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FLOOD VULNERABILITY ASSESSMENT IN GASHUA: ISSUES AND PROSPECTIVES

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ABSTRACT

In most developing economies, destruction of lives and properties are common especially the riverine communities along the Lake Chad area of Africa where flooding are annual disaster routine. Gashua is a riverine community with gentle slope terrain and have recently witnessed rapid growth and development. This community have being witnessing torrential rainfall coupled with budding anthropogenic activities. Thus, the development of the area has being facing serious risk of flood vulnerability which were largely as a result of it location along river Yobe. This study focused on examining flood risk vulnerability in Gashua through the concurrently use of quantitative and qualitative data. The study utilizes geo-referenced data with the aid of Geographic Information System (GIS) technique for flood vulnerability analysis. The study revealed that soil type and terrain of this area contributed to poor draining of rain which subsequently leads to water overflow in the area. Moreover, this study also uncovered that poor drainage systems as well as poorly planned street layout in the build up areas has contributed to increasing magnitudes of destruction during flood events in this area. The study finally recommended that the need for immediate essential upgrade of urban renewal and immediate re-construction of the town drainage system.

Keywords: *Disaster Management, Environmental Hazard, Flooding, Water Resource,*

1. INTRODUCTION

Flooding is a disaster which occurs when the contents of a river valley over flows its banks to surrounding areas [1]. Moreover, in other word flood happened when there is heavy rainfall beyond the saturation of the soil of an area which consequently leads to overflow on the land. The effect flooding and its socioeconomic implications have potentials of posing serious environmental concerns in the affected area. Flooding is a common environmental issue in riverine communities in Chad basin of Africa [2]. This zone is very susceptible to flooding due to it relatively flat and gently sloping terrain with occasional occurrences of torrential rainfall and failures of dams in the upstream.

Nigeria is endowed with abundant amount of ground and surface water resources [3]. The recent wetland degradation around the country has affected the supplies as well as the channeling of ground and surface water resources [2]. For example, within the riverine communities of Chad basin, flood usually happened during the peak of rainy season that is coupled with various human activities such as overgrazing, excessive deforestation for irrigation agriculture, cutting of woods for fuel, etc. [4]. Although, the Northern extraction of Nigeria recent evidence of climatic changes is obvious as seen in the decreasing annual rainfall within the region, hence, the rainfall is often excessive when it do arrived [5; 6; 7].

Going by the recent Nigeria's population explosion, the rivarine communities are essential for the country agricultural opportunities [8] as well as a decent medium for engaging the region budding unemployed youths [1; 9; 10]. Flooding is a natural phenomenon that is expected around almost all river banks and basin when there is excessive recharge [1; 11; 12]. The severity of any flood event depends on the response of hill slope runoffs produced and the down pour of prolonged rainfall or snow meltdown [9; 10; 13]. The magnitude of flooding within an area can be affected by several human activities [14; 15; 16]. Furthermore, it's a fact that human preferred living around riverine areas that are prone to annual flooding event for their water abundances [17].

These riverine areas tend to be reasonably fertile for agricultural activities. These areas are often suitable for crop production and also often served as shores for navigations by boats for transportation of goods and people [18; 19]. Regional economic activities and values of a region usually was catalyzed the respective region developmental initiatives if properly utilized [5]. The present study was conducted at Gashua town in Yobe State, Nigeria. The study examined flood vulnerability of Gashua town through the use of Geographic Information Service (GIS) data and other related geo-referenced data. The study also examined various quantitative data regarding the recent budding flood issues, likelihoods as well as the extent of flooding events in this region.

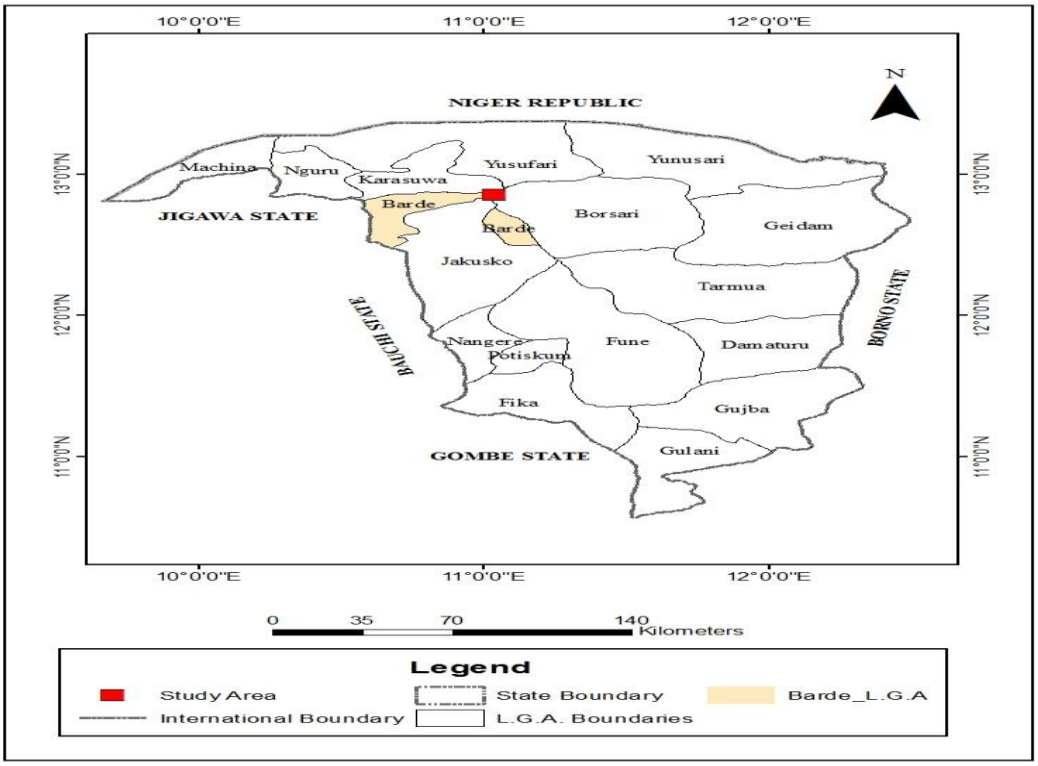
2. MATERIALS AND METHODS

The present is an empirical study that depends solemnly on primary data from various sources. The data involved includes primary data from survey using questionnaire tool and geo-referenced data (explicitly, GIS and Remote Sensing) and critically examined flood risk vulnerabilities in Gashua. The data obtained were from the survey were analyzed using simple statistical analysis with aid of charts and percentages. The method utilized by this study stresses on the application GIS mappings and integration of descriptive statistics to display spatial trends of floods vulnerabilities in Gashua.

2.1 Area of study

Gashua is a riverine community situated in relatively flatland in Northern part of Yobe State and also is the Bade Local Government headquarters. Gashua town is lies along the famous river Yobe few kilometres from convergence of River Jama'are and Hadejia. According to the last national population census in 2006, the population of Gashua was about 125,000 persons. This community experienced an annual average rainfall of 500 to 1000mm with maximum summer temperature range of 38°C to 40°C (March-April) and minimum temperature of as low as 23-28°C (June to September) [15]. The spoken language of the indigenous people of this town is called Bade. Gashua is one of the most developed towns in Yobe State and was regarded to have both economical as well as ecological relevance to the entire ecosystem of this region which is largely associated with the location of the town within Nguru-Gashua Wetlands [17].

Figure 1: Political map of Yobe State showing Bade LGA and the study area



Source: *Primary Survey, 2018*

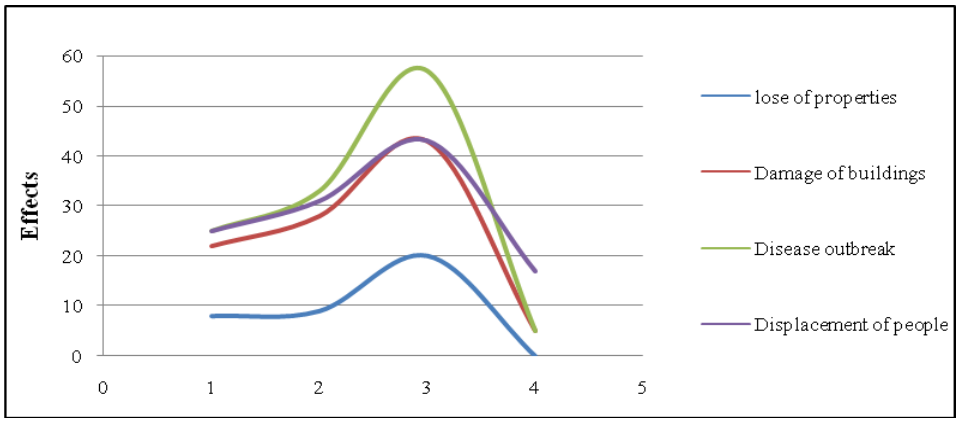
3. RESULTS

The results section of this study presented various primary data obtained from the survey conducted using questionnaire on temporal and spatial analysis of flood trends in the study area. This section presented results of direct and indirect effects of flooding events (lose and damages properties, diseases outbreak and displacement of properties), diverse environmental impacts (transportation of human and animal bodies, transportation of reptiles, hindering of movement, inciting pollution, causing suffering and panic among people), flooding spatial occurrences, duration, magnitude and frequencies, and distribution of flooding frequencies and duration across different elevation in the study area. All the results of the present study were examined and analyzed across various elevations (334-336m, 337-338m, 339-340m and 341-342m).

3.1 Modern Effects of Flooding

Whenever a flood event happened, the flood tends to have devastating effects on both individuals as well as the relative communities. These effects often have physical, economic, social, as well as environmental consequences which can either be negative or positive depending on the location and extent of the flood. These consequences of flooding events greatly depend on the flood speed and depth, duration, location and vulnerable groups. The result in figure (2) below showed various implications of flooding event across different elevation in the study area. These effects have both direct and an indirect implication that includes loss and damages properties, diseases and outbreaks as well as displacement of properties.

Figure 2: Distribution of various effects of flooding across various elevations



Source: *Primary Survey, 2018*

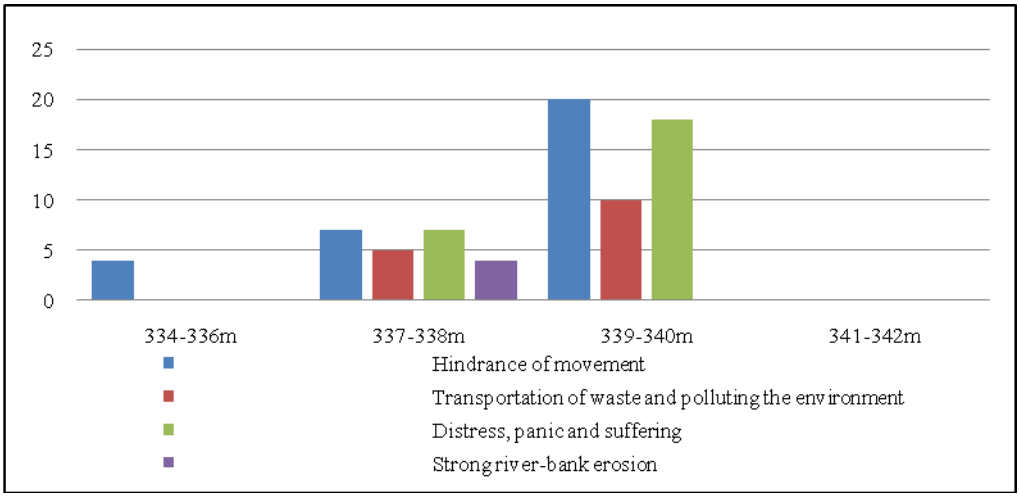
Note: In figure (2) above, the elevations 334-336m, 337-338m, 339-340m and 341-342m were represented as 1, 2, 3 and 4 respectively.

The result in figure (2) showed the effects of flooding to be more pronounced at 337-338m elevation within the study. All the effects examined; i.e. lose and damages of properties, diseases outbreak and displacement of people were discovered to be severe at areas within 337-338m.

3.2 Impact of Flooding

Floods events have devastating consequences on the people, economy and the environment. This study assesses various environmental concerns and their impacts on relative ecosystems and environment at different elevation within the study area and presented the results in figure (3) below. Environmental impacts examined includes the transportation of human and animal bodies, transportation of reptiles, hindering of movement, inciting pollution, causing suffering and panic among people, erosion of river bank, causing hunger despair and consequently causing injuries to many fatalities.

Figure 3: Distribution of flood impact across different elevations



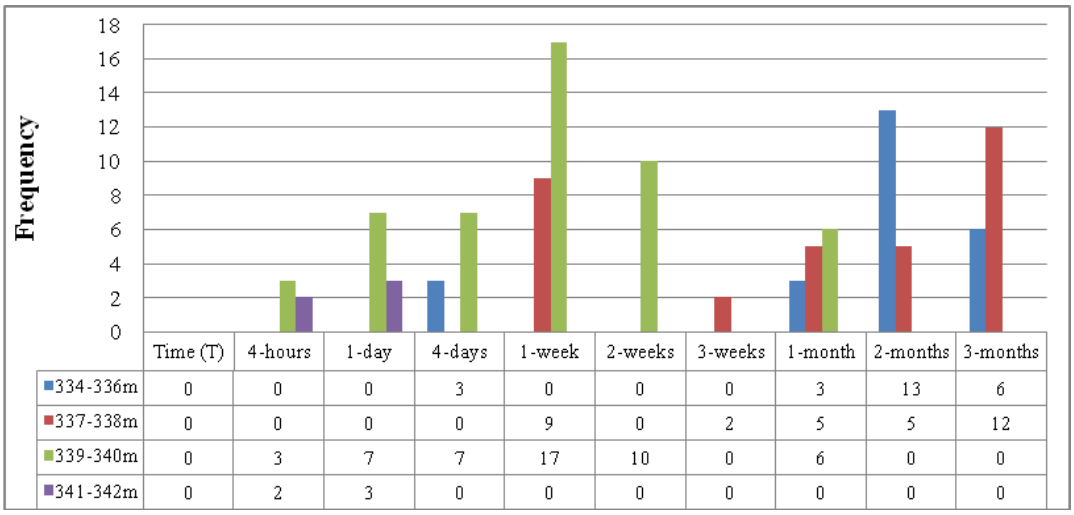
Source: *Primary Survey, 2018*

The result in figure (3) above discovered that effects of flood such as hindrance of movement and transportation networks, wide movement of waste and pollution, and subsequently cases distress, panics and suffering are more severe in area with elevation around 337-338 and 339-340m in the study area.

3.3 Frequency and Duration of Flooding

The characterization of flooding events on the basis of it spatial occurrences, duration, magnitude and frequencies enable experts, planners and decision makers to prepare for possible potential hazards and minimized the level of damages within the affected area. The result in figure (4) below showed the distribution of flooding frequencies and duration across different elevation in the study area.

Figure 4: Distribution of frequency and duration of flooding



Time (T)	4-hours	1-day	4-days	1-week	2-weeks	3-weeks	1-month	2-months	3-months
334-336m	0	0	0	3	0	0	0	3	13	6
337-338m	0	0	0	0	9	0	2	5	5	12
339-340m	0	3	7	7	17	10	0	6	0	0
341-342m	0	2	3	0	0	0	0	0	0	0

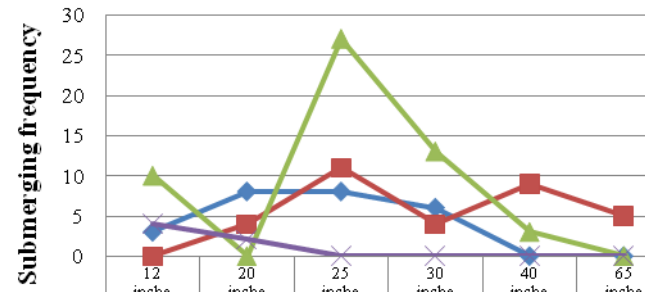
Source: *Primary Survey, 2018*

The result in figure (4) above showed frequencies of flood ad different elevations (334-336m, 337-338m, 339-340m and 341-342m). The observations were recorded during a period of three month of rainy season at the study area. This study uncovered

3.4 Level of Submerging

Whenever there is a flood event in an area, water flow rate exceeds the capacity of the river channel especially around the meanders and bends of the waterways. Continuous rainfall of over a long period of time is the major cause of flooding event in this region. Therefore, the present study examined rainfall distribution for a period of three months within the study. The result in figure (5) below showed the distribution of flooding frequencies and duration across different elevation in the study area.

Figure 5: Distribution of submerged areas



	12 inches	20 inches	25 inches	30 inches	40 inches	65 inches
RELIEF ZONES 334-336m	3	8	8	6	0	0
RELIEF ZONES 337-338m	0	4	11	4	9	5
RELIEF ZONES 339-340m	10	0	27	13	3	0
RELIEF ZONES 341-342m	4	2	0	0	0	0

Source: *Primary Survey, 2018*

The result in figure (5) above showed the distribution of flooding frequencies and duration across different elevation in the study area. Based on the waterlogged nature of the study area, the result showed that areas around 339-340m are the most affected with flooding event even from the onset of rainy season.

4. DISCUSSIONS

4.1 Flood Risk Vulnerability

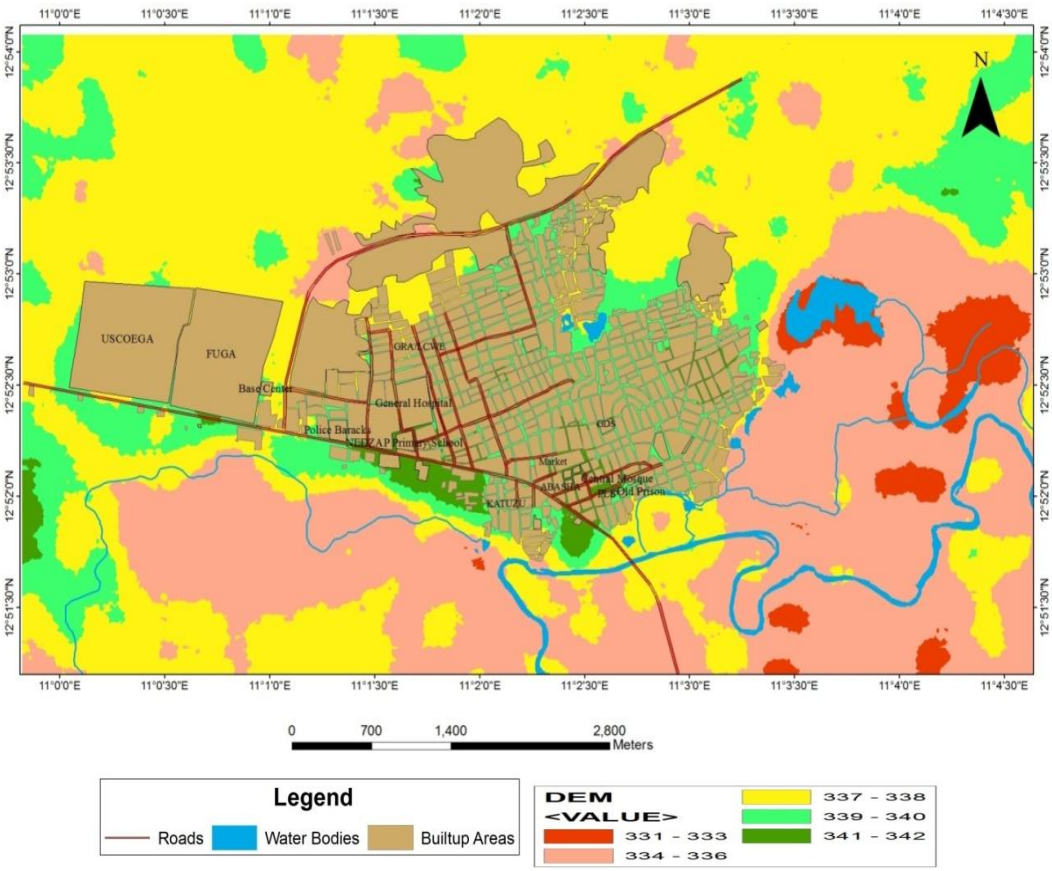
The understanding of fundamentals of flood risk management and forecasting is essential for mitigation and implementation of relevant measures for minimizing the level damages especially in riverine communities. Therefore, the adoption of flood risk management with aim of reducing physical, human as well as socioeconomic losses is sophisticated and very much relevant. This study discovered that most of the respondents in other relief zones reported that they have at least for once experienced flood disasters with the exception of only areas located at an elevation of 339-342m. The present study proved that there is a serious relationship between relief and occurrence of flooding in this area. Moreover, it was also understood that earlier settlers of the Gashua town are mostly living in higher altitude relief. However, the people and properties at 339-342m elevation are the least affected in terms of destructions of people and lives. Despites more than half of the population acknowledges the presence of well connected drainage system, these drainage systems do not necessarily empty the flooded water from the street.

Figure 6: Pictures of submerged areas

Source: *Primary Survey, 2018*

The present study also observed that in Gashua most of the drainage channels are inefficient in preventing flood events. Most of the people of this region strongly affirmed that about 90 percent reported inefficiency of drainage channels. Moreover, the study also discovered that about 60 percent of respondents also have at one time reported witnessing flood events.

Figure 7: Distribution of Digital Elevation Model of Gashua



Source: *Primary Survey, 2018*

The figure (7) above showed digital elevation of model of Gashua, based on the model it was understood that about 90 percent of the community build up areas are living at risk of flood event. These includes areas at elevation from 331 to 340m, hence, this leaves only 341-342m elevation as the safest (Kara and Abasha). Moreover**,** the residents of Gashua reported that both torrential and stream overflow as major sources of flood water. In Gashua, most areas in lower relief zones especially those located on the flood plains of river Yobe are highly affected by annual stream overflow. Furthermore, areas at higher relief zone are mostly affected by torrential rainfall especially those located around Filin Tanda pond; 12 to 65 inches of submerged level were reported. Thus, inadequacy and inefficiency of drainage systems and blockage of drainage channels are among the solid factors causing flood events and disasters. Moreover, the study further revealed that declining discharges of river Yobe, enable urban land use to encroach the flood plains, especially at Karambanin Afuno (Hausa's risk) and parts of Takari/Zango residential areas.

5. CONCLUSION

The present study examined flood vulnerabilities in Gashua through critically assessing recent issues as well as potential eventualities of flooding in this area. In this study, it was discovered that flood events are often annual proceedings which causes a lot of damages and destructions to the regions' limited infrastructures. This study understands that the flood events of this region are mutually caused by both river bank overflows and torrential rain which were hasten by ineffective drainage channels, building on flood plains and poor urban planning. Though, resident local population are quite aware of the consequences of flooding events around the lower elevation, however, the people still chooses to developed land and live in zones where there is high anticipated chances of flooding event. The present study believed that there are larger scale changes across entire catchments which consequently expose this region to higher chances and magnitude of flooding events.

The study wrap-up by demonstrating that within the lowland area of Gashua, the areas at 334-336m elevation are the most vulnerable areas to flooding, explicitly, Filing Tanda pond while the safest area are the areas at 341-342 elevation (explicitly, Kara and Abasha). Moreover, areas within this region with poor street layouts also experiences frequent annual flood event largely due to the region poor street layout and drainage system during the rainy season. Finally, the study recommended the needs for future urban land use expansion suitability study, urban renewal to upgrade the sub-standard structures and immediate re-construction of the town drainage channels.

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