Dutse Journal of Pure and Applied Sciences (DUJOPAS) Vol. 3 No. 1 June 2017

Community Perception and Adaptation Strategies toward Flood Hazard in Hayin-Gada, Dutsin-Ma Local Government Area, Katsina State, Nigeria)

UMAR, Nura Khalil Ministry of Education Science and Technology, Jigawa State, Nigeria

MUAZU, Abubakar Department of Environmental Sciences, Faculty of Science, Federal University Dutse, Nigeria

Abstract

This study examined community perceptions on flood hazard and adaptation strategies in Hayin-Gada, Dutsin-Ma. A sample size of 400 respondents were drawn for self-administered questionnaire. Data collected were analyzed descriptively. Findings revealed that, the major causative factors of flood were intense rainfall, topography, lack of dam embankment and regulatory outlets as well as overflow of stream and dam burst. Flood occurs at every rainy season, posing effect on people and their properties. Hence, conversion of mud houses to bricks, seeking expert advice in doing so, the use of appropriate building material and building only in the approved way and in approved areas, were reported as the most pre-flood adopted strategies. Public early warning system was rather unreliable. Moving of valuable property to safe place, coordinating with government and other NGOs to support victims, evacuation from affected homes and exchange of help to each other were reported as the most adopted strategies both during and post-flood phases. It was recommended that, proper embankment protection and dam regulatory outlets should be made available and real time flood forecasting and effective early warning systems should be developed.

Keywords: Intense Rainfall, Regulatory outlet, Protection.

INTRODUCTION

Floods are the most common natural disaster and the leading cause of natural disaster fatalities worldwide (Doocy *et al*., 2013). Thus, 70% of all global disasters are approximately linked to hydro-meteorological events, commonly perceived as water erosion and flood (Dyhouse, 2003;

WMO, 2006). Flood is the most common and widespread of all the disasters. Its consequences is vast on the physical environment, economic and social well-being of inhabitants (Marilise *et al.,* 2013).

Flood occurs when there is an inundation of any area which is not normally covered with water, through a temporary rise in the level of a river, lake or sea, and when excess precipitation exceed natural infiltration, evaporation, and possible transmission (Werner *et al.,* 2006). Floods are generally regarded as extreme hydrological events, where there is excess of water which may have devastating effects.

In Nigeria context, flooding events are influenced by a range of factors including: the overflow of the numerous rivers that transverse the country, unprecedented rainfall amounts and intensity, dam breaks and levee failure, the unavailability and/or insufficient drainage systems and the underutilization of dams in some parts of the country. In some locations, illegal dumping of refuse along water ways and drainages has influenced flooding events in urban cities (Emmanuel et al., 2014)

Semi-arid climates is being characterized with rainfall below potential evaporation; rainfalls are little and erratic and exhibit strong spatial and temporal variability this contribute essentially in flash flooding nature of the region. Though there are different factors that cause flash floods in semi arid lands that include natural factors such as short heavy rainfall, intense convection rainstorms, poor drainage coupled with other factors such as geomorphologic, geological, and anthropogenic factors (Ahmed et al., 2015).

The incident of flood in Nigeria is becoming a reoccurring decimal, leading to colossal loss of properties and lives. Evidently, the 2012 flood that displaced 7.7 million people, windstorms as well as rainstorms that have led to the death of hundreds of persons has placed the country as a highly challenged nation by flood risk as well as limited capacity to curtail the challenges (Ojo, 2013).

In Katsina state particularly, flood has almost become an annual event (Muhammad, 2015). Indeed, the Katsina State Emergency Management Agency (KSEMA, 2014) recorded about 4,000 people in 21 LGAs across the state affected by flood in 2013. Hassan (2014) in News 24 Nigeria reported that 200 people or more were affected by flood, of which; many of the victims were from Bakori, Musawa and Dutsin-Ma LGAs.

On a community-wide scale, flood in the study area is muchly attributed to flash flood event and perhaps causing an over flow of the tributary affecting the lives and properties of the

community. People perception of living with the event has not been given prominence in the research arena. Determining the impacts of importance to a community provides the mechanism for prioritizing adaptation options (Emmanuel et al., 2014). Obviously understanding the consequence of the phenomenon on different sectors provides an insight for the designing and implementation of action plan strategies.

The main objective of the study is to examine public perceptions on causes of flood hazard as a recurring phenomenon and its impact, as well as to provide suitable adaptation strategies toward flooding in Hayin-Gada.

THE STUDY AREA

Hayin-gada is a community named after a bridge (which drains both rain and dam water situated in Kuimi north-eastern Hayin-gada) in Shema ward, Dutsin-Ma town and in Dutsin-Ma LGA of Katsina state, Nigeria. The community is made up of: Kanya, Primary and TV view center electoral polling units with land area of about 24,192km^2 (INEC, 2015). Dutsin-Ma is located between latitude 12^{0}34'1.072"N and 12^{0}15'35.76"N, longitude 7^{0}24'3.32"E and 7^{0}27'23.294"E (Figure 1).

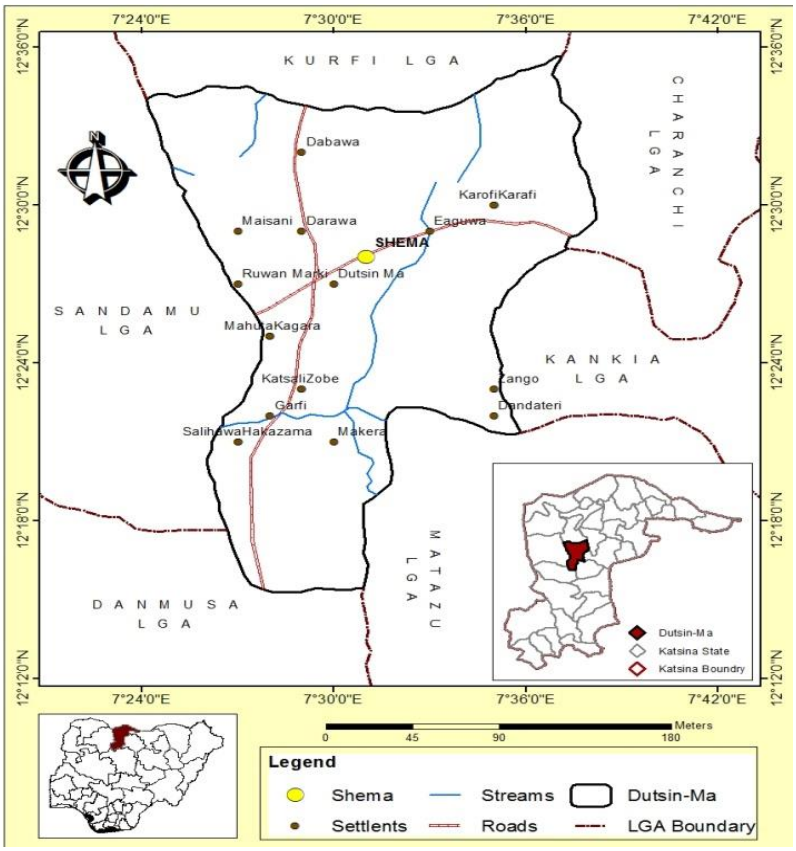

Figure 1: Dutsin-Ma, Showing Shema Ward

Source: Adopted from Administrative Map of Katsina State

The climate of the area is tropical continental, which is dry (Koppen‟s Aw), with the total annual rainfall ranging from 700-800mm (IBRAHIM and Saifullaih, 2016). Generally, the topography is

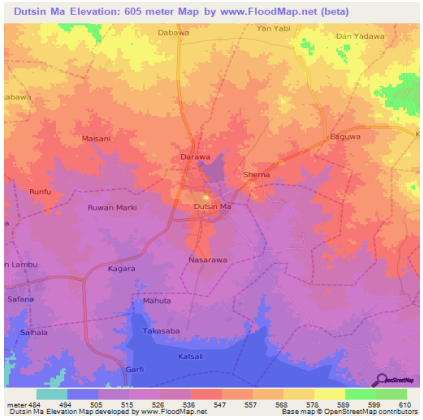

Figure 2:Elevation of Dutsin-Ma map.
Source: www.floodmap.net/Elevation/ElevationMap/(2014)

gently undulating with an elevation of between 526m-547m (Figure 2) with scattered iron stone hills and outcrops overlying basement complex rocks and characterized with sandy drift plain (CHUKWUJEKWU, 2010). The drift deposits of the soil are more courses resulting in light brown sandy soil that are reddish in colour with medium fertility and easily worked. The study area has experience a rapid population growth with an estimated total population figure of about 9, 000 people (INEC, 2015).

MATERIALS AND METHOD

The data used for this study were sourced via primary source. This was done through structured questionnaire designed for the residents of Hayin-gada. Structured questionnaire gives a valuable method of collecting a wide range of information from a large number of individuals. And is being regarded as a quantitative method of research with low level of involvement of the researcher and high number of respondents (the individuals who answer the questions) (Trueman, 2016) . The questionnaire focuses on the people perception on flood. It was divided into four sections: the sections addressed the resident's socio-demographic information; perception on flood and measures adapted in flood mitigation. Given the size of the study area all households were considered as the target population from which the sample size was drawn. The structured questionnaire was administered to 400 respondents across the three polling units of the study area namely; Kanya, Primary and TV view center using Krejcie and Morgan (1970) method for determining sample size. Thus, the information collected on the community perceptions toward flood hazard are later subjected to descriptive statistics such as tabulation, charts and percentages.

RESULTS AND DISCUSSION

Socio-demographic Characteristics of Respondents and Housing Quality Index

The socio-demographic characteristics considered include; sex, age, educational qualification and occupation of respondents (Table 1). Thus, understanding the socio-demographic characteristics of respondents provides an avenue to generate available data that can be translated into meaningful information which can be used to establish strategies toward flood hazard occurrences in the study area.

Table 1: Respondents sex, age, highest education attainment and occupation

Sex	Frequency	%	Age	Frequency	%	Level of Education	Frequency	%	Occupation	Frequency	%
Male	293	73.2	15-24	59	14.8	No formal Education	59	14.8	Farming	115	28.8
Female	107	26.8	25-34	80	20	Primary	53	13.2	Trading	99	24.8
			35-44	151	37.8	Secondary	110	27.5	Civil Service	90	22.5
			45-54	77	19.2	Vocational	59	14.8	Artisan	65	16.2
			55 and above	33	8.2	Tertiary	94	23.5	Others	31	7.8
						Others	25	6.2			
Total	400	100		400	100		400	100		400	100

Source: Field Survey, 2017

Out of 400 respondents, there were 293 (73.2%) males and 107 (26.8%) females given sex ratio of 2.9:1. The age range was 15 to 55 and above with highest number between 35-44 (33.8%). About 110 (27.5%) of the respondents had secondary school education, 23.5% had tertiary education, 14.8% comprises of those respondents having vocational training and attained no any formal education respectively. 13.2% of the respondents had primary education and the other category of the respondents with 6.2% had not attained any form of education. Furthermore, about 115 (28.8%) of the respondents were farmers, 24.8% engaged in trading, 22.5% were civil servants, 16.2% artisans and others had 7.8%.

Public Perception on Flood in Hayin-Gada

The causes of flood in Hayin-gada as perceived by the respondents are computed in Table 2. Other related variables deliberated include the recurrence of flood and its associated impacts, where both human casualties and impacts on properties were identified. Results are also presented in Fig. 3, 4 and 5 respectively.

Table 2: Causes of Flood as Perceived by People in Hayin-Gada

Causes of Flood	Major Cause		Moderate Cause		Minor Cause		Total	
Man-Made Causes	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**
Deforestation	10	2.50	50	12.5	340	85.0	400	100
Lack of drainage network	80	20.0	286	71.5	34	8.50	400	100
Lack of proper embankment	326	81.5	62	15.5	12	3.0	400	100
Building on water channels	94	23.5	293	73.3	13	3.25	400	100
Sand Mining	12	3.0	388	97.0	0	0.0	400	100
Lack of dam regulatory outlets	390	97.5	5	1.25	5	1.25	400	100
Natural Causes								
Intense rainfall (long period of rain)	396	99.0	3	0.75	1	0.25	400	100
Overflow of stream and dam burst	340	85.0	50	12.5	10	2.50	400	100
Traditional beliefs	4	1.0	120	30.0	276	69.0	400	100
Topography	286	71.5	80	20.0	34	8.50	400	100

Source: Field Survey, 2017

Flooding may be caused by both natural and man-made induced factors. From the table above, there was this perception as presented from the administered questionnaires. Thus, 99.0% of the respondents ranked intense rainfall that is, as the result of long period of rain accelerate flash floods occurrence and sudden release from an impoundment created behind the dam. And regarded it as one of the major natural cause of flood in the study area. Rainfall intensity, duration and amount are generally believed to be the principal factors in most flood events in the tropics which are partly or wholly climatological in nature (Muhammad, 2015). This agrees with Ocheri and Okele (2012), who revealed that flooding events in Makurdi town, Benue state, occur mostly at the event of rainfall intensity and amount. 71.5% of the respondents attested that the topographic configuration of Hayin-Gada substantially influences flooding occurrences in the area. The Dutsin-Ma elevation map (Figure 2) portrayed the configuration of the terrain of the study area within watersheds. 85.0% of the respondents are of the view that overflow of stream and dam burst are some of the natural causative factors in accelerating the rate of floods in the area. Thus, the bridge has a steep-sided slope whose bank gets overtopped which in turn floods the adjoining settlements. Nott (2006) was of the opinion that, the most vulnerable landscapes for floods are low-lying parts of floodplains. In a similar perception, major causes of flood along Apete Community in Ibadan, were attributed to heavy rainfall, dam failure and narrow bridges (Odunola and Balogun, 2015).

Table 2 shows that the major man-made causative factors accelerating the rate of flooding as perceived by the respondents include lack of dam regulatory outlets that allows water to be drawn , either continuously or as needed from the reservoir and about 97.5% of the respondents are on this view. Similarly 81.5% responded that lack of drainage networks and proper embankment protection also exacerbated the rate of flooding. It is believed that good

drainage systems are intended to regulate surface water runoff and provide opportunities to reduce the causes and impacts of flooding. In addition, encroachment of buildings along the stream channel and sand mining aids the incidence. However, deforestation with 85.0% and traditional beliefs 69.0% respondents respectively as according to this findings (Table 2) were ranked the minor causes of flood. Research has shown that Deforestation plays many roles in the flooding equation because trees prevent sediment runoffs and
forests hold more water than farms or grasslands. Also among the respondents they were on the belief that this kind of phenomenon occurs in respect to the will of the supreme creator and man has nothing to do to avoid the occurrences.

Perception of Impacts

Table 3 presents the severity level of impacts on the assessed sectors in the study area. As it is presented, it shows that housing sector is the most affected sector with about 71.5%. This can be related to the peoples' attitude encroaching their buildings along the stream channel bank. Perception on the other sectors especially health, agriculture and water and sanitation were relatively high. While the remaining sectors their severity impacts is relatively as compare to health and agriculture. Thus, the stability of these sectors basically will enhance the livelihood of the community.

Table 3: Severity of impacts on the assessed sectors

	`Agriculture		Housing		Water & Sanitation		Health		Economic Activities		Transportation	
	F	%	F	%	F	%	F	%	F	%	F	%
Severity Impact	224	56	286	71.5	210	52.5	234	58.5	204	51	185	46.25
Medium Impact	72	18	70	17.5	58	14.5	77	19.25	71	17.75	120	30
Minimal Impact	22	5.5	30	7.5	17	4.25	-	-	46	11.5	66	16.5
No Impact	12	5	-	-	25	6.25	45	11.25	45	11.25	20	5
Don't Know	70	37.5	14	3.5	90	22.5	44	11	34	8.5	9	2.25
TOTAL	400	100	400	100	400	100	400	100	400	100	400	100

Agriculture

From this findings, 56% of the respondents indicated severe impact. While 37.5% of the respondents said 'don't know' . No one indicated 'no impact' to agriculture. It revealed that 28.8% of the inhabitants of the community are farmers and engage in both rain fed and dry season farming. This ascertained that their livelihood rest on agriculture. They stressed that over stay of flooded water into their farmlands consequently affect their crops. But sometimes used to be beneficial to them, as immediately the flooded water recessed, they engage in recession farming.

Housing

From the survey of the study, it revealed that high proportion of houses mud wall-structured houses with thatched or zinc roofing. Very few houses were built with bricks and zinc roofing system. There were also few houses built with corn stalk and reeds along the water channel. These kind of buildings were perceived to be more vulnerable to floods than a household in a stone house, whose housing structure represents high coping capacity and more resilience to flood hazards. Table 3 shows that 71.5% of the respondents indicated 'severe impact' and no one indicated 'no impact' on housing. From the general perception it indicates that the low quality of houses aggravated the severity of the damage.

Economic Activities

Socio-economic dynamics is recognized as a factor that drives vulnerability (Emmanuel et al., 2014) Findings from the study indicate a high degree of poverty, since majority of respondents are subsistence farmers and artisans. This has compounded and makes it not easy for the households to move far a little from the watershed terrain site and also livelihood depends on harvests, damage to farms has direct impact on economic activities. In this sector, 51% of the respondents indicated 'severe impact', 71 (17.75%) indicated 'medium impact, 46(11.5%) of the respondents indicated 'minimal impact'. 45(11.25%) indicated 'no impact' and 34 (8.5%) indicated ' don't know'.

Health

From the Table 3 out of the 100% respondents, 58.5% indicated 'severe impact' on human health. As Hajat et al. commented; the complex nature of flooding events on health is responsible for poor impact assessment (Hajat, Ebi, Kovats, Menne, Edwards, & Haines, 2003). This influences the respondents perception on the phenomenon. It was noted from the respondents that the common disease outbreak known include malaria, typhoid, cholera, diarrhea and skin infections.

Water and Sanitation

The occurrence of flooding in an area is usually accompanied with contamination of water body especially drinking water. The result indicated that 52.5% of the respondents indicated severity of the impact on drinking water. While 22.5% does not know its impact. The residents especially those very close to the stream sourced their drinking water from the running stream and on such occurrences the water are unsafe for drinking. Among the respondents indicates the prevalence of cholera and diarrhea cases.

Transportation

The only main road linking the community to the other part of Dutsin-Ma town is along the stream under study, except one decide to take the by-pass which is lengthy. Thus on the occurrence of this phenomenon the bridge is overflow by flooded water often became difficult to cross. Emergency aid seems very difficult. 46.5% of the respondents indicated 'severe impact'. While the remaining assessing severity impact factors were low. The amount of perception from the respondents is highly linked to the existing road.

Flood Adaptation Strategists in Hayin-gada

Man responds to flood through adjustment, flood abatement and flood protection measures (Marcellinus, 2015). Adjustment covers any action to minimize or ameliorate flood hazards (NEMA, 2011). The case in Hayin-gada is summarized in Table 4. The Table discusses flood adaptation activities for three phases (i.e. pre-flood, during flood and post-flood). From Table, re-building of muddy houses to bricks (69.5%), as well as seeking expert advice and use appropriate building materials, and build only in the approved way and in approved areas (52.5%) were reported most employed pre-flood adaptation measures. These techniques were found commonly used. Maharjan, *et al.* (2011) also discovered that, Tharu community around Koshi River Basin of Nepal India, had started to construct double story housings to escape from flood due to its occurrence and frequency. Table 4 further revealed that majority of the respondents does not help in every way to construct drains and ditches or embankments, to protect buildings, constructions, and utilities (85.0%) at pre-flood phase.

Table 4: Flood Mitigation Strategists and Measures Adopted by People in Hayin-gada

Adopted Measures/Strategists	Agreed		Disagree		Undecided		Total	
Pre-Flood Phase	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**
Help in every way to construct drains and ditches or embankments, to protect buildings, constructions, utilities	10	2.50	340	85.0	50	12.5	400	100
Never put refuse or solid materials in drains, and discourage others from doing so.	188	47.0	100	25.0	112	28.0	400	100
Don't remove plants or trees unnecessarily, help to replant cleared areas.	180	45.0	90	22.5	130	32.5	400	100
Always help to clean gutters or drains and encourage others to do the same.	80	20.0	198	49.5	122	30.5	400	100
Re-building of muddy houses to bricks	278	69.5	112	28.0	10	2.50	400	100
Seek expert advice and use appropriate building materials, and build only in the approved way and in approved areas	210	52.5	90	22.5	100	25.0	400	100
Public early warning system are available and are of good aid	10	2.50	294	73.5	96	24.0	400	100
During Flood and Post-Flood Phase								
Identify a higher place where you can run to during floods.	50	12.5	298	74.5	52	13.0	400	100

Move valuable property into the safe place	358	89.5	14	3.5	28	7.0	400	100
Coordinate with government and other NGOs, to support the flood affected	278	69.5	80	20.0	42	10.5	400	100
Evacuation from affected homes to safer zones (government designated)	396	99.0	3	0.75	1	0.25	400	100
Manage housing for flood affected people	10	2.50	340	85.0	50	12.5	400	100
Exchange help to each other to bring the situation and livelihood to the original level received	344	86.0	48	12.0	8	2.0	400	100

Source: Field Survey, 2017

It is good to acknowledge that lack of funding for long-term projects and faith in government intervention or lack of awareness of proper preventive methods of flood risks exacerbated much of the incidence . From the findings, 49.5% of the respondents disagreed that, their gutters have always been clean or drains and people are always encouraged to do the same. So, large parts of the ground are covered with sands at dry season, thereby obstruct sections of natural channels and builds drains that ensure water movement faster than it could under natural condition thus, restricts where flood water can go (Hassan, 2014). Public early warning system was rather unreliable or unavailable as the respondents found it of no aid (73.5%). This is a highly visible measure that may have generate perceptions and largely contribute to influence motivation to prepare against flood. Thus, the sense of being at risk does in itself move people to action (Eychaner, 2015). On such account, Sinclair and Pegram (2003) stated that, floods cannot be prevented but their devastating effects can be minimized if advance warning is available.

A similar finding in Bonny Island exposed that, people had no knowledge of flood early warning system and community education as a result majority of the respondents show a great level of indifference to the impact caused by flood by their attitude and lack preparedness (Akuro, *et al.,* 2013). According to Gwary (2008), the first priority during and at post-flood phase is to minimize risk by undertaking rescue efforts to the affected people and to bring their lives into normal condition. The case in Hayin-Gada does not board well, for majority of the respondents (74.5%) claimed to have no higher place to run to during floods, so remain home and move their valuables into safe places (89.5%). Also many (69.5%) contended that, the community does not share housing with the victims. Rather, as asserted by the majority (99.0%), they coordinates with government and other NGOs, for support. Such as; evacuation from affected homes to government designated safe zones. They also majorly (86.0%) exchange help among themselves to bring the situation and livelihood to the original level. Devkota *et al.* (2014) also found out that, exchange help within communities was the most flood adaptation measure.

CONCLUSION AND RECOMMENDATIONS

Flood in Haying-Gada is seasonal and the community resilience is reduced and therefore increased the vulnerability of the people. While factors, such as rainfall intensity and duration, cannot be controlled, the issue of dam burst may continue to prevail and damages will continue to increase. Early warning of flooding based on climatic variability does not help people in the area to prepare ahead of time. Most effective indigenous action taken was at the community level to adapt to the risks posed by floods. The dependency syndrome and its pitfalls for creating less resilient communities as a result of aid dependency in might have contributed to decreased ability to cope as well as contributing to livelihood insecurity in the area. Deficiencies particularly of institutional capacities to implement risk reduction measures through public early warning system, shed light on the risk context of the area and how vulnerability is complicated by increasing exposure to risks. If menace flooding of Hayin-Gada is continually ignored, the risk of exposure to flooding will be on the increase and more properties, farmlands and crops, public infrastructures and lives may be lost in due course. It is therefore recommended that: Proper embankment protection and dam regulatory outlets should be made available and the dam should be put more in to usage (irrigation for instance); Real time flood forecasting system and effective early warning system that fits the local level consciousness and local condition should be developed; It is important that, people brought to temporary shelter should get health and sanitation services that helps to prevent an outbreak of disease.

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