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SOCIOECONOMIC CHALLENGES OF ENVIRONMENTAL CATASTROPHES: A STUDY OF ANNUAL FLOODS AT DURA FLOOD PLAIN ALONG GBOKO TO KATSINA-ALA ROAD, BURUKU LGA, BENUE STATE, NIGERIA

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ABSTRACT: *Comic articulations and the phenomenal configuration of relief features, and anthropogenic activities are progressively getting vast portions of the global landscape susceptible to flood events of varying catastrophic magnitudes. This paper, using 150 structured questionnaires, field surveys, journal articles, conference papers and rainfall records as bases for empirical analysis, traced the root causes of river-related annual floods with a focus on the River Dura floodplain along the Gboko to Katsina-Ala road. The paper also examined the major socioeconomic challenges of the annual floods within the context of agricultural productivity, transportation and commercial activities, and income generation by the local inhabitants. The study also employed Remote Sensing and Geographic Information System (GIS) to produce a map of the study locality, which captures the floodplain. Results from the study revealed that annual floods in the locality are largely due to heavy rainfalls of high frequency. The study further revealed that large-scale disruption of farmlands, crops, and traffic flow along the federal highway and footpath are some of the major challenges associated with the annual floods. The study accordingly recommends the immediate extension of the bridge across the River Dura, dredging of the river, construction of a dam and use of bio-techniques to boost the level of crop resistance against inundation to alleviate the adverse effects of the annual floods in the locality.*

KEYWORDS: Environmental catastrophes, Annual floods, Transportation, Flood plain, Inundation.

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INTRODUCTION

The phenomenal configuration of global relief features in the forms of mountains, hills, plateaus and plains, summarily categorized as high and lowlands, have been the pioneering potential factors for the occurrence of large-scale flooding events on the surface of the Earth (Dawson, 2023). Floods on their part are flows of water into areas that are normally dry. According to Can, Hoany and Dung (2024), floods occur in regular and ill-defined patterns, with the regular pattern associated basically with seasonal changes and hence the phrase "annual floods," while ill-defined floods are substantially triggered by anthropogenic activities and occur mainly in built-up areas with population thresholds. In all cases, however, floods occur at varying magnitudes, with multiple catastrophic effects on both the environment and human society at the points of their occurrence and hence, the increasing concerns about the nature and socioeconomic challenges of flooding events (Onu, 2024).

Assessing from global perspectives, the menace of flooding has been largely due to two cardinal points: the phenomenal melting of ice from polar ice caps and prolonged rainfall of high intensity. In a study on annual floods in Pakistan, Asia, Manzoor, Muhsan and Khan (2022) report that the Himalayan Glacier over the multiple peaks of the Great Himalayan Mountains has remained the only major potential threat for flooding events. The authors conclude that global warming caused by carbon dioxide and greenhouse gas emissions translates to temperature rise, which causes the melting of polar ice. The waters then flow into the open oceans, producing a corresponding rise in sea level, which submerges coastal areas with devastating ecological and socioeconomic effects. Similarly, Elneel, Zitouni, Husameldin and Gali (2024) note that sea-level rise is among the most spectacular challenges associated with the melting of polar ice, with far-reaching socioeconomic effects that retard development. In Greenland, flooding along coastal lowlands is more typical of ice melting than rainfalls, just as melting ice from the Alpine and Arctic glaciers has led to catastrophic floods at lowlands in Colorado and other parts of the northern hemisphere, where over 40% of glacier volume has been lost between 2000 and 2023 alone (O'Connell & Bayers, 2025).

On the other hand, prolonged rainfall has also proved devastating in regions of very low relief profile, especially those punctuated by rivers and other water channels, which often overflow their basins and spread water into their banks affecting agricultural operations, critical infrastructures and other social services. This scenario is typical of East and South Asian countries. The seasonal pattern of flooding events around the Bakassi River watershed, northeast of Jakarta, Indonesia, is a good reference point where recurrent annual floods have reduced the local inhabitants to incredible poverty levels (Wijaya, Yuli & Priyono, 2024).

Across Africa, flooding has exerted multiple adverse effects in Yemen, at the horn of Africa, where agricultural communities have, over the recent years, suffered lots of crop damage and salinization of farmlands due to the surging effects of wave actions over the sea, storms and rising sea levels (Aklan, 2024). Despite the enormous economic value attached to the Nile River in North Africa as the major source of irrigation agriculture, seasonal flooding events due to rising sea levels, water release from the Aswan Dam and climate change occur along its lower basins in Sudan and Egypt, which destroy crops and, oftentimes, settlements within the flood risk areas (Serwey & Sadek, 2022; Hekal & Fahmy, 2023). Nigeria has likewise suffered widespread adverse impacts of flooding. According to Menegbo and Emengini (2024), Rivers State is among the worst-hit areas, where flooding exerts tremendous effects on farming communities and structural facilities, which disrupts food production through inundation and

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drowning while transportation architectures are regularly rendered inconsequential. In many coastal localities of Nigeria like Bayelsa, Cross River and Lagos, flooding takes the patterns of both prolonged rainfalls of heavy intensity and sea level rise due to ocean wave actions. In the Gwagwalada Area Council of Abuja within the Middle Belt Region, flooding on an annual basis results in massive destruction to crops, farmlands, and health and educational infrastructures, all of which disrupt the overall process of food production, income generation and transportation, translating to significant setbacks within the economy of the locality (Abiola, Adewale, Obafemi & Ademola, 2023).

In Benue State, flooding events have progressively become an annual catastrophe with record levels of widespread destruction of farmlands, crops, housing and transportation architecture, including federal highways and footpaths. According to Porter and Yio (2023), global climate change with its attendant effects of prolonged rainfall has been the main cause of large volumes of annual floods, especially along river courses. Settlements, farms, road networks and institutional infrastructures located within the spectrum of basins of such rivers tend to suffer untold damages and disruption of activities. Furthermore, flooding events with their devastating effects have been ascribed to rainfall frequency and intensity that have increasingly characterized Benue State and the study locality, with other factors playing secondary causes. In all manifestations of the menace of annual floods, a spectacular feature that is constant is their destructive and disruptive tendencies, which adversely bear on ecological and socioeconomic routines, which ultimately lower the quality of life in the study area (Shabu, Ali, Nyajo & Ukula, 2021).

It is against the background of the foregoing, which aptly shows that flooding events have grossly underdeveloped communities across the globe, Africa, Nigeria and Benue State, as well as the study area, that this study is undertaken to trace the root causes of the flooding and examine its adverse effects on the locality of the Dura floodplain and recommend appropriate response strategies to reduce the sufferings of the masses.

Statement of the problem

Annual floods have progressively become recurrent natural phenomena across the global community, especially with the increasing trend of climate change. In Nigeria, in most parts of Benue State and the study area in particular, floodwaters destroy farmlands and crops at the Dura community on a yearly basis, thereby bastardizing their major source of income and livelihood. Additionally, the federal highway and its adjoining footpaths, which are the major links between the masses and the outside world, all get occasionally submerged during peak flows of rainy seasons. This development has intensified hardship, as the rainy seasons, rather than come with blessings, tend to heighten their socioeconomic problems. In 2011, 2012, and 2018, the federal highway was phenomenally submerged, shutting down traffic flow for two days by the menace of flooding. In 2023 and 2024, the environmental monster again shut down the same road for half a day and three weeks, respectively in October. This scenario resulted in a great threat to social security, as great multitudes of travelers from different parts of Nigeria were unexpectedly piled in one location and left stranded for days at this contemporary period of growing insecurity in the country.

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Objectives of the study

i To identify the remote and proximate causes of the annual floods at the Dura floodplain.

ii. To examine the effects of the floods on agricultural operations and food security in the locality.

iii. To examine the impact of annual floods at Dura flood plain on transportation along Gboko-Katsina-Ala road.

Hypotheses

Hypothesis 1: *There are no significant links between heavy rainfalls of prolonged duration and the annual floods at River Dura.*

Hypothesis 2: *The annual flood at River Dural has no adverse impact on agricultural activities by local residents.*

Hypothesis 3: *There is no significant relationship between the annual floods and traffic disruption on the federal highway during flooding events.*

The study area

The study area is located between Latitude 7°18'30"N to 7°19'0"N and Longitude 9°8'0"E to 9°8'30"E. Situated within the Mbaakura District of Buruku LGA, along the Gboko to Katsina-Ala road, the area is low-lying in terms of altitude and has a tropical Guinea savannah climate with a distinctive wet and dry season lasting from April to October and November to March, respectively, on a yearly basis. The rainy season is characterized by moderate rainfall and a short August break, which resumes with an unusually high rainfall amount that coincides with the apparent overhead Sun in late September and October, thereby marking its maximum peak. It is interesting to note that the main flood events occur at this time, when the River Dura experiences its peak flows of water, which results in a series of socioeconomic challenges in agricultural, transportation and commercial affiliations, which necessitate this study.

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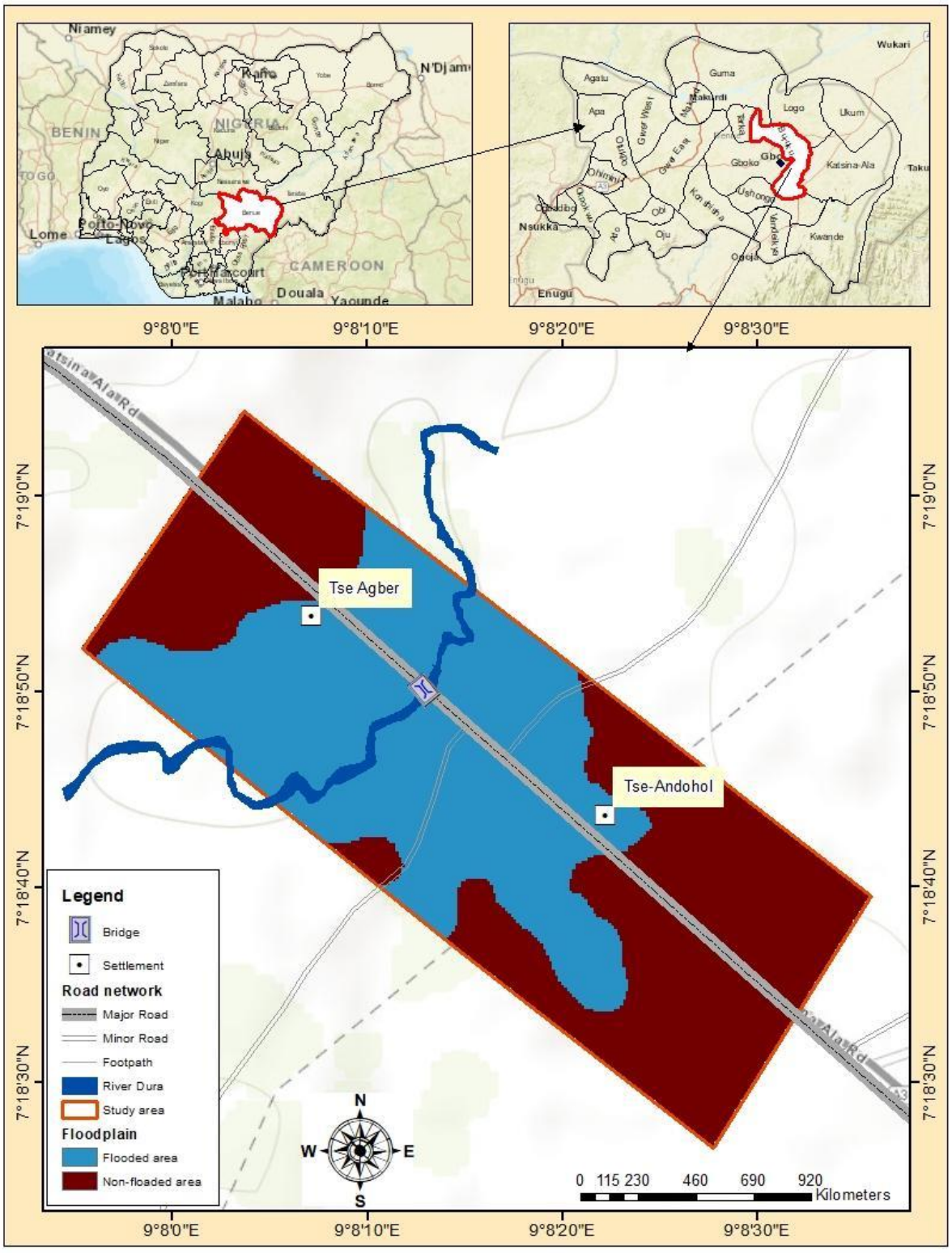

Figure 1: Dura floodplain along Gboko-Katsina-Ala road.

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LITERATURE REVIEW

Causes of flooding

There are multiple causes of flooding events in the study area, which include the following, among others.

Relief configuration

Flooding within the study locality is basically a function of relief configuration, based on which the dura flood plain, as the name implies, is a vast area of low land topography. In a study of seasonal floods in the River Benue valley, using relief records and water table as bases for chi-square analysis, Ogunwuni and Ihiengbo (2025) reported that areas of low relief along the banks of the River Benue and poor socioeconomic standing among the masses are risk locations and more susceptible to annual floods during the peak periods of the rainy season. This study explains on account of the large volumes of water spilled over to the banks during the season. It is worthy to note here that the River Dura is a tributary stream of the Benue River, all of which are located within a common vast expanse of lowland known as the River Benue trough. Thus, flooding within the trough occurs as a single phenomenon of widespread extension.

Seasonal changes of prolonged rainfall

Prolonged rainfall, especially one of high intensity, has a great tendency for the occurrence of floods. According to Shabu et al. (2021), in their study of annual floods in the Benue Trough using time series analysis, surveys and peak flow data, intense rainfall of high frequency produces more flows of water than the basin's ability for absorption. This leads to large volumes of water, which spill over to the floodplains from the river basins and banks. Earlier, Umaru and Adenyi (2020) had reported that river-related flooding along the River Benue Basin within Kogi State territory has characteristically assumed an annual pattern due to seasonal changes and the accompanying heavy rainfalls, especially during the peak periods of rainy seasons. This same position is held by Ladan and Riwanu (2024) in a study based in Nigeria’s far northern state of Katsina using field surveys and questionnaires administered within the River Tille Basin. The study reported that heavy rainfalls occurring in quick succession produce water volumes that are greater than the carrying capacity of the river, thereby resulting in the spillover of water to the riverbanks and their surroundings.

Dam construction projects

The construction of dams across rivers to generate electricity results in large volumes of water bodies called reservoirs. Originally, dam constructions were intended to generate hydroelectric power, control floods, improve crop yield through irrigation agriculture and create job opportunities. Many hydroelectric power projects have, however, been accompanied by flood devastation, especially in the event of the collapse of dams or periodic release of water when their carrying capacity is attained. Flooding along the River Katsina-Ala basin, of which the Dura floodplain is an extension, is due partially to water release, in which the Kashimbila Hydroelectric Power Dam in Takum, Taraba State, usually undergoes water release on an annual basis (Ihum & Fabian, 2018). Elsewhere in Africa, dams often collapse due to water excesses over carrying capacity. A typical example is the collapse of the Derna Dam, hence the Derna flood disaster on September 11th, 2024, which resulted in unprecedented catastrophes in the coastal region of Libya, North Africa (Imran et al., 2023).

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Melting of polar ice

Global temperature rise due to the expanding scope of industrialization and its attendant effects of increasing magnitudes of Carbon dioxide and greenhouse gas emissions into the Earth's atmosphere has triggered the melting of polar ice caps. This phenomenon adds to water volume over the oceans and seas, resulting in a corresponding rise in sea levels. This trend of global warming, ascribed to multiple factors, has caused serious flooding over the coast of Greenland and Alaska and far-reaching impacts in coastal lowlands within the tropics (Green, Haigh, Quinn, Neal & Wahl, 2025). Similarly, Hanesen, Karecha, Sato, and Kelly (2025) reported in their study on global warming that there has been a rise in global temperature with serious implications for the melting of ice, which contributes to the run-up to flooding events in the tropics.

Socioeconomic effects of flooding

Flooding within the study area has caused serious challenges in agriculture. In Africa, flooding has adversely impacted agriculture in Yemen at the horn of Africa, where agricultural communities have, over the recent years, suffered lots of crop damage and salinization of farmlands due to the surging effects of wave actions over the sea, storms and rising sea levels (Aklan, 2024). Despite the enormous economic value attached to the Nile River in North Africa, as the major source of irrigation agriculture, seasonal flooding events due to rising sea levels, water release from the Aswan Dam and climate change occur along its lower basins in Sudan and Egypt which, destroys crops and often times settlements within the flood risk areas, (Kamal Serwey & Sadek, 2022; Hekal & Fahmy, 2023). Nigeria has likewise suffered wide-spread adverse impacts of flooding. According to Menegbo and Emengini (2024), Rivers State is among the worst hit areas, where flooding exert tremendous effects on farming communities and structural facilities, which disrupts food production through inundation and drowning while transportation architectures are regularly rendered inconsequential.

On road transportation, Iherduru et al, (2024) studied the impact of flooding on roads in Port Harcourt, Nigeria, using 385 questionnaires administered in Rumuigbo, Abacha Road, GRA phase 11 and a host of others. The study reported that floods reduced traffic flow by 40-65 percent during heavy showers and a few hours after. Across borders, Borousks-Stefanska et al (2025) studied the impact of flooding on roads in Lodz, Poland using questionnaires. They reported that flooding even in the urban suburbs usually caused a 40 percent reduction in the efficiency of roads.

Theoretical framework

This study adopts the theory of Environmental Possibilism by Lucien Febvre, renowned historian of American extraction (1889-1975). He formulated the theory in 1932 as a geographical introduction to history, in which he states, "there are no necessities but possibilities everywhere and man as master of possibilities is the judge of their use." The basic tenet of this environmental doctrine holds that despite hostilities, imbalances, and inadequacies in the endowments of nature, human society commands scientific and technological ingenuity, which it employs to overcome nature. The theory is found suitable in this study because of the unfavorable physical conditions within the Dura floodplain during the rainy season. Going by the theory, the Dura floodplain is definitely to be fixed through routine advancement in science and technology over time in life.

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METHODOLOGY OF STUDY

The Dura floodplain covers three main settlement areas, Agber and Andohol, all with spatial spread on both the northern and southern sides of the Gboko to Katsina-Ala road, which punctuates the plain in a northwestern and southeastern direction, with a bridge at River Dura. A total number of 150 questionnaires were administered, with 50 in each of the settlements, via a multistage random sampling technique. To enhance visualization, the study employed remote sensing and Geographic Information System (GIS) to produce the map of the study area. Field surveys were also conducted at the peak of the rainy season in October 2024 and March 2025 to respectively ensure adequate coverage of socioeconomic challenges during peak flows and the preparatory endeavors by farmers for cultivation at the peak of the dry season. Oral interviews were also conducted on one key informant in each of the settlement areas. The study combined frequency tables and simple percentages as bases for analysis. The Pearson correlation based on the IBM Statistical Package for Social Sciences (SPSS) software was adopted in testing of the study hypotheses.

RESULTS AND ANALYSIS

Demographic and socioeconomic profile of respondents

Data on demographic and socioeconomic statuses of sampled respondents were collected and are presented in table 1.

Table 1: Demographic and socioeconomic statuses of sampled respondents

Variables		Frequency	Percentage
Gender	Male	108	72
	Female	42	28
			100
Age	20-30 years	18	12
	31-40 years	21	14
	41-50 years	48	32
	51-60 years	42	28
	61 & above	21	14
			100
Marital status	Single	43	28.66
	Married	74	49.33
	Separated	33	22
			99.99
Educational	No formal education.	78	52
	Prim sch.	38	25.33
	Sec sch.	26	17.33
	Tertiary level	8	5.33
			99.99
Farming practices		57	38
	Fadama Agric	10	6.66
	Fishing	30	20
	Tubers	21	14

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	Mixed Farming	32	21.33
	Agroforestry		**99.99**
Business			
	Retail Shop	26	17.33
	Agro-based Trade	29	19.33
	Commercial driving	27	18
	Motorcycle transport	18	12
	Ferrying	10	6.66
	Others	40	26.66
			99.98
Residential location			
	Within floodplain	39	26
	Adjacent locations	84	56
	Nearby Uplands	27	18
			100

Source: *Field Survey, October 2024 and March 2025*

Table 1.1 indicates that 72 percent of sampled respondents were male, while 28 percent were female. The table further indicates that 12 and 14 percent of them were within the age brackets of 20-30 years and 31-40 years, respectively. Similarly, the table shows that 32 percent of the respondents fall within 41-50 years whereas 28 and 14 percent fall within the age brackets of 51-60 and 61 years and above, respectively. In the same vein, the table indicates that 28.66 percent of the sampled respondents were yet to marry, while 49.33 percent were married and 22 percent of them were separated for various reasons. Moreover, the table indicates that 52 percent of the sampled respondents have no formal education, while 25.33 and 17.33 respectively had attained primary and secondary levels of education. Again, the table indicates that only 5 percent of the sampled population has acquired tertiary education.

On the other hand, Table 1.1 shows the occupational statuses of the sampled population, which indicates that 38 percent of them were engaged in fadama agriculture, whereas 6.66 percent were into fishing. Again, the table indicates that 20 and 14 percent of the sampled population were respectively engaged in the production of tubers and mixed farming, while 21.33 percent practiced agroforestry farming. On residential status, the table indicates that 26 percent of the sampled population lived within the vicinity of the floodplain, while 56 and 18 percent, respectively, lived in locations adjacent to the floodplain and in upland locations near the floodplain.

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Socioeconomic challenges of floods

Table 2.1: Structural and agricultural disruptions caused by annual floods at Dura floodplains from 2011 to 2023.

Variables	Abakwa	Agber	Andohol	Monetary Value
Farmlands	-	14 plots	8 plots	8 million
Grains	Rice	Rice	Rice	5 million
	Millet	Millet	Millet	
	Soybeans	G.nut	G.Nut	8 million
	Groundnut	Beans		
Tubers	Yams	Yams	Cassava	
	Cassava	Cassava	Potato	15 million
	Sweet Potato	Potato		
Agroforestry	Mango Stands	Orange stand	Orange	
	Orange stands	Oil Palm	Tomatoes	
	Cashew	Tomatoes	Vegetable	6 million
	Tomatoes	Vegetable		
Total				42 million

Source: Field Survey, October 2024

Table 2.1 Indicates that structural disruptions by annual floods involved 5 buildings in Agber village and 6 residential buildings in Andohol village, while there was no structural disruption in Abakwa over the period from 2011 to 2023. The table also indicates that agricultural lands involving 14 and 8 plots of farmlands respectively in Abakwa, Agber and Andohol settlement areas were disrupted over the study period by annual floods. In the same vein, assorted grains, tubers and tree crops were damaged over the same period, with a total estimated monetary value of 43 million naira only.

Table 2.2 Obstruction of traffic flow by floodwaters on the federal highway during peak periods of the rainy season.

Year	Duration	Estimated Cost in Monetary terms
2011	3 days	
2012	5 days	Not determined
2013	2 days	
2014	1 day	
2015	4 hours	
2016	-	
2017	-	
2018	-	
2019	4 hours	
2020	3 hours	
2021	1 day	
2022	2 days	
2023	1 day	

Source: *Field Survey, October, 2024*

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Table 1.2 indicates that floodwaters caused serious obstruction to traffic flow on the federal highway that passes through the Dura floodplain, with higher magnitudes in 2011, 2012 and 2013, when floodwaters covered the road trapping some lorries and a luxurious bus, all fully loaded with assorted items, for 3, 5, and 2 days, respectively. From 2014 to 2020, the trend diminished from 1 day to a few hours, which again increased to 1 and 2 days in 2021, 2022 and 2023, respectively. The estimated cost of damages in monetary value could not be determined due to inadequate logistics. Both the lorry and the luxurious bus were on a return journey from Onitsha, one of the leading commercial cities in Nigeria. They were fully loaded with assorted trade items.

Apart from the highway, bush paths were also adversely affected by flooding, as shown in Table 2.3 on the next page. The table indicates that virtually all the bush paths within the study locality are affected adversely through being cut off from traffic flow. The table indicates more serious effects during the 2011, 2012 and 2013 annual floods, which for months disrupted free movement in the locality. The table further indicates that between 2014 and 2019, the effect was minimized to weeks, which again intensified during the 2020, 2021, 2022 and 2024 flooding events, with effects ranging respectively from 1, 2, 3 and 1 month. This implies that for most parts of the rainy footpaths within the locality are usually out of use.

Testing of Hypotheses

Hypothesis 1 *There is no significant relationship between heavy rainfalls of prolonged duration and the annual flood events at the Dura floodplain.*

Table 3: Test of link between heavy rainfall and annual floods.

Variables	N.	Pearson Correlation	Sig. (Two Tailed Test)
Annual floods Heavy and prolonged rainfalls	150	0.843	0.000

The correlation is significant at 0.01 level, (2 tailed).

Source: *Extracts from IBM SPSS output. October, 2024*

Table 3.1 indicates a positive correlation coefficient of 0.843, which implies a strong and significant link between prolonged heavy rainfalls and annual flood events. This means that the two natural phenomena move in the same direction at all times. Thus, increasing magnitudes of frequent, heavy and prolonged rainfall lead to corresponding intensities in flooding events in the Dura flood plains. Therefore, the null hypothesis, which states that there is no significant relationship between rainfall intensity and flooding events at Dura, is hereby rejected. An alternative hypothesis, that there is a significant relationship between the two is upheld and put in place accordingly.

Hypothesis 2: *Annual floods at the Dura floodplain have no diverse impacts on agricultural activities in the locality of the plain.*

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Table 3: Test of relationship between flooding events and agricultural challenges in the flood plain.

Variables	N.	Pearson Correlation	Sig. (Two Tailed Test)
Flooding events Agricultural impacts	150	0.333	0.000

Correlation is significant at 0.01 level, 2 tailed.

Source: *IBM SPSS Extracts. October, 2024*

Table 3.2 represents extracts from IBM SPSS output. The table indicates a positive correlation coefficient of 0.333, which shows a significant impact of flooding events on the agricultural operations at the Dura flood plains. It is imperative to note that the test does not indicate a very strong relationship, even though it is positive and therefore significant. This state of affairs is due mainly to the homogeneity of other possible variables within the locality that also affect agricultural productivity. These could be poverty, low level of technological applications and other issues, all of which are subject to another study. Based on the test instrument and analysis, the hypothesis, which denies the existence of adverse impact of flooding on agricultural operations in the study area, is therefore rejected in favor of the alternative hypothesis, which goes that "Annual floods at River Dura have multiple impacts on agricultural activities in the floodplain.

Hypothesis 3: *There is no significant relationship between the annual floods and vehicular traffic disruption at the federal highway passing through the Dura floodplain.*

Table 4: Test of links between annual floods at peak periods of rainy season and vehicular traffic at federal highway passing through Dura floodplain

Variables	N.	Pearson Correlation	Sig. (2 Tailed Test)
Flooding during the peak period of the rainy season. Vehicular traffic	150	0.655	0.000

The correlation is significant at 0.01 level, (2 tailed).

Source: *IBM SPSS Output.October, 2024*

Table 3.3 indicates a strong positive correlation coefficient of 0.655, which implies a significant relationship between the two variables, indicating that annual floods and vehicular traffic disruption move together in the same direction at all times. Thus, increasing flooding activities lead to increasing magnitudes of disruptions in vehicular traffic at the Dura floodplain. Therefore the hypothesis, which denies the existence of a significant relationship between the annual flood and vehicular traffic disruption, is hereby rejected in favour of an alternative hypothesis, that there is a significant relationship between the two variables

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Figure 1: A 12-tyre lorry fully loaded with floor and wall tiles en-route to Zaki-Biam from Onitcha falls at Tse-Agber within the floodplain. In the far background, a long line of desperate Lories waiting hopelessly.

Source: *field survey, October, 2024*

Figure 2: A Benue Links Transport company bus and other vehicles crossing over the flooded road.

Source: *field survey, October, 2024*

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Figure 3: The same point in the flood plain at the peak of dry season, February, 2025

Figure 4: A Benue Links Transport company bus and other vehicles crossing over the flooded road.

Source: *field survey, October, 2024*

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Figure 5: Small vehicles maneuver through a swampy diversion to a nearby compound while long vehicles park for days, which turn to weeks depending on rainfall.

Source: *field survey, October, 2024*

Figure 5: Container truck, two lorries and trailers trapped in swamps arising from the floods. Local youths use tree logs to minimize sinking and improve traffic.

Source: *field survey, October, 2024*

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DISCUSSION OF RESULTS

This study examined the annual floods at Dura flood plain covering a time from 2011-2023. The following are major issues raised in the study. That the annual floods here are basically a function of seasonal changes. Through which the high intensity of peak rainfalls during the rainy season leads to excessive volumes of water beyond the carrying capacity of River Dura leading to the flow of water into the plain. This finding aligns with earlier findings by Shabu et al. (2021), and Wijaya et al. (2024), in their respective studies on peak rainfalls in the river Benue Trough and the Bakassi River Watershed in Indonesia, South East Asia, in which they reported that frequent and heavy rainfalls significantly boost volumes of water, which cause extensive flooding events. The finding again aligns with that of Amariena et al. (2023), who studied the preponderance of extensive lowlands over highlands, to which excess water from flooding events flows during heavy rainfalls into the river basins. It is worthy to note here that the study locality is completely located within an extensive lowland.

The study also revealed that annual floods have adversely affected agricultural activities within the study area. This finding is harmonious with earlier findings by other studies. For instance, Asaasuen, Ukange and Adamgbe (2024), in their study of seasonal changes and their effects on agrarian activities in Benue North Central Geographical District reported that frequent flash floods have devastating effects on crops, as the former results in excessive accumulation of water in lowlands and hence an adverse effect of inundating crops. Earlier, Tertese, Adnan, Aondosoo and Mala (2022) had studied the socioeconomic and environmental effects of flooding activities in Makurdi LGA and reported that flooding caused a series of destruction to crops cultivated along the River Benue Basin. In northern Africa, despite the great importance attached to annual floodwaters of the River Nile in Egypt, Sudan and other neighboring countries as a major source of irrigation in the desert region, floodwaters have produced devastating effects on farming operations, leading to great losses with huge financial implications (Kamal et al., 2022; Hekal & Fahmy, 2023).

This study furthermore found that flooding has caused lots of hardship in the area of transportation through phenomenal shot down of traffic flows on the highway and foot paths during annual floods. This study harmonizes with earlier studies such as those by Imran et al. (2023), and Arrighi et al. (2024), in their respective studies on rising sea levels in Italy which lead to the submergence of transportation architectures like roads runways as well as collapse of dams in the Libyan coastal city of Derna which produced the most devastating effects of flood waters ever in the history of the country on September 2023 involving the shutdown of more than half of the roads in Derna through rainstorms and rising sea levels.

CONCLUSION

This study x-rayed annual flooding in all its ramifications from causes to socioeconomic impacts on the local inhabitants of Dura flood plains along Gboko to Katsina-Ala road in Buruku LGA of Benue State, Nigeria. The study found that annual floods in the locality are caused mainly by high frequencies of extreme rainfalls, especially during the peak periods of the rainy season in September and October on a yearly basis. Similarly, this study found a series of socioeconomic challenges such as disruption of agricultural operations, and great damages to crops. Furthermore, the floods have made an adverse impact on traffic flows on the federal highway passing through it, as vehicular traffic usually halt at the peak of the flood as

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captured in photo elicitation during field survey. It is necessary to add here that disruptions in traffic flows on the highway constitutes a great threat to social security, as hundreds of travellers drawn from different parts of Nigeria, unexpectedly get trapped within a common front for days. This scenario does not paint a good picture of safety for the travellers given the current tumbling security atmosphere in the country.

RECOMMENDATIONS

- Dredging of River Dura to boost its water carrying capacity during rainy seasons and minimize flooding events.
- The government and local inhabitants should collaborate and expand the scope of agricultural practices to involve mechanized agriculture.
- Immediate adoption of irrigation agriculture to enhance dry season cultivation as a response strategy to balance up the shortcomings of rainy season damages by flood waters.
- Introduction of bio-techniques to boost crops' level of resistance to inundation and also the pace of growth and maturity.
- The immediate extension of the bridge across River Dura along its eastern terminal to cover the area where the federal highway is usually submerged by annual floods. The bridge is not long enough.

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