

Flood Hazard Assessment and Control in Yola, Adamawa State of Nigeria

Friday Adejoh Ogwu

Department of Urban and Regional Planning,
Modibbo Adama University of Technology, Yola, Adamawa State, Nigeria

Email: fridayogwu@hotmail.com, fridayogwu@mautech.edu.ng

ABSTRACT

The hazard and damage caused by flood cannot be overemphasized in terms of loss of life, properties, displacement of people and disruption of socio-economic activities as well as the loss of valuable agricultural land due to the attendant inundation of flood plains. Urban flooding is gradually becoming a serious ecological problem in Yola. Several areas in Yola along major river valleys are affected by floods every year. To gain better understanding of the flood problem especially for planning purposes, the paper uses a combination of recent data on flood plains such as land use/cover, river/ flood stage and historical to assess and predict future flood and likely impacts. In addition, extreme description statistical tools such as tables and pie charts distribution are used to analyze data on causes of flood, impacts and flood frequency in different return period of flood hazards of certain magnitude as well as the extent of flood inundation to determine areas under high risk. The paper employed the use of physical planning tools with a view to assess flood hazard in selected areas of Yola North (Doubeli, Jambutu, Limawa, Gwadabawa and Rumde) and made recommendations for effective hazard control and management in the study area.

Keyword: Flood hazard, Assessment and Control, Yola, Adamawa State.

INTRODUCTION

Basher and Garba (2007) stated that, released flood issues as observed in recent times, are likely to get worse in this century due to climate change as well as the alarming increase in environmental mismanagement. To further buttress this point, the second working group of the inter-governmental panel on climate change (IPCC, 2007) estimated that impact of global warming or specific regions of the world as predicted that heavy precipitation events, which are likely to crease in frequency, will argument flood risk. This means that floods will get more severe in areas already prove to disaster.

In Nigeria, most floods occur because of excessive rainfall and dam failures. It has been estimated that more than 700,000 hectares of useful land for agriculture and human settlements are rendered useless due to annual floods (Nyomo and

Aggreneal, 2008). The 2012 Nigeria floods began in early July and have killed 363 people and displaced over 2,100,000 people as November 5th.

Affected areas are Adamawa, Taraba, Plateau, Kogi and Benue has been hit the worse. Nigeria has a rainy season and suffers from seasonal flashes floods. These flash floods are sometimes lethal, especially in the rural areas or overcrowded slums, where drainage is poor or does not exist at all. On 2nd July, 2012, many Nigeria coastal and inland cities experience heavy rains and residence of Lagos and Ibadan were gasping for breath due to the flooding. Flooding has forced hundreds of thousands of Nigeria from their homes as dangerous animals including crocodiles, snakes and hippopotamuses, have invaded their houses.

The release of water from Lagdo dam in Adamawa State has killed at least 17 and has left about 50,000 Adamawa residences homeless. The affected local government areas include Fufore, Yola North, Yola South, Demsa, Numan, Lamurde, Guyuk and Shelleng. Others are Girei, Michika, Mubi North and Mubi South local government areas. The areas or local government that were most affected were settlement of Yolde pate, eighty units settlement along the popular chouchi bridge and banking Kogi, all in Yola North.

As a result of the flood events every year, government spends huge sums of money on compensation and rehabilitation and construction of culvert and drainage, yet the problems are unabated. It is therefore necessary to use physical planning tools or strategies such as development plan and development control to provide basis for concerted action – plan to be carried out in flood plain planning or flood control plan by either government or non – governmental agencies as applicable.

Statement of Problems

The problem to be investigated is the inherent loss of life and property resulting from flood occurrence in Yola North, which is already in alarming rate. Flood along the Benue valley in Jimeta almost occur annually between August and September where river bank over flow it water. It claimed over 17 lives and displaced more than 50,000 others. Flood occurrence in the study area has over the years become a recurring phenomenon causing severe damages to lives and properties. The most prevalent of these are due to heavy amount of rainfall and poor sanitary condition of residential land users along the river. Therefore the paper aims at renewing factors worthy for flood control and management.

Flood occurrence in this selected ward of Yola North (Jambutu, Doubeli, Rumba, Limawa, and Gwamdabawa) has become more or less an annual phenomenon causing severe damage to lives and properties. Many other problems are due to direct action by the government of Adamawa even some well-intertwined activities that were transferred at alleviating flood problems, but which through poor

design, in proper execution or a misunderstanding of the hydrology of the layer watershed actually has resulted in increased flood risk.

As a result of annual flood events, government spends huge sums of money on compensation and rehabilitation and construction of gullies and drainage yet the problems are unabated. If this trend continue the whole situation will become disastrous. In such a potentially disastrous situation, it is therefore necessary to provide basis for converted action-plan for flood hazard control with a view of reducing the impact of flooding in the study area. It is along this framework that this research attempts the application of physical planning tools for flood control planning as a strategy for flood hazard reduction in selected ward of Yola North (Doubeli, Jambutu, Rumbe, Limawa and Gwamdabawa).

Aim and Objectives

The aim of this paper is to assess the factors that are responsible for flooding in the study area, with a view to proposing planning solutions for its control and management.

This aim will therefore be achievable through the following objectives.

1. To identify flood hazard prone areas.
2. To review the impact of various flood disaster in the study area.
3. To identify the various land use after led by flood in the study area.
4. To apply physical planning tools to mitigate flood hazard in the study area.

Study Area

Yola North is located between latitude $9^{\circ} 14''N$ and longitude $12^{\circ} 38''E$ at an attitude of 135.9m above sea level. It is situated in the Sudan savannah vegetation zone of the country. It is bounded by Girei and Yola South local government area of the South and eastern parts respectively.

Yola North is dominated by eleven (11) wards which include; Doubeti, Yewla, Rumde, Limawa, ALkalawa, Ajiya, Gwadabawa, Luggere, Nassarawo, Jambutu and Karewa.



Figure 1.1 Map of Nigeria Showing Adamawa State.
Source: Ministry of land and survey Yola

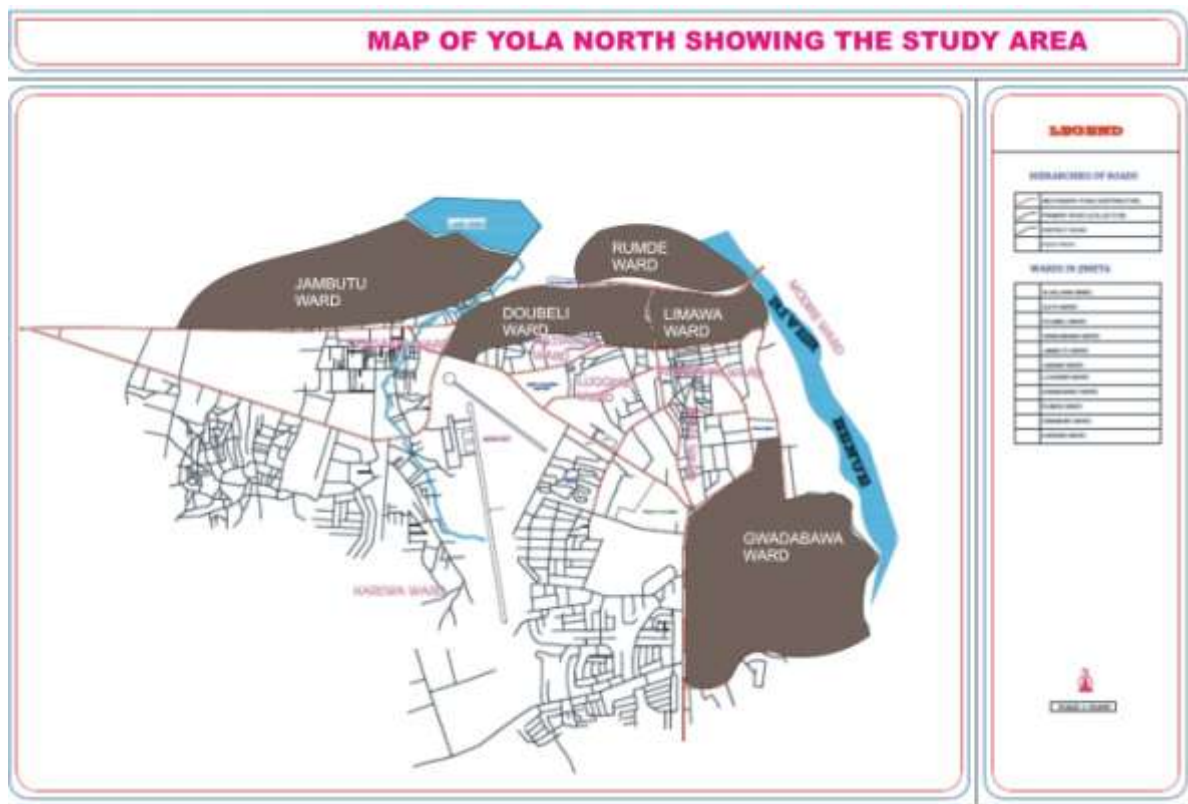


Figure 1.2 Map of Yola North Showing the Study Area.
Source: Field survey 2016

LITERATURE REVIEW

Planning can be viewed as a method of decision making that identified goals and ends, determined means and programs; which are thought to achieve these ends. Accordingly, town planning can be defined as the art and sacrifice of ordering the use of land character and the siting of buildings and communication routes so as to serve the maximum degree of economy, convenience and beauty (Keeble L, 1967). It is concerned with doing the right thing, at the right time, in the right place and for the right people.

Therefore, desirable end of town planning endeavour is an aesthetically pleasant environment. Town Planning is a feature oriented problem solving strategy within a define area. Town planning is tailored to set goals based on the images of the desire future. Policies are designed and plans are implemented to guide the system towards the goals, or to change the existing system if it cannot achieve the goals.

Flood Hazard

Flood can be defined as an overflow or inundation threatens lives and properties. Straton *et al* (1969) defined flood as any abnormal high water stage or flow overland, in streams, flood ways, lake and coastal areas that result in a significant detrimental effects on the residential housing. Similarly, Rashid (1982) and Odemorho (1988) defined food as any overflow of water in urban streets or land, sufficient to cause significance property damage, traffic obstruction, nuisance and health hazards.

Flood can happen when the absorptive capacity of the soils and flow capacity of rivers channels, streams or coastal areas are exceeded due to heavy or continuous rainfall. This causes water in a river channel to overflow its bank into adjoining land area known as floodplain. Floodplains are, therefore highly prone to flood. In addition, coasts and deltas, areas immediately below dams, inland shorelines and alluvial fans are vulnerable to floods (Smith and Pettey, 2008). Accordingly, (Leopold, 1964), see flooding as a natural and recurring event for a river or stream. Statistically, streams will equal or exceed the mean annual flood are very 2.33 years. Flood is a natural hazard. The United Nations International Strategy for disaster reduction (UNISDR, 2004) defines hazard as a potentially damaging physical events, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. A natural hazard is the probability of occurrence, within a specific period of time in a given area of a potentially damaging natural refers to all atmospheric, hydrologic, geologic (especially seismic and volcanic), wildfire phenomenon that, because of their

location, severity and frequency have the potential to affect humans, their structures, or their activities adversely (Barton, 1978).

Occasionally flood hazard and flood risk are used interchangeably. Flood risk has the additional implication of the statistical chance of a particular flood actually occurring while hazard is a naturally occurring on human – induced process which has the potential to create loss (Smith and Petly, 2008).

Socio- Economic Impact of Flood

Flooding is one of the most destructive types of natural disaster. In the 20th century out of the top 100 most fatal natural disasters, 12 were associated to flooding. Floods resulted in the death of 7 million people (E – M – DAT: According to the Disaster Center (<http://www.disaster.com>) out of the 12 most fatal flood events, 10 occurred in China alone.

The negative socio – economic impacts of floods result to loss of lives and property, damage to property, destruction of crops, loss of livestock, non – fluctuating of infrastructure facilities and determination of health condition owing to water borne diseases. Flash floods, with little or no warning time, cause more deaths than slow – rising riverine floods.

In monetary terms, the extent of damages caused by floods is on the one hand dependent on the extent, depth and duration of flooding and the velocities of flows in the flooded area. On the other hand it is dependent on the vulnerabilities of economic activities and communities. As communication links and infrastructure such as power plants, roads and bridges are damage and disrupted, economic activities come to a standstill, resulting in dislocation and the dysfunction of normal life for a period much beyond the duration of the flooding.

Natural disaster such as flooding have the potential to eradicate decades of investment in infrastructure and the personal health of a state, in addition to the insurmountable loss of lives. The situation is much worse fir developing regions. The poor are the most severely affected by natural disasters including foods. According to UN 2004, people from the low – income category accounted for approximately half of those killed in floods from 1975 – 2000. Historical records show that the world has witnessed about 3,500 floods since 1900 till 2008 killing about 7 million globally. China is the country that witnessed the highest number of flood – related fatalities, a staggering 6.6 million, during that time period (EM - DAT). Analyzing impacts for a longer duration it is observed that the world experienced total damages around 1800 billion United States from natural hazard, out of which 235 is attributed to floods alone.

The concept of flood is formulated with regard to socio – economic and environmental effects, as quoted by Theman (2010), in the words of Hybrids (2004).

He further stated that floods produce widespread of impacts in both rural and urban areas. The obvious effects of flooding particularly in urban areas depend on their intensity as stated by Idoko (2006).

METHODOLOGY

This chapter outlines the methods that will be used in collection and collation of data, analysis and presentation. It elaborates the processes and characteristics of the data to be used, which form basis for the analysis and interpretative present in the analysis research work.

Other data are on the effects of flood on the area of study and causes of this flooding.

Data Types

There are two types of data that is used in this study, they are spatial and attribute data. The spatial data include maps, plates, pictures, as well as pictures of the defined area. While, the attribute data has to do with facilities, utilities and services (Critical facility).

Sources of Data

Two basic sources of data have been explained in this research work. They are primary and secondary data.

Primary Data

These are flood hazards related information that will be collected in the field through personal observation, personal interviews to the inhabitants that are affected by flood hazards and government and non-governmental agency responsible for controlling flood hazard. The following represents key areas where the primary sources of data will be obtained are;

- a. State and federal environmental production agency.
- b. State emergency management agency.
- c. Adamawa state urban planning and development authority.
- d. Ministry of land and survey, Yola.

Secondary Data

These data will be sourced from relevant literature review on flood hazard control planning which guides the researcher about the concept and knowledge of the research. Journals, newspapers, published and unpublished works on flood hazards control planning, internet facilities, and other related literatures will be consulted and explored.

Data Collection Instruments

The instruments that are for the purpose of this research include the use of oral interview and administration of questionnaires method. The oral interview method involves face – to – face interview with respondents on issue relating to flooding, as well as the use of telephone calls were made. Questionnaires were administered randomly among the population for easy coverage of the area. A total number of 100 questionnaires were administered within the study area.

Data Analysis Procedures

Base on the information that were obtained through out interview and questionnaire administration, the data were analyzed with the aid of quantitative method to obtain in percentages of responses to the various problem stated.

DATA PRESENTATION, RESULT AND DISCUSSION

This chapter report and explain the outcome or finding of the research work. Hence, the finding to the methods by which data collected were analyzed and the method by which finding are presented with brief comments are detailed in this chapter.

The information in this chapter consists of quantitative data e.g., table, graph and figures accompanied by a text, explaining the results as contained in the illustrations provided.

The presentation and data analysis is based on the hundred (100) questionnaire administered in the study area. The results obtained were stated in table below.

Table 4.1: The most affected Ward in the study area.

Ward	Number of respondents	Percentages (%)
Jambutu	20	20
Doubeli	35	35
Limawa	20	20
Rumde	15	15
Gwadabawa	10	10
Total	100	100

Source: field survey. January, 2016.

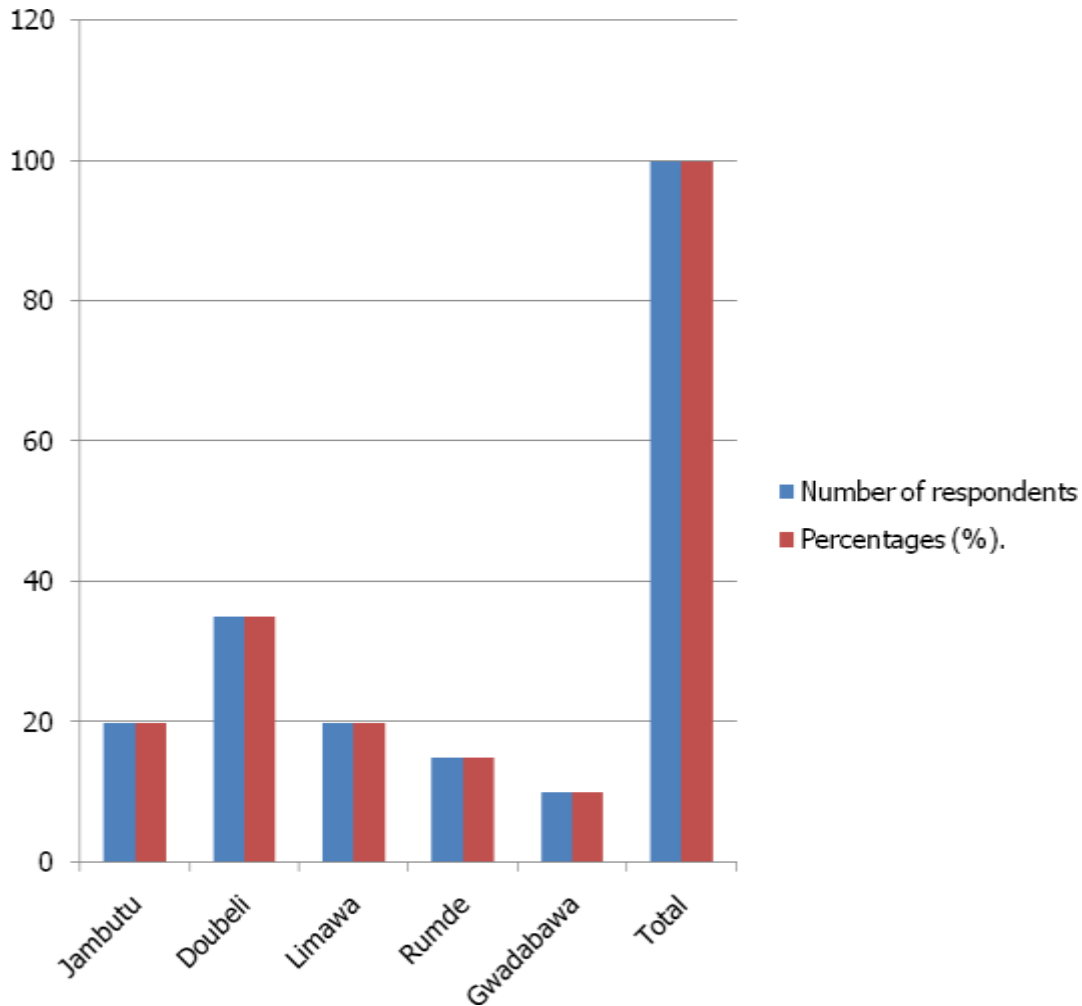


Figure 4.1: various views of respondents during the field survey as regard to the most affected ward in Study area

From the figure above, the respondents' views Doubeli ward as the most affected ward in yola in study area with 35%, whereas 20% of the respondents were of the opinion that Jambutu and Limawa ward are most affected by flood in study area. 15% of the respondents view Rumde ward as the most affected ward in the study area while 10% were of the opinion that Gwadabawa is the most affected ward in study area.

Number of Respondents

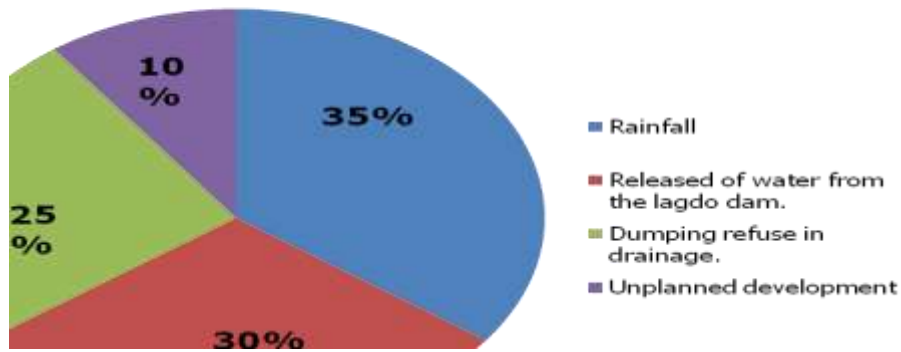


Figure 4.2 Numbers of Respondents

In the figure above, the respondents view rainfall as the major causes of flooding in the area which comprises of 35% of respondent, release of water from the Lagdo dam is 30% of the view of other respondent then 10% of the respondent were of the opinion that flood in the study area result by unplanned development as a cause of flood. 25% of respondent were also of the opinion that dumping of the refuse in the drainage is cause of flooding in the area. This information is also detailed in the above chart.

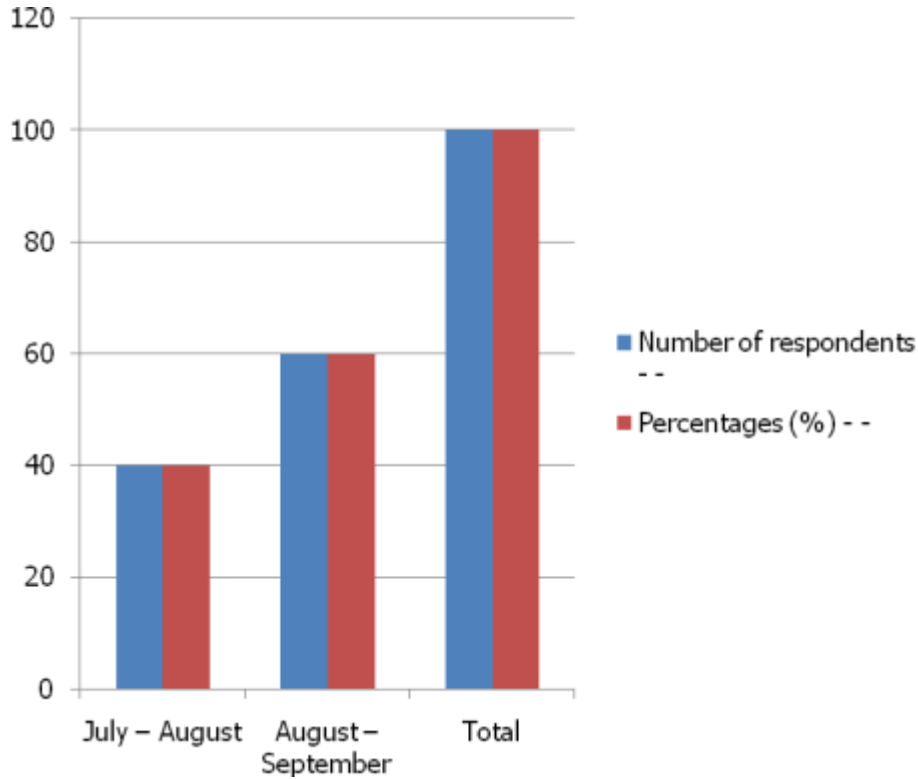


Figure 4.3: Months of Flood Return Period

In the above figure 60% of the respondents were of the view that flooding in study area occur between the months of August and September, while 40% of the respondents were of the view that flooding occur between the month of June and August. There were no responses for the months of May and June and July.

Table 4.2: Responses as regard to flood impact on lives and properties.

Responses	Number of respondents	Percentage (%)
Negative	96	96
Positive	4	4
Total	100	100

Source: field survey, January, 2016.

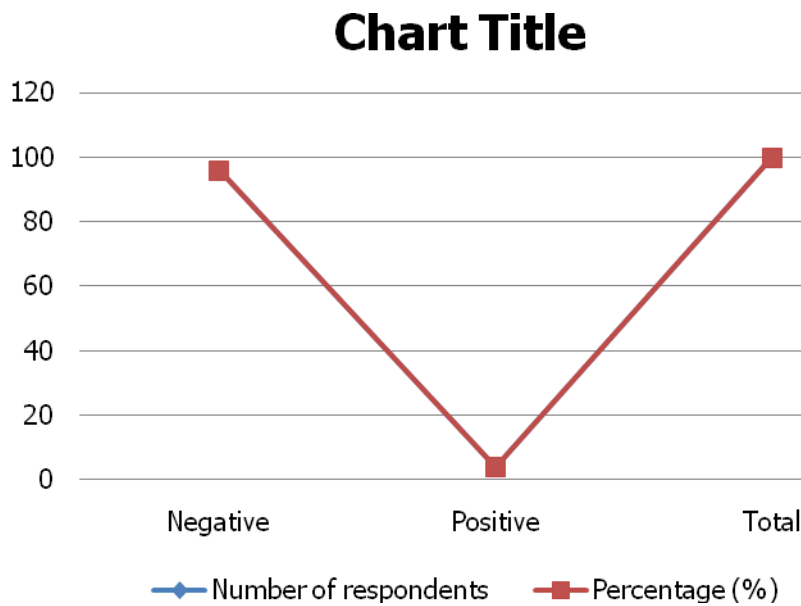


Figure 4.4: Flood impact on lives and properties

In table 4.13 a high proportion of the respondents (95%) were of the opinion that flooding has severe negative impact on both their lives and property, while some few proportion (5%) of the respondents were of the view that it changes the soil structured thereby adding value to the soil for improved yield, hence it has possible impact.

DISCUSSIONS

This study provides evidence that the major causes of flooding in the area as observed were as results of main sources; natural (rainfall) and artificial (human activities: blocking the drain with refuse, development on flood plain, inadequate drainages channels etc). The elements that are affected include human population / capital facilities and resources such as settlements, life line production facilities, public assembly facilities and cultural patrimony; and economic activities and the normal functioning of settlements. The structural vulnerability analysis shows that the sector is the sector most vulnerable to flooding compared to other sector. The human settlements that are most vulnerable are those on and around floodplains and the degree of loss and damage that result from the occurrence of flooding is but in this area. Many of the roads that lead to several houses in the study are un-tarred and some without drainage, hence large amount of runoff is discharged to houses of inhabitants. In some areas drainage are blocked with refuse dumps and grown

grasses as shown in the place 4.2, 4.3, 4.4. This reduces the free flow of storm water; hence resolve to an overflow to the settlement around. Flood occurrences has destroyed electric poles, buildings, roads etc, specifically in month of August to September this has caused huge damages to almost every respondents that were interviewed. According to the residents it also destroys aesthetic of the environment and accessibility of many roads within the area. The respondents further lamented that, the flood disaster brought the problem of having to adjust to a new live condition because of the numerous negative effective associated with flood. The most pathetic problem now is the adequately of the State Emergency Management Agency to effectively perform its functions, it is expected to conduct a disaster prevention and preparedness activities to the affected people before the flood. Therefore, there is the need for the State Emergency Agency to effective carryout it functions not only when to comes to a discharge of relieve materials but to adopt different measures that will control flood in the study area.

Existing Conditions of Drainage

The existing drainage systems are inadequate and not comprehensively layout. In some area available drainage are blocked with refuse dumps and grown grass. This reduces the free flow of storm water; hence result to an overflow to the settlement around. The drains are not maintained through regular clearing; and households dump refuse into them thereby blocking the drains.



Figure 4.5: Blockage drainage at Rumde ward



Figure 4.6: Blockage drainage at Limawa ward



Figure 4.7: Blockage drainage that goes through River Benue



Figure 4.8: Buildings at flood plains at Limawa ward



Figure 4.9: Buildings at flood plains in Limawa war

CONCLUSION

The paper provides evidence that flood damage in the Study area may not be solely a function of the amount and duration of precipitation, but also be driven by planning decisions affecting the natural landscape. Precisely where we choose to develop and how we protect communities from natural hazards influence how much property damage floods produce. Carefully weighing the costs and benefits of these decisions thus becomes critical to building sustainable, resilient communities for future generations, within the frame work provided by this tactics, the only economical way for Yola to reverse the trend towards increased vulnerability to flooding is to implement and enforce existing regulations such that development activities are purposefully located and designed to minimize flood damages. To accomplish this, regulatory reviewers must be thoroughly familiar with the flood plain and land use regulations that are on the books and they must carefully screen applications to ensure that proposed development will be in full compliance. Such an admonition, of course, comes with the additional caveat that regulated must be provided with adequate support in order to fully perform their duties. This entails sufficient staffing, training and logistical support.

Furthermore, it is often a matter of political will to see that existing regulations, that may be strict on paper, are actually enforced within the spirit as well as the letter of the law. This implies to activities proposed by private developers and landowners, but just as importantly to activities undertaken by instrumentalist of the Government of Yola. Flood control planning is not a single actor work it encompasses many actors, among the "actors" involved in the process of flood hazard control are planning agencies, line ministries emergency preparedness and response centers, Therefore proper management of development can help alleviate many of the flood problems of the future.

RECOMMENDATIONS

Based on the findings of this study, the paper therefore recommends the following for Adamawa State Government:

- a. The Adamawa State Urban Planning and Development Authority and Adamawa emergency management agency most ensure full compliance of development guidelines for Yola metropolis as regards to the encroachment of flood plains especially in the affected ward of, Doubeli, Rumde, Limawa, Gwadabawa and Jambutu
- b. Flood control structures should be constructed in areas of high vulnerability.
- c. Estimates the lives at risk due to flooding at each of the subject wards and comparison of the lives at risk with available guidelines or criteria and provides flood warning systems.

d. Prioritization of the risks to facilitate the development of a defensible and transparent risk management plan.

The general public should adhere to the following:

- a. Avoid building in a flood prone area unless you elevate and reinforce your home
- b. Elevate the furnace, water heater and electric panel if susceptible to flooding
- c. Install. "Check valves" in sewer traps to prevent floodwater from backing up into the drains of poor home and seal basement walls with water proof compounds to avoid sewage.

REFERENCE

- Barton, M. (1978) *The Price of Flood Disaster. Perception and Reality: Assessing Priorities for the Development of Nigeria*. Retrieved October 3, 2011.
- Basher, O. and Garba I. (2007) *Physical development of urban Nigeria*. UK: Sage
- Hybrids, D.A. (2004) *National Technical Guidelines on Erosion and flood control and coastal zone management*, *European Journal of Environment*, 6 (10).
- Idoko, T. (2006) *Flood management to prevent flooding damages in western black sea region in Turkey*. *International Journal of the physical sciences Vol 6(29)*. Pp. 6759-6766, 16 November, 2006.
- Intergovernmental Panel on Climate Change (IPCC) 2007. *Risk of Human Induced Climate Change*. Available at www.ipcc.ch/report/publications_data_assessment/. Accessed on May 2, 2013.
- Keeble, L.W. (1967) *Principles and Practice of Town and Country Planning*. England: Estates Gazette.
- Leopold, J.D. (1964) *Global trends in water-related Disaster; an insight for policy maker*. New York: Sage
- Nyomo D.J. and Aggreneal S. P. (2008) *flood inundating Harzad modeling of the river Kaduna Using remote sensing and Geographic information system journal of Applied sciences Research*, 4(12): 1822-1833, 2008, INS/net publication.

- Odemorho, R.C. (1989) A study of urban flood problem in Benin-city, Nigeria. Developed by Federal Ministry of environment, Sea Giant law and policy journal Vol, No.1
- Rashid, R. (1982) Under Seige: P.L.O. Decision Making During the 1982 War. Columbia University Press.
- Smith R.D. and Pettey, A. (2008). Resistance to Resistance Coaastal Hazard Policy. New Jersey: Science & Planning
- Straton, J.B., Maureen, D.G., and Fordham, A.B. (1998). Participation planning for flood mitigatin; models and approaches, Australian Journal of Emergency Management. Vol 3 (7).
- Theman, I. N. (2010) Application of GIS in flood country. England: Rutledge.
- United Nations (UN) 2004 Guidelines for recovery of flood losses. Available on-line at [www.Unisdr.org](http://www.unisdr.org); Accessed on July 16, 2014.
- United Nations Disaster Relief Organisation. (Geneva, UNDRO, 2004). Case report on hurricanes Davids and Fredrick in the Dominican Republic. Available at www.urd.org. Accessed on July 17, 2012.