Indonesian Journal of Earth Sciences, Vol. 2, No. 2 (2022): 226-235

P-ISSN: 2798-1134 | E-ISSN: 2797-3549 | DOI: 10.52562/injoes.v2i2.415

Indonesian Journal of Earth Sciences

http://journal.moripublishing.com/index.php/injoes

Analysis of Flood Disaster Adaptation Strategies Among People of Guma Local Government Area, Benue State, Nigeria

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Received: 15 October 2022; Accepted: 18 December 2022; Published: 26 December 2022

Abstract: One of the most important issues in flood risk management is to find a way to cope with uncertainties. Despite centuries of experience with flood management, flood disasters become more frequent and are increasing in severity due to climate change. This work examined flood disasters adaptation strategies among people of Guma Local Government Area, Benue State. Data on the demographic characteristics of respondents, flood frequency, duration, and impact in the area, as well as flood mitigation and adaptation strategies were obtained using a questionnaire. A total of 380 respondents were sampled through random sampling. Data were analyzed using frequencies and percentages, and presented in tables. Results revealed that, the respondents are susceptible to the impact of flood disaster due to their socio-demographic characteristics. Furthermore, the results show that the frequency of floods disaster is biennial, while its duration is between one to two weeks. Floods impacts both directly and indirectly, involving destruction of farm crops, and disruption of transportation. Lastly, the results show that, the respondents mostly clear filled/blocked drainages around them to mitigate the impact of flood and many of the respondents construct wooden bridges across drainages/gutters in order to adapt to flooding in their areas. The study recommends that non-flood-sensitive economic activities should be embraced to mitigate the impact of flooding in the study area. There should also be public sensitization on the need to adopt both structural and unstructural measures of adapting to flood disaster as climate change continues to trigger more severe, and frequent floods.

Keywords: Adaptation Strategies, Flood Disaster, Flood Mitigation

INTRODUCTION

Records from the Intergovernmental Panel on Climate Change (IPCC) indicate that the global average temperature has increased by at least 0.4 degrees Celsius (0.72 degrees Fahrenheit) since the 1970s, and that by 2100, it could increase to around 4 degrees Celsius (7.2 degrees Fahrenheit) above preindustrial temperatures. While the global effects of climate change may seem too small to be noticed by people living around the world, we have already experienced the effects of climate change through severe weather events, including forest fires, hurricanes, droughts, heat waves, floods, and storms (National Geographic, 2022). The impact of these sudden events, in addition to the gradual change in climate effects over time, will put added stress on vital water, sanitation, flood management, transportation, and energy infrastructure (Asian Development Bank (ADB), 2015). The number of people affected by natural disasters has also been increasing. This is particularly true for hydrological disasters. Before the 1990s, 5-year averages did not reach 50 million people. There is a growing literature on the evidence linking anthropogenic climate change (Thomalla et al., 2006) with natural disasters. Flooding is the number one source of disaster loss and damage worldwide; globally the number of people exposed to floods each year is increasing at a higher rate than population growth (Miller et al., 2008; UNISDR, 2011). Several factors

determine flood damage and vulnerability, including exposure, sensitivity and adaptation (McCarthy, 2001). Flood exposure relates to measurable indicators such as frequency and duration while flood sensitivity is associated with indicators such as population density, economic value, among others. While flood exposure and sensitivity influence potential damage, actual damage can be mitigated by adaptation defined as the ability to avoid potential damage through adjustments in ecological, social or economic systems in response to flood impacts (McCarthy, 2001).

Floods are defined as the overflowing of the normal confines of a stream or other body of water or the accumulation of water over areas that are not normally submerged (Etuonovbe, 2011). Floods include river (fluvial) floods, flash floods, urban floods, pluvial floods, sewer floods, coastal floods, and glacial lake outburst floods (UNISDR, 2011). Bates & Kundzewicz (2008) note that floods are affected by various characteristics of the climatic system, most notably precipitation (intensity, duration, amount, timing, phase – rain or snow), and also temperature patterns (responsible for such phenomena as soil freezing, snow and ice melt and ice jam formation). Floods are also affected by drainage basin conditions, such as pre-existing water levels in rivers, the snow and ice cover, the soil character and status (permeability, soil moisture content and its vertical distribution), the rate of urbanization, and the presence of dikes, dams and reservoirs (Ward, 2008). Close to sea level, river flooding may be concurrent with storm surge or extreme tide events (Brakenridge et al., 2013). Several studies have adduced extreme rainfall to be the major cause of floods worldwide, including Nigeria (Ologunorisa & Tersoo, 2006). For instance, Ayoade as cited in Hula & Udoh (2015) observed that flooding in the tropics is regarded as partly or wholly climatological in nature as they result from torrential rainfall. In view of this, there is a compelling need to adopt concrete adaptive measures to survive flooding whose frequency of occurrence and severity is expected to increase.

According to USAID (2014), climate change is likely to affect the location, type, and magnitude of flooding in both urban and rural areas. As a result, it is necessary to include climate change considerations in the design of new flood management structures or the assessment of existing structures (Twig & Calderon, 2019). Climate change effects may occur through gradual changes (such as sea level rise) or through modifications to the seasonal or annual patterns of precipitation and temperatures. The frequency and severity of flooding are also increasing in many parts of the world associated with population pressure, urbanization and climate change (Hirabayashi et al., 2013; Jongman et al., 2014). This is evident when one considers the number of people affected by flooding in recent decades. For instance, flooding accounts much of the loss event worldwide between 1980–2014 more than any other single disaster (Munich RE, 2015) and tops the list of natural disasters by economic damages in 2014 (Guha-Sapir & Hoyois, 2015).

In 2012, killer floods inducing more than 50 fatalities each, occurred in Madagascar, Niger, and Nigeria (Kundzewicz, 2013). Peduzzi (2009, 2012) observed the international loss databases show an increase in reported flood disasters and flood losses through time. However, part of this increase may be attributed to improvements in reporting, population increase, and urbanization in flood-prone areas, increase of property value and degraded awareness about natural risks (due to less natural lifestyle) (Alaci, 2017). In Nigeria, flood disaster has been perilous to communities and institutions. It has shattered both the built-environment and undeveloped plan (Oladokun & Proverbs, 2016). It has claimed many lives, and millions of properties got lost due to its occurrence Weldegebriel & Amphune (2017). This underscores the importance of this work, in academics, and in terms of policy formulation.

Adaptation strategies consist of a broad plan of action to be implemented through policies and measures over the short-, medium- and long-term (Adger et al., 2007); adaptation measures should focus on actions aimed at specific issues. Measures can be individual interventions or they can consist of packages of related measures. Some adaptation measures are designed with the capacity to be modified at a future date as climate changes and where the benefits, although mainly met under projected future climate change, may be relatively large. For example, (Twig & Calderon, 2019) constructing drainage systems with a higher capacity than required by current climatic conditions often has limited additional costs, but can help to cope with increased run-off as a result

of expected climate change impacts. The work is significant as it examines the major causes and effects of flood disaster in the area. Also, the strategies employed/adopted by people of Guma Local Government Area in adapting to flood disaster which is a serious environmental and socio-economic problem, are assessed. The study reveals the ways through which the impact of the disaster can be reduced. Lastly, the recommendations made on better mitigation and adaptation strategies/measures to flood disaster are considered very important.

MATERIALS & METHODS

Study Area

Guma Local Government Area, is one of the 23 local government areas in Benue state. It is located between latitudes 70 33' and 80 15'N, and longitudes 80 30' and 90 15' E. It is bounded to the north by Nassarawa state, on the east it is bounded by Logo Local Government Area, while to the southwest it is bounded by Makurdi Local Government Area. To the southeast, Guma is bounded by Tarka Local Government Area (see Figures 1 and 2). Due to its close proximity to river Benue, Guma Local Government Area is drained by both small and major streams which all drain into the much bigger streams. Due to the nature of its drainage, Guma Local Government Area is vulnerable to periodic floods.

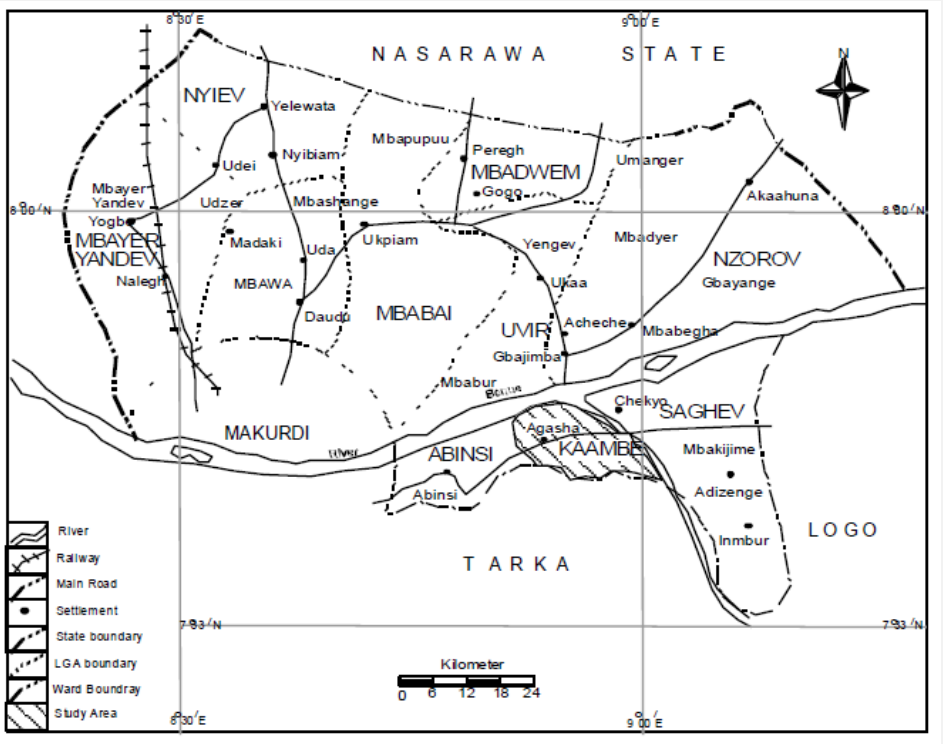

Figure 1. Guma Local Government Area (Adapted from Shabu and Tyonum, 2013).

Instrument of Data Collection

The instrument for data collection in the study was a three-sectioned questionnaire; sections A, B, and C. Section A covered socio-demographic characteristics (age, sex, education, occupation and income) of respondents, and section B covered flood frequency and impact of flooding on means of livelihood of the respondents. Meanwhile, section C covered flood adaptation measures and flood mitigation strategies. A total of 388 copies of the questionnaire were administered to respondents in the area, however, only 380 were returned completed and valid for analysis. Upon collection and analysis of data from the respondents, the following results were obtained as presented in section 3.

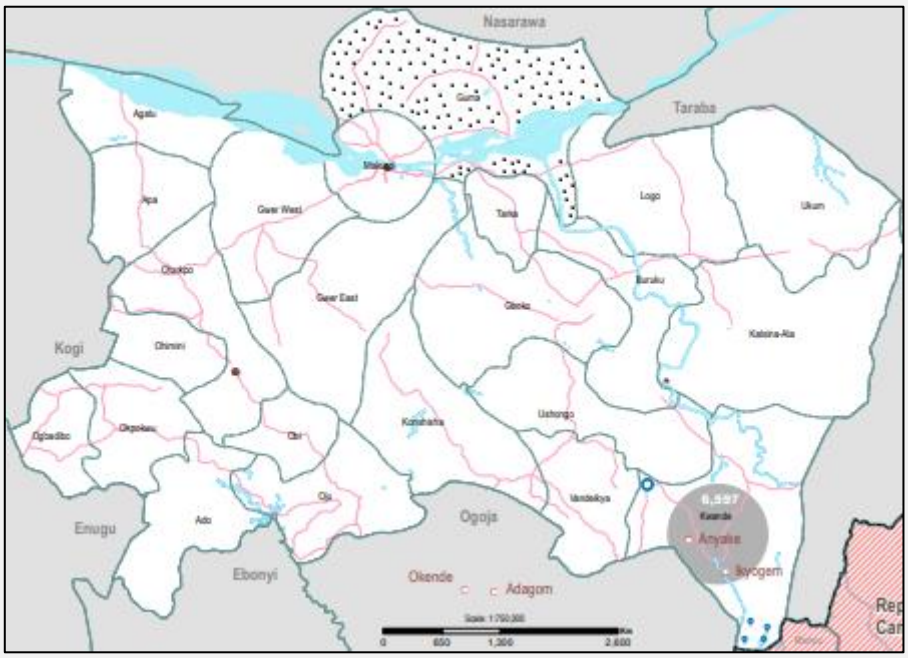

Figure 2. Benue State showing the position of Guma (the shaded area) (Source: Benue State Ministry of Land and Survey, 2010).

RESULTS AND DISCUSSION

Socio-demographic Characteristics of Respondents

The socio-demographic characteristics of respondents considered in the study include; sex, level of education, age, income, occupation, family size, and duration of stay in the area. These characteristics are considered because they are critical in understanding adaptation strategies of people, who live in flood-prone areas.

The result of the demographic characteristics of the respondents is presented in Table 1. The result shows that 53.7% of the respondents were male while 46.3% were female. The result indicates that majority of respondents were male. This could be due to the fact that, most of the household heads in the area are males. Moreover, males are more willing to volunteer information compared to females who are commonly reserved. In terms of age of the respondents, 12.3% were in the age category of 18 – 25years, 38.2% of the respondents were in the age group of 26 – 35years. Meanwhile, the age categories of 46years and above, and 36 – 45years had 28.7 % and 20.8 respectively. It can be inferred from the result that the respondents cut across different age groups, but majority are in the active productive age groups (18 – 25, 26 – 35, and 36 – 45). Only a few (20%) fell in the group of 46 years and above. This, seemingly has a positive impact on flood mitigation and adaptation efforts as they would contribute to the required labour force.

The result of marital status of the respondents shows that 75% of the respondents were married, and 22.4% were single. Meanwhile, 2.1% of the respondents were divorced and 0.5% were separated. The result of respondent's demographic characteristics also shows that, in terms of educational attainment, 45.3% did not acquire formal education while 28.4% of the respondents acquired primary education. Meanwhile, 14.7% acquired secondary education and 11.6% of the respondents acquire tertiary education.

The result further shows that 37.1% of the respondents earn between N200,000 – 300,000 annually and 22.4% N101,000 – 200,000. Meanwhile, 21.8% earn N300,000, 18.7% earn between N1000 –100,000 annually. This result implies that majority of the respondents earn very little income which could influence their choice of flood adaptive strategies. The result also shows that on the basis of occupation, farming had 49.0% of the respondents, artisans had 21.0% of the respondents, and 13.1% of the respondents were civil servants. Meanwhile, 10.3% were retirees

and 6.6 were into business. It can be inferred from the result that the respondents were predominantly farmers with just a few, engaging in other economic activities. Furthermore, the result shows that majority of the respondents (72.6%) had family sizes of between 9 – 12 members while 14.2% had family sizes of about 5 – 8 members. Meanwhile, other respondents (10.8%) had family members numbering about 13 and above, and 2.4% of the respondents had family sizes between 1 – 4 family members. It can be inferred from this result that majority of the respondents have large family sizes of over 10 members. In terms of duration of residence in the area, the result shows that majority of the respondents (47.9%) stayed in the area about 31years and above while 30.0% of the respondents stayed there for about 21 – 30 years. The result also shows that 16.8% of the respondents stayed in their areas for about 11 – 20 years and 5.3% stayed there for as long as 1 – 10 years and above.

Table 1. Demographic Characteristics of Respondents

Characteristics	Frequency	Percentage	Characteristics	Frequency	Percentage
Sex of the respondents			*Occupation*		
Male	204	53.7	Farming	186	49
Female	176	46.3	Artisans	80	13.1
Total	380	100	Civil servants	51	21
Age group			Business	39	10.3
18 – 25	47	12.3	Retirees	24	6.6
26 – 35	145	38.2	Total	380	100
46 and above	109	28.7	*Family size*		
36 – 45	79	20.8	9 – 12	276	72.6
Total	380	100	5 – 8	54	14.2
Marital status			13 and above	41	10.8
Married	285	70	5 – 8	9	2.4
Single	85	22.4	Total	380	100
Divorced	8	2.1	*Duration*		
Separated	2	0.5	> 31 years	182	47.9
Total	380	100	21 – 30 years	114	30
Educational level			11 – 20 years	64	16.8
Non-formal	172	45.3	1 – 10 years	20	5.3
Primary	108	28.4	Total	380	100
Secondary	56	14.7			
Tertiary	44	11.6			
Total	380	100			
Annual income					
₦1K - 100K	71	18.7			
₦101K – 200K	85	22.4			
₦201K – 300K	141	37.1			
>=₦300K	83	21.8			
Total	380	100			

Source: Author's Field Work 2021

Frequency of Occurrence, Duration, and Impact of Flooding in the Area

The result of the frequency of occurrence and impact of flooding is presented in Table 2. The result shows that majority (42.6%) of the respondents' experience floods biennially,

meanwhile, 41.6% experience flooding in their areas once in four years. The result further shows that 12.4% experience flooding annually, while other respondents (3.4%) experience flooding once in a long time. On the duration of flood, the result shows that 55.8% of the respondents reported that flood waters stay in their area for about 1 – 2 weeks, while other respondents (28. 4%) said that flood waters stay in their area for less than a week before receding. The result further shows that 15.8% of the respondents said flood waters stay for about 1 – 3 weeks in their area before receding.

Table 2. Frequency of Occurrence, and Impact of Flooding in the Area

Characteristics	Frequency	Percentage
Duration of Stay in the Area		
1 – 10 years	182	47.9
11 – 20 years	114	30
21 – 30 years	64	16.8
31 years and above	20	5.3
Total	380	100
Frequency of Flood occurrence		
Biennial	162	42.6
Quadrennial	158	41.6
Annual	47	12.4
Once in a long time	13	3.4
Total	380	100
Duration of Stay of Flood waters		
1 -2 weeks	212	55.8
Less than 1 week	108	28.4
1 – 3 weeks	60	15.8
Total	380	100
Nature of Flood Impact		
Destruction of farm crops	255	67.1
Destruction of houses/furniture	80	21.1
Destruction of harvested produce	35	9.2
Collapse of buildings	10	2.6
Total	380	100
Indirect impact of flood		
Disruption of transportation	268	70.5
Closure of market	82	21.6
Closure of school	30	7.9
Total	380	100

Source: Author's Field Work 2021

The result of direct impact of flooding in the study area shows that majority (67.1%) of the respondents identified destruction of their farm crops, and 21.1% of the respondents identified destruction of their houses/furniture as the major impact of flooding in their area. Meanwhile, other respondents (9.2%) identified destruction of harvested/stored farm produce as the direct impact of flooding in their area, and 2.6% of the respondents said the direct impact of flooding in

their area is collapse of buildings. It can be inferred from the result that flood waters are usually extensive, thus, destroying mostly cultivated crops, due to continued inundation of farms.

The result of the indirect impact of flooding in Guma Local Government Area shows that 70. 5% of the respondents identified disruption of transportation as the indirect impact of flooding in their area, while other respondents (21.6%) identified closure of market squares as the indirect impact of flooding in their area. The result also shows that, 7.9% of the respondents said flooding impacts them indirectly through school closure. The result corroborates the position of many authors including Shabu & Tyonum (2013), and Hula & Udoh (2015). They posited that, the impact of flood could be direct and indirect covering several aspects of the environment and socio-economic wellbeing of the people.

Flood Mitigation and Adaptation Measures

The result of flood mitigation measures shows that, 82.9% of the respondents cleared blocked drains to mitigate the impact of flood in their areas, and 11.3% constructed new drains in their areas (see Table 3). The result further shows that other respondents (5.8%) elevated/raised the floors of their buildings to mitigate flood impact in their areas. It can be inferred from the result that clearing of drainages is the major flood mitigation strategy used by respondents in their areas. The result further shows that, in terms of flood adaptation strategies among the respondents, 62.1% of the respondents use sandbags to block flood waters from entering into their compounds, other respondents (20.0%) construct wooden bridges over drainages/gutters (see Figure 3). Meanwhile, 17. 9% of the respondents relocate to safer places during flooding. It can be inferred from the result that majority of the respondents rely on the use of sandbags as an adaptive strategy.

Table 3. Flood Mitigation and Adaptation Measures

Mitigation measures	Frequency	Percentage
Clearing of blocked drains	315	82.9
Construction of new drains	43	11.3
Raising of building floors	22	5.8
Total	380	100
Adaptation measures	235	62.1
Use of sandbags	76	20.0
Relocation	69	17.9
Total	380	100

Source: Author's Field work 2021

Those measures are not effective in flood adaptation, as such, more concrete measures would be required to adapt to flooding in the area. The result implies that the peoples' socio-economic status has greatly influenced their choice of adaptive measures. The result agrees with the position of Adger et al. (2007), that the capacity to adapt is dynamic and influenced by economic and natural resources, social networks, entitlements, institutions and governance, human resources, and technology. The people should also employed both structural and unstructural measures of mitigating and adapting to flood disaster. Policy makers (government and non-governmental organization) should invest in building flood resilience through effective adaptation (structural and unstructural) measures.

Figure 3. (i) Sandbags used in flood mitigation; (ii) Wooden Bridge made by locals.

CONCLUSION

The study found that people who are largely peasant farmers, and as such, economically poor, do not adopt effective flood adaptation measures. The study also found that flood waters are usually extensive, thus, destroying mostly cultivated crops, due to continued inundation of farms. Majority of the people rely on the use of sandbags as an adaptive strategy. This result means that majority of the respondents have no formal education while only a few acquired tertiary education. This could negatively affect their level of awareness on modern flood mitigation strategies and adaptation measures. In view of these findings, it is recommended that, the people should be sensitized on the need to engage in non-flood-sensitive economic activities and non-weather sensitive means of livelihood.

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