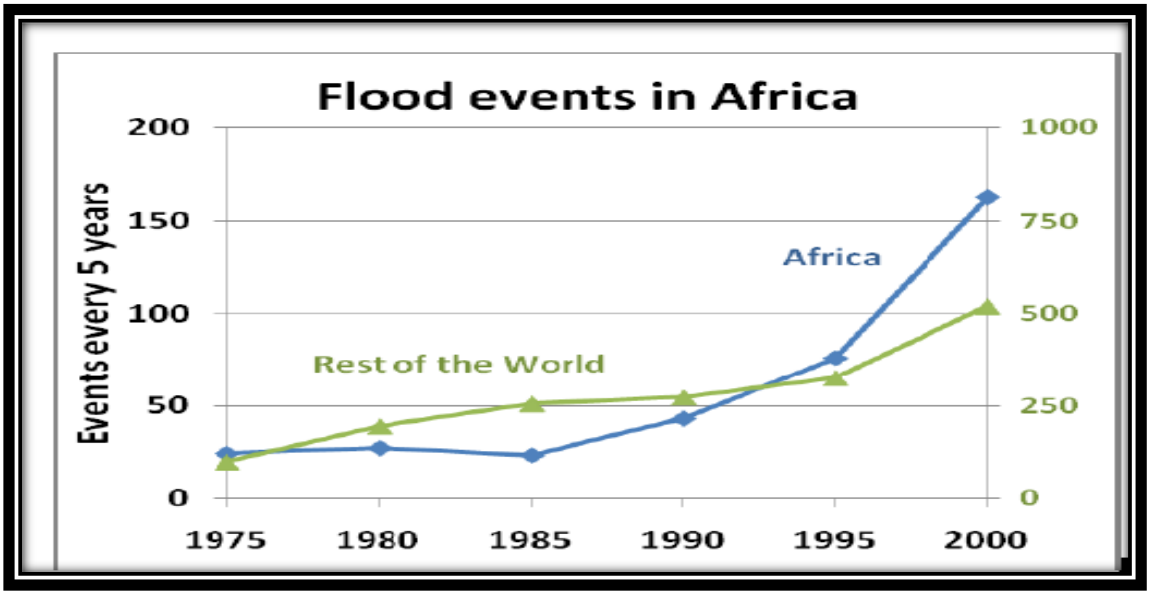

Figure 3: Reported Flood Events in Africa and the rest of the World
Source: Extracted from Jha et al, 2011, Urban Flood Risk Management Handbook, East Asia Consultations, Jakarta, May 25-26, 2011

Notwithstanding the startling trends shown in Figure 3, the heavy flood events in Africa have remained largely unnoticed and understudied for lack of data and have been downplayed in global policy debates (Tarhule, 2005). This is despite the enormity of the problem and the low adaptive capacities of victims. Two key factors make the African case critical. First, the continent has been cited as the most urbanising region of the globe with an average population growth of 4.4% against a global average of 2.5% (Douglas et al., 2008, p. 188, UN Habitat, 2011) and second, it has been identified as the region most vulnerable to climate change and variability (IPCC, 2012). In addition, lack of preparedness, low adaptive capacities, increasing population densities, urban poverty, and growth of slums and conflicts increase the vulnerabilities of African Cities (Adelekan, 2010).

Cases of urban flooding in African cities mentioned and discussed in literature reveal devastating impacts. In the north of Africa, over 8,800 lives were lost between 1927 and 1995 in Algeria, Tunisia, Egypt and Morocco (Jha et al, 2011b, p. 61) due to urban flooding. Similar events were also recorded in the southern part of the continent between 2000 and 2009. Heavy flood events resulting from extreme precipitation caused 1,148 lives, rendered 500,000 people homeless and jobless, and destroyed 150,250 homes and many assets estimated at US$ 715 million in Mozambique, Zimbabwe, South Africa, Zambia and Namibia (Jha et al., 2011b, p.12 & 61)

In eastern Africa between 2002 and 2006, over 210 died and thousands were made homeless. Countries most affected were Rwanda, Kenya, Burundi, Tanzania and Uganda (Douglas et al., 2008, p.190) and Ethiopia (UN Habitat, 2007). Other devastating floods in the sub-region happened in Ethiopia (2005 & 2007), Kenya (2003, 2006 &2008) and Uganda (2004 & 2007)

The West African sub-region has had the worst urban flood events on the continent. Flood events in 1982, 1991, 1995, 1998, and 1999 affected more than 500,000 people in each case (GFDRR, 2011b). In 2010 alone, over 1.7m people were affected by flooding with 52,000 cholera cases recorded in its wake (GFDRR, 2011a). Countries severely affected include Togo (200,000 people), Benin (680, 000 affected), Nigeria (300,000 people affected), Burkina Faso (133,000 people affected) and Ghana (141,000 people affected).
Even the “Sahel sub-region” in central Africa, usually associated with desertification, has experienced flooding (Tschakert et al., 2010) with major flood events occurring in Mali (2002, 2003, 2007), Niger (2003, 2007, 2008), Chad (2001, 2007, 2008), and Sudan (2003, 2006, 2007), It can therefore be argued that over the last decade, more countries in Africa have experienced urban flooding than any other continent (See Figure 3).

KEY ISSUES ASSOCIATED WITH FLOODING IN URBAN AFRICA

Trends of Exposure, Vulnerability and Urban Poverty

Douglas et al. (2008, pp.193-194) assert that the intensity of these events is increasing with time. In addition, with rapidly increasing urban populations, especially in slum communities, increasing flood disasters in African cities will impact negatively on urban poor in particular and urban development in general. In most cities, large-scale urbanization and population increases have led to large numbers of people, especially the poor, settling and living on

flood plains in and around urban areas exposing them to severe flood events (Adelekan, 2010).

The Role of Rapid Urbanization and Climate Change and/or Variability

The role of Africa's urbanization and climate variability and changes in urban flooding has been debated internationally over the past three decades with no particular resolution identified. However the last decade has seen some efforts towards raising the profile of debates to get the necessary global attention (UN Habitat, 2011; IPCC, 2012). Predictions suggest that the climate in Africa will become more variable with more frequent and severe extreme weather events (IPCC, 2012). The Special Report on Extremes (SREX) of the Intergovernmental Panel on Climate Change suggests that while December, January and February rainfalls will increase in eastern equatorial Africa, June, July and August rainfalls will decrease markedly in both northern and southern Africa (IPCC, 2012, p. 122 & 123). Rapid urbanization coupled with high population densities on the other hand will increase the risk of major flood disasters by restricting the natural flow and infiltration of flood waters (ActionAid International, 2006).

The Role of Government and Other Stakeholders

Literature reviewed shows that most African governments have national disaster and emergency policies that include urban flooding (Douglas et al.,2008, GFDRR, 2011a) but have been overwhelmed by rapid urbanization, limited investment in storm water management infrastructure, unsustainable urban land management and high climate variability and changing patterns (GFDRR, 2011b). These weaken the countries' ability to implement such disaster risk management plans. Again, urban flood management does not appear to have any special treatment. Urban flood victims are therefore left to their fate to adopt and use a wide range of unsustainable adaptation mechanisms (Adelekan, 2010, p. 446-447).

Current Adaptation Mechanisms for Local Communities

Adaptations to urban flood risks and events have been mainly individual or household-based with very rare communal actions (Douglas et al., 2008, p. 197-198). Urban dwellers in Africa deal with flood events in a variety of ad hoc ways. These include:

- Creating high places in their homes using blocks, furniture, stones on which they put valuable items (ActionAid International, 2006, Douglas et. al., 2008)
- Temporarily vacating their residence to join family and friends in other "safer" locations within the affected cities and/or constructing temporary shelters (Adelekan, 2010);
- Moving to central and/or public places such as churches, mosques, chief's palace and other such locations deemed safe (Douglas et al., 2008); and
- Construction of barriers to prevent ingress of flood water into their houses (Adelekan, 2010).

Three clear worrying issues emerge from the above approaches. First of these is that the uncoordinated nature of the approaches lead to very little success. Second, there is very little approval and therefore involvement of government agencies; and third, these victims return to their original locations after the flood events, without any plans of relocating to safer places. Efforts by local government institutions and community based non-governmental organizations appear to be inadequate or late - if occurring at all.

FLOODING IN THE CONTEXT OF GHANA

Ghana ranks high amongst African countries most exposed to risks from multiple weather-related hazards. The country is exposed to floods particularly in the northern savannah and the coastal belt (Tschakert et al., 2010)(See Figure 4). Common causes of flooding are intense rainfall run-off, dam-burst and tidal surges (Karley, 2009, p.26). Areas prone to flooding include: the Accra plains along the coast; Pra River and Ankobra River basins in the Western Region; White Volta basin in the Northern region; Black Volta basin in the Upper West Region; and Afram basin in the Eastern and Ashanti regions (Karley, 2009).

The eastern coast of the country is exposed to risks of landslides and coastal hazards such as storm surges and coastal erosion (Appeaning Addo et al., 2011) Seismic hazards are most pronounced in areas around Accra, the capital. Between 1990 and 2008 Ghana experienced six major floods with devastating results in 1991 (2 million people affected), 1995 (700, 000), 1999 (325, 000), 2001 (144, 000), 2007 (325, 000), and 2008 (58, 000) (Karley, 2009, Rain et al., 2011). These floods events revealed weaknesses in the disaster preparedness and emergency response system, and exposed vulnerabilities of people, land use and infrastructure systems.

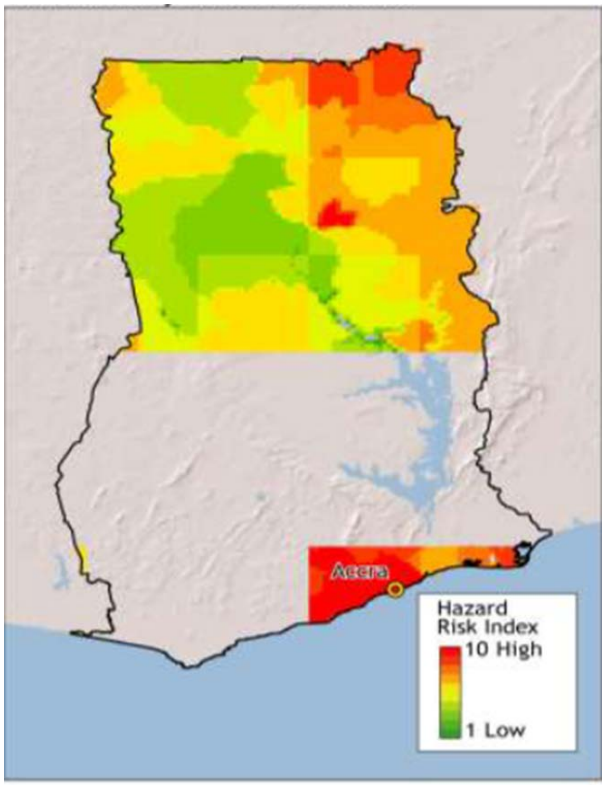

Figure 4: Flood Mortality Risk and Distribution
Source: GFDRR, 2011a, p. 6

URBAN FLOODING IN ACCRA - A CASE STUDY

Accra in Context

Accra, the capital of Ghana, is a coastal city of West Africa along the Gulf of Guinea with an estimated population of about 3 million (Rain et al., 2011, Ghana Statistical Service, 2012).

It is a rapidly expanding city with an annual population growth rate of 4.3 per cent between 1984 and 2000; and about 4 per cent between 2000 and 2010 (Ghana Statistical Service, 2012). With this population growth trend, Accra has been described as one of the most populated and fastest growing metropolis in Africa (UN Habitat, 2007). The metropolis is approximately 300km^2 (Grant and Yankson, 2003) and lies between longitude 0˚ 1" W and 0˚ 15" E and latitudes 5˚ 30" N and 5˚ 50" N respectively (Nyarko, 2002). Accra is characterised by lowlands and occasional hills with an average topography of between 20 and 70 meters above mean sea level (Nyarko, 2002, p. 3). Figure 5 shows the continental and national contexts of the Accra Metropolitan Area (AMA), the study area.

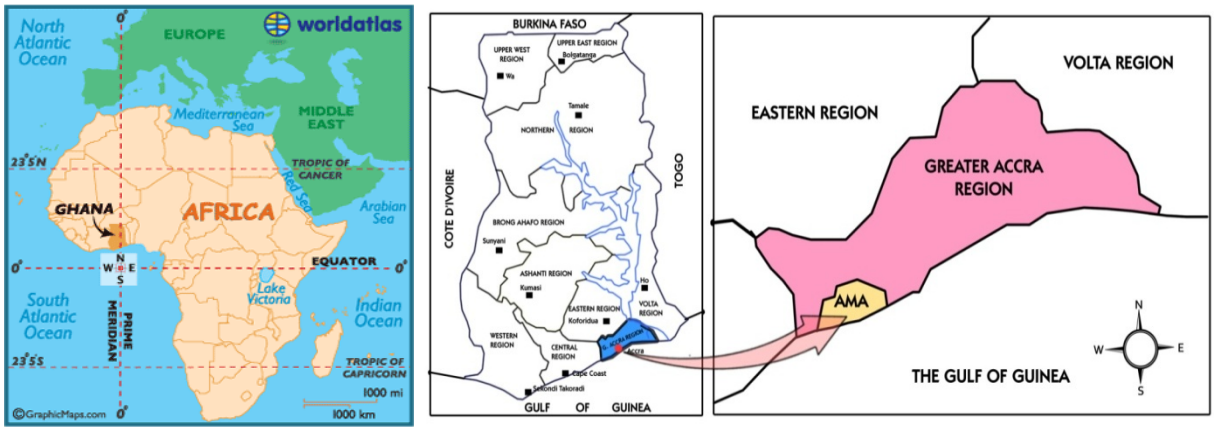

Figure 5: Africa and Ghana contexts of Study Area.
Source: World Atlas.com and Arkoful, 2008.

As a tropical equatorial city, Accra is mainly affected by two major climatic processes namely; fluctuations of El Niño Southern Oscillation (ENSO) and the Inter-Tropical Convergence Zone (ITCZ) or the West Africa monsoon (GFDRR, 2011a). The ENSO brings warmer and drier than average conditions in the city between December and March while the ITCZ is responsible for rainfall patterns as it oscillates north-south between the north-eastern and south-western prevailing winds. The city's climate is characterised by two rainfall maxima in a year. The major rainy season occurs between May and July with the peak occurring in June while the minor one occurs between September and October with the peak occurring in October.

The Problem of Urban Flooding and Causes

Urban flooding has been a major issue in Accra since the early 1930s (Karley, 2009) with significant flood disasters having been recorded in 1973, 1986, 1995, 1999, 2001, 2002, 2010 and 2011 (Rain et al., 2011). These events have mainly occurred between the months of May-June, and October in all the reported years. Many drivers have been attributed to these events. Key attributions of flooding in Accra mentioned in literature include:

- The overflow of Odaw River out of its natural valley and catchment (Rain et al, 2011, Arkoful, 2008);
- Massive and uncontrolled growth of Accra and poor drainage systems (Afeku, 2005, Karley, 2009 and Rain et al, 2011);
- Prevention of natural infiltration by impervious surface (Yeboah, 2003, Afeku, 2005); and
- Rain et al. (2011) and Appeaning Addo et al. (2011) have suggested the possible role of climate variability and change in Accra's flooding.

EMERGING ISSUES IN URBAN FLOODING IN ACCRA

Nature and Extent of Urban Flooding in Accra

Urban flooding in Accra is a perennial occurrence with an estimate of more than 172,000 slum residents at risk per year for the next 10 years (Rain et al., 2011, p. 13). A World Bank report also predicts that about 400 km^2 and 137,000 people in Ghana are at risk from storm surges and coastal inundation and 70% of these are likely to be urban poor residents in Accra (Rain et al., 2011).This proportion keeps increasing with rapid rural-urban migration. For instance in June 2001, Karley (2009, p. 27) reports that torrential rainfall that caused flooding in Accra left 11 people dead and over 100,000 others homeless. The last major flood event that occurred in October 2011 affected 43,000 people, killed 14 people and displaced 17,000 others in a day (UNEP/OCHA, 2009, p. 9). After the incident 100 cases of cholera were reported. It is clear that the gravity of the situation has overwhelmed both city and national authorities in the past and flood frequency now appears to be increasing.

Urban Growth and Flooding in Accra

Accra accommodates 25 % of Ghana's Urban Population (Otoo et al., 2006, p.2). With urban population growth of 4 - 4.3 per cent and doubling time of 16-17 years (Ghana Statistical Service, 2012), the city has grown rapidly, with slums developing along major river banks (Afeku 2005, Karley, 2009). Average population density has increased from 6.32 persons/ha at independence to over 76 persons/ha (Grant and Yankson, 2003) along with an increase of 6.6 per cent per annum in the built-up area since 1985. This has resulted in a 35% increase in the physical expanse of Accra between 1985 and 2005 (Grant and Yankson, 2003, Otoo et al., 2006). The effect of this growth is a drastic reduction in the city's vegetation cover. According to Weeks et al. (2012), 80% of Accra's total land area has lost over 50% of vegetation cover. Yeboah (2003) and Afeku (2005) have thus associated Accra's flooding with this rapid and uncontrolled urban growth.

Perspectives on Climate Variability and Change

Projections by the GFDRR (2011a) and IPCC (2012) for Ghana and West Africa indicate that the proportion of total annual rainfall that falls in 'heavy' events tends toward increases, suggesting that the wet seasons are projected to get wetter. Again, projected changes in 1 and 5-day rainfall maxima tend toward increases, but projections vary a great deal. Sea level rise is also projected at 5.8 cm, 16.5 cm and 34.5 cm by 2020, 2050, and 2080, respectively. Already affected by coastal erosion, especially along the eastern coastline, the coastal regions of Ghana are likely to be affected by further sea level rise and storm surges by the end of this century (Meehl et al., 2007).

For the city of Accra, rainfall events have gradually increased since1986 (See Figure 6). In addition, the rate of increase in mean annual rainfall has been faster than the average number of rainy days per year. This is an indication of a general increased intensity of precipitation events per rainy day over the years. A sea level rise of 6mm/year has been predicted for the next century over a historical value of 2mm/year (Appeaning Addo et al., 2011, p. 2046), with a mean erosion of 1.13m/year (+/- 0.17m/yr). Appeaning Addo et al (2011) predict that over 926 houses, some 650,000 people and about a square kilometre of land in selected coastal communities are at risk of inundation by the end of 21st century, an indication of Accra's vulnerability to the impacts of predicted climate change and variability.

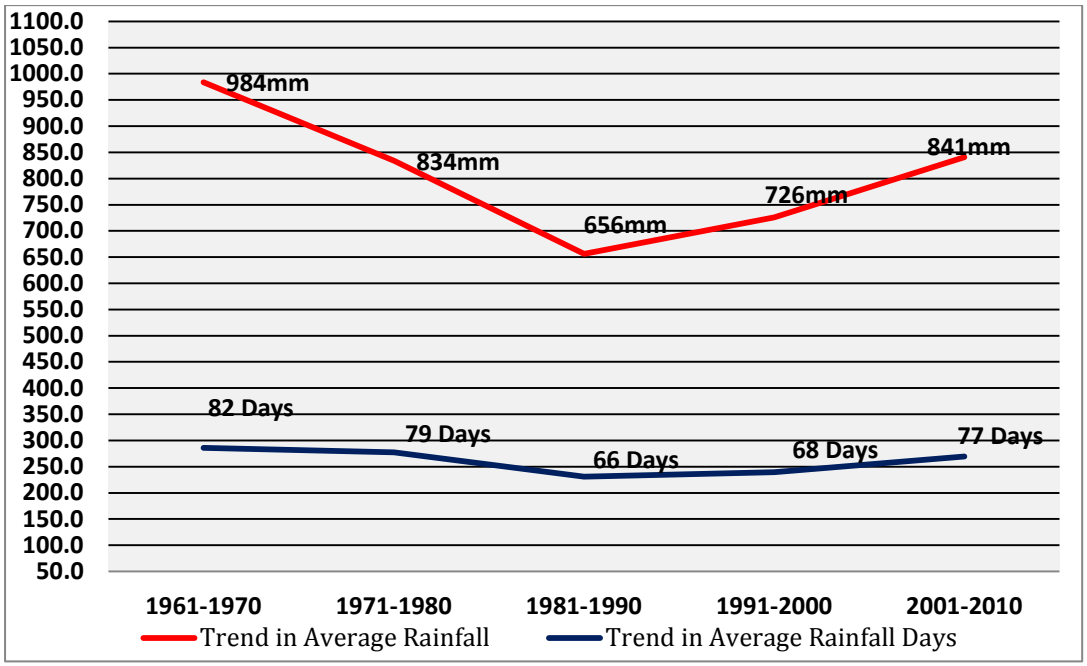

Figure 6: Changes in Mean Annual Rainfall per Decade for Accra 1961-2010
Source : Calculated from Ghana Meteorological Agency's Data, August 2012

Changes in Urban Hydrology

The rapid growth of Accra has adverse implications for the fragile equilibrium between urbanisation and water systems in the city. More communities are becoming flood-prone with increasing population, floodplain encroachment, and corresponding pollution of the water environment (Odai, 2009, p.45). Coupled with urbanization and encroachment are the perennial overflow of rivers draining the city (Arkorful, 2008) and poor physical planning and flaws in the drainage network (Karley, 2009; Rain et al, 2011) preventing the natural flow of storm water (Afeku, 2005, p. 36 & 37). With increased urbanisation in Accra, runoff coefficients and peak discharge of the various rivers in the city have been high.

Media Coverage, Public Sensitisation and Education

The main outlet for urban flood information in Accra has been local electronic and print media (Ahadzie & Proverbs, 2011). About 167 cases of flooding in Accra have been reported in Ghanaian newspapers since 1995. Content analysis of these newspaper reports on urban flooding show that over 71% of newspaper reports and articles covered non-scientific speculation of causes and effects of flooding and supply of relief items (Ahadzie and Proverbs, 2011). The rest of the issues covered include public sensitisation and education (7%), predictions (3%), rescue activities (3%), review of consultancy or research reports (1%) and calls to discuss the issue of flooding (less than 1%). This is an indication of poor public education and sensitisation on the key issues of urban flooding which is supposed to be the foundation of any meaningful flood risk management and adaptation.

Impacts and Cost of Damage

The cost of flood impacts in the city of Accra now runs into several millions of dollars. Between 1955 and 1997 property worth over US$30 million was destroyed, 100 lives lost and 10,000 people were rendered permanently homeless (Gyau-Boakye, 1997). The

National Disaster Management Organisation of Ghana (NADMO) (2009) estimated the cost of managing flood damage to have increased from US$ 2 million to US$ 4million per major flood event over the last decade. The total value of assets at risk from flooding in Accra now exceeds US$ 6 million per year (Karley, 2009). This has been increasing from the US$500,000 recorded in 2007 by the Ghana National Disaster Management Organisation (NADMO, 2009). In 2008 it was estimated that flooding in July and August caused more than US$1 million worth of damage in the city. This shows an approximately 100 per cent increase in the cost of damage from flooding per year. Apart from these monetary costs of urban flooding, devastation in terms of homelessness, spread of diseases and emotional trauma continue in communities for months and sometimes years (Karley, 2009, p.37).

MOVING FORWARD, THE BASIS FOR INTERVENTION

The foregoing has revealed critical issues and gaps in the management of urban flood disasters in African cities and particularly in Accra. It is clear that urban flooding has now become almost a perennial phenomenon, causing disasters on increasing scales and severity. The challenge is enormous and appears to have overwhelmed all stakeholders, especially city authorities. Coupled with this is the conspicuous lack of an integrated urban flood risk management model (Ahadzie and Proverbs, 2011) that takes into consideration the rapid urbanisation of the city and its susceptibility to climate variability and change. As a result, a proactive and coordinated flood risk management system is considered very prudent and urgent in building flood resilient cities.

It goes without saying that an integrated flood risk management approach will be an important step towards building resilience against the perennial urban flooding in Accra. Such an initiative must take into consideration the causes and early warning systems, types of flood events, impact areas, characteristics of victims, evacuation and humanitarian procedures and local involvement in reducing exposure and vulnerability to flood events. In addition flood risk management requires some legal and regulatory, institutional and structural changes in urban governance and land use planning. It must also be noted that managing urban flood risk is a dynamic process and must respond to changes in space and time. This also requires the principle of participatory engagement and coordination of local, regional and national action at appropriate scale. An implementation, monitoring and evaluation framework is a fundamental prerequisite at every stage of any effective flood risk management process.

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