Impact of Flood Danger in Built-Up Areas in Nigeria and Floor Management Systems for Espousal

Igibah, Ehizemhen. C; Sadiq, Abubakar. A.
Department of Civil Engineering, university of Abuja, F.C.T Abuja, Nigeria.
*Corresponding author: igibahchrist1@gmail.com, lightjesuniyi@yahoo.com +234 7052275257

Abstract- Tendency of flood danger happening often and size in built up areas in Nigeria, caused man to take steps of providing flood mitigation as remedy against flooding. Diverse flood danger regulation standard was implemented in various region of the universe yet flood occurrence perseveres. This paper appraises key sources of floor hazard in cities along with different floor risk regulation standard in order to develop acceptable floor danger mitigation standard for built up areas. Pertinent information for analyzing the component of flood risk and tendency in flood danger mitigation standard were obtained through corresponding empirical learning and theories. The outcome shows the incapability of non-structural as well as structural standard to totally terminate flood happenings. Flood hazard in cities can sustainably minimize by consolidating present measures together with partial logical transformation of land operation to its natural position.

1. Introduction

Flood danger is one among destructive natural hazards that leads to environmental and resources deteriorating, waste of lives and harm to goods (Forton, 2011). Above 3,000 floods tragic happened in a range of twenty years i.e. 1990 – 2010 which liable for 200,000 lives loss and three billion mankind were vagrant across the globe (Smith, 2013). Nearly 200 million human beings averagely in over ninety nations are revealed to ruinous flood incident yearly and it assumed to increase subsequently due to climate change and stable demographic growth in addition to urbanization (UNESCO, 2008). World natural hazards key concern is the making of systems, scheme and strategies of the universal government at diverse levels to mitigate the flood events. Persistence occurrence of flood happenings apart from the undertaken standard shows the incapacity of flood regulation measures to sufficiently limit floods. A justifiable floor danger management needs flood danger evaluation to locate forces and factors that generate possible flood hazard. This article reviewed diverse empirical and theoretical literatures as a system for gathering fact concerning sources of floor danger in cities with the associate flood mitigation standard to locate a sound floor danger management standard for built up areas. Some literatures ascribe floor danger to change in climate (karley, 2009). Affirm that source of flooding in Ghana are enormous rainfall that produce prodigious run – off that causes floods. (crisis, 2009) attested that the flood occurrences frequently expanding cannot be separated from climate change. Different researchers insist that the flood happenings growth was not only assignable to the intense climate changes (Hooijer, 2004). In principle flood hazard is normally predict as the probability of risk (climate change) and the exposure of the elements at danger. Simple grasp of the three features that produce hazard given the vital details for factoring most floods correlated. Majority flood correlated aspects is the overall administration of flood danger simultaneously bestow substantially to the growth and wellbeing of mankind (WMO, 2009). Since floor danger means probability function of flood risk and the likely damage, most flood minimizing standards focus at lessen the probability of flooding and diminish the possible damage (Hooijer 2004). Hence options available to handle flood dangers involve structural (embankments, dyke and dams). For example (Sultana, 2007) avow that structural standards like embankments can proffer safety against innumerable kinds of flooding. Another view on flood mitigation highlights the unification of water resource and land-use administration, risk management and transform the floor danger Management (FDM) paradigm from protective to pro-active, from impromptu to integrated
flood management. Centers on handle and living with floods, balancing floods for sound development and near the decision – making procedure divergently by learning to handle danger and stay with the floods (WMO, 2009). Whether retort to flood danger capture structural or mixture of both structural and non-structural standards, public participation of communities at danger in decision formation is necessary for flood hazard management sustainability in built up areas. Beyond all the standards above the review uncover flood event and persevere frequency in cities areas and it became perceptible that absolute avert from flood danger is inexorable. The article also reveals that a slowly orderly land use transformation to its original state could sustainably lessen flood danger and flood frequency (Scilling, 2014).

2. Literature Review

2.1 Theoretical System for Flood Danger Ineluctable

There is no hesitation for an expansion of flood danger in diverse built up area and metropolis across the globe. Particularly river floods that account for nearly complete loss of lives and one – third of all economic diminution from natural risks globally (UNESCO, 2008). Between 1990 – 2010, range of twenty years floods are liable for 200,000 loss of lives and attacked 3 billion mankind by making them vagrant (Smith, 2013). Constant rising of flood events worldwide and the increasing flood danger make environmental scholar contemplate on what could be the potential standards against it. Innumerable diverse views exist explaining the key causes of flood danger and these are analyzed below and shown in Fig. 1.

![Fig 1: Benue flood August 2017 displacing over 250,000 people.](image)

2.1.1 The Climate Factors

Several findings were discovered from flood danger research works carried out in numerous built up areas concerning factors accountable for flood danger, catastrophic problems may place at the boundary of natural and social environment. Reality flood danger has been viewed theoretically as outcome of the climate change, the socio cultural environment and periodically jointly mixture of built environment along with climate. Certain environmental scientist insists that climate change together with universe warming is directly or indirectly expanding the quantity of ice melting as well as rain thus increasing run off vastness and later flooding. For example, flood catastrophic in Zimbabwe are correlated to two various circumstances: localized ponderous seasonal rainfall trigger river overfull and the cyclone induced floods prompt to constant and seasonal flood (Ghimbi, 2007). As claimed by (Karley, 2009) the enormous rainfall instigate tidal waves, run-off together with dam – burst and widen flooding was outcome of cyclone Eline 2000 across Southern Africa like Malawi, Botswana, South Africa and so on (Vaz, 2000). (Crisis, 2009) Affirmed that expanding flood occurrences frequency cannot be disparate from change in climate.
Nevertheless, floor risk along with its danger could not be reckon with as only factor answerable to flood hazard, consequently other factors are required to give requisite cognizance and illumination of the procedure.

2.1.2 The Socio – Cultural Factors

The second views assert that cultural events have meaningful impact on the operation of the physical natural environment with measures that only answerable to environment. Of all land utilization reforms that influence hydrology of a region substantially, urbanization is most energetic changes producer in peak flow features, water quality, hydrological utilities and total run off (Leopold, 1968). Expansion of mankind population in the built-up areas, encroachment and alteration of river structure flood plains are responsible for increasing destruction and danger sources from floods (al S. e., 2010). Runoff volume control mainly by infiltration features and affiliated to vegetation, land, soil type together with slope, then directly related to percentages of regions covers by roads, roofs and other water resistance surface at period of hydrograph expanding during storms (Leopold, 1968). Rising of impermeable surface like the consequence of expanding flood peaks throughout storm period and diminishing low flows betwixt storms (Leopold, 1968). For instance, abolition of vegetated land engulfs by substitute it with concrete surfaces in cities areas of rising water proof surfaces, trigger overland flow expansion and lessen infiltration, elude the natural storage along with weakened of the surface causing flooding and rapid run-off. Consequently, urbanization volume rising and surface runoff frequency through amendment of natural drainage structure and changing of run off to streams, concluding result is massive volume of runoff, releasing shorter space of time and possibly causing serious increase in floor peaks (Smith, 2013). For example, empirical studies reveal that climate is not momentous factors in the scrutinized floor destruction growth in Africa based on (al B. e., 2010) study on flood mortality in Africa. The procedure includes but not restrained to physical environment substandard planning, faulty waste management, insufficient drains for cities also flood plain regions profession (Hooijer, 2004). Scrutinize the effect of urbanization for thirty years on two sub-catchments of the Thames, revealing obvious flood occurrence expansion with growth escorted by diminished in storage. (Daniel, 2012) as well attest that the common notion of heavy rainfall as been the principal source of cities flood is disprove, but absence of infrastructure in built up area play a key role for flood hazard in Gombe region, Nigeria. This view theorized established on empirical research that the rising flood danger is not only have root in climate change but the expanding build-up environment influence how environment works as principal cause for flooding. Hence advance in flood studies integrate two factors for flood occurrence in the world.

2.1.3 Collaborate effect of climate and socio-cultural factors

(Pielke, 2000) contend that, there is a fragile relationship betwixt hydrological factor and the destructive floods, because the destructive floods happen from a collaborate impact of physical and societal procedures, and floods emerge from integration of meteorological and hydrological extremes (WMO and GWP 2008). The flood danger is expanding as a result of continued encroachment of mankind and properties as well as climate change in regions at risk of flooding outcome is increasing possible destruction. (Hooijer, 2004) and (Criss, 2015) Finalize that flood volume increases due to in- channel structures along with climatic change outcome. In line with the above views, flood danger can be grasping as a function of hazard, subjection and vulnerability (Hooijer, 2004). Climatic change could be seen as risk together with socio-cultural environment could be appraised as subjection to hazard and the helplessness people in the danger zone. However, in order to effectively comprehend the idea of flood dangers in the city, it is important to study various types of danger components surrounding flood administrative for existing of man in his environment setting. Thus, flood danger hazard can be signalized by climatic change leading to expectation and potency high river flows that result to influx in an area. Unsafe and exposure introduce dubiety of mankind and his values in flood waters domain together with population and valuables located in dangerous region. Hence, flood danger can be seen as a decussate integration of vulnerability, danger together with exposure and if any one among these three components rises or reduces, then danger expands or diminishes.
consequently. As such apprehension flood danger notion could be an effective standard for hazard minimizing.

### 2.1.4 SOME STATISTICS OF FLOOD OCCURRENCES IN NIGERIA

| S/N | Flood Location | Impact on the community | Period |
|-----|----------------|--------------------------|--------|
| 1   | North-east region Borno state Rann | Flood cut off roads and made helicopter landings difficult. Aid convoys by road to Rann, in Borno state which hosts 43,000 emigrant populaces, has become enormously tough. About 800 metric tons of food, nourishment, health, WASH and shelter supplies are awaiting delivery. Both logistics segment and WFP are exploring the possibilities of bringing in relief from Cameroon. | OCHA, 11 Aug 2017 |
| 2   | North -east region Borno state LGAs like Gwoza, Ngala, kaga balge, Dikwa, Damboa, and Bama | Flood has greatly lessened access to places that are in urgent severe need of sector and emergency shelter interventions attributable to privation of response capacities, security, access, land obtainability and logistics required to set up apposite sites. | IOM, UNHCR, CCCM Cluster, Shelter Cluster, 21 Aug 2017 |
| 3   | North central 21 LGAs in Benue state, Nigeria | Heavy rains on 4th September, 2017, have led to showy floods, discharges and river spilling over which affected 250,000 people in Benue State, Nigeria. Hundreds of houses besides crop fields destroyed. Both the State Government and the National Emergency Management Agency (NEMA) set up two camps in Makurdi, for populaces that have lost their homes. Also, the Nigerian Red Cross supplied food and non-consumable items to the displaced people while UNICEF increasing access to drinking water in the two camps as well carried out a rapid assessment which discovered these floods as the most severe since 2012. | OCHA, 6 Sep 2017 |
| 4   | Lagos State | There was a snarl-up on major roads, instigating people to annul or postpone appointments they might have had. Thousands of stranded travelers had to pay increased fees to the limited bus drivers who were agreeable to risk travelling on the roads. | On 2 July 2012 |
| 5   | Ibadan, Oyo State | Flooding caused some inhabitants at Eleyele, Challenge and Oke-Ayo to abscond from their residences so as to save their lives. Some Christians were prevented from attending churches in the morning because few bridges caved in. | Mid-July 2012 |
| 6   | Jos, Plateau State | No less than 39 people were exterminated due to flooding in the North- central Nigerian Plateau state. Heavy rainfall instigated the Lamingo dam to overflow which sweeping across a number of localities in Jos, and roughly 200 households were submerged. Besides, about 35 people were missing, when Manasie Phampe, the state head of the Red Cross, publicized that relief efforts were | Late July 2012 |
continuing. The floods left 3,000 populates destitute that are taking shelter in government buildings in Jos.

7 Delta and Bayelsa State
   About 120,000 people rendered homeless, according to state authorities and the Nigeria Red Cross. Several camps set up were also flooded forcing populates to flee. In Yenagoa, 3,000 people were taken shelter at the Ovom state Sports Complex. In Delta State, 20 health clinics, 5 hospitals, numerous schools, churches and government buildings were destroyed by flood. Schools were either closed or engaged by internally emigrant people.
   Early October, 2012

8 Kogi State
   Approximately 623,900 persons were being displaced and 152,575 hectares of farmland damaged. It is the worst flooding besides a national disaster according to a NEMA coordinator this prompt Nigerian President Goodluck Jonathan to released 17.6 billion naira (US$111 million) to many states and agencies for rehabilitation, mutilation response and flood relief.
   October, 2012

2.1.5 Viability models for flood danger management (FDM)

Hold the divergence betwixt the three components that generates hazard, vulnerability, danger together with exposure – confer the valuable information for factoring in almost all flood associated aspects in the entire management of flood dangers and instantaneously provide considerably progress and welfare of mankind (WMO, 2009). The models accessible for flood danger mitigation comprises of orthodox structural standards (embankments, dams, reservoirs, dyke) and unsegregated non-structural (planning of land, flood caution systems, expulsion, insurance and preparedness) alternatives; government, individual and agency. The first element is the risk and the structural model aim at especially the flood danger zone. The ancient structural flood hazard lessen policies is normally a fundamental on river education, embankment construction as well as reservoirs retention, targeted at minimizing flood risk, which means flooding expectation. For example, (Sultana, 2007) ascribed to structural policies such as (dam, dyke and slope) could afford protective measures against various kinds of flooding. Cities water management in nearly all advanced technological countries of America, China and Europe is been specified by wide margins of safety involves large infrastructure and technical amenities (Pielke, 2000). Recently flood regulation policies include flood-proofing standards like homesteads foundation, plinths upgrading, creating domestics environment for animals (livestock) in flood shelters (Sultana, 2007), the policy has been on protection and regulation rather than on administration.

Secondly, other models examined flood danger in a diverse angle by integrating exposure and unprotected features of the flood danger. Since, it is identified that structural flood regulation cannot provide solution to flood danger and risk challenges, because flood regulating standards have been usually organized in separation from other development. Thus, they are reactive instead of proactive, by concentrating on structural policies, and in search of solutions from mono-disciplines (Shresha, 2012). Also, to contend that flood regulation policies must be mixed with non-structural methods, like planning of land usage to generate extensive flood management (Smith, 2013). Subsequently the paradigm moves from post-disaster rejoinder and relief centric system to pre-disaster proactive readiness and mitigation centric system center on catastrophe as direct perturb and a general understanding of the notion of vulnerability as necessity for developing a major concept. Nevertheless, order and sustainability need transpose from the natural structural flood protection to more extensive Flood danger Management (FDM) system that encompass of retrieval, prevention, guarding, readiness and response. The most effective and sustainable minimizing flood dangers can be obtained through decreasing possible damage (vulnerability) in the region prone to flooding through land use adaptation together with spatial planning. For instance, in recent time, a
noticeable paradigm move in this aspect is flood plains design and hovering residents’ practices became more effective to cope with a highly unforeseeable surrounding in Netherlands (Wostl, 2005). More so 20,000 loss of lives in Indian East Coast in 1977 originated from principal storm, but after this calamity, an advance warning system was introduced when the same location was strike with selfsame flood enormity, in 1996 and 2005, the casualties’ number was 1000 (UNESCO, 2008). The principal aim of cities FDM is to reduce loss of lives and destruction of economic, by using natural resources for the welfare and benefit of the mankind.

The third prospective insisted that flood dangers tend to be grasp better by local community’s participation, on account of their nearness to the waterways acts as consistent to the risks they are uncovered to. Thus, readiness to be involved in the flood administrative planning is important (al c. e.). Perhaps flood danger takes structural, integrated, or non-structural standards; there still need of public participation techniques in making common resolution about flood danger sustainability. The objective is to provide mitigate flood danger measures which involves how to lessen vulnerability and resilience expansion and ability of local people that has been affected by the flood. Sound FDM system incorporate water resource, environmental and hazard administration, replacing flood mitigation regulation paradigm from defensive to pro-active, from extempore to integrated flood administration and concentrate on how to control and live with floods, stabilize floods for credible progress, and tackle the decision-making procedure in various ways by training on danger management and living with the floods. Because cities flooding is ineluctable as much as built up areas keep expanding together with the rising flood hazard across the globe.

3. Result and Discussion

Established on the prevailing literature three panoramas predict the elements accountable for flood danger in built up areas, climate change reckoned as one of the elements that generates flood risk. Secondly socio-cultural happenings like built up areas expansion seriously lessen infiltration potential and thereby producing more runoff and the next flood occurrence. In addition, propinquity of cities structures subject to flood zone ravage flood hazard in built up environment. Lastly combination of socio – cultural and climatic effects as the key point for cities flood occurrence. Thereby flood danger normally incorporate three components; unprotected, hazard and vulnerability. Climate is the main initiator of flood hazard and profession of mankind at floodplains and their socio-economic state expanding unprotected and vulnerability of flood danger. To effectively mitigate flood danger, apprehension of the three components is needful. Structural flood standards focus on hazard, while non-structural standards target unprotected and vulnerability components. And modern FDM prescribe a universal method of structural and non-structural standards with local people participation of elements at risk for effective and sound FDM in urban settings. A serious evaluation of the available flood danger standards, the reviews unveils that a slow systematic changing of cities land use to its original state could maintain flood danger reduction and flood persistence in city environment (Scilling, 2004).

4. Conclusion

Nigeria has a showery season as well suffers from periodic flash overflows, these flash overflows are sometimes disastrous, specifically in the countryside areas or congested purlieus, where there is lack of drainage. Also, tendency of swift mankind, city development, the growing flood danger in built up areas, most environmental scholars ascertain that complete flood security in nearly all cases could wholly unavoidable, but FDM can provide mitigate flood danger measures which involves how to lessen vulnerability, reduce loss of lives and destruction of economic, by using natural resources for the welfare and benefit of the mankind specially communities participation of local people that are nearness to the waterways so as to aware of consistent to the risks they are uncovered to because through local communities participation, they can grasp flood dangers better. Conclusively, flood dangers could not be completely ignored but can only be minimized to an expected stage and FDM would not attempt to eradicate flood dangers wholly in city areas but will only strive to create strategies to mitigate non-structural standards with community participation.
References
[1] Baldassare G, Montanari A, Lins H, Kontsoyiannis D, Brandimarte L and Bloscl G. Flood Fatalities in Africa: From Diagnosis to Mitigation, Geophysical Research Letters, 37. 2010.
[2] Criss R. Increased flooding of large and small watersheds of the central USA and the consequences for flood frequency predictions, In Criss RE, Kusky TM, Eds, Finding the Balance between Floods, Flood Protection, and River Navigation, Saint Louis University, Center for Environmental Sciences, 2009, 1 (2):16-21.
[3] Criss R. Statistics of Flood Populations in a Changing. World. J.Earth Sci., 2015 6(4):1-9.
[4] Karley K. Flooding and Physical Planning in Urban Areas in West Africa: Situational Analysis of Accra, Ghana, Theoretical and Empirical Research in Urban Management, 2009, 4(13):25-41.
[5] Samarasinghe M, Nandala K, Weliwitiya P, Fowzi M, Hazarika M and Samarakoon L. Application of Remota Sensing and GIS for Flood Risk Analysis: A Case of Kalu-Ganga River, 2010, 2(3): 1-6.
[6] Scilling K, Gassman P, Kling C, Cambell T, Wolter C and Anold G. The Potential for Agricultural Land Use Change to Reduce Flood Risk in a Large Watershed. Hydrological Processes, 2014, 28(8): 3314-3332.
[7] Sultana P. Can England Learn Lessons from Bangladesh in Introducing Participatory Floodplain Management? Water Resources Management, 2007, 22 (3): 357-376.
[8] Sri Lanka. International Archives of the Photogarmetry, Remote Sensing and Spatial Information Science Vol.38, Part 8 Kyoto.
[9] Smith K. Environmental Hazards: Assessing Risk and Reducing Disaster, 2013, 6th Ed., New York, Routledge.
[10] Shresha B, Chapag S and Thapa R. Flash flood risk management: A Training of the Trainers Manual, International Centre for Integrated Mountain Development Kathmandu, Nepal, 2014.
[11] Pielke R. Flood Impacts on Society, Damaging Floods as a Framework for Assessment, in: Floods, edited by: Parker DJ, Routledge Hazards and Disasters Series, 2000, 1 (2): 133–155.
[12] Vaz C. Coping with Floods: The Experience of Mozambique. Retrieved December, 15, 2016 from www.thewaterpage.com/floods.
[13] WMO. Integrated flood management: APFM Concept Paper, Geneva, Switzerland: World Meteorological Organization, Associated Programme on Flood Management, 2009.
[14] Wisner B, Blaikie P, Cannon T and Davies I. At Risk: Natural hazards: people’s Vulnerability and Disasters, London, Routledge, 2004.
[15] Woslt P. Information, Public Empowerment and the Management of Urban Watersheds, Environmental Modeling and Software, 2005, 20 (1): 457-467.
[16] Correia F, Forham M, Saraiva M and Bernardo F (1998). Flood Hazard Assessment and Management: Interface with the Public, Water Resour. Manage.12:209-227.
[17] Forkuo K. Flood Hazard Mapping Using Aster Image with GIS, J. Geomant. Geosci., 2011, 1 (4): 932-950.
[18] Hooijer A, Klijn F, Pedroli B and Van O. Towards Sustainable Flood Risk Management in the Rhine and Meuse River Basins: Synopsis of the Findings of IRMA- SPONG. River Res. Applicat. 2004, 20 (6): 343-357.