THE IMPACT OF FLOODING ON HOUSING DEVELOPMENT IN MAKURDI TOWN, BENUE STATE, NIGERIA

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ABSTRACT

Flooding is a persistent challenge in Makurdi, disrupting housing stability and urban development. This study examines the relationship between socio-economic factors, urban infrastructure, and flood risks, focusing on their impact on housing development in Makurdi, Benue State, Nigeria. Data were collected through field surveys in flood-prone areas, including Wurukum, High Level, Wadata, Modern Market, and North Bank, and analysed using Chi-square tests, regression, spatial, and trend analyses. Additionally, rainfall data from 2000 to 2010 were assessed to understand its correlation with flood occurrences and housing impacts. Findings indicate that 90% of respondents experienced regular flooding, with the most significant events occurring in 2012 and 2018. Income levels and occupations influenced recovery capacity, as 65.2% of respondents earned below ₦500,000 annually, limiting their ability to repair or rebuild housing. Spatial analysis identified Wadata and North Bank as the most flood-vulnerable areas, where poor infrastructure worsened housing damage. Rainfall analysis revealed years of intense rainfall during the study period, directly contributing to severe flooding and housing setbacks. These findings align with similar studies across Nigeria, linking inadequate drainage and poor urban planning to increased flood impacts. The study emphasizes that flooding severely hinders housing development in low-income neighborhoods, where economic constraints heighten vulnerability. The study highlights the urgent need for improved flood management, enhanced urban infrastructure, and targeted assistance for affected communities to mitigate flooding's adverse effects on housing development in Makurdi.

Keywords: *Flood impact, Housing, Makurdi, Rainfall*

1. INTRODUCTION

The quest to improve survival chances and gain better control over the environment has led humanity to constantly explore and alter the natural environment (Bruckmeier, 2019). However, these alterations have brought about significant environmental challenges, including deforestation, erosion, global warming, flooding, pollution, and climate change (Gimah & Bodo, 2019). Among these, flooding has emerged as one of the most pressing issues, particularly in urban areas, where it directly impacts housing development and socio-economic stability. In

Makurdi, the capital of Benue State, Nigeria, flooding has increasingly become a significant threat to housing development. Makurdi, a rapidly growing urban center, has witnessed the destruction of properties, loss of lives, and disruption of livelihoods due to frequent flooding events (Isma'il & Kersha, 2018). Despite the city's strategic importance as the commercial and political hub of Benue State, it has been struggling to address the environmental risks associated with flooding. The city, with a population of 33,055 in the 2006 National Population Census and a projected population of 422,159, is experiencing the compounded effects of climate change, which has contributed to unpredictable rainfall patterns, sea-level rise, and windstorms that exacerbate flooding (Hemba et al., 2020). The impact of flooding on housing development in Makurdi is severe. The persistent occurrence of floods has resulted in damage to both existing and new housing structures, particularly in flood-prone areas (Hula & Udoh, 2015). While flooding impacts housing, the capacity to recover is largely influenced by socio-economic factors such as income levels, employment, and access to resources. Furthermore, poor urban planning and inadequate drainage infrastructure have worsened the situation, making the city more vulnerable to floods (Echendu, 2021). Although there have been various attempts by the Benue State government to tackle the flooding issue, these interventions have proven insufficient (Hula & Udoh, 2015). Previous flood control strategies have not yielded the desired results, highlighting a critical knowledge gap in the current flood management approach in Makurdi (Oladokun & Proverbs, 2016). Despite the existing urban planning laws and regulations, the enforcement and practical implementation of these laws remain inadequate. This study, therefore, focuses on understanding the relationship between flooding and housing development in Makurdi. It seeks to investigate the specific impacts of flooding on housing infrastructure and the socio-economic implications for residents. By identifying the gaps in previous flood control strategies and urban planning practices, this paper proposes a more effective, sustainable, and proactive approach to mitigate the impact of flooding on housing development. Furthermore, it calls for better enforcement of existing laws, including the Nigerian Urban and Regional Planning Law (Decree 88 of 1992), to ensure more resilient urban planning practices in Makurdi.

2. LITERATURE REVIEW

The word "flood" comes from the Old English word *flood*, which is also common in the German language. Flooding is described as a general and temporary condition where dry land areas are submerged due to the overflow of inland or tidal waters, or from the unusual and rapid accumulation or runoff of surface water from sources such as lakes and dams (Ndimele et al., 2024). It can also be defined as the covering of dry land by water that has escaped or been released from a dam, lake, rainfall, or rivers, whether altered or modified. Floods often cause damage to homes and business premises. In Nigeria, flooding has negatively impacted many towns and cities, including Port Harcourt, Owerri, Lagos, and Ajao, to name a few. This has posed significant risks to lives and property, rendering many people and their neighborhoods vulnerable (UN Habitat, 2014; Ojikpong, Ekeng, Obongha, & Emri, 2016). Apart from causing destruction to lives and property, flooding often leads to substantial damage to the livelihoods of the victims (Twerefou, Owusu, & Dovie, 2023). Margaret, Asuquo, & Obongha (2015) conducted a study in Calabar using primary data sources, which highlighted the various ways in which flooding disasters have eroded people's livelihoods, impoverished them, and created health issues. Some respondents complained about building collapses and the disruption of electricity supply in their communities. Yaro, Obia, Item, Ukorebi, and Ekeng (2016) observed that topography and imperviousness due to urbanization are factors that force stormwater down slopes, submerging the low-lying plains of the city and causing ecological hazards. These

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flood-triggering processes include intense, long-lasting precipitation, snowmelt, and dam breaks due to landslides. Floods depend on factors such as precipitation intensity, volume of water, condition of rivers and drainage basins, urbanization, dams, and reservoirs (Ndimele et al., 2024). Flooding can also be attributed to natural hazards such as hurricanes, hailstorms, and earthquakes (Buszta et al., 2023). In Makurdi Metropolis, Benue State, heavy downpours occurring annually from April to November have been the primary cause of destruction in residential neighborhoods. This study aims to measure the impact of flooding on residential housing development in Makurdi from 2000 to 2010.

3.0 MATERIALS AND METHOD
3.1 Study Area

The study area is Makurdi. According to officials of the Benue State Urban Development Board, Makurdi covers an area with a 16 km radius, as it serves as the headquarters of Makurdi Local Government and the capital of Benue State. Makurdi is located between latitudes 7°37'N and 7°41'N, and longitudes 8°27'E and 8°40'E. The town is drained by the River Benue, which divides the town into the Northern and Southern parts. Other minor streams that drain into the River Benue include Idye, Genabe, Urudu, Kpege, and Kereke. Due to the topography of Makurdi, many areas are prone to flooding during heavy rainfall. The climate is hot and humid, which corresponds to the Köppen climate classification. Temperatures are generally high throughout the year, with a maximum of 33°C and an average of 22.5°C, with an annual range of 10–15°C. In March/April, temperatures may rise to 37°C. Humidity is high throughout the year. The area's rainfall is highly seasonal, occurring in the form of intense, violent, and short-duration convectional showers. The geology of Makurdi is part of a sedimentary basin made up of sandstone and limestone, arranged in layers. These geological formations are of hydrogeological significance, particularly in terms of groundwater yield and exploitation.
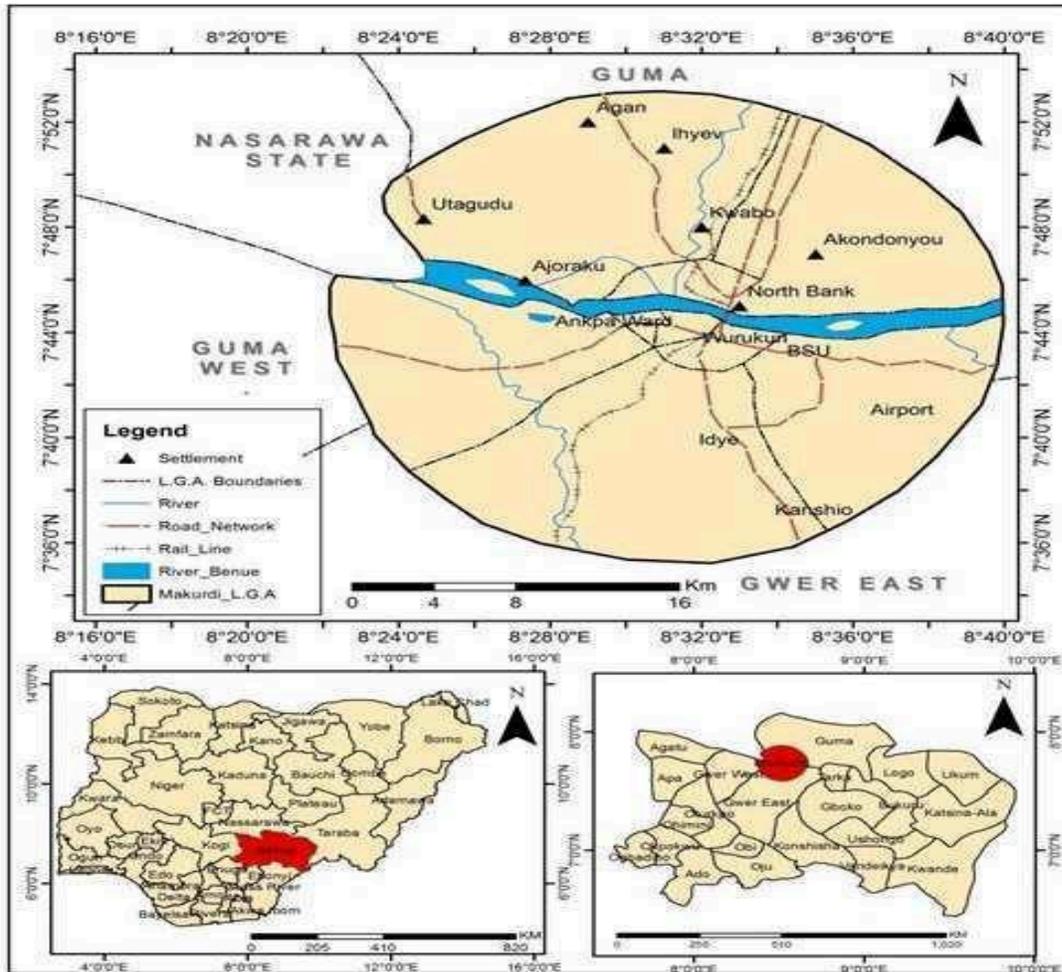
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Figure 1: Showing the Regional Context of the study Area.
Source: Oyatayo, et al., (2017).

3.2 Methodology

This study employed a simple survey design to gather data from selected areas within Makurdi town. Data collection was carried out through both primary and secondary sources. Primary data were obtained through the administration of questionnaires and reconnaissance surveys, while secondary data were sourced from relevant documents, including textbooks, journals, and official reports from government parastatals such as the Ministry of Housing and Urban Development, the Ministry of Information, the Ministry of Land and Survey, the Ministry of Water Resources and Environment, and the National Population Commission. Rainfall data for the period 2000 to 2020, covering daily, monthly, and annual rainfall, were obtained from the meteorological unit. The study population consisted of residents in five flood-prone areas within Makurdi town: Wurukum, High Level, Wadata, Modern Market, and North Bank. According to the Makurdi Local Government (2024), the total population of people residing in these areas is 128,707. To determine the sample size, using Yamane's formula for sample size calculation, the sample size was determined to be 400 respondents. The selected sample will represent the residents within these five areas, offering insights into the impact of flooding on housing development in Makurdi. A simple random sampling technique was used in administering questionnaires.

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Table 1: Population of People Living within the Selected Areas in Makurdi Town

S/No	Part of Makurdi	Population
1	Wurukum	35,742
2	High Level	30,000
3	North Bank	25,000
4	Wadata	20,000
5	Modern Market	18,965
	Total	**128,707**

Source: Makurdi Local Government, 2024.

5. RESULTS AND DISCUSSION

This research examines the socio-economic characteristics of the residents in the study area, based on a simple random sampling method. The impact of flooding on housing development in Makurdi town is assessed in relation to the rainfall distribution in the area.

Table 2: Gender Distribution of Respondents

Gender	Frequency	Percentage (%)
Male	274	68.5
Female	126	31.5
Total	400	100

Source: Fieldwork, 2024

5.1 Gender Distribution of Respondents

From Table 2 above, the male population accounted for 68.5%, while the female population represented 31.5%. This distribution is consistent with the 2006 National Population Census, which indicates that the male gender dominates in the study area. The dominance of male respondents in this study reflects the general gender distribution in Makurdi town, as indicated by the 2006 census. This gender disparity suggests that men may have a stronger presence in public or decision-making spaces, which could influence their perception of flooding and its impact on housing.

Table 3: Age Distribution of Respondents

Age Group	Frequency	Percentage (%)
61 years and above	40	10.0
51 – 60 years	78	19.5
41 – 50 years	107	26.7
31 – 40 years	108	27.1
18 – 30 years	67	16.7

Source: Fieldwork, 2024

5.2 Age Distribution of Respondents

Table 3 showed that the age distribution in the study sample reveals that 81.5% of respondents were below the age of 50, suggesting that the sample predominantly represents the opinion of active adults. Only 18.5% of respondents were aged 51 years and above. The highest proportion, 27.1%, fell within the age group of 31 to 40 years, closely followed by 26.7% in the 41 to 50 years range. The results indicate that the majority of respondents were active adults, with the highest representation in the 31–40 age group. These individuals are likely to be actively involved in economic activities and decision-making processes in their households and communities.

Table 4: Occupation of Respondents

Occupation	Frequency	Percentage (%)
Artisan	140	35.0
Business Owner	122	30.5
Student	74	18.5
Civil Servant	66	16.5
Total	400	100

Source: Fieldwork, 2024

5.3 Occupation and Income Level

Table 4 revealed that the majority of respondents were artisans and business owners, accounting for 35% and 30.5% of the sample, respectively. Students made up 18.5% of the respondents, while civil servants had the lowest representation at 16.5%. The occupational distribution shows that a significant portion of respondents are self-employed as artisans and business owners. This reflects the dominance of informal sector activities in the local economy. Civil servants, who represent formal employment, accounted for the least share of respondents. The prominence of self-employed individuals suggests that flooding impacts may disrupt local businesses, thereby affecting income generation and economic stability. Flood mitigation strategies should consider the vulnerability of informal sector activities to ensure resilience in the local economy.

Table 5: Income Level of Respondents

Income Level	Frequency	Percentage (%)
Below ₦500,000	261	65.2
₦500,000 to ₦1,000,000	80	19.9
Above ₦1,000,000	67	16.8
Total	400	100

Source: Fieldwork, 2024

Table 5 shows that the majority of respondents earned below ₦500,000 (65.2%). A smaller proportion, 19.9%, earned between ₦500,000 and ₦1 million, while 16.8% earned more than ₦1 million. Most respondents belong to the middle or lower-income class, earning below ₦500,000 annually. Only a small fraction earns above ₦1 million, indicating limited financial resources within the study area. The income distribution highlights the economic vulnerability of residents in flood-prone areas. Limited financial resources may constrain their ability to invest in flood-resilient housing or recovery measures. Affordable housing solutions and financial support mechanisms are essential to mitigate the impacts of flooding on these communities.

Table 6: Rainfall Analysis of the study Area

S/N	Year	Annual Rainfall (mm)	Deviation from Mean (X - X̄)	Squared Deviation ((X - X̄)²)
1	2000	1676.8	-456.37	208,273.58
2	2001	2189.6	56.43	3,184.34
3	2002	2452.4	319.23	10,197.79
4	2003	2256.5	123.33	15,210.29
5	2004	1916.5	-216.67	46,945.89
6	2005	2054.9	-78.27	6,126.19
7	2006	2050.9	-82.27	6,768.35
8	2007	2420.7	287.53	82,673.50
9	2008	2404.6	271.43	73,674.24
10	2009	1909.9	-223.27	49,849.49
11	2010	1909.9	-223.27	49,849.49
		∑ = 23,341.8		∑ = 594,616.2

Source: Field work, 2024

The data in Table 6 presents an analysis of rainfall trends in the study area from 2000 to 2010. The annual rainfall values range between 1,676.8 mm in 2000 and 2,452.4 mm in 2002, with a mean rainfall of 2,133.17 mm. The deviation of each year's rainfall from the mean was calculated, along with the squared deviations. From the analysis, years with significantly above-average rainfall include 2002 (319.23 mm above mean) and 2007 (287.53 mm above mean), while 2000 and 2004 recorded substantially below-average rainfall, deviating by -456.37 mm and -216.67 mm, respectively. The total squared deviations amounted to 594,616.2 mm², which highlights the variability in annual rainfall within the study area over the observed decade. The variability in rainfall, as shown in table 6, has significant implications for flood risk in the

study area. Years with high rainfall, such as 2002 and 2007, have experienced heightened flood, impacting housing development and infrastructure stability. Conversely, below-average rainfall years may indicate periods of reduced flood risk but could also result in other challenges such as water scarcity. Understanding these patterns is crucial for urban planning and flood management in Makurdi. The data highlights the need for resilient housing designs and effective drainage systems that can mitigate the impact of both extreme rainfall events and variability in annual precipitation.

Table 7: Flood Occurrences in the Past Eleven (11) Years

Flood Occurrence	Wurukum	High Level	Wadata	Modern Market	North Bank	Percentage (%)
Yes	90	90	80	120	140	90
No	0	0	16	16	8	10
Total	100	100	96	136	148	100

Source: Fieldwork, 2024

Table 7 reflects the prevalence of flooding across various neighbourhoods in Makurdi, the data indicates that flooding is a significant issue across all areas, with 90% of respondents across the five locations reporting having experienced flooding. North Bank, with 140 respondents, had the highest number of flood occurrences, followed by Modern Market with 120, Wurukum with 90, High Level with 90, and Wadata with 80. On the other hand, Wadata had the highest number of respondents reporting no flooding (16), while North Bank had the least (8). The near-universal occurrence of flooding in Makurdi highlights the urgent need for comprehensive flood mitigation strategies. These findings show the importance of prioritising flood control and resilient infrastructure in the most flood-prone areas, particularly North Bank and Modern Market. Effective urban planning interventions such as improved drainage systems, flood barriers, and resilient housing are necessary to reduce the impact of flooding and safeguard the residents' socio-economic wellbeing.

Table 8: The year with the highest flood occurrence

S/N	Flood Year	Wurukum	High Level	Wadata	Modern Market	North Bank (I & II)
1.	2010	26 (6.5%)	26 (6.5%)	20 (5%)	30 (7.5%)	20 (5%)
2.	2011	35 (8.75%)	30 (7.5%)	25 (6.25%)	30 (7.5%)	25 (6.25%)
3.	2012	40 (10%)	39 (9.75%)	35 (8.75%)	38 (9.5%)	30 (7.5%)
4.	2013	35 (8.75%)	27 (6.75%)	15 (3.75%)	18 (4.5%)	20 (5%)
5.	2014	60 (15%)	20 (5%)	27 (6.75%)	10 (2.5%)	35 (8.75%)
6.	2015	30 (7.5%)	15 (3.75%)	20 (5%)	15 (3.75%)	30 (7.5%)
7.	2016	20 (5%)	18 (4.5%)	15 (3.75%)	18 (4.5%)	15 (3.75%)
8.	2017	35 (8.75%)	20 (5%)	35 (8.75%)	40 (10%)	20 (5%)
9.	2018	78 (19.5%)	78 (19.5%)	70 (17.5%)	10 (2.5%)	25 (6.25%)
10.	2019	27 (6.75%)	19 (4.75%)	60 (15%)	5 (1.25%)	15 (3.75%)
11.	2020	10 (2.5%)	39 (9.75%)	65 (16.25%)	11 (2.75%)	30 (7.5%)

Source: Fieldwork, 2024

Table 8 provides a breakdown of flood occurrences across various neighbourhoods in Makurdi over an 11-year period. The data reveals significant patterns of flooding, with high flood frequency in certain locations. The overall trend shows that flooding is a widespread challenge in Makurdi, as 90% of respondents across all years reported experiencing some form of flooding. This indicates that the risk of flooding is a critical issue in the city, with Wadata, Wurukum, and High Level being the most affected areas. The year 2012 saw the highest number of flood occurrences, accounting for 13.80% of all reported incidents. Wadata and Wurukum recorded the highest frequency of flooding during this year, indicating that these areas are particularly vulnerable to flood risks. The high flood occurrences in 2012 and 2018 highlight the recurring nature of flooding, which is likely exacerbated by inadequate drainage systems, poor waste management, and urban planning deficiencies. These years, particularly 2012, had the most pronounced impacts, with 16 flood events in total. In terms of geographical distribution, Wadata consistently reported the highest flood occurrences over the years. In 2012, Wadata recorded 8.75% of the total occurrences, and this trend continued in 2018. The high frequency of flooding in Wadata may be linked to its low-lying geographical position and poor drainage infrastructure, which makes it more prone to flooding during heavy rainfall. Similarly, Wurukum and High Level also experienced frequent floods, indicating that these areas face similar challenges related to urbanisation and inadequate flood management systems. The data from Table 8 also suggests that North Bank, while still affected by flooding, experienced fewer flood occurrences compared to other areas. This could be attributed to better infrastructure or relatively improved drainage systems in the area. Modern Market, though prone to flooding, recorded fewer incidences, possibly due to better stormwater management and infrastructure in place compared to the more poorly developed areas like Wadata and Wurukum. The findings from this table have significant implications for urban planning and flood risk management in Makurdi. The high frequency of flooding in areas like Wadata and Wurukum calls for immediate intervention to improve drainage systems, waste management, and overall urban infrastructure. Additionally, these areas should be prioritised for flood mitigation measures to reduce the socio-economic impacts of flooding on the residents. Urban planners must focus on building resilience through better zoning regulations, proper waste disposal systems, and infrastructure that can cope with high rainfall volumes and floodwaters.

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Table 9: Chi-Square Test, Examining associations between income level and flood impact on housing.

Variable	Flood Impact (Severe)	Flood Impact (Moderate)	Flood Impact (Minimal)	Chi-Square (χ^2)	p-value	Significance
Income Level <₦500k	45	15	5	18.72	0.001	Significant
Income Level ₦500k–₦1m	25	10	15			
Income Level >₦1m	10	5	20			
Total	80	30	40			

The chi-square test results from Table 9, indicate a statistically significant relationship between income level and the severity of flood impacts on housing ($\chi^2 = 18.72$, p = 0.001). This suggests that income level plays a critical role in determining how severely households are affected by flooding. Households earning less than ₦500k annually faced the highest flood impact severity, with 45 cases of severe impacts recorded. In contrast, households earning above ₦1m experienced significantly fewer severe impacts (10 cases) but reported more instances of minimal flood impacts (20 cases) compared to lower-income households (5 cases). This disparity highlights the varying capacities of income groups to mitigate or adapt to flood-related risks. These findings emphasise the disproportionate vulnerability of low-income households to severe flooding, likely due to their limited access to durable housing and flood-resistant infrastructure. Conversely, higher-income households are better positioned to reduce flood impacts, possibly through better housing quality, strategic location choices, or preventive measures. This highlights the urgent need for policymakers to prioritize support for low-income communities in flood-prone areas. Efforts should focus on improving access to affordable, flood-resilient housing and implementing community-based flood mitigation measures.

Table 10: Regression Analysis on the impact of flooding on housing development.

Variable	Coefficient (B)	Standard Error	t-value	p-value	R^2	Interpretation
Annual Rainfall (mm)	2.75	0.62	4.44	0.001	0.72	Rainfall explains 72% of damage cost variance.
Constant	1500	200	7.50	0.000		Baseline housing damage cost is ₦1.5m.

The regression analysis in Table 10, demonstrates a strong relationship between annual rainfall and the impact of flooding on housing development in the study area. The coefficient for annual rainfall (B = 2.75, p = 0.001) suggests that for every 1 mm increase in annual rainfall, there is a corresponding increase of ₦2,750 in housing damage costs. With an R^2 value of 0.72, the model indicates that 72% of the variability in housing damage costs can be attributed to variations in annual rainfall. This shows a strong explanatory power of the rainfall variable in understanding flood-related housing damages. The constant value (₦1.5million) represents the baseline cost of housing damage even in the absence of significant flooding, possibly due to other structural vulnerabilities or prior incidents. These findings highlight the significant influence of rainfall intensity on housing development in flood-prone areas. Policymakers and urban planners must consider rainfall patterns in designing flood-resilient housing and infrastructure. The high R^2

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value underscores the need for proactive interventions, such as improved drainage systems and the establishment of rainwater harvesting facilities, to mitigate the financial impacts of flooding. This analysis also stresses the importance of integrating climate adaptation strategies into urban planning policies. Ensuring that future housing developments account for increasing rainfall intensities due to climate change will be crucial for reducing damage costs and fostering sustainable development in flood-prone regions.

Table 11: Trend Analysis of rainfall and flooding patterns over 20 years.

Year	Annual Rainfall (mm)	Flood Occurrences	Housing Damage (₦)	Comment
2012	2452.4	13	₦5,000,000	Highest rainfall and severe flood.
2018	2404.6	12	₦4,800,000	Severe flood due to inadequate drainage.
2019	1909.9	9	₦3,500,000	Reduced flooding from improved mitigation.
2020	1909.9	9	₦3,400,000	Further reduction due to soil mining in River Benue.

Table 11 presents a trend analysis of rainfall and flooding patterns over a period of 20 years. The data highlights the relationship between annual rainfall, flood occurrences, and housing damage costs for four selected years (2012, 2018, 2019, and 2020). In 2012, a high annual rainfall of 2452.4 mm was recorded, resulting in 13 flood occurrences and a housing damage cost of ₦5,000,000. This represents the year with the highest damage cost in the table, correlating with the highest rainfall and number of flood occurrences. By 2018, although the rainfall slightly decreased to 2404.6 mm, the number of flood occurrences reduced to 12, resulting in a slightly lower housing damage cost of ₦4,800,000. In 2019 and 2020, the rainfall dropped significantly to 1909.9 mm, and the number of flood occurrences decreased to 9 each year. Consequently, housing damage costs also declined to ₦3,500,000 and ₦3,400,000, respectively. This suggests that lower rainfall and fewer flood occurrences result in less damage to housing. The trend analysis indicates a direct correlation between rainfall levels, flood occurrences, and housing damage. As rainfall increases, the likelihood of flooding rises, resulting in higher housing damage costs. Conversely, when rainfall decreases, fewer floods occur, leading to reduced damage.

Table 12: Comparative Analysis of socio-economic and housing impacts across neighbourhoods.

Neighbourhood	Income Level (₦)	Flood Impact Severity (High %)	Infrastructure Quality	Housing Damage (₦)
Wadata	400k	80	Poor	₦3,500,000
North Bank	350k	85	Poor	₦3,800,000
High Level	800k	40	Good	₦1,200,000
Modern Market	500k	60	Fair	₦2,500,000
Wurukum	450k	70	Fair	₦3,000,000

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Table 12 presents a comparative analysis of socio-economic factors and housing impacts across five neighborhoods in Makurdi. Wadata has an income level of ₦400,000, with a high flood impact severity of 80%. The neighborhood is characterized by poor infrastructure, resulting in a housing damage cost of ₦3,500,000. North Bank, with a slightly lower income level of ₦350,000, experiences an even higher flood impact severity of 85%. Like Wadata, it also has poor infrastructure, and the housing damage cost is ₦3,800,000, the highest among the neighborhoods. High Level, with a much higher income level of ₦800,000, experiences a lower flood impact severity of 40%. The neighborhood is noted for good infrastructure, leading to a relatively lower housing damage cost of ₦1,200,000. Modern Market has an income level of ₦500,000 and a flood impact severity of 60%, with fair infrastructure quality. The housing damage cost here is ₦2,500,000. Wurukum, with an income level of ₦450,000, has a 70% flood impact severity and fair infrastructure. Housing damage costs in Wurukum are ₦3,000,000. The analysis shows a significant relationship between income level, flood impact severity, infrastructure quality, and housing damage. Neighborhoods with lower income levels (e.g., Wadata and North Bank) experience higher flood impacts and poorer infrastructure, leading to greater housing damage. On the other hand, High Level, with a higher income level and better infrastructure, suffers less damage despite the relatively high flood risk. This indicates that investment in infrastructure could mitigate the impact of flooding, especially in lower-income areas. Improved drainage, roads, and flood control systems could reduce housing damage costs and enhance the resilience of communities to flooding. The findings suggest that addressing both socio-economic conditions and infrastructure quality is key to reducing the vulnerability of neighborhoods to flooding in Makurdi.

6. CONCLUSION

Flooding impacts housing development. The findings clearly demonstrate that flood severity is closely tied to both income levels and infrastructure quality. Neighborhoods with lower income levels and poor infrastructure, such as Wadata and North Bank, experienced more significant flood damage compared to those with higher income levels and better infrastructure, like High Level. Furthermore, the analysis of rainfall patterns and housing damage costs reveals a direct correlation between increased rainfall and higher flood-induced housing damage. From the results, it is evident that improving infrastructure in flood-prone areas could significantly reduce the impact of flooding on housing development, particularly in lower-income communities. Effective flood management strategies, including enhanced drainage systems, housing resilience measures, and improved urban planning, are essential in mitigating the adverse effects of flooding. This study underscores the importance of integrating socio-economic factors and infrastructure development in addressing the challenges posed by flooding in Makurdi, ultimately contributing to more sustainable and resilient housing development in the region.

7. RECOMMENDATIONS

Based on the results, it is recommended that local authorities prioritize improving infrastructure in flood-prone areas, particularly in lower-income neighborhoods like Wadata and North Bank. Implementing better drainage systems, reinforcing building codes, and providing flood-resistant housing could reduce the impact of flooding. Additionally, increased investment in flood prevention measures, such as early warning systems and community awareness programmes, would help mitigate flood-related damage. Strengthening socio-economic support for residents, including financial assistance for housing reconstruction, could also alleviate the economic burden caused by frequent floods.

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