Socio-economic Impact of Flooding on the Riverine Communities of River Benue in Adamawa State, Nigeria

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Abstract

This paper examines the impact of floods on the socioeconomic lives of residents of the flood plain of River Benue in the Adamawa area. The specific objectives of the paper include examining people's perception of the causes of flooding in the study area, assessing the impacts of flooding on the socioeconomic activities in the study area, analyzing the People's Response/Adjustment to Flood in the study area. Three Riverine communities were purposively selected and data for the study was elicited through questionnaires administered to randomly selected respondents in the selected riverine communities in the area. The results obtained indicate that majority of the respondents over 80% are aware of the devastating effects of flooding but they fail to act because of their preference of occupying the location despite their experience. Thousands of hectares of farmlands and other properties have been destroyed by flood over the years. Another finding shows that the impact of flood on transportation is, perhaps, the most devastating such that agricultural productivity in the area is limited as a result of lack of effective means of mobility. Changes in modal split were also found to be associated with the flood regimes. Traditional responses to the menace of flooding have been on the increase due to the ad hoc manner of government participation in providing an enduring solution. The rescheduling of field crops planting and levee construction were among the common responses of the people.

Keywords: Flood, River Benue, Transportation, Socio-economic, Environment

INTRODUCTION

Floods are the most frequent natural disasters globally, effecting over 2.8 billion people and is responsible for over 200,000 deaths over the past 3 decades (Hashizume, 2013). The riverine areas are naturally prone to flooding. The occurrence of environmental hazards such as flooding is not new. However, what is new is the increasing level of damages to lives and properties witnessed as a result of high magnitude and highly frequent floods experienced in the developing counties such as Nigeria. Studies on water, poverty and flood have observed that there was an increasing rate of flood occurrences and severity in recent years; resulting to loss of lives, injuries, homelessness, damage to environment and infrastructure as well as impacting on agriculture, health and education (Efobi and Anierobi, 2013; Sadiq, 2012; Bariweni *et al*, 2012). In recent years, the ravaging effects of flooding in Nigeria became so drastic that it was seen as a national disaster. Among the 36 states of the federation, Adamawa state was among the 34 states that have bitter experience of the flood (NEMA, 2012).

Measures of tackling floods have been suggested (Ayoade, 1988; Khalequzaman, 1994; Tukur and Ray, 1995, Isma'ila and Kershie, 2018, Uzoma & Abdulkadir, 2019 and Ozoh, 2020). However such measures are often resisted as a result of the increasing levels of poverty and/or cultural considerations, and the lack of sufficient interest on the side of governments. In the Loko area of Adamawa State, for example, the government intervention in the flood disaster of 1991 was only partially successful as some of the people rejected the re-settlement project; Since then the government has scarcely embarked upon any serious measures 'beyond the usual

distribution of relief materials to cushion the impacts. Thus, floods have now become a yearly event to contend with by the people.

However, concern on the effects of flood, have largely centered on destruction of properties, farmlands and human and animal live, which are often quantified in monetary terms. To date, only a few studies have examined potential impacts or adaptation of climate change on transportation systems. Studies have rarely focused on the implications of the devastations to physical infrastructures like roads which inadvertently affect the efficient evacuation of agricultural products from the rural areas to urban markets. For example, Ezekiel (2000) barely mentioned the Demsa floods that truncated routes leading to many settlement areas thereby paralyzing the economic and social life of the people.

Dama *et al* (2014) posited that Floods have been identified to be caused by many factors including surcharges in water level due to natural or man-made construction on flood plains, sudden dam failure, inappropriate land use planning, mudflow, inadequate drainage capacity, ice jam, snowfall, and deforestation of catchment basins.

Globally, and in Nigeria in particular, wide spread flooding progressively cause devastating ecological havocs by destroying lives, properties, agricultural lands and social infrastructures (Fubara, 1987).Generally, the impacts of flooding are of two types-positive and negative effects. The negative impacts are categorized into two broad categories: these are the primary impacts and the secondary impacts and they are also known as tangible and intangible losses respectively (Garg, 2010).

He noted that tangible losses caused by flooding are damages which can be quantified in monetary terms, and include: loss of cattle and livestock, destruction of personal property, loss of earnings and services, loss of growing and pre-harvest crops in agricultural fields, reduction in property values, collapsing of bridges, buildings, roads, communication, infrastructures, destruction of schools, hospitals, loss incurred in flood-fighting measures, relief, evacuation and rehabilitation of flood victims and other social amenities in the area affected that were destroyed (Garg, 2010).

Garg (2010) regarded these losses as most important, and cannot be evaluated in monetary values, and include: losses of human life, anxiety and general social distress, snake bites and physical ailments and economic hardship, insecurity, and so on. Other effects also includes Water supplies that results in contamination of water (water pollution). Clean drinking water becomes scarce. Unhygienic conditions and Spread of water-borne diseases result. The effects of flooding from the sources outlined above are felt by various 'receptors'. These include, people, buildings, infrastructure, agriculture, open recreational space and the natural world.

The flood plains of river Benue in Adamawa state is a favorable locale for wide range of economic activities notably farming and fishing, these traditional livelihoods are interconnected and spatially they are connected to the immediate communities and the larger Adamawa State. The connectivity livelihoods and their communities is often affected by flooding through its significant effects on transportation the main of this is the assessment of the socio economic effects of flooding in riverine communities of the lower reaches of river Benue in Adamawa State. The specific objectives of the paper are- examining people's perception of the cause of flooding in the study area, assessing the impacts of flooding on the socioeconomic activities in the study area, analyzing the People's Response/Adjustment to Flood in the study area.

MATERIALS AND METHODS

Sampling Techniques and Method of Data Presentation

Data used in this study was obtained through a questionnaire survey of randomly selected respondents from the riverine communities. A multi stage sampling technique was adapted in first selecting the communities and respondents from whom primary information was elicited. The three (3) riverine communities were purposively selected considering their population sizes, proximity to river Benue and the nature of livelihoods within those communities. The sample size was purposively determined and the composition of respondents reflect the major livelihoods in the study area viz- farmers and fishermen. A total of 150 respondents were randomly selected for the study.

The data obtained from the questionnaire survey were analysed and plotted. In addition to questionnaire survey, Oral interviews and discussions were held with officials of local, state and federal government agencies like agriculture, water resources and emergency relief departments and other stakeholders with a view to assessing their response and commitment in enhancing the socio-economic life of the people in the flood prone areas.

The study area

Adamawa State, located in the North-Eastern part of Nigeria lies between latitude 7° and 11° N and longitude 110 and 14° E covering a land area of about 38,741 km^2 (Figure, 1). It is characterized by a rugged terrain with hills and mountains constituting about 27% of the total land mass (Tukur, 1999). The gentle undulating surfaces are generally found around the numerous river valleys that traverse the State. The mean annual rainfall in the area is between 850-1000 mm with over 41% of the rain falling in August and September (Sadiq and Faruk, 2020), the high rainfall intensity and the damming of river Benue upstream had a significant influence on the annual flow regime of river Benue.

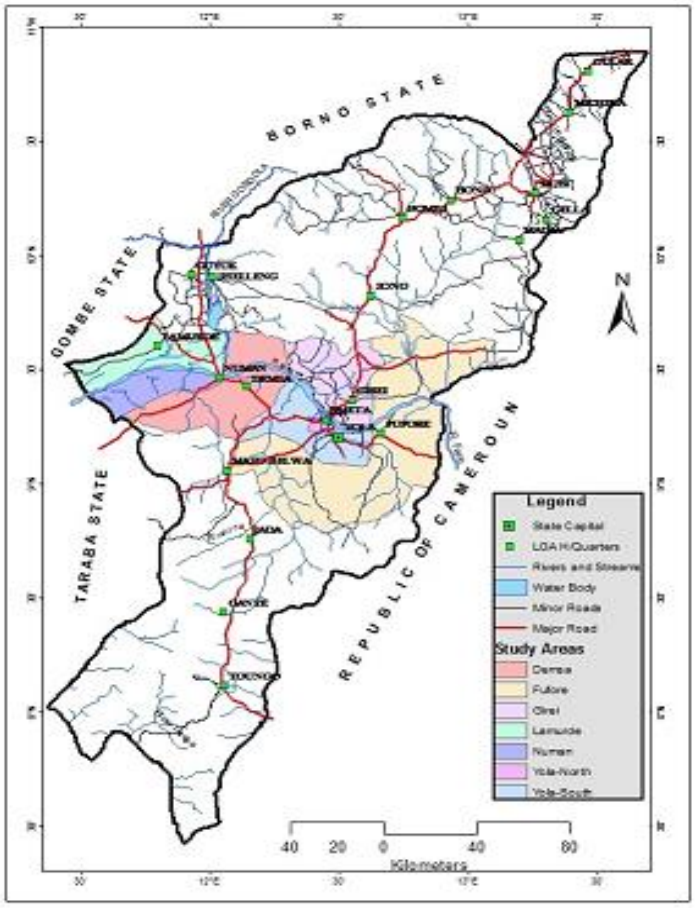

Figure 1: The Study Area

A peak discharge of 7,140 cum/sec was recorded along the River Benue (UBRBDA, 2019), there is a marked fluctuation in the discharge of the river mainly high discharges were attributable to high intensity rainfalls experienced in August and September and release of water from the Lagdo Dam in the Republic of Cameroon.

The Adamawa state has two distinct vegetation types, the Sudan Savanna occupies the northern half of the state and the Guinea belt predominates in the south. Much of the tree vegetation is rapidly exploited for fuel wood and other uses such that some parts of Guyuk council area are now threatened with ecological problems akin to aridity. However, more than 70% of the population of the over 2.7 million people in the State is engaged in agricultural practices. The banks of the Benue, Gongola and Mayo-Ine rivers, among others, provide fertile grounds for both rain-fed and dry/irrigated season farming. In addition, these rivers have attracted fishermen from many parts of the State and the county at large. Therefore, a number of farming and fishing communities have emerged along the river valleys. In recent times, the changing pattern and intensity of land use activities coupled with high rainfall and the effects of dams have been deemed to cause high discharges and increased siltation of the river beds, thus limiting the capacity of the rivers in containing excess water. These have resulted in frequent floods that affect many communities including the people of Yola metropolitan area.

RESULTS AND DISCUSSIONS

People's Perception on the Causes of Flooding in the Study Area

The perception of residents of flood prone areas is important in understanding and evaluation of the effectiveness of responses by government, communities and individuals in averting the deleterious consequences of flooding. Despite the fact that the negative impacts of flooding is well appreciated by the inhabitants with more than 75% of the respondents agreeing that that the disadvantages of floodable areas are numerous but will not accept to live elsewhere for cultural reasons and attachments to their traditional livelihoods, the 2nd generation Hausa migrants of the Basin area indicated that they would have no better place to call their own than the floodable area (Ancestral Domain). In Table 1, the highest percentage (56.7%) of the respondents ascribed the cause of flooding to the release of water from Lagdo dam (in the neighboring Cameroon); 27.3% attribute it to rainfall intensity, while 16.7% thought that rainfall intensity and silting are responsible for the flooding.

Table 1: People's Perception on the Causes of Flooding in the Study Area

Causes of Flooding	Sampled Areas							
	Yola		G/Numan		Fufore		Total	
	F	%	F	%	F	%	F	%
Release of water from Lagdo Dam	45	30	18	12	22	14.67	85	56.67
Rainfall Intensity	23	15	16	10.67	4	2.67	43	28.67
Rainfall intensity and silting (Clog up)	7	4.67	12	8	3	2	22	14.67

Despite the high proportion of the respondents that are aware of the causes and consequences of flooding, yet flooding has been a recurring disaster in the study area, the socioeconomic disposition of the respondents mainly the nature of traditional livelihoods (which are land based) has enormously contributed to the vulnerability of the respondents to menace of flooding.

Impact on Socio-economic Activities in the Study Area

Flooding has a significant impacts on the socio-economic lives the inhabitants of the floodable areas in the selected communities and Adamawa State in general. Infrastructure and services such as public and private buildings, Road Networks and Electricity supply facilities are destroyed by flooding. In the after math of the 2019 floods in Adamawa State, an estimated

381 houses damaged,493 houses are partially damaged, with over 365 water and sanitation facilities destroyed affecting over 12,000 individuals (DTM,2019). Most of farmlands were submerged leading to heavy crop and livestock lost and an estimated figure of about 12,000 persons were displaced from the selected communities for this study.

Findings from the study reveals that 89% of the respondents across all the selected communities were displaced from their houses or farmland and other forms of displacements mainly affecting their productivity and causing colossal loss of investment and properties. On the overall, the respondents were affected by a combination of socioeconomic impacts (Table 2).

Table 2: Impact on Socio-economic Activities

Impacts on Socio-economic Activities	People's Views					
	Yes		No		Neutral	
	F	%	F	%	F	%
Limit Farming/Fishing activities	104	69	33	22	13	8.67
Damage to perishable Farm outputs	89	59	47	31	14	9
High cost of transport Fare	133	88.67	17	11	2	1
Hike in price of manufactured goods	129	86	6	4	15	10
Limit movement/travel disruption	79	52.67	43	28.67	28	18.67
Low volumes of agricultural outputs	137	91	3	2	10	6.67
Inefficient farm inputs distribution	122	81	8	5	20	13

The implications of the socio economic disruptions occasioned by flooding is the inefficiencies in the distribution of agricultural commodities , evacuation of agricultural products and significant impact on fishing and increasing cost of transportation and in the long run instability in the prices of food and other vital commodities in these communities.

People's Response/Adjustment to Flood

The understanding of the causes of flood, coupled with the people's knowledge of its temporality would have a significant bearing on the nature of their responses and adjustments. The people have devised different strategies that make them adaptable to the occurrence of floods. In Table 2, 44% of the respondents relocate to safe zones during the flooding period and 46% reschedule their planting of field crops in order to harvest them before the peak flood period. This practice is most prominent in the Dasin area of Fufore. Ten per cent (10%) of the respondents expand the river channels so as to enhance the capacity of the channels to contain excess water as practiced, in Demsa and the surrounding settlements.

Table 3: People's Response/Adjustment to Floods

Adjustment to Flooding	Sampled Areas							
	Yola		Greater Numan		Fufore		Total	
	F	%	F	%	F	%	F	%
Relocation of settlement	21	14	30	20	15	10	66	44
Rescheduling of planting	23	15	19	12.67	27	18	69	46
Embankment	6	4	3	2	6	4	15	10

These measures are commonly adopted in many parts of Adamawa state. The increasing popularity of the measures is not unconnected with the poor response of the government in controlling the menace of floods. Aside from the resettlement project at Loko in 1992 and the post flooding relief materials in 2012 and 2019 there has not been any such physical efforts aimed at mitigating the problem. The concern has always been expressed in terms of appeals

made to the residents of the affected areas to avoid the flood plains and through the provision relief materials by government and private agencies, and philanthropic organizations. In the year 2000, the state emergency relief agency expended more than N25 million and the procurement and distribution, of relief materials to flood victims in the affected areas and in 2012, Over 500million was expended on procurement and distribution of relief materials, Such ad-hoc measures of the government easily fades away without any lasting impact just like the media type on flood occurrence.

Flood Implications on Transportation

Inland Waterways Transportation

The seasonal Fluctuation in the water volume of the River Benue affects the navigability of the river. Thus, the peak flood, periods, which also coincide with the highest rainfall regime in the area (July-September) enhances the navigability of the river to the Republic of Cameroon. Table 4 below paraded an array of engine vessels ranging from fishermen's canoe to large cargo engines which were mostly seen during this period either as passenger/freight traffic or on other missions to and from the neighboring Cameroon Republic. The principal commodities (alongside passengers) being transported include fish, cereals, honey, cotton seeds etc. (Umar and Galtima, 2020). However during the dry season, the River Benue virtually serves to connect areas located laterally opposite each other along the banks Demsa to Borrong for passenger and freight traffic and exceptionally the few fishing canoes that travel longer distances.

Table 4: Modes used for Inland Waterways

Modes used for Inland Waterways	Length (m)	Carrying Capacity Equivalence (tons)	Normal/Dry Period		Flooding/Rainy Period	
			F	%	F	%
Fishermen's Canoe	6	6-7 Persons	134	89	46	30.67
Passenger Canoe	12-24	25-65 Persons & 225 full Baskets of Fish	6	4	54	36
Cargo (Engine) Boat (Medium)	27-30	45 tons	-	-	10	6.67
			-	-	8	5
Boat (Large)	30-33	60 tons	-	-	7	4.67
Flying Boat (Ferries)	6-10	12-14 Persons	10	6.67	23	15

Impact of Flooding on Road transport system

The flood impacts on transportation as perceived, by the people have far reaching consequences. Observations from table 6 below have revealed that overland road transport system is most affected because most of the rural roads that connect the settlements are laid in the 'flood plains, and are mostly un-paved which make them very vulnerable. In Table 8, as many as twelve route- ways were truncated. This drastically reduces evacuation of farm products distribution of finished goods and passenger flow which all have enormous socioeconomic implications.

Table 5: Impact of Flooding on Waterways

Impacts of Flooding on Waterways	Sampled Areas			
	Normal/Dry Period		Flooding/Rainy Period	
	F	%	F	%
Navigability	12	8	111	74
Mode availability	23	15	19	12.67
Travel disruption/delay	36	24	13	8.67
Waterway blockage	69	46	7	4.67
Damage to goods	-		-	-

Passenger trip volumes were generally reported to be 30% less than the normal flow periods. In the Demsa & Borrong axis the people indicated that the floods impose limitations on the scale of farming and fishing activities as a result of the transportation problems that it creates. The perishable nature of fish and the lack of storage facilities make it very cumbersome to handle using inadequate and inefficient water transport to the markets in either Numan or Yola. The Intergovernmental Panel on Climate Change (IPCC, 2007) observed that of all the possible climate impacts on transportation, the greatest in terms of cost is that of flooding.

Table 6: Nature of Road Transport Network in the Study Area

Sampled Areas	Nature of Transportation Routes			
	Paved Surfaces		Un-Paved Surfaces	
	F	%	F	%
Yola	31	21	17	11
Greater Numan	14	9	38	25
Fufore	5	3	45	30
Total	50	33	100	66

In Table 7, the survey shows that as many as 25% of the people have indicated a change in the mode of transport as a result of the floods. More than 60% of the change was recorded in the Numan area where the rivers (Benue and Gongola) are the major means of access to the varying communities. An assessment of the modal changes showed that about 50% of the travels in the riverine communities in Fufore and the Numan areas are affected solely with the canoes. More than J. 3% of journeys is under taken on foot, animals and by bicycle. The modal variation in these localities occurs as a result of the need to avert the consequences of flooding. The respondents cite this as an adjustment mechanism. The prices of manufactured items such as sugar, plastic materials, soft drinks, textiles etc. were found to be exorbitant by as much as 25% above the normal costs. The Fufore area is notorious for this problem, which is compounded by its proximity to the Cameroon Republic.

Table 7: Modal Split

Modes of Transport	Normal/Dry Period		Flooding/Rainy Period	
	F	%	F	%
On Foot	8	5	23	15
Animal Carriage	5	3	4	2.67
Bicycle	15	10	14	9
Motorcycle	36	24	32	21
Tricycle	37	24.67	34	22.67
Taxi/Car	33	22	26	17
Truck	12	8	11	7
Bus	8	5	6	4

Table 8: Impacts of flooding on Road Transportation

Impacts of flooding on Road Transportation	Normal/Dry Period		Flooding/Rainy Period	
Impact on Transport Mode	F	%	F	%
Vehicle stuck	-	-	11	7
Vehicle submerge	-	-	8	5
Limits availability of modes	13	8.6	88	58.67
Accident prone	13	8.6	17	11
Impact on Transport Routes	F	%	F	%
Washed away Surface	-	-	80	53
Truncated roads	-	-	12	8
Route diversion	20	13	38	25

Government Intervention

In the past, Adamawa State's government intervention on flooding is often ad hoc and unsustainable. However, due the high frequency and magnitude of flooding especially in the riverine communities; government's approach to flooding has significantly changed. In the event of the 2019 flooding, the government through Adamawa State Emergency Management Agency (ADSEMA) has established six (6) camps in Yola North and Yola South Local Government Areas, distributed relief materials and has partnered with the Marine Police to rescue affected persons that were trapped in the flooded areas (Leadership, 2019). It is very pertinent to note that the intervention by the State government is in one aspect of disaster management – evacuation/ rescue of the affected population and distribution of relief materials, much effort is required in the humanitarian agencies being proactive in disaster preparedness-issuing early warning and eliciting response from riverine communities that are at risk of flooding. Post disaster operations such as Reconstruction / Resettlement and Livelihood Restoration should be pursued vigorously in order to cushion the effects of flooding on the socio economic lives of the communities.

CONCLUSION

Flooding has been a major and recurring climatic hazard especially affecting the residents of the floodplains. Over the years, the socioeconomic impacts of flooding is becoming increasingly devastating and worsening the economic plight of the peasants that rely on the flood plains for their habitation and livelihood. The awareness of the causes of flooding has a minimal influence on the level of disaster preparedness which would have diminished the implications of floods and moderate the relationship between frequency and magnitude of flood in the area. In view of the increasing recurrence of flooding and its wide ranging impacts on transportation and agricultural production, the following recommendations were made:

a) Government at all levels should maintained a functional hydrological station that will provide data for accurate flood prediction/ forecasting which will form the basis for early warning on impending flooding.
b) There is need for the introduction and adaptation of improved varieties of crops that are highly water-resistant to farmers in the study area. This will help to minimize unnecessary premature harvesting of crops during flooding.
c) Since most of the roads within the Riverine communities in the study area are un-tarred, they be should be properly tarred so as to avert the prevailing problems of flooding on such roads.
d) As a measure to beef up hazard preparedness, government should make massive use of electronic media in issuing flood warnings, this will be a complement of other actions aimed at minimizing the effects of flooding such as drama, public demonstration and other traditional means that will trigger positive adjustment amongst the vulnerable population.
e) Government should consider dredging of river Benue towards enhancing its capacity to contain more water and its navigability.

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