



**ENVIRONMENTAL AND LIVELIHOOD IMPACTS OF RECURRING FLOOD EVENTS ON
DOWNSTREAM COMMUNITIES OF SHIRORO DAM NIGER STATE, NIGERIA**

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Abstract

The devastating effect of the recurring flood has pose a serious environmental and livelihood impacts in the study area ranging from loss of arable land, crops, economic trees, animals and even lives and properties. The aim of this paper is to examine environmental and livelihood impacts of recurring flood events on downstream communities of Shiroro Dam, Niger State Nigeria. The sources of data used include primary and secondary. The primary sources include reconnaissance survey, questionnaire administration and purposive selection of affected communities and respondents of the study area In order to develop detailed and comprehensive literature review, the information was obtained from written documents. To achieve this therefore, data were sourced from the gazettes, internet facilities, text books, journals, published and unpublished thesis from University library etc. with regards to environmental and livelihood impacts of recurring flood events on downstream communities of dam internationally and locally. The methods of data analysis include frequency percentage, sustainable livelihood index, and 3-point Likert type scale. The result shows that 179 of the respondents believed that the major cause of recurring flood in the study area is from heavy rainfall, 110 of the respondents agreed that the major cause of recurring flood is due to overflow of Shiroro dam, siltation of the river ranked third with 57 of the respondents and blockage in the drainage ranked the least with one respondent. The damages of flood occurrences in the riparian communities include collapse of buildings and displacement, property destruction, loss of lives, farmland/crops submerge and loss of animals as indicated in the study. Damages as a result of recurring flood events in the study area were of different classes and magnitude as indicated in the study. Farmland/crops submerge ranked the highest with 30% of the respondents, collapse of buildings and displacement of people ranked second with 28% of the respondents, property destruction ranked third with 20% of the respondents, loss of lives ranked fourth with 18% of the respondents and loss of animals ranked the least with 4% of the respondents. The implication of damages as a result of flood occurrence in the study area is low standard of living, inadequate food security and environmental degradation. In conclusion, there is need to develop better and appropriate measures (as discussed

under the implications and recommendations sections) to prepare and mitigate the environmental and livelihood impact of recurring flood events on downstream communities of Shiroro dam, Niger State, Nigeria.

Keywords: *Flood, Recurring flood, Shiroro dam, and Downstream communities*

Introduction

Flooding as an environmental problem has been one of the major challenges of downstream communities of Shiroro dam over the years. Flooding is a significant rise of water level in a stream, lake, reservoir or dams that overflows the banks. The National Erosion and Flood Control Action Plan Committee (2010) defined flooding as a condition which exists when discharge of a river or stream cannot be accommodated within the margin of its normal channels so that waters spread over adjoining land. Also, flooding is a situation in which water from a river or from rain covers large areas of land (Macmillan, 2009). Etuonovbe (2011), added flooding is one of the most common environmental hazard in Nigeria. Thus, resulting to vulnerability of populations and infrastructure. Although flooding is one of many hazards occurring in human environment, its effects are significant both in terms of discomfort, destruction of lives, properties and pollution. The severity of flooding has been reckoned with, by the level of damage done (Williams, 2011).

Flooding not only damage property and endanger the lives of humans and animals, but have other effects as well. Floods and its effects all over the world are becoming a threat to sustainable development in human settlements (Aderogba, 2012). Nigeria is one of the country bless with water resources which has impacted positively on the economic development. But we must know that flooding and water disturbance locally, Nationally, Regionally and globally are environmental challenges that need prevention to ensure sustainability (Akolokwu, 2012). Flooding is one of the major environmental crises one has to contend within the century. This is especially the case in most wetlands of the world (Bariweni *et al.*, 2012). The reason for this is the general rise in sea level globally, due to global warming as well as the saturated nature of the wetlands in many parts of the world such as Nigeria. Floods occur on many waters periodically, these rivers overflow as a result of excess rainfall. One good thing about the river overflows is the fact that it deposits sand; silt and debris on the surrounding land as flood waters flow into the banks. After the river water calmed and return back to its normal flow, the materials deposited will help increase the fertility of the land. The organic materials and minerals deposited by the river water therefore maintain the soil fertility and productivity (Abowei and Sikoki, 2010). Flooding that happened in some parts of Nigeria in 2012 including downstream communities of the study area is the country's worst flood history. (Bahago *et al.*, 2019) also carried out a geospatial analysis of the 2012 Flood event, downstream of Shiroro Reservoir at Gurmana to delineate and map the actual flood extent of the 2012 flood, produce flood vulnerability map and determine the impacts of the flood on the life and property of the residents of the study area. Floods are among the most frustrating natural disasters in the universe, claiming more lives and leading to more damage of property than any other natural phenomena.

Several studies have been conducted both internationally and nationally on flood recurring events and they include Anunoobi, (2013); Bahago *et al.*, (2019); and Jubril and Yunusa, (2012). Little published thesis and journal have covered the research topic which has created paucity of knowledge and this paper intend to fill the gap. Flooding has been one of the major recurring challenges of downstream communities of Shiroro dam on yearly basis and this is attributed to heavy precipitation. The devastating effect of the recurring flood has pose a serious environmental and livelihood impacts in the study area ranging from loss of arable land, crops, economic trees, animals and even lives and properties. The aim of this paper is to examine environmental and livelihood impacts of recurring flood events on downstream communities of Shiroro Dam, Niger State Nigeria.

The study area is situated in confluence between Rivers Kaduna and Dinya within Shiroro Local Government Area of Niger State. The sample locations are located within Longitude 5°50'01"E to 07°10'41"E and Latitude 8°51'01"N to 10°20'04"N (Figure 1) Kaduna River is the major River feeding the lake. The River takes its source from the west and Northwest of Jos Plateau (Garba and Mohammed, 2011). The river flows westward from the plateau at an elevation of 1,500 metres to 1,800 metres through Kaduna town at an elevation of 633metres, the major left hand tributaries of the Kaduna River at the upstream of Shiroro reservoir are the River Sarkin/Pawa and River Dinya (Garba and Mohammed, 2011). They rise from hilly areas within the basement complex plains near Kaduna (Garba and Mohammed, 2011).

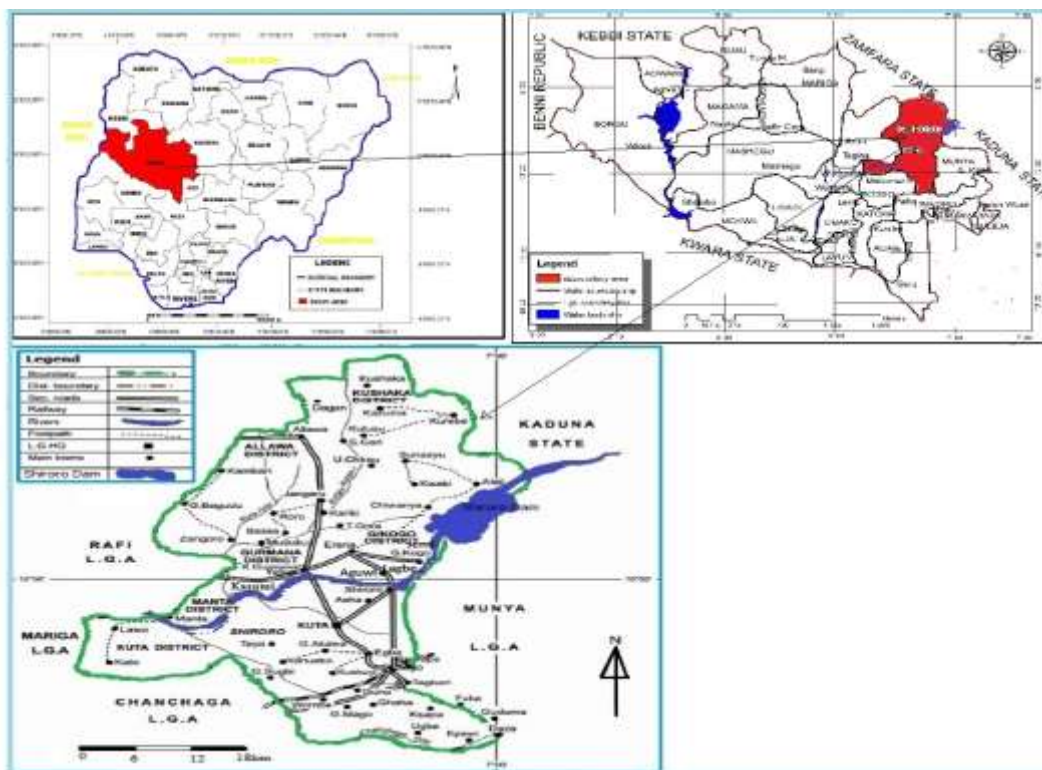


Figure 1: Map of the Study Area

Source: Niger State Geographic Information System (2021)

Materials and Methods

The sources of data used include primary and secondary. The primary sources include reconnaissance survey, questionnaire administration and purposive selection of affected communities and respondents of the study area. In order to develop detailed and comprehensive literature review, the information was obtained from written documents. To achieve this therefore, data were sourced from the gazettes, internet facilities, text books, journals, published and unpublished thesis from University library etc. with regards to environmental and livelihood impacts of recurring flood events on downstream communities of dam internationally and locally. The methods of data analysis include frequency percentage, sustainable livelihood index, and 3-point Likert type scale.

Results and Discussion

The major causes of recurring flood events in the study area include heavy rainfall, poor drainage system, overflow of Shiroro dam, blockage in the drainage and siltation of the river as revealed in Table 4.2 of the study. As revealed in Table 1, it has been shown that 179 of the respondents believed that the major cause of recurring flood in the study area is from heavy rainfall, 110 of the respondents agreed that the major cause of recurring flood is due to overflow of Shiroro dam, siltation of the river ranked third with 57 of the respondents and blockage in the drainage ranked the least with one respondent.

Table 1: Major Causes of Recurring Flood Events in the Study Area

S/No.	Causes	Number of Respondents	Percentage (%)
A	Heavy rainfall	179	49.7
B	Poor drainage system	13	3.6
C	Overflow of Shiroro dam	110	30.6
D	Blockage in the drainage	1	0.3
E	Siltation of the river	57	15.8
	Total	360	100

Source: Field Survey (2022)

This indicates that heavy rainfall is the major cause of flood in the study area while siltation of the river as well as poor drainage system and blockage in the drainage were the minor causes of flood in the study area. The implication of result, show that heavy rainfall was the main cause of recurring flooding in the study area and it occurred during the months of August, September and October.

The damages of flood occurrences in the riparian communities include collapse of buildings and displacement, property destruction, loss of lives, farmland/crops submerge and loss of animals as indicated in Figure 1 of this study. Damages as a result

of recurring flood events in the study area were of different classes and magnitude as indicated in Figure 1. Farmland/crops submerge ranked the highest with 30% of the respondents, collapse of buildings and displacement of people ranked second with 28% of the respondents, property destruction ranked third with 20% of the respondents, loss of lives ranked fourth with 18% of the respondents and loss of animals ranked the least with 4% of the respondents. The implication of damages as a result of flood occurrence in the study area is low standard of living, inadequate food security and environmental degradation.

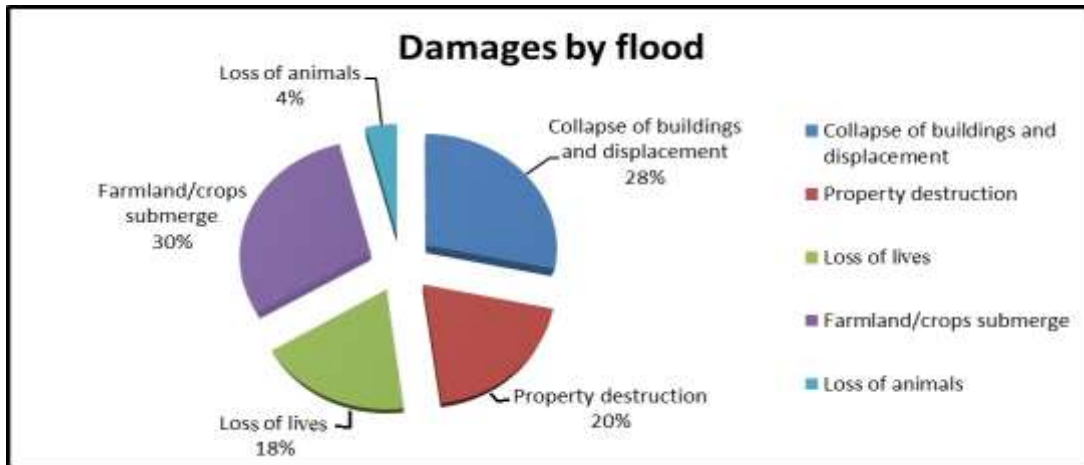


Figure 1: Damages by Recurring Flood Events in the Study Area
Source: Field Survey, 2022

The livelihood impacts were analysed using food security and health status of the respondents. The health status was analysed through health of sampled population during the recurring flood events in the study area as indicated in Table 2 of the study. As indicated in Table 2, highly vulnerable ranked the highest with 159 sampled population, vulnerable ranked second with 123 sampled population, fairly vulnerable ranked third with 66 sampled population and not vulnerable ranked the least with 12 sampled population. This revealed that the majority of health of the sampled population was highly vulnerable and this was as a result poor healthcare delivery during the recurring flood events across the study area.

Table 2: Vulnerability of the Health Status of Sampled Population

S/No	Responses	Frequency	Percentage (%)
A	Not vulnerable	12	3.3
B	Fairly vulnerable	66	18.3
C	Vulnerable	123	34.2
D	Highly vulnerable	159	44.2
	Total	360	100

Source: Field Survey (2022)

As depicted in Table 3, 237 (65.8%) of the respondents responded in the affirmative saying there is food availability in the study area, while 123 (34.2%) of the respondents were of the view that the study area lack sufficient food to sustained it inhabitant due to recurring flood events. This shows that level of food availability is adequate and this reflects on the crop they cultivated, which include yam, maize, sorghum, millet and groundnut in most of the communities while Manta and Kasumi are some of the communities that suffered most for inadequate food availability in the study area due to recurring flood events.

Table 3: Present of food availability

Options Locations	Food Availability		
	Yes	No	Percentage
Gurmana	25	9	9.4
Gussoro	50	10	16.7
Manta	29	34	17.5
Jemi	65	14	21.9
Kasumi	21	30	14.2
Yelwa	47	26	20.3
Total	237	123	100

Source: Field Survey, 2022

As shown in Table 4, 207 (57.5%) of the respondents responded in the affirmative saying there is food accessibility in the study area, while 153 (42.5%) of the respondents were of the view that the study area lack sufficient food access to sustained it inhabitant. Gurmana ranked the highest in food accessibility with 55 respondents and Gussoro ranked the least with 21 respondents. This shows that level of food accessibility is fair and this was as a result of adequate income to purchase food, food transfer from relatives or member of the community and adequate food production in the study area.

Table 4: Food Accessibility in the Study Area

Options Locations	Food Accessibility		
	Yes	No	Percentage
Gurmana	55	24	21.9
Gussoro	21	36	15.8
Manta	34	25	16.4
Jemi	37	14	14.2
Kasumi	24	25	13.6
Yelwa	36	29	18.1
Total	207	153	100

Source: Field Survey, 2022

Table 5 on proper food utilization in the study area indicated that 168 (46.7%) of the sample responded in the affirmative, while 192 (53.3%) were of the view that study area had suffered inadequate food utilization due to loss of nutrients while nourishment preparing, insufficient sanitation, despicable consideration and managed and social practices that uselessly affect utilization of nutritious sustenance for certain relatives in the study area. Manta ranked the highest with 38 respondents and Kasumi ranked the least with 20 respondents.

Table 5: Food Utilization in the Study Area

Options Locations	Food Utilisation		
	Yes	No	Percentage
Gurmana	24	45	19.2
Gussoro	31	20	14.2
Manta	38	27	18.1
Jemi	32	25	15.8
Kasumi	20	32	14.4
Yelwa	23	43	18.3
Total	168	192	100

Source: Field Survey, 2022

As observed in Table 6 based on food stability in the study area, 201 (55.8%) of the sample responded in the affirmative, while 159 (44.2%) were of the view that study area had suffered inadequate food stability due to high vulnerability to recurring flood events and periodic food and nutrition insecurity in the study area. Gurmana ranked the highest with 49 respondents and Gussoro ranked the least with 21 respondents. This implies that there is less food stability within the study area and this cut across the entire sample points in the study area.

Table 6: Food Stability in the Study Area

Options Locations	Food Accessibility		
	Yes	No	Percentage
Gurmana	49	30	21.9
Gussoro	21	36	15.8
Manta	34	25	16.4
Jemi	37	14	14.2
Kasumi	24	25	13.6
Yelwa	36	29	18.1
Total	201	159	100

Source: Field Survey, 2022

Flood hazard coping strategies for the study area include Engineering Scheme, Flood Abatement Schemes, Flood-Protection Scheme, Public Relief Funds, Flood Insurance, Flood Forecasting and Warning Schemes and Floodplain Zoning as revealed in Table 7.

Table 7: Effective Flood Coping Strategies Adopted by the Communities

S/No	Coping Strategies	VG	G	NG	Total
A	Engineering Scheme	10	1	0	11
B	Flood Abatement Schemes	4	3	0	7
C	Flood-Protection Scheme	69	7	0	76
D	Public Relief Funds	113	33	0	146
E	Flood Insurance	0	0	0	0
F	Flood Forecasting and Warning Schemes	69	31	0	100
G	Floodplain Zoning	9	11	0	20
	Total	257	103	0	360

Source: Field Survey (2022)

As indicated in Table 7, public relief funds ranked the highest with 146 respondents, flood forecasting and warning schemes ranked second with 100 respondents, flood-protection scheme ranked third with 76 respondents, floodplain zoning ranked fourth with 20 respondents and flood insurance ranked the least with no response. The implication of this finding is that public relief fund either from government or private donor is the major flood coping strategy in the study area.

Guidelines for reducing flood losses published by United Nations Department of Economic and Social Affairs in conjunction with United States National Oceanic and Atmospheric Administration (NOAA) in 2004 include Flood Forecasting and Disaster Response and Water-related Disaster Reduction and Response. This publication is based on the findings of those two sustainable development and policy action and is a contribution to the overall efforts that are required to help society cope with the impact of recurring flood events. Focused efforts are required to reduce the risk of recurring flood events on the study area. Flood forecasting and warning systems, data collection systems, flood plain management practices and land-use planning, as well as economic and social measures can be adopted within an integrated framework to lead to sustainable solutions in the study area. Concerted efforts are required to achieve these solutions, and such efforts are necessary to stem the rising losses from water-related disasters as result of recurring flood. It is truly hoped that these guidelines will assist in the planning and implementation of actions leading to more healthy and resilient study area.

Conclusion

From the study, it was clear that households cope differently when affected by recurring floods in downstream communities of Shiroro dam. The current coping strategies being employed by most respondents were not very effective. The finding revealed that the flood coping strategies were not sustainable because they had been using them and yet the situation did not seem to improve. The downstream communities coping capacities should not be underestimated but rather built upon. The focus must be on improving livelihood conditions of the people.

The downstream communities should be encouraged to build their shelters using durable materials and away from the flood prone area as a way of coping with the floods. Clearly, there is need to develop better and appropriate measures (as discussed under the implications and recommendations sections) to prepare and mitigate the environmental and livelihood impact of recurring flood events on downstream communities of Shiroro dam, Niger State, Nigeria. Above all, the aim must be to involve all the players to enhance downstream communities' resilience to floods due to location of Shiroro dam. This is because as they put it, their livelihood revolves around the water: farming, fishing, transport and ancestral history.

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