Original Article *Journal of Sustainability and Environmental Management (JOSEM), Vol. 1, No. 2 (2022), 210 – 217*
p-ISSN 2822-1729, e-ISSN 2822-1737 Available online at https://www.nepjol.info/index.php/josem

Appraisal of Socio-economic, Infrastructural and Environmental Impacts of Flood in Makurdi Local Government Ares of Benue State, Nigeria

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Abstract: Among the common natural hazards experienced in the world today, flood is said to be the most devastating in terms of the area covered and frequency of occurrence. Floods cause serious damage to lives and properties, disrupt economic activities, and, in turn, threaten the sustainable development of human settlements. In Nigeria, flooding has become a recurring phenomenon, sometimes with devastating effects. This study was aimed at assessing the socio-economic, infrastructural, and environmental impacts of floods in Makurdi Local Government Area (LGA). A non-probability sampling technique involving the use of a well-structured questionnaire was adopted in obtaining the required information. Purposive random sampling was used to select four hundred (400) flood victims from the nine (9) local wards bordering the Benue River. Analysis was done using Microsoft Excel and the findings were presented in tables and charts using percentages. The result showed that floods have a huge impact on the community, with greater damage 44% recorded on socio-economic activities (farming, marketing, and administration), followed by a 32% impact on infrastructural facilities (roads, hospitals, and schools), and a relatively lower impact 24% recorded on environmental variables (water, land, and vegetation). An Analysis of Variance (ANOVA) test conducted on these revealed that there is a significant variation in the impact created by floods on the study variables. Flood mitigation and preparedness plans were found to be the leading challenges to long-term flood disaster management in the area. The paper calls for collaborative efforts from residents, flood disaster management agencies, or stakeholders to reduce the impact and improve decisions towards ameliorating the menace of floods in the area. The evidence in this paper seeks to promote actions toward combating flooding and improving flood disaster management in Nigeria.

Keywords: *Environment, Flood, Impact, Infrastructure, Natural disaster, Socio-economic*

Conflicts of interest: None
Supporting agencies: None

Received 05.04.2022; Revised 07.05.2022; Accepted 17.05.2022

Cite This Article: Ikyapa, T.P., Abdulhamid, A., Rilwanu, T.Y., Daura, M.M., Alogo, P.A. (2022). Appraisal of Socio-economic, Infrastructural and Environmental Impacts of Flood in Makurdi Local Government Ares of Benue State, Nigeria. *Journal of Sustainability and Environmental Management*, 1(2), 210-217.

1. Introduction

The current rise in the global population has led to a progressive growth in economic activities and a corresponding increase in built-up communities with varying degrees of infrastructural facilities. These communities are often heavily flooded as a result of high rainfall, poor drainage, and indiscriminate waste disposal along water channels, which compromise the economy, health, and safety of the people in those communities. Among the common natural hazards experienced in the world today, flooding is said to be the most devastating disaster that causes serious damage to lives, properties, economic activities, and a huge threat to environmental sustainability, the extent of which is determined by the location and structure of the settlements, which, in most cases, are sited close to water bodies. Evidence suggests that floods represent the most costly natural hazards one of the most frequent in terms of occurrences in the past

three decades, and their effects can be enormous when considering economic loss (Koç, et al 2021). Changes in land use patterns occasioned by population growth have increased human vulnerability to floods. Floods cause direct death, morbidity, indirect effect on water born and infectious diseases. The impacts created on environmental variables and businesses are directly related to their location (Zaman, 2012). Home to almost 15% of the world's population, as well as some of the most iconic species, Africa faces serious environmental challenges that make her highly vulnerable to climate change. Nigeria, for instance, is said to be free of other natural disasters such as earthquakes, volcanoes, and typhoons at the moment, but weather-related disasters such as floods and desertification are severely impacted, with floods dominating in terms of area coverage (Hossain et al., 2020).

Though the severity of floods differs across geopolitical and ecological zones in the country, social activities and food production are heavily affected as traders and farmers are left with very little to cater for themselves when extreme events occur. In 2020 alone, 24 out of 36 states in Nigeria experienced some form of either pluvial or fluvial flood, which are the two dominant types of flood in the country. Some of the events in recent years are: 2012, 2014, 2017, 2018, and 2019. These flood events primarily impacted the states adjacent to the major rivers (Benue & Niger), and in most cases exacerbated pollution, erosion, and other degradation processes in the areas where they occurred (Adewuyi & Olofin, 2014). Although natural factors (high rainfall & topography) have great influence in Makurdi, anthropogenic factors are of greater significance in the severity of floods. (Isma'il & Kersha, 2018). Caused mostly by a combination of factors such as heavy rainfall, poor drainage facilities and inadequate management of reservoirs (mainly dams) upstream, Makurdi Local Government Area (LGA) has continuously experienced flood episodes at uneven intervals. (Peter et al., 2020). In order to prevent these huge flood losses, disaster risk management requires reliable assessment in terms of the infrastructural impact of the potential flood events, as well as the economic and environmental damages caused (Koç et al., 2021).

Several approaches have been utilized to understand flood situation in Makurdi. While, Oyetayo et al. (2018) utilized Catchment Morphometric Ranking Matrix to understand flood vulnerability pattern, Shabu and Emmanuel (2013) employed residence copping measures in the flood prone areas of the town. The operation of geospatial technologies (GIS & Remote Sensing) has also been useful in a wide range of application as done by Oyetayo et al (2018), and Peter et al (2020) to understand the vulnerability and risk of flood in Makurdi. On flood impact, majority of the studies carried out in the area like Ismail and Kersha (2018), and Pant et al. (2018) focused on one of the socioeconomic, infrastructural, or environmental variables but not the interplay of the three. It is on this note that this study is aimed at exploring the impacts of floods on these (socio-economic, infrastructural, and environmental) variables in Makurdi LGA, to improve adaptation strategies for future flood management, provide a feasible solution to the problem, reduce the impact, and build a flood-resilient community.

2. Materials and methods

2.1. Study site

Makurdi LGA is located in North-Central Nigeria, latitude 7˚ 33' 00" N to 7˚ 47' 00" N and longitude 8˚ 27' 00" E to 8˚ 4'00" E. The local government is bordered by Guma to the north, Gwer-east to the south, Gwer-west to the west and Doma local government area of Nassarawa State to the north-west (Figure 1). Covering 804 km2 land mass in a 16km radius circle, Makurdi became the capital of Benue state in the year 1976 following the division of Benue-Plateau into two distinct states (Isma'il & Kersha, 2018). Because of its centrality and high economic activity present, Makurdi serves not just as the capital of Benue state, but also as the administrative headquarter of Makurdi local government with 11 council wards (Agan, Ankpa, Bar, Clerks/Market, Central/South Mission, Fiidi, Mbalagh, Modern Market, North-bank 1, North-bank 2, and Wailomayo wards). The study area is one of the major cities and the main location of commercial activities, serving as a local trade centre for agricultural products (sesame, rice, cassava, millet, yams, cotton, soybeans, groundnuts, and livestock) in Benue State (Awopetu et al., 2013).

The town is also drained majorly by the Benue River, which cuts across the town from east to west, separating it into two major parts (the North and South-Banks). Makurdi is also drained by other smaller rivers like the Genebe, Katsina-Ala, Kereke, Idye, and Kpege Rivers, with the Katsina-Ala River on the outskirts serving as the major tributary of the bigger Benue River. Most of these rivers dry up during the hot season, leaving behind some sizeable stagnant pools. It is important to note that the town, especially the southern part, is waterlogged as a result of its low relief (Oyatoyo et al., 2018). Figure 1 illustrates the location of the study area in Nigeria.

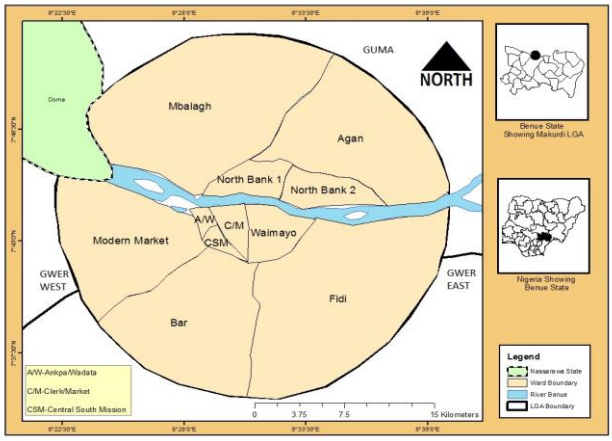

Figure 1: Location map of Makurdi Local Government Area showing the 11 council wards

The climate of Makurdi falls within the Guinea Savannah zone of the country, which is the transitional belt that divides the forested belt of the south from the real savannah in the north. Rainfall within the area ranges from 775 to 1792mm, with a mean monthly relative humidity of between 43% in January to 81% in July and August. While it is made up of a combination of tall trees and grasses of average height, most of the trees are deciduous in nature, meaning they shed their leaves during the dry months. (Peter et al., 2020). The town is composed basically of sedimentary rock, with extensive portions of limestone and marble on the outskate. Sandstone predominates in the area and is divided into micaceous and feldsphatic sandstones. Some of which are exposed in parts of the town. While the relief is generally low-lying (averaging 100 m to 250 m) and gently undulating with inselbergs, laterites, and knolls, the soils in the area reflect the geology (Oyatoyo et al 2020). In Makurdi town, there are two major soil types: hydromorphic soils formed from alluvium sediments along the River Benue, and red ferrasols formed from sedimentary rocks away from the immediate river channel. (Ahile & Ityavyar, 2014).

2.2. Population and sampling

Predominantly inhabited by the Tiv, Idoma, and Igede people, Makurdi also serves as a home to many other minority languages like the Etilo, Jukun, Egede, Hausa, Yoruba, and Igbo-speaking people who are either engaged in commercial activities, civil service duties, or agricultural peasantry. It is not surprising that, in terms of flood frequency and magnitude, the Clerk Mission, Modern Market, Mbalagh, and Wailomayo wards are the most susceptible, considering their relief, with each experiencing varying degree of flood. As a result of floods occurring almost annually in at least one part of the town, flood losses in the area are substantial. (Shabu & Emmanuel, 2013). For the purpose of this study, non-probability sampling technique was utilized, where four hundred (400) questionnaires were administered in nine (9) out of eleven (11) local wards, which were purposively selected due to their close proximity to the major river (Benue).

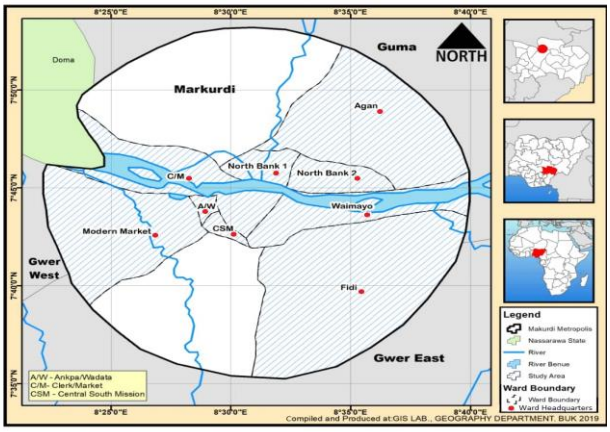

Figure 2: Map of Makurdi LGA showing the sampled wards

2.3. Statistical methods

This study was developed based on three impact factors, including socio-economic, infrastructural, and environmental variables. A structured questionnaire was administered to the residents of the area, the questionnaires were administered in the month of November 2020, shortly after the flood event, to gain viable information about the situation in the area. The data recorded was analysed using descriptive and inferential statistics via Microsoft Excel. Analysis of variance (ANOVA), was also used in determining the variation in the level of damages caused on the major variables under study.

2.4. Hypothesis

The following hypotheses were developed for testing via data analysis in order to determine the impact of flooding on the major aspects (socioeconomic, infrastructural, and environmental variables) under study in the area.

H1: There is a significant variation in the level of damage caused by floods on the study variables in the area.

Ho: There is no significant variation in the level of damage caused by floods on the study variables in the area.

3. Results and discussion

3.1. Level of flood damage on agriculture

From the analysis, 41% of the research respondents indicated that flood disasters cause serious damage to farmlands; few indicated that the level of damage to farmlands is less, and a very small number indicated that flood disasters do not cause any damage to farmlands (Figure.3). Depending on the amount of soil nutrient wash away from and the type of sediments deposited on the farmlands during floods, they can be rendered uncultivable for a period of time. The result also shows that 43% of the respondents indicated that the flood disaster causes serious damage to crops; only few of the respondents said the flood disaster does not cause any damage to crops (Table 1). The level of damage flood disaster causes to crops is serious, as indicated by the majority of the research respondents. This finding, however, is in line with the findings of Adewuyi and Olofin (2014) that farmers suffer serious losses of crops worth millions of naira each year as a result of flood disasters. Agricultural sector is very important in eradicating hunger and achieving Sustainable Development Goals (SDG) 2, but this key sector is seriously impacted by flood in Nigeria (Echendu, 2020)

It has been revealed from the analysis that floods do not cause much damage to livestock rearing in the study area, as indicated by the majority of the respondents. Only a few of the respondents said the level of damage to livestock farming is high (16%) (Figure 3). This has clearly proven that the level of damage flood disaster

causes to houses in the area is severe. On average, the analysis revealed that flood disasters cause serious damage to agriculture in the study area, with farmlands and crop produce exposed to a very high impact (Figure 3). It is clear from the analysis that the level of damage caused to livestock in Makurdi LGA is minimal, compared to other agricultural variables. This is partly because livestock can be moved to safer places when extreme events occur, while crops and farmlands are stationary variable. It is also important to note that the majority of the residences are crop farmers and only a few of them are into livestock production, which could be the reason behind the high response rates in respect to damages caused to farmland and crop production as opposed to livestock farming. In all this finding is in line with the assertion of (Shabu & Emmanuel, 2013) that whenever a flood occurs, it usually causes serious damage to socioeconomic activities of the people in the affected areas. Makurdi been the food basket of the nation, it is important to state here that the impact created by flood on agriculture is negatively affecting food production process, which has a huge implication on food security in the country.

3.2. Level of flood damage on trade/economic activities

The result of the findings shows that the damage caused by flood disasters to trade and economic activities in the study area is less as opined by the majority of the respondents. 45.25% and only 16.75% indicated that flood disasters do not cause any damage or destruction to trade in the affected areas (Table 1). This contradicts the findings of Awopetu et al (2013). This means that the major markets in the study area are not as affected as one may expect, probably due to good planning and the building condition of the markets, which is situated away from the flood-prone areas. This effect is significant enough to thwart commercial activities, especially during rainy seasons. This poses a serious threat to the economic prosperity of the affected areas, which if not properly addressed, may affect the study community, making it to lose its economic glory and affluence. Floods have the capacity to destroy the social capital of the people and physical terrain as well as take away the little savings of victims. When the situation becomes frequent, the effects become compounded exacerbating the living condition of the people threatening the achievement of sustainable development goals 1. As manifested by many flood victims, annual flooding only ensues that poverty is further entrenched in the area (FGN, 2013).

3.3. Impact on infrastructural facilities

From the result, about 44.25% of the research respondents indicated that the level of damage a flood disaster causes to roads is serious, and only a few others showed that the damage is less (table 2). This is due primarily to the dilapidated nature of the street roads in some local settlements. It is important to note that the level of damage caused to roads in the area is minimal as compared to other components. The analysis of the level of damage flood disaster causes to electricity and electrical gadgets revealed that there is a serious destruction to electrical infrastructure in the study area as indicated by the majority of the respondents (42.5%). Similarly, the assessment of the level of damage caused by the flood disaster on health facilities in the area revealed that the flood disaster did not cause any serious damage to health or health facilities in the area; only 29% said the damage was serious (Table 2). On average, the results confirmed that flood disasters cause serious damage to infrastructure in the study area, with houses and roads having the highest level of damage. This agrees with the findings of (Ahile & Ityonum, 2014). Urban infrastructures under the risk of flood do not make for sustainable cities. Nigeria is witnessing not only a spike in population but also rapid urbanization. The rapid population growth and unplanned urban centers raise concerns on the sustainability of the urban infrastructure which are heavily affected during floods. (Salami & Giggins, 2017).

3.4. Level of flood damage on educational facilities

The outcome of the analysis shows that 38.25% of the respondents believe flood disasters affect classes or classroom activities. However, 27.5% feel that flood disasters do not cause much threat or damage to classrooms in the study area (Table 3). This indicates that the level of flood damage to classrooms is high. It is important to note here that a flood disaster has a direct effect on student attendance as many affected schools are closed down during flood episodes while classes in the unaffected schools are used as relocation shelters or camps for flood victims during flood disaster events. As such, normal lessons and school activities are suspended for as long as the situation lasts. Schools in Nigeria serve as sometimes as emergency shelters, during disasters like flooding, so they cannot serve their primary educational purpose. This effect becomes profound in areas that experience annual flood and access to education is already inadequate. Students miss many months every year without school, providing quality education towards achieving SDG 4 becomes difficult (Salami and Giggins, 2017).

3.5. Impact on environment

The assessment of the level of environmental damage caused by flood disasters in the study area showed that about 58% of the research respondents indicated that flood disasters cause serious damage to the land in the affected areas, while 14.25% indicated that flood disasters do not cause any damage to the land area (Table 4). From the result, it is clear that whenever a flood disaster occurs, it usually causes serious damage to the lands of the affected areas, especially in the form of erosion and pollution, which is caused by the deposition of rubbish in areas

where it is not wanted. Many areas in Nigeria lack adequate sanitary facilities and when it floods, the likelihood of outbreak of diseases like cholera and diarrhea drastically increase. Land pollution become eminent and portable water becomes contaminated with industrial waste, bacteria, sewage and other chemical substances as tube-wells are submerged during flood (Isma'il & Kersha, 2018).

An analysis of the level of flood damage to vegetation also revealed that there is serious damage caused to the vegetation of the study area whenever flooding occurs, as indicated by 37.5% of the respondents. 26.25% of them also stated that the disaster did not cause any damage to vegetation in the study area (Figure 4). This finding reveals that although the level of flood damage to vegetation in the area is not as high as other environmental variables, it is capable of causing weakening the soil structure, causing soil erosion and distorting the natural vegetation, and invariably threatening environmental sustainability in the study area.

The analysis of the respondents indicated that flood disasters cause serious damage to the quality of water in the study area, as indicated by 75.25%, while only 12.25% indicated that floods do not have any effect on the quality of the water (Figure 4). This finding reveals that whenever a flood occurs, it usually contaminates the existing water resources of the affected areas since it carries along so many contaminants that are capable of polluting water bodies. This result is in line with the findings of Pant et al (2018), that water is heavily polluted when extreme flooding occurs. In a community where water for domestic use is sourced through local streams and wells, it becomes extremely difficult to get good water for consumption at home, except in the very few communities with access to pipe-born water supply. When water levels rise above normal and overflow the banks of a river or the shores of an ocean, the surrounding areas are vulnerable to flooding, which can result in injuries, property damage, loss of life, health effects, economic disruptions, and socio-psychological problems (Hossain et al, 2020).

3.6. Impact on major variables under study

According to the analysis in general, flood has a greater impact (44%) on socioeconomic activities, as indicated by the majority of respondents, followed by infrastructural facilities (32%), and a relatively low impact (24%) on environmental variables (Table 5).This agrees with the findings of (Zaman, 2012). That flood has a serious impact on socioeconomic activities.

3.7. Differences in level of flood damages in Makurdi Local Government Area (LGA)

To test the hypotheses earlier stated, Analysis of Variance (ANOVA) test was deemed appropriate due to the categorical nature of the data. The result of ANOVA at 0.05 level of significance shows that the critical F is 5.143253 and the F-Value is 9.846228 (Table 8). Based on this result, the null hypothesis (There is no significant variation in the level of damage caused by floods on the study variables in the area) is rejected and the alternative hypothesis (There is a significant variation in the level of damage caused by floods on the study variables in the area) is accepted.

This implies that the variation in the level of damage caused by floods on socio-economic, infrastructural, and environmental variables in Makurdi LGA is significant. In other words, the damage caused in the study area is not even amongst the variables; as shown in table 6, more damages are incurred on socio-economic activities as compared to infrastructural and environmental variables. This impact is capable of causing population shift, alteration of the social structure, and, economic hardship in the area.

The outcome from the analysis of flood disaster management in Makurdi LGA showed that there is a good response and recovery plan in the area, as indicated by the majority of the respondents (63.35%), while flood preparedness and mitigation was found to be relatively poor in the area (33.75%). See Table 7. This agrees with the findings of Ahile and Ityonum (2014). That, although awareness is high, preparedness and mitigation plans are always poor in urban Makurdi as households are not adequately prepared for future occurrences.

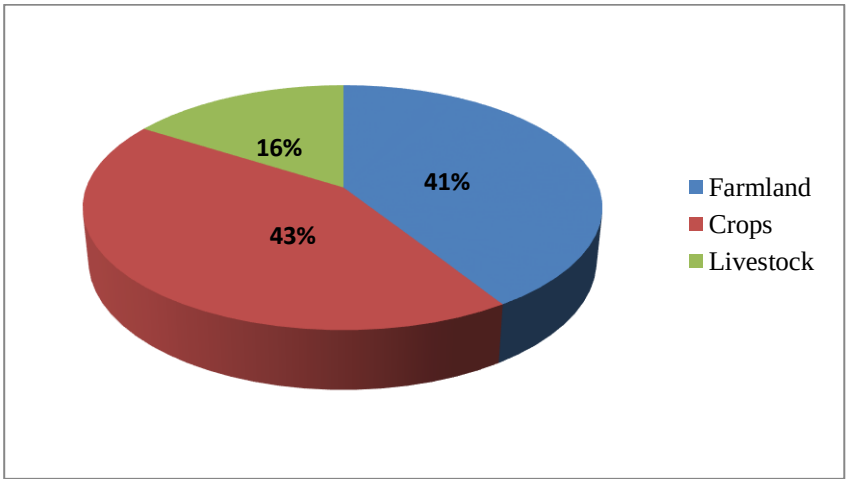

Figure 3: Level of flood damage on agriculture

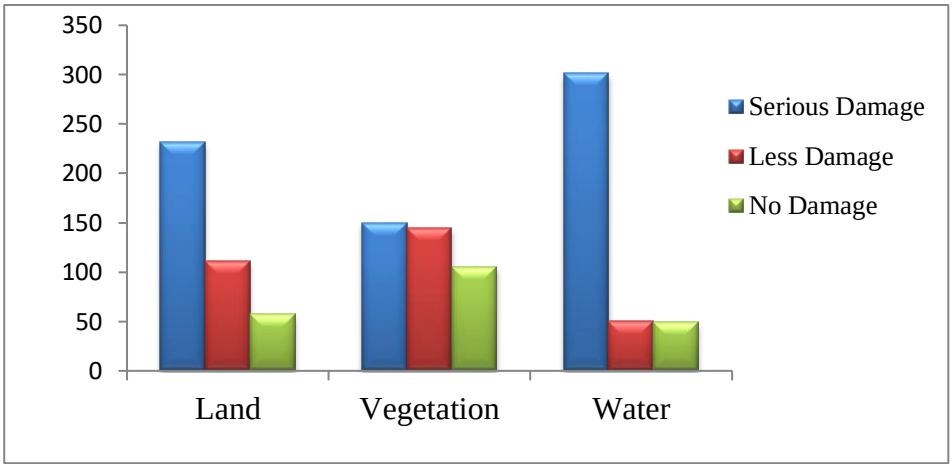

Figure 4: Level of environmental damages caused

Table 1: Level of flood damage on trade/economic activities

Level of Damage	Frequency (F)	Percentage (%)
Serious damage	152	38
Less damage	181	45.25
No damage	67	16.75
Total	**400**	**100**

Table 2: Level of flood damage to infrastructure

Variables	Level of damage							
	Serious Damage		Less Damage		No Damage		Total	
	F.	%	F.	%	F.	%	F.	%
Houses	276	69	98	24.5	26	6.5	400	100
Roads	177	44.25	165	41.25	58	14.5	400	100
Electric Gadgets	108	27	122	30.5	170	42.5	400	100
Health Facilities	116	29	141	35.25	143	35.75	400	100

Table 3: Level of flood damage to classrooms

Level of Damage	Frequency (F)	Percentage (%)
Serious damage	153	38.25
Less damage	137	34.25
No damage	110	27.5
Total	**400**	**100**

Table 4: Level of environmental damage

Variables	Level of damage							
	Serious Damage		Less Damage		No Damage		Total	
	F.	%	F	%	F.	%	F.	%
Land	232	58	111	27.75	57	14.25	400	100
Vegetation	150	37.5	145	36.25	105	26.25	400	100
Water	301	75.25	50	12.5	49	12.25	400	100

Table 5: Average impact on the major variables

Variables at risk	Frequency (F)	Percentage (%)
Socio-economic	173	44
Infrastructural	128	32
Environmental	96	24
Total	**400**	**100**

Table 6: ANOVA single factor

Source of Variation	SS	df	MS	F	P-value	F Critical
Between Groups	11340.67	2	5670.333	9.846228	0.012736	5.143253
Within Groups	3455.333	6	575.8889			
Total	**14796**	**8**				

Table 7: Assessment of flood management plans

Variables	Number of responses							
	Good Plan		Poor Plan		No Plan		Total	
	F.	%	F.	%	F.	%	F.	%
Flood Mitigation	123	30.75	166	41.50	111	27.75	400	100
Flood Preparedness	135	33.75	131	32.75	134	33.50	400	100
Flood Response	254	63.50	94	23.50	52	13.00	400	100
Flood Recovery	216	54.00	91	22.75	93	23.25	400	100

4. Conclusion

Makurdi Local Government Area, which happens to be one of the few cities sited along major rivers in Nigeria, has been affected time and again by flood disaster episodes. This study clearly assessed the impact of flood on socio-economic, infrastructural, and environmental variables. The result indicates that the impact on socioeconomic activities is enormous (44%), as the disaster brings about serious destruction to farming, trading, and administrative activities in the area. Impacts on infrastructural facilities are not left out as significant damage (32%) is recorded on roads, hospitals, and schools etc. Domestic water sources are also polluted, just like land degradation and destruction of vegetation cover, which all make up (24%) of the environmental variables. The result also showed that, though there is a good flood disaster management plan in place to curtail the challenge, flood mitigation and preparedness strategies are poor. Results from the statistically tested hypothesis on the impact of flooding on the major variables revealed that there is a significant variation in the level of damage caused on the various aspects under study. This contributes to existing literature and is likely the first to evaluate the interplay of the three variables (Socio-economic, infrastructural and environmental) in the area.

To make headway and ensure sustainability, the anthropogenic causes of flood must be addressed; these require reviewing urban planning and integrating proper flood risk management. The policy implication of the result also suggests that, financial and logistical support should be provided by the local, state and federal governments for business owners affected by the flood, in order to maintain the social structure, reduce economic hardship, and, to keep food supply chain functioning in the area. While impacts on environmental and infrastructural variables cannot be undermined, it is important to improve flood mitigation and preparedness plans, which were found to be the leading impediments to flood disaster management in Makurdi LGA.

Acknowledgements

The authors would like to appreciate the staff and management of geography department, faculty of earth and environmental sciences, Bayero University Kano for providing an enabling environment to carry out this research. To the participants in Makurdi LGA, authors appreciate all for creating time out of your busy schedule to give the information required. We also want to express our sincere appreciation to the anonymous peer reviewers for their valuable feedback. Finally but more importantly, we appreciate God Almighty for giving us the grace to undertake this study.

References

Adewuyi, T.O., and Olofin, E.A., (2014). Spatio-temporal analysis of flood incidence in Nigeria and its implications for land degradation and food security.

*Journal of Agricultural Science, 6(*2), 150-160. https://doi.org/10.5539/jas.v6n2p150

Oyatayo, K.T., Iguisi, E.O., Sawa, B.A., Ndabula, C., Jidauna, G.G., Iorkua, S.A., (2018). Assessment of parametric flood vulnerability pattern of Makurdi Town, Benue State, Nigeria. *Confluence Journal of Environmental Studies, 12(*2), 11–24.

Koç G., Natho S., Thieken A.H., (2021). Estimating direct economic impacts of sever flood events in Turkey. *International Journal of Disaster Risk Reduction, 58(*2021),102222 https://doi.org/10.1016/j.ijdrr.2021.102222

Salami, R.O., Meding J.K., and Giggins H., (2017). Urban Settlements Vulnerability to flood risk in African Cities: A Conceptual Framework. *Jamba Journal of Disaster Risk Studies 9(*1), 1-9. Doi:10.4102/jamba.v9i1.370

Awopetu, R.G., Awopetu, S.O., & Awopetu, M. S. (2013). The impact of flood on the socio-economic status of residents of Wadata and Gado-villa communities in the Makurdi metropolitan area of Benue State, Nigeria. *Disaster Management and Human Health Risk, 133(*2), 347-357. https://doi.org/10.2495/DMAN130311

Ahile, S.I., and Ityonum E.M, (2014). Household perception and preparedness against flooding in Makurdi Town, Benue State, Nigeria. *IOSR Journal of Environmental Science, Toxicology and Food Technology, 8(*11), 01–06. https://doi.org/10.9790/2402-081130106

Echendu A.J., (2020). The impact of flooding on Nigeria's Sustainable Development Goals (SDGs). *Ecosystem Health and Sustainability, 6(*1), 1791735 https://doi.org/10.1080/20964129.2020.1791735

FGN. (2013). *Nigeria Post-disaster Needs Assessment. A Report by Federal Government of Nigeria, with technical support from the Europian Union, United Nation, World Bank, and other Partnes, Nigeria.*

Hossain A.A., Cohen, S., & Praskievicz, S. (2020). Sensitivity of urban flood simulations to storm–water infrastructure and soil infiltration, *Journal of Hydrology, 588(*4) 125-138. https://doi.org/10.1016/j.jhydrol.2020.125028

Isma'il, M., & Kersha, A.J., (2018). An assessment of the environmental effects of flooding in Makurdi Area of Benue State, Nigeria. *Journal of Scientific Research and Reports, 20(*5), 1-11. https://doi.org/10.9734/JSRR/2018/9848

Pant, R., Thacker, S., Hall, J.W., Alderson, D., & Barr, S. (2018). Critical infrastructure impact assessment due to flood exposure: Critical infrastructure impact assessment due to flood exposure. *Journal of Flood Risk Management, 11(*1), 22–33. https://doi.org/10.1111/jfr3.12288

Peter, I.T., Adnan, A., Terwase, S., Adamu, C.S., (2020). Flood risk assessment in urban Makurdi, Benue State, Nigeria. *ASIO Journal of Humanities, Management & Social Sciences Invention (ASIO-JHMSSI), 6(*1), 07-17. doi: 10.2016-14781119

Shabu, T., & Emmanuel T.T., (2013). Residents' coping measures in flood prone areas of Makurdi Town, Benue State. *Applied Ecology and Environmental Sciences, 1(*6), 120-125. https://doi.org/10.12691/aees-1-6-4

Oyatayo, K.T., Ndabula, C., Abaje, I.B., Jidauna, G.G., Iwan, M.T., Mshlia, A.M., (2020). Trend analysis of rainfall and its implications for flooding in Makurdi Drainage Basin, Benue State, Nigeria. *FUDMA International Journal of Sciences (FUDIJOSS), 2(*2).

Zaman, M. (2012). Impact of recent flood on the economy of small business at Rockhampton. *Procedia - Social and Behavioral Sciences, 65(*2012), 116-126. https://doi.org/10.1016/j.sbspro.2012.11.100.