

Managing Flood in Ilorin, Nigeria: Structural and Non Structural Measures

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ABSTRACT--- *Flooding in Ilorin city has become a yearly occurrence. Increasing population which results in competition for space and more generation of wastes, improper drainage design and insufficient drainage systems, paving of surfaces, refuse dumping in drainages and water ways are amongst the causes of flooding in the city. Flooding in Ilorin comes with damages to properties and infrastructures sometimes worth millions of dollars, displacement of people, loss of sources of income, disruption of ecological habitats and sometimes loss of lives. The most affected people are those residing on the flood plains of the Asa River which drains most of the runoffs from the city. In an effort to combat the flood menace around the river, the Federal government of Nigeria has implemented the construction of flood prevention structure on the river banks. This effort should be combined with non structural measures as some of these structures further cause damages downstream.*

Keywords--- Flooding, Impact, Ilorin, River, Management

1. INTRODUCTION

Among direct natural disasters, floods take the largest number of human lives and cause the most property damage (Cunningham and Cunningham, 2012). There has been an increase in the rate at which flooding is experienced today in most parts of the world. This has been attributed to climate change which has increased the rate at which precipitation is received in some parts of the world and reduced it elsewhere. Urban area flooding is not just related to heavy rainfall and extreme climatic events; it is also related to changes in the built-up areas themselves (Douglas et al. 2008). Today, rapid increase in human population especially in the urban areas has induced indiscriminate paving of surfaces which reduces the rate at which rainwater infiltrates the ground thereby increasing runoffs. The modes of waste disposal in urban areas are very poor in most developing nations including Nigeria. Due to illiteracy, a good percentage of the populace disposes off their refuse in drainages and waterways thereby blocking them or reducing their capacity. Erecting of structures on flood plains are common in urban areas due to competition for space, available water for agricultural purposes and several other reasons. These among others are the causes of flooding in these areas.

According to Folorunsho and Awosika (2001), Ologunorisa (2004), flooding in Nigeria occurs as coastal, river and urban flooding. This study only considers the urban and river flooding types as the study area is inland. Unlike in developed countries where advanced technology and massive capital investments has helped in mitigating the flood threats to human lives, the situation in the developing countries remains a problem due to poverty and lack of technological knowhow on flood management (Ologunorisa and Adeyemo, 2005).

There is almost no year that havoc is not wrecked by flooding in Ilorin. The affected communities are always those found on lower elevations and those that had built on floodplains. With increased storm frequency resulting from climate change and continuous increase in population of the city, there is an urgent need for putting in place improved drainage systems and proper river management, better planning and reviewing laws guiding erecting of structures and refuse disposal.

Ilorin, North Central Nigeria has been studied to determine the causes and impacts of flooding and to evaluate ways of reducing its impacts on the residents of the city. The study combines physical observations within the city especially

areas that are more susceptible to flooding and direct questioning of the settlements that are always affected and government agencies.

2. AREA OF STUDY

The area of study is Ilorin, located on latitude $8^{\circ} 24'N$ and $8^{\circ} 36'N$ and longitude $4^{\circ} 10'E$ and $4^{\circ} 36'E$ of Nigeria (figure 1). Being a state capital and a commercial area, Ilorin has experienced a rapid increase in population over the years. The population of Ilorin today stands at around 1.5 million as against the population of 532,089 in the year 1991 (populationmatters.org). The climate of Ilorin comprises of the dry and wet seasons with the wet season starting around May and lasting for about four to five months. There is variability both temporally and spatially in the rainfall of Ilorin (Ajadi, 1996). Olaniran (2002), has reported the total annual rainfall of the area to be about 1200mm. The relative humidity of the city is 65% in the dry season and between 75 to 80% in the wet season according to Tinuoye (1990). The mean monthly temperature of the area varies from $25^{\circ}C$ to $28.9^{\circ}C$ (Ajadi et al. 2011).

3. METHODOLOGY

The method employed for this study was physical observation of the study area and direct interviews with communities that are always affected by the flooding and government agencies. The survey of Ilorin city most especially the areas that are more susceptible to flooding were carried out. The survey of flood plains of existing rivers and drainages were carried out to check their present conditions. Information was gathered from the State Town Planning Development Authority and the State Ministry of Environment through conducted interviews. Random interviews were also conducted with residents of the areas that are mostly affected by flooding in the city. Based on these information and the observations carried out, the following were arrived at as the causes of flooding in the city.

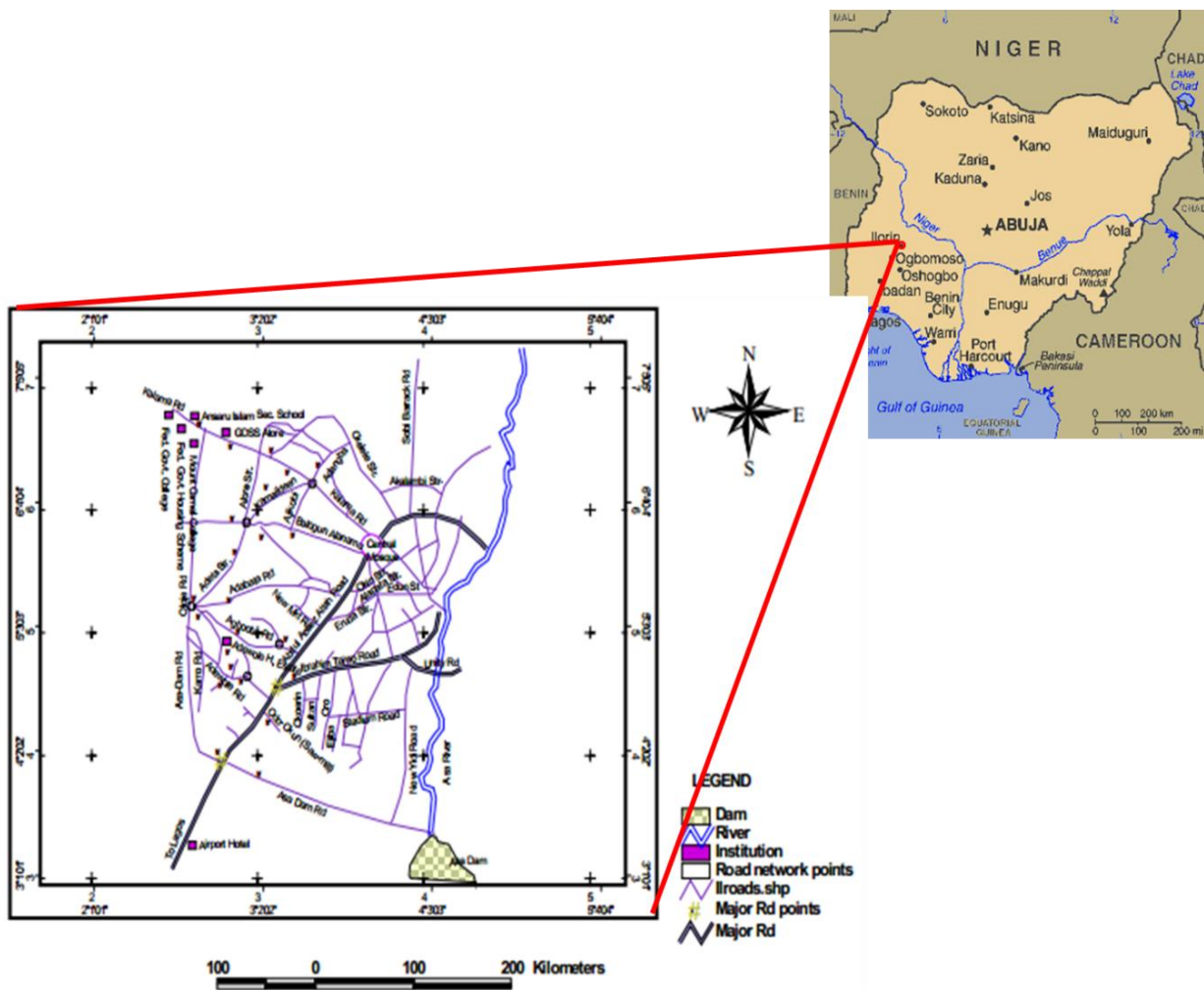


Figure 1: Map of study area (adapted from Ajadi et al. 2011) and its location on Nigerian map.

3.1 Causes of flooding

Kwara State Ministry of Environment

- Building on flood plains (Figures 2a and 2b).
- Dumping of refuse in drainages and rivers (Figure 3).
- Farming on flood plains, which causes siltation.

Kwara State Town Planning Development Authority

- Building on flood plains.
- Improper land use.
- Dumping of refuse in water ways.

Individuals/Groups

- Building on flood plains.
- Dumping of refuse in drainages.

Surveys carried out have shown the causes of flooding to also include:

- Inadequate management of rivers leading to increased sedimentation and growth of vegetation within their channels thereby reducing their capacity making them overflow their banks (Figures 4a and 4b).
- Increase in runoffs due to increase in paved areas resulting from increased urbanization.
- Lack of or improper design of storm water drainages.
- Improper maintenance of existing drainages.
- Non abiding by rules and regulations governing waste disposal.
- Improper waste management.



Figure 2a: Houses on flood plain before rainfall.



Figure 2b: Houses on flood plain after rainfall.

3.2 Impacts of Flooding

“Flooding does not occur every year on every river, but flooding is a natural process on all rivers” (Plummer et al. 1999). The case of flooding in Ilorin is yearly on varying scales (Kwara State Ministry of Environment). Those residing on the plains of the Asa River which is the main drain for all the rainfall within the city (Kwara State Ministry of Environment) are the most affected.



Figure 3: Refuse dumped in Asa river channel at Maraba, Ilorin.



Figure 4a: Vegetation growth in the river channel of Asa River at Unity road, Ilorin (before rainfall).



Figure 4b: River channel capacity reduced at Unity road due to sedimentation and vegetation (after rainfall).

The impacts of flooding on the flooded areas of Ilorin are:

- Invading of houses by high waters (Fig. 2b) rendering several temporarily homeless.
- Flooding of agricultural fields, resulting in loss of agricultural products.
- Streets become in conducive to drive or move in.
- Lives are sometimes lost.
- Houses on flood plains are undercut by rivers and lost during flood erosions.
- Social infrastructures such as water wells are contaminated and electricity supplies cut.
- Ecological habitats of organisms are also affected and source of livelihoods such as for fisher men are distorted.

3.3 Mitigating the Impacts of Flooding

Flooding is an inevitable event, but the extent to which communities are affected hangs on their preparedness and planning. In many developing countries especially in Africa according to Olowu (2010), the weakness of state infrastructures, absence of appropriate legal and policy frameworks and sometimes inadequate resources particularly render them more vulnerable to the gory consequences of large-scale disasters.

Most of the problems arising from flooding in Ilorin had its origin from improper planning starting several decades ago. The weakness of institutions in carrying out their duties has left the city poorly planned. For example, how are people allowed to build on flood plains in the first place? Who were and where were the people that approved the plans and citing of these houses at these locations? There is an urgent need to put in place laws or review of laws governing land use by the government. A consideration of relocating people away from the flood plains though capital intensive is an option that would pay off at the long run.

Another issue is that of refuse disposal. There are inadequate facilities for waste disposal and management in the city which is why refuse are being dumped in drainages or in water ways. An improvement on refuse disposal and management as well as sensitization of the public will inadvertently save the drainages and water ways of blockages and of course help mitigate flooding.

Proper river management e.g. through dredging and reducing sedimentation and vegetation growth would help retain the water within the river channels.

Building of levees, floodwalls and dredging are used in controlling flooding. This is one of the efforts (figure 5) of the federal government in combating flooding along the Asa River in the city. It should however be noted that such structures can transfer the problem downstream and simply exacerbating floods there (Cunningham and Cunningham, 2012). The disastrous floods along the Missouri and Mississippi Rivers and their tributaries north of Cairo, Illinois in 1993 are examples of flood control failures (Plummer et al. 1999).

Rain water harvesting from roofs of houses especially where infiltration rate is low due to paving will ensure reduced runoff thereby reducing the risk of flooding. The harvested water can be used in recharging the aquifers where the water tables are declining.

Proper records of water elevation and river and stream discharges should be taken and kept for future uses in prediction of flood size and frequency. This will allow the time for evacuation of people and will reduce the risk of loss of lives and property damage.



Figure 5: Construction of flood prevention structure along Asa River at Maraba.

4. CONCLUSIONS

The problem of flooding in Ilorin has originated from improper planning. Mistakes have been made on improper land use plan most especially. The flooding problems are however manageable with great commitment from both the government at all levels and the residents. Some of the efforts in solving the problems can be swiftly implemented but others such as

relocating of people away from flood plains have to be gradual due to huge capital requirement. There is need for more orientation of people about flooding and the risks associated with it as people seem to be less educated about it.

Since the flooding in Ilorin has become yearly, all possible approaches in finding a lasting solution to the problem should be assessed and if beneficial should be implemented.

5. RECOMMENDATIONS

Based on the findings from this study, we recommend the following:

- Adoption of a combination of structural and non structural controls of flooding.
- Improvement on waste disposal and management by provision of more waste disposal facilities and presence at all locations.
- Improvement on studies on flooding and environment through funding of researches in the areas.
- Improves land use planning.
- Rain water harvesting from roof tops for injection into declining groundwater tables or channeling it away from flood susceptible areas.

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7. REFERENCES

- Ajadi, B.S., Pattern of Water Supply in Ilorin City, Nigeria. An Unpublished B.Sc Dissertation, Department of Geography, University of Ilorin. In: Ajadi, B.S., Adedapo, A. and Tunde, A.M. (2011) Impact of Climate on Urban Agriculture: Case Study of Ilorin City, Nigeria. *Global Journal of Human Social Science*. Vol. 11 Issue 1, 1996.
- Ajadi, B.S., Adedapo, A. and Tunde, A.M., Impact of Climate on Urban Agriculture: Case Study of Ilorin City, Nigeria. *Global Journal of Human Social Science*. Vol. 11 Issue 1, 2011
- Cunningham, W.P. and Cunningham, M.A., *Environmental Science: A Global Concern*. McGraw – Hill, New York, 2012.
- Douglas, I., Alam, K., Maghenda, M., McDonnell, Y., Mclean, L. and Campbell, J., Unjust waters: climate change, flooding and the urban poor in Africa. *Environment and Urbanization* 2008 20: 187, 2008.
- Folorunsho, R. and Awosika, L.F., Flood Mitigation in Lagos, Nigeria through Wise Management of Solid Waste: a case of Ikoyi and Victoria Islands, Nigeria. Paper presented at the UNESCO – CSI Workshop Maputo 19 – 23, November, 2001. In Olajuyigbe, A. E., Rotowa, O.O. and Durojaye, E., *An Assessment of Flood Hazard in Nigeria: The Case of Mile 12, Lagos*. *Mediterranean Journal of Social Sciences*. Vol. 3 (2), 2012.
- Ologunorisa, E.T., An Assessment of Flood Vulnerability Zones in the Niger Delta, Nigeria. *International Journal of Environmental Studies*, U.K, 61 (1), 2004. In Olajuyigbe, A. E., Rotowa, O.O. and Durojaye, E., *An Assessment of Flood Hazard in Nigeria: The Case of Mile 12, Lagos*. *Mediterranean Journal of Social Sciences*. Vol. 3 (2), 2012.
- Ologunorisa, T.E. and Adeyemo, A., Public Perception of Flood Hazard in the Niger Delta, Nigeria. *The Environmentalist*, 25, 39 – 45, 2005.
- Olajuyigbe, A. E., Rotowa, O.O. and Durojaye, E., *An Assessment of Flood Hazard in Nigeria: The Case of Mile 12, Lagos*. *Mediterranean Journal of Social Sciences*. Vol. 3 (2), 2012.
- Olaniran, “Rainfall Anomalies in Nigeria: The contemporary understanding” 55th inaugural lecture, university press, Ilorin. 66pp, 2002. In Ajadi, B.S., Adedapo, A. and Tunde, A.M., *Impact of Climate on Urban Agriculture: Case Study of Ilorin City, Nigeria*. *Global Journal of Human Social Science*. Vol. 11 Issue 1, 2011.
- Olowu, D., The Hyogo Framework for Action and its Implications for Disaster Management and Education in Africa. *JAMBA: Journal of Disaster Risk Studies*, 3(1):303-320, 2010. In Adedeji, O.H., Odufuwa, B.O., and Adebayo, O.H., *Building Capabilities for Flood Disaster and Hazard Preparedness and Risk Reduction in Nigeria: Need for Spatial Planning and Land Management*, 2012.
- Plummer, C., McGary, D., and Carlson, D., *Physical Geology*. McGraw – Hill, New York, 1999.

- Tinuoye A., “Climatic Condition in Dry and Wet Years at Ilorin” Unpublished B.Sc. Project Work, University of Ilorin, 1990. In Ajadi, B.S., Adedapo, A. and Tunde, A.M., Impact of Climate on Urban Agriculture: Case Study of Ilorin City, Nigeria. Global Journal of Human Social Science. Vol. 11 Issue 1, 2011.
- www.populationmatters.org (Accessed on 07/08/2015)