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Assessing Social Vulnerability to Floods and Coping Strategies in Adamawa Catchment, Nigeria

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Key words: Adamawa, Coping strategies, Social flood vulnerability, Flood hazard, Flood risk.

SUMMARY

There is increasing vulnerability of populations and infrastructure to flooding and flood related hazards in the Adamawa catchment of Nigeria. Little is known about the human dimension involved in flood vulnerability in the catchment. This study assessed social flood vulnerability to flooding and coping strategies adopted by the human dwellers in the Adamawa catchment. A structured questionnaire was used as the instrument for data collection using a stratified and systematic sampling technique. The responses were analysed using descriptive statistics (frequency counts and percentages). The results show that rural dwellers are mostly at risk of flood hazard. The effect of flood was greatest in agricultural areas through destruction of farmland and agricultural products. The vulnerability score revealed that the agricultural sector is the most vulnerable with 32.8% for both cultivated and irrigated land. Biodiversity and forests are the least vulnerable sectors with 3.3% each. Analysis of livelihood patterns of people living with flood shows evidence of the presence of natural capital (56.9%). Findings on the socio-economic impact of flood based on degree of physical and natural resources affected shows severe effect (34%). Analysis of caste differentiation show that Batchma and Mbula people are mostly impacted. The capacity to cope with floods were mainly between self-support and government support. Analysis of livelihood resources available to cope with flood impact shows that all the resources were of medium availability; economic (39.5%), human capital (38.1%), and social and institutional capacity (33.2%). In conclusion, the catchment is under the threat of flood and most of the people living within lack the required human, financial and social capital to cope with the situation.

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1. INTRODUCTION

Flooding is a well-known seasonal problem in Adamawa catchment which usually exposes the people to different risks. Majority of the population living in the area depend on agriculture as a means of livelihood. Farming activities in the catchment are mainly done in flood prone areas. This flooding destroys agricultural produce such as rice, fruit trees and vegetables thereby causing hunger and losses to subsistence farmers and commercial scale farmers. The destructive impacts of flooding along the Benue River including the loss of lives and property and displacement of people has been documented in previous works (e.g. Galtima and Bashir, 2002; NEMA, 2010; Nkeki *et al*. 2013). Nwilo *et al*. (2012) observed that floods in regions adjacent to major rivers like the River Benue displace thousands of people annually, many of them with no access to clean drinking water, leading to cholera outbreaks. The implication is that the catchment is under serious environmental challenges particularly the threat of flood. The flood problem has taken a new dimension in recent times as more communities are becoming vulnerable.

The concept of vulnerability is very important when it comes to issues of flooding and quantification of their impact on man and the environment. Vulnerability is defined by UNDP (2004) as the conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards. This definition is in line with Luers *et al.* (2003) and Adger (2006) who identified the following types of vulnerability: social, individual, urban, ecological, and economic. Vulnerability is both a biophysical risk and a social response within a specific geographic domain (Zheng *et al*., 2009). The position is in line with the conceptualisation of hazard-of-place model for vulnerability (Cutter, 1996; Cutter *et al.*, 2003). According to Cutter *et al*. (2003), risk interacts with mitigation to produce the hazard potential. The hazard is either enhanced or moderated by geographic filters (site and situation of place, proximity) as well as the social fabric of the place. The effect of these hazards is referred to as natural disaster. An extreme natural event becomes a disaster when it has a large impact on human settlements and activities (Genovese, 2006). Miiller *et al*. (2011) observed that vulnerability is non-tangible and quantitatively challenging to capture. However, UNDP (2004) and Wisner *et al*. (2004) gave an expression for risk which shows that vulnerability cannot be explained in isolation. The mathematical expression defined risk as the product of hazard and vulnerability.

The literature is replete with studies investigating flood vulnerability (e.g. Ologunorisa *et al*., 2005; Musungu *et al.*, 2012; Nwilo *et al*., 2012; Ikhuoria *et al*., 2012; Nkeki *et al.*, 2013; Ojigi *et al*., 2013; Olayinka *et al*., 2013) especially in Nigeria. However, more research needs to be directed at investigating the social perspectives of flood vulnerability in the Adamawa

catchment. In response, this study employs a Participatory Vulnerability Approach (PVA) to assess the human dimensions involved in flood vulnerability and coping strategies within the investigated area.

2. MATERIALS AND METHODS

The study area is located along River Benue in the Upper Benue drainage basin of Nigeria. The study area border is approximately defined by longitudes 11º 46'E to 14º 14'E and latitudes 8º 37' N to 9º 41'N as shown in Figure 1. The human dimension involved in flood vulnerability is investigated using the Participatory Vulnerability Approach (PVA) through questionnaire administration, discussion with relevant agencies and data from the emergency events records, obtained from Adamawa State Environmental Management Agency (ADSEMA). The purpose of the vulnerability assessment is to have insight into the people's perception on flood vulnerability and coping strategies in the investigated area. The steps taken in achieving the goals are discussed in the following subsections.

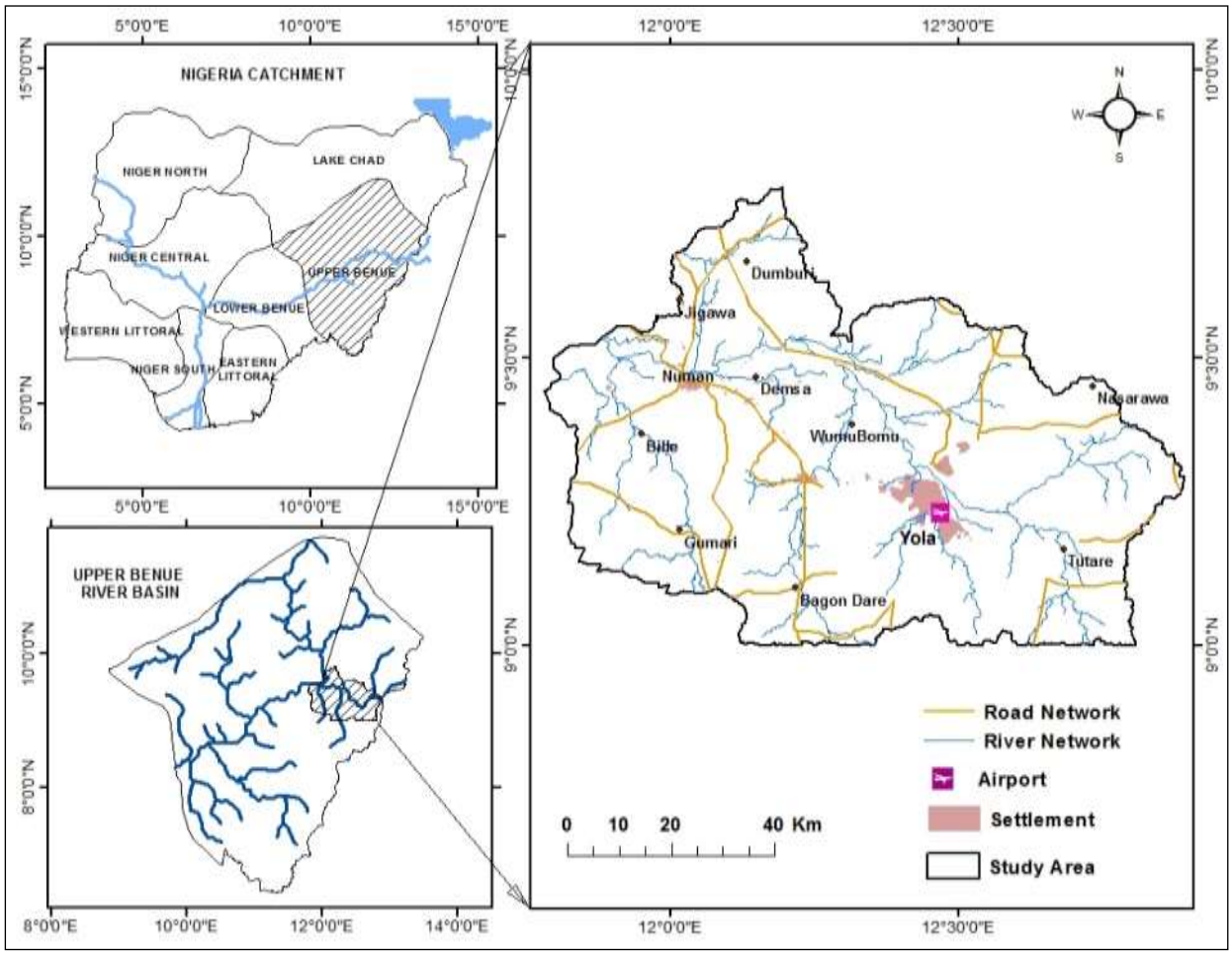

Figure 1: Adamawa catchment in Nigeria (Source: Adzandeh *et al*., 2020)

2.1 Sampling Technique

A stratified and systematic sampling method was used in this study for questionnaire administration. The investigated area was first stratified into seven areas and then quadrants were imposed on each of the seven locations to get five zones for good spatial spread across the study area (see Figure 2). The PVA is proposed because it is considered to be an effective tool in flood vulnerability studies. A sample copy of the designed questionnaire that was employed for the PVA is included in Appendix A1. The questionnaires were distributed based on the number of households in each of the 7 areas based on the 2006 national population census (see Table 1). This approach is in line with Ader and Mellerbergh (2008) who noted that sample size should be small in order to improve quality and accuracy of research work. The number of questionnaires for each of the 7 areas was further divided into 5 for the zones. Two copies of questionnaires were used on one street (one for the first and the other on the last house of the street). The next two streets were overlooked and so on. In cases where some members of households in a street within a sample frame were absent, the second or third street was selected. The peoples' responses were used to extract the relevant information required.

Table 1: Ranking according to number of households

S/N	Area	Number of Households	No. of Questionnaires	Percentage (%)
1	Demsa	37,498	67	15.8
2	Fufore	44,025	79	18.6
3	Gombi	29,062	52	12.2
4	Lamurde	19,604	35	8.2
5	Numan	24,062	43	10.1
6	Yola North	41,968	75	17.7
7	Yola South	41,238	74	17.4
Total		237,457	425	100

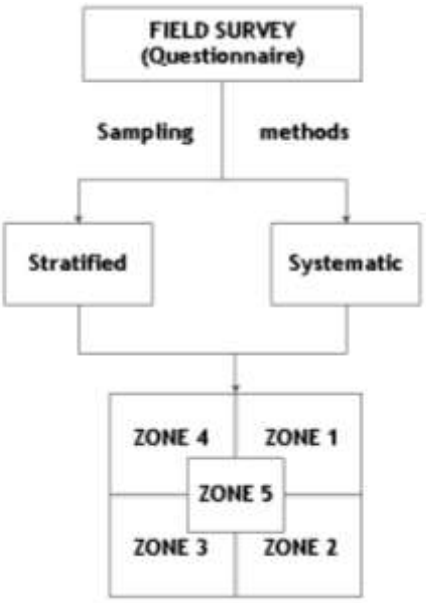

Figure 2: Sampling technique for questionnaire administration

The 2001 population data for the study area was projected to 2019 and the average household value of 6 for Adamawa was applied to arrive at the number of Households H/H for the localities. The population projection calculation was based on the formula by Gakure and Uloko (2013) in Equation 1:

$$P_n = P_o (1+ r/100)^2 \quad (1)$$

Where P_n is the population figure for the projected year; P_o is the existing or base population figure; r is the growth rate and n is the number of years projected. The national growth rate in Nigeria is given as 3.2% (NPopC, 2006).

2.2 Data Collection

A total of 425 questionnaires were administered to members of the communities. The questionnaire was designed to retrieve demographic, socio-economic and livelihood data including sectors vulnerable to flood hazard (livestock, biodiversity, cultivated land, etc.). Livelihood data was sourced from questions such as: what are the major livelihood patterns of people living with flood (focusing on social capital, human capital, financial capital, natural capital, physical capital, and political capital)? What are the major effects of flood in livelihood of flood victims? Physical capital refers to man-made structures e.g. roads, bridges, buildings, and irrigation channels, etc. Human capital refers to good health care, welfare services, skills and knowledge through education, etc. Financial capital means saleable assets including livestock, income, savings, and remittance flow, etc. Natural capital refers to goods and services such as timber, river water, ground water, biodiversity, firewood, etc. Social capital refers to relationships of all forms: gender-based, age-based, class-based, and professional, etc.

Among the respondents, 63.8% were male and 36.2% female. In the aspect of education, at least 69.9% of the respondents had education up to tertiary level. This shows a good mastery of the questionnaire by the respondents given their level of education. Analysis of the length of stay of the respondents showed that 47.3% had been in the area for 11 - 29 years, 16.7% had been in the area less than 10 years, whereas 36% had spent more than 30 years in the area. Information on their length of stay is very necessary given that the study combined the use of historic data and up-to-date records. As such, their responses based on experience with the different flood events are important.

2.3 Data Analysis Techniques

In analysing the data gathered from the administration of the questionnaire, descriptive statistical tools of frequency counts and percentages were used. The various categories of variables (demographic data, socioeconomic data, livelihood data and sectors vulnerable to flood hazard) were analysed. The process of analysis was undertaken in the Microsoft Excel 2013 software environment. The variables regarding sectors vulnerable to flood hazard were ranked and the final vulnerability scores (V_S) were computed using Eq. 2 (LFP, 2010). The frequency, area of impact and potential damage magnitude values are defined by a scale from 1 to 5, where 1= low and 5= high.

$$V_S = (\text{Frequency} + \text{Area of impact}) \times \text{Magnitude} \quad (2)$$

3. RESULTS AND DISCUSSION

3.1 Population at Risk, Causes and Effects of Flooding and Severity Impact

Generally, the awareness level of residents on the issue of vulnerability to flood hazard was found to be relatively high. A breakdown shows that 65.4% of the respondents were of the opinion that the vulnerability to flood is increasing whereas 34.6% are of the view that the vulnerability is decreasing (Table 2).

Table 2: Increasing or decreasing vulnerability

Response	Frequency	Percentage (%)	Cumulative Percentage (%)
Yes	278	65.40	65.40
No	147	34.60	100.00
Total	425	100.00	

The rate of people mostly at risk to flood hazard was categorized into rural dwellers, urban dwellers, farmers, traders, and fishermen (Table 3). From the responses obtained, 51.1% believe that rural dwellers are mostly at risk of flood hazard, 24% believe that farmers are mostly at risk while 17.2% believe that fishermen are mostly at risk.

Table 3: People mostly at risk of flood hazards

Group	Frequency	Percentage (%)	Cumulative Percentage (%)

Rural dwellers	217	51.10	51.10
Urban dwellers	15	3.50	54.60
Farmers	102	24.00	78.60
Traders	18	4.20	82.80
Fishermen	73	17.20	100.00
Total	425	100.00	

Four variables (heavy rains, release of water from dam, impervious surfaces, and channel blockage) were analysed to determine the causes of flooding. It was discovered that the release of water from dam contributes to 40.2% of flooding in the area while heavy rains constitute 25.6% (Table 4). Release of water from dam dominates as the major influence of flooding in the area. This is obvious because Lagdo dam is located upstream of River Benue, in Cameroon Republic. Annually, water is released from the dam which usually causes the river to overflow its banks downstream, thereby leading to flooding. In a related study conducted by Galtima and Bashir (2002) on the people's perception of the causes of flooding in Yola, Greater Numan and Fufore area of Adamawa floodplain, 58.3% of the flooding was attributed to the release of water from Lagdo dam. Mayomi *et al.* (2013) also observed in their study that floods at the valleys and downstream area of River Benue were very devastating after water was released from Lagdo dam. In another study, Kwari *et al.* (2015) discovered that communities and properties washed away in a previous flood in parts of Adamawa were situated along the floodplains with the risk of inundation during the wet seasons. In Jimeta metropolis of Adamawa, Barde (2019) attributed the occurrence of serious flood hazards to the backflow of the runoffs caused by the insufficient carrying capacity of R. Benue and Lake Gerio. The present study shows that heavy rain was also another major cause of flood hazard in the area. Naturally, the climate is changing, and this increases climate induced hazards such as flooding. The Adamawa environment has witnessed an increase in rainfall events in recent times. Other factors like channel blockage (19%) and impervious surface (15%) have little contribution. On whether flooding is a seasonal event in Adamawa, 77% agreed that it is a seasonal event while 23% responded negatively.

Table 4: Causes of floods

Causes of flood problem in Adamawa	**No. of Respondents**	**Percentage (%)**
Heavy rain	109	25.60
Release of water from dam	171	40.20
Impervious surfaces	64	15.10
Channel blockage	81	19.10
Total	425	100.00

The severity of the impact of the flooding and the risk were measured as shown in Figure 3. In terms of the severity of the potential impact (Figure 3a), 4.9% of the respondents view the

potential impact of the flooding as not serious, 54.1% view it as serious while 41% view it as very serious. On the risks associated with flooding (Figure 3b), 34.6% believe the risk is very high, 40.5% believe the risk is high while 22.1% believe the risk is moderate. Generally, the potential impacts and risks associated with flooding in the area are beyond moderate levels.

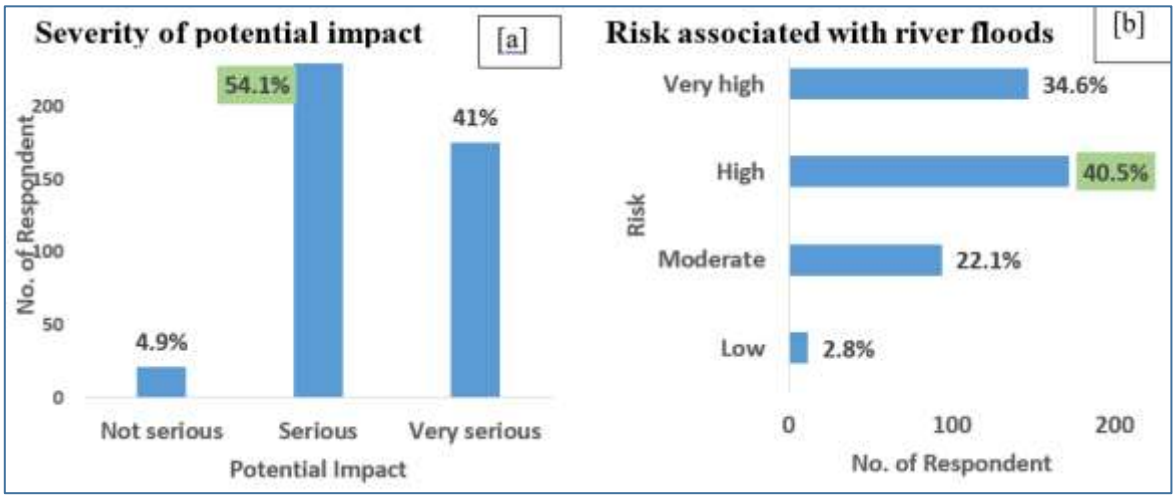

Figure 3: (a) Severity of potential impact, and (b) risk associated with river floods in the basin

Figure 4 shows the responses on the effects of flood hazard on livelihoods of victims. The effect was greatest in agriculture through destruction of farmland and agricultural products on which majority of the people in the area depend on (Figure 4). The percentage distribution of their responses on the effects of flood hazard are as follows: farmland and farm products (21%), property damage (20.5%), disease (19.3%), and infrastructural damage (11.3%). In a related study, Musa and Shabu (2019) concluded that the most flood-affected land cover in their study along R. Benue in Adamawa was farmland.

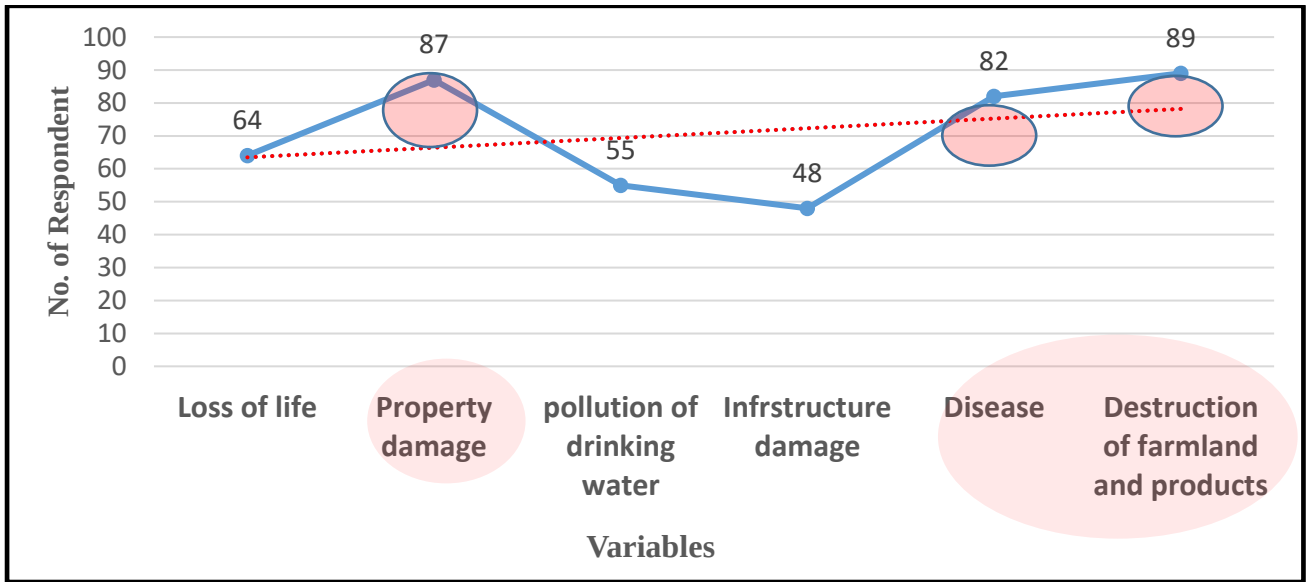

Figure 4: Effects of flood in livelihood of flood victims

Also, the actual impact of the 2013 and 2015 floods were analysed in this study following a comprehensive report from the Adamawa State Emergency Management Agency (ADSEMA). The analysis shows that, in 2013, a total of 4,919 people and 972 houses were affected, and 2,876 farmlands were destroyed. In 2015, it was observed that, a total population of 206,747 were affected with Demsa, Lamurde, Numan, and Fufore Local Government Areas (LGAs) accounting for 22%, 20%, 14% and 13% respectively. At least 173 communities were seriously affected and a total of 43,647 persons were displaced from the communities. The implication is that the study location is under serious environmental challenge particularly the threat of flood. This is evident in the destruction of houses and large number of displaced persons recorded. Also, the floods had a negative impact on agriculture as farmland and crops suffered a lot of water stress created by the flood conditions.

3.2 Livelihood Resources Vulnerability Assessment

Livelihood resources vulnerability assesses the intensity of impact of floods on livelihood resources. Figure 5 shows the livelihood patterns of people living with flood. Resources used by the people to secure their livelihoods were categorised in the widest sense of the five capitals (physical, human, financial, natural, and social) of the sustainable livelihood framework. Findings shows that there is evidence of the presence of natural capital in the study area (56.9%). Also, 51.1% believe that they have physical capital against 48.9% who think otherwise. It was observed that 52.4%, 56.8%, and 50.2% of the respondents were of the opinion that people living with flood lack human, financial and social capital respectively.

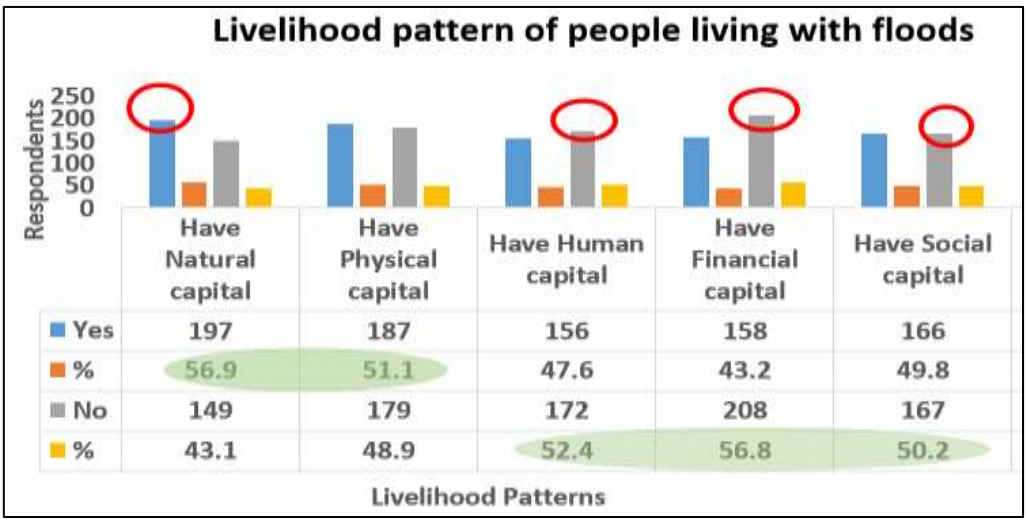

Figure 5: Livelihood pattern of people living with floods

3.3 Effect of Flood on Natural and Physical Resources and the Socio-economic Impacts

The degree to which natural and physical resources were affected by flood and the socio-economic impacts of flood were also analysed as shown in Figure 6. A rating system of low or no effect on the resources, moderate effect on the resources, severe effect on the resources and very high effect on the resources was used. The analysis of most significant factors revealed that both natural resources and physical resources experienced severe flood effects.

3.4 Vulnerability across different Sectors

Vulnerability to flood hazards was assessed across different sectors (biodiversity, transportation corridors, built-up areas, irrigated agricultural land, forest, cultivated land and livestock), and social groups (age, gender, ethnic, caste/culture groups). The most vulnerable people and groups within a community and most vulnerable sectors were identified. A rating system (Not vulnerable, Low vulnerability, Medium vulnerability, High vulnerability, and Very high vulnerability) was used to assess the vulnerability of the social groups and the distribution is shown in Table 5. It was observed that both males and females recorded very high flood vulnerability with scores of 34.4% and 32.2% respectively. It was also shown that elders are the most vulnerable to flood hazard (36%). For vulnerability to flood hazard according to class differentiation, it was seen that the poor are mostly impacted, accounting for 46.6% of the very high vulnerability group. It was also observed that the vulnerability level of middle class is medium (43.5%) while the rich or wealthy experience little or no vulnerability to flood hazard. In a related study, Mayomi *et al.* (2013) showed that 62% of 120 surveyed communities along the valleys of R. Benue in Adamawa State were highly vulnerable to flood.

Five ethnic groups were investigated for caste differentiation in the area. The groups are Fulani, Bata, Batchma, Mbula and the Jukum. Apart from the Fulani who are the major cattle rearers and the Jukum whose occupation is mainly fishing, other groups in the area take to farming as their major occupation. Findings from the analysis of culture/caste differentiation shows that the Fulanis suffer less impact from flood hazard. The survey reveals that 8% of the Fulanis are not vulnerable, 24.2% are of low vulnerability and 32% of medium vulnerability. The group mostly impacted with very high vulnerability are the Batchma and Mbula accounting for 42.3% and 40.6% of respondents respectively. The greatest score of Bata people is 36.2% high vulnerability. Also, 38.1% reported high vulnerability of the Jukum people to flood hazard. In a study conducted at three riverine communities in Adamawa State, Abubakar *et al.* (2020) noted that most of the respondents (over 80%) were aware of the devastating impacts of flooding but that they were still attached to the area despite their experiences.

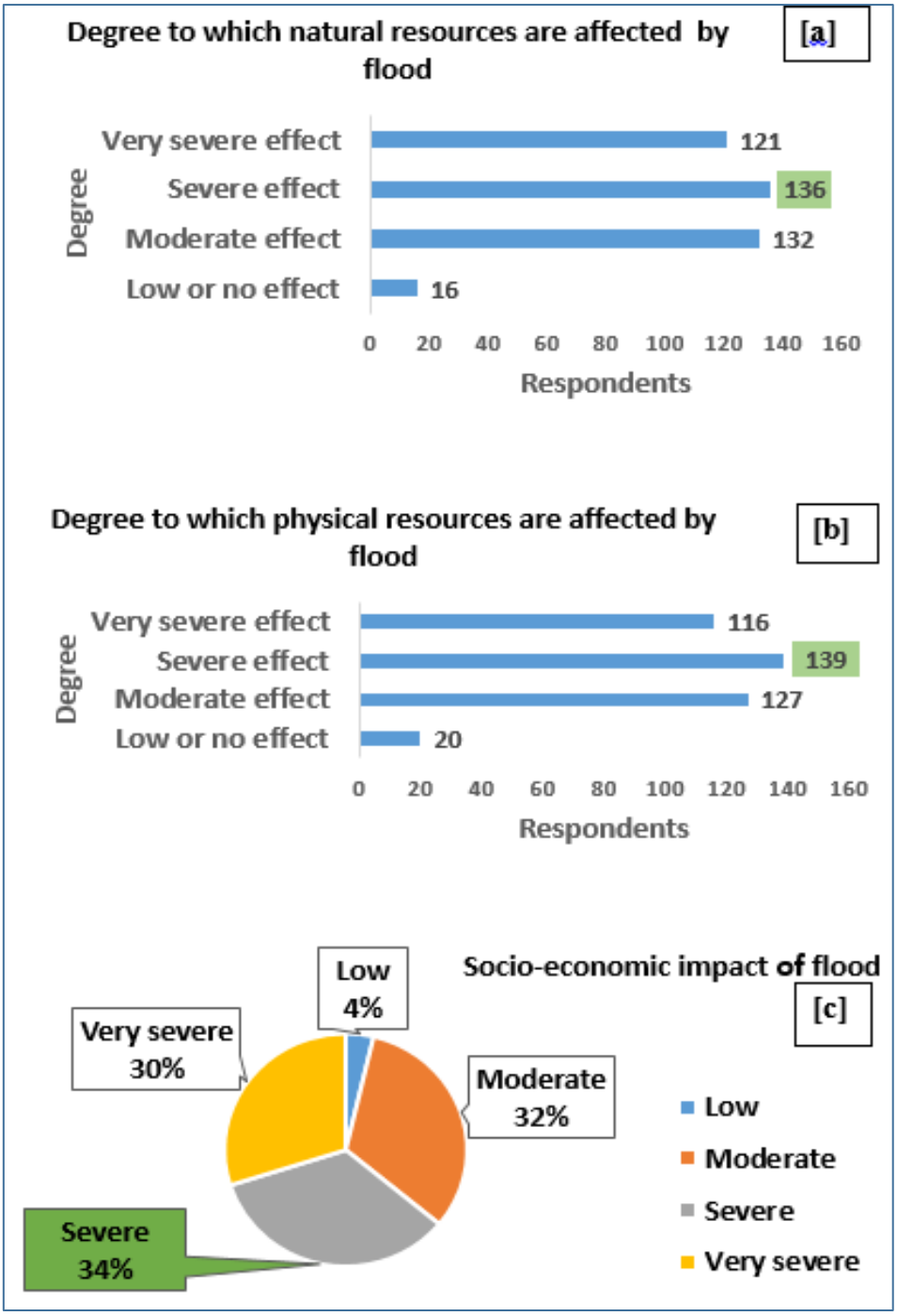

Figure 6: (a) Degree to which natural resource; (b) physical resources are affected by flood and (c) Percentage response on socio-economic impact of flood

Table 5: Vulnerability levels according to social groups

Social groups		Flood Hazard vulnerability level									
		Not		Low		Medium		High		Very high	
		R	%	R	%	R	%	R	%	R	%
Age differentiation	Young	43	10.1	76	17.9	58	13.6	139	32.8	109	25.6
	Adult	48	11.3	35	8.2	123	29.0	103	24.2	116	27.3
	Elderly	13	3.1	45	10.6	84	19.8	153	36.0	130	30.5
Gender differentiation	Male	21	4.9	50	11.8	91	21.4	121	28.5	142	33.4
	Female	19	4.5	51	12.0	94	22.0	124	29.2	137	32.2
Class differentiation	Poor	12	2.8	22	5.2	57	13.4	136	32.0	198	46.6
	Middle	11	2.6	56	13.2	185	43.5	101	23.8	72	16.9
	Well off	110	25.9	120	28.2	60	14.2	63	14.8	72	16.9
Culture/caste differentiation	Fulani's	34	8.0	103	24.2	136	32.0	84	19.8	68	16.0
	Bata	16	3.8	52	12.2	70	16.5	154	36.2	133	31.3
	Batchma	14	3.3	36	8.5	65	15.3	130	30.6	180	42.3
	Mbula	32	7.5	29	6.8	62	14.6	130	30.6	172	40.5
	Jukum	17	4.0	35	8.2	67	15.8	162	38.1	144	33.9

** R= Respondents and %= percentage

3.5 Vulnerability Score

The vulnerability score was assessed through participatory approach and community tool kit provided by LFP (2010). The computation was based on frequency, area of impact, and potential damage magnitude obtained from field survey of peoples' perceptions. A scale of 1 - 5, where 1= low and 5 = high was defined for the variables used in the assessment. Seven variables were used including: roads (transportation corridor), built-up area, biodiversity, forest, cultivated land, irrigated land, and livestock (Table 6). The empirical formula in equation 2 (LFP, 2010) that relates frequency (f), area of impact (A), and potential damage magnitude (M) was utilized in analysing the rated values for vulnerability score. Table 6 captures the details. The analysis reveals that the agricultural sector is the most vulnerable. This was reflected in the 32.8% for both cultivated land and irrigated land. The vulnerability of built-up areas to flood scored 16.3%. Biodiversity (3.3%) and forest (3.3%) are the least vulnerable sectors.

Table 6: Sector vulnerability score

Sector	Frequency	Area impact	Magnitude	Vulnerability score	Percentage (%) vulnerability
Built-up area	2	3	2	10	16.3
Transportation corridors	2	2	1	4	6.6
Biodiversity	1	1	1	2	3.3
Forest	1	1	1	2	3.3
Cultivated land	2	3	4	20	32.8
Irrigated land	2	2	5	20	32.8
Livestock	1	2	1	3	4.9

3.6 Coping Capacity and Resources

The capacity to cope with floods and livelihood resources available to cope with flood impact in the study area are reported in Tables 7 and 8 respectively. Three variables (self-support, institutional support and government support) were used to evaluate the coping strategies of the people (Table 7). The contribution was seen mainly between self-support (41.9%) and government support (40.9%). It is believed that, although the government played a strong role in providing support and relief materials to assist victims to cope with flood disaster, it only compliments the self-support coping strategy. Assessment of the livelihood resources available to cope with flood impact in the study area shows that all the three resources were of medium availability: 39.5% (economic resources), 38.1% (human capital resources) and social and institutional capacity (33.2%). Details of the analysis are shown in Table 8. The rescheduling of field crops planting, and levee construction is a common response to flooding by some communities in Adamawa (Abubakar et al, 2020).

Table 7: Capacity to cope with floods

How people currently cope with floods	No. of Respondents	Percentage (%)
Self-support	178	41.90
Institutional support	73	17.20
Government support	174	40.90
Total	425	100.00

Table 8: Available resources to cope with flood impact

Availability Level	Economic Resources	%	Human Capital	%	Social and Institutional	%
Low or no availability	51	12	67	15.8	93	21.9

Medium availability	168	39.5	162	38.1	141	33.2
High availability	62	14.6	57	13.4	69	16.2
Very high availability	144	33.9	139	32.7	122	28.7
Total	425	100	425	100	425	100

4. CONCLUSION

In summary, this paper has presented a quantitative methodology through Participatory Vulnerability Approach to understand the human dimensions involved in flood vulnerability in Adamawa Catchment of Nigeria. The method employed descriptive statistical tools of frequency counts and percentages to analyse various categories of variables. A structured questionnaire was used as the main instrument for data collection. Results show that rural dwellers are mostly at risk of flood hazard. Release of water from dam and heavy rain were identified as main contributors to flooding in the area. Analysis of livelihood patterns of people living with flood shows evidence of the presence of natural capital. Findings on the socio-economic impact of flood based on degree of physical and natural resources affected shows severe effect. Analysis of caste differentiation shows that Batchma and Mbula are mostly impacted. The vulnerability score reveals that the agricultural sector is the most vulnerable while biodiversity and forest are the least vulnerable sectors. Adamawa is facing serious environmental challenge particularly flood threat in recent times, but the overall resilience and coping mechanisms are poor. The methodology used in this study has revealed the human dimension involved in flood vulnerability in Adamawa catchment. These findings contribute to the body of knowledge on flood vulnerability in Nigeria and provides crucial insights to government and stakeholders in adopting a holistic strategy to tackle the flood hazard. The existing literature is replete with recommendations on how to avert and manage flooding. An additional recommendation is for the government to adopt citizen-centred and public participatory approaches in the planning and implementation of disaster management projects to ensure their continued sustainability.

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APPENDIX A1 - QUESTIONNAIRE ON ANALYSIS OF VULNERABILITY TO FLOODING IN ADAMAWA CATCHMENT, NIGERIA

I am carrying out a research on "Analysis of flood vulnerability in Adamawa State". Please be assured that your response will be used only for academic research purposes. Kindly answer the questions below. Please either tick good in any of the options provided or fill the spaces where applicable.

Personal Information

1. Sex: Male ( ) Female ( )
2. Age differentiation: Young ( ) Adult ( ) Elderly ( )
3. Level of Education: Primary ( ) Secondary ( ) Tertiary ( ) No formal ( )
4. Occupation: Trading ( ) Farming ( ) Civil servant ( ) Unemployed ( ) Student ( ) Others ( )
5. Who (people, communities) are mostly at risk from flood hazard? (a) Rural dwellers (b) Urban dwellers (c) Farmers (d) Traders (e) Fishermen (f) Others, specify:_____
6. Why are they most vulnerable? _____
7. Are people's vulnerability increasing or decreasing? Increasing ( ) Decreasing ( )

A. Score the following social groups according to level of flood vulnerability

Guidance note:

0 = Not vulnerable to flood 1 = Low vulnerability to flood 2 = Medium vulnerability to flood
3 = High vulnerability to flood 4 = Very high vulnerability to flood

8. How vulnerable are young people? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
9. How vulnerable are adults? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
10. How vulnerable are the elderly? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4

Gender differentiation

11. How vulnerable are males? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
12. How vulnerable are females? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4

Class differentiation

13. How vulnerable are poor people? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
14. How vulnerable are the middle class? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
15. How vulnerable are the well-off (rich)? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4

Culture/ Caste differentiation

16. How vulnerable are the Fulani's to flood hazard? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
17. How vulnerable are the Bata people to flood hazard? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
18. How vulnerable are the Batchma people to flood hazard? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
19. How vulnerable are the Mbula people to flood hazard? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
20. How vulnerable are the Jukum people to flood hazard? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4

B. Score the following sectors according to level of flood vulnerability

21. How vulnerable are irrigated agricultural lands? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
22. How vulnerable are biodiversity? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
23. How vulnerable are high altitude agriculture? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
24. How vulnerable are rain-fed agricultural land? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
25. How vulnerable are wetland soils ecological type? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
26. How vulnerable are savannah soil ecological type? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
27. How vulnerable are settlers to flood vulnerability? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
28. How vulnerable are settlements on flat terrain location? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
29. How vulnerable are settlements on floodplain location? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
30. How vulnerable are settlements on undulating terrain? (a) 0 (b) 1 (c) 2 (d) 3 (e) 4

31. Assess the sectors vulnerability level bases on frequency, area impact and potential damage magnitude? Grade from 1- 5, where 1 = lowest grade and 5 = highest grade

Sector	Frequency (1-5)	Area Impact (1-5)	Potential Damage Magnitude (1-5)
Forest			
Cultivated land			
Built Up			
Livestock			
Irrigated agricultural land			
Transportation corridors			
Biodiversity			

C. Types of livelihood resources affected

Guidance note:

Physical capital = Man-made structures e.g. roads, bridges, buildings, irrigation channels, etc.
Human capital = Good health care, welfare services, skills and knowledge through education, etc.
Financial capital = Saleable assets including livestock, income, savings, remittance flow, etc.
Natural capital = Goods & services: timber, river water, ground water, biodiversity, firewood, etc.
Social capital = Relationships of all form: gender-based, age-based, class-based, professional, etc.

(Please tick more than one option where necessary)

32. What are the major effects of flood in livelihood of flood victims in Adamawa?
    Loss of life ( ) Disease ( ) Property damage ( ) Destruction of farmland and products ( )
    Pollution of drinking water ( ) Infrastructure destruction ( ) Others, specify:_____

33. What are the major livelihood patterns of people living with flood? (Tick)

Livelihood Pattern	Yes	No
Have Natural capital		
Have Physical capital		
Have Financial capital		
Have Human capital		
Have Social capital		

34. What are the causes of flood problem in Adamawa?
    Heavy rain ( ) Release of water from dam ( ) Impervious surfaces ( ) Channel blockage ( )
    Others, specify:_____
35. To what degree are natural resources affected by Flood?
    Low or no effect ( ) Moderate effect ( ) Severe effect ( ) Very severe effect ( )
36. To what degree are physical resources affected by Flood?
    Low or no effect ( ) Moderate effect ( ) Severe effect ( ) Very severe effect ( )
37. Assess the socio-economic impact of Flood based on the degree of physical and natural resources affected.
    Low or no effect ( ) Moderate effect ( ) Severe effect ( ) Very severe effect ( )
38. From your experience, what is the frequency of flood event in Adamawa?
    Low frequency ( ) Moderate frequency ( ) High frequency ( )

D. Types of livelihood resources available to cope with flood impact

39. What is your take on the availability of economic resources to cope with flood impact?
    Low or no availability ( ) Medium availability ( ) High availability ( ) Very high availability ( )
40. What is your take on availability of human capital to cope with flood impact?
    Low or no availability ( ) Medium availability ( ) High availability ( ) Very high availability ( )
41. What is your take on social and institutional capacity to cope with flood impact in Adamawa?
    Low or no availability ( ) Medium availability ( ) High availability ( ) Very high availability ( )
42. Do the households affected by flooding have good sanitation (e.g. toilet)? (a) Yes (b) No
43. What is the nature of housing type in the affected areas?
    (a) Poor (b) Moderate (c) Good
44. What is the common source of water supply in the area?
    (a) Tap (b) Well (c) pond (d) others
45. How often is rainfall in this community?
    (a) 2-3 months (b) 3-4 months (c) 4-5 months
46. How frequent is flood occurrence in the area?
    (a) Low (b) Moderate (c) High (d) Very high
47. What are the chances of flood occurrence this year?
    (a) Low (b) Moderate (c) High (d) Very high
48. How severe are the potential impact of floods in the area?
    (a) Not serious (b) Serious (c) Very serious
49. Has there been any disease outbreak associated with these floods? Yes ( ) No ( )
50. What is the nature of risk associated with river flood in Adamawa?
    (a) Low (b) Moderate (c) High (d) Very high
51. How do people in the community currently cope with floods?
    (a) Self support (b) Institutional support (c) Government support
52. Is flooding a seasonal event in the area? YES or NO
53. List the different years you have witnessed flood in Adamawa?

_____

_____

BIOGRAPHICAL NOTES

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