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ASSESSMENT OF ENVIRONMENTAL EFFECTS OF FLOODING ON THE RESIDENTS OF ANGWAN NUNGU, LAFIA LOCAL GOVERNMENT AREA OF NASARAWA STATE

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ABSTRACT

This study assessed the environmental effects of flooding on residents of Angwan Nungu, Lafia Local Government Area, Nasarawa State, Nigeria. Using a descriptive cross-sectional survey design, data were collected from 110 respondents through structured questionnaires and analyzed using descriptive statistics. Findings indicate that flooding in the community is primarily caused by heavy rainfall, riverbank overflow, poor drainage systems, indiscriminate waste disposal, and construction on natural water channels. The impacts of flooding were significant, affecting physical health, psychological well-being, and social cohesion, access to essential services, land use, housing, livelihoods, and agricultural yields. The study concludes that both natural and human-induced factors exacerbate flooding, and proactive interventions are essential to reduce vulnerability. Recommendations include regular drainage maintenance, competent infrastructural development, community awareness campaigns, reinstatement of sanitation exercises, and the establishment of a reliable early flood warning system. The study provides evidence-based insights to inform sustainable flood management and resilience strategies in flood-prone urban communities.

Keywords: Assessment, Environmental Effects, Flooding, Angwan Nungu

INTRODUCTION

Flooding is one of the world's most destructive environmental hazards, affecting millions of people annually through the inundation of normally dry land and the resulting destruction of property, loss of life, and disruption of socio-economic stability. Globally, rising temperatures have intensified extreme weather events, leading to heavier rainfall, glacier melt, and thermal expansion of oceans, which increase the likelihood of severe flooding (Intergovernmental Panel on Climate Change (IPCC), 2022). Flooding is now recognized as the most frequent natural hazard, responsible for over 20,000 deaths and

affecting well over 75 million people each year (Adenekan *et al.,* 2021). In developing regions, especially Africa, the consequences are pronounced because many rapidly growing urban centers lack the structural capacity and planning systems necessary to withstand flood-related pressures. Nasarawa State Emergency Management Agency (NSEMA), 2023, has identified this limitation as a major constraint to improving the living conditions of urban slum dwellers and achieving global development goals.

Within the Nigeria context, poor urban planning, weak environmental governance, and the uncontrolled expansion of settlements into flood-prone areas have increased vulnerability to flooding. New developments often encroach on wetland areas that naturally serve as buffers against floodwater, while inadequate drainage systems and the blockage of existing channels by refuse and sediments further exacerbate runoff intensity. Ezekiel and Adesina (2020) observed that although urban development often contributes to environmental pressures, it is low-income settlements and marginalized groups that disproportionately suffer the impacts of flooding. These global and continental patterns are similarly reflected in Nigeria, where a significant portion of land lies less than eight meters above sea level, leaving nearly 30% of the country susceptible to recurrent flooding. Coastal floods, river floods, flash floods, urban floods, and dam failures continue to affect communities nationwide, causing displacement, infrastructural destruction, business interruption, and heightened disease risk (Danjuma & Musa, 2022).

Lafia Metropolis in Nasarawa State mirrors these national vulnerabilities. Since the creation of the state in 1996, the metropolis has experienced rapid population inflow, expansion of residential and commercial zones, and increased socio-economic activities. However, much of this growth has occurred without adherence to proper planning regulations. People have reclaimed wetlands for housing and industrial estates, sited developments on marginal lands, and obstructed natural waterways. These human-induced alterations combine with climate-related increases in rainfall to create critical flooding pressures in the city. Poorly designed or blocked drainage systems further intensify stormwater accumulation, converting even moderate rainfall into community-wide inundation.

Angwan Nungu, a low-lying neighborhood within Lafia, experiences the most severe consequences of these combined physical and human factors. Each rainy season, the community faces recurrent flooding that destroys homes, erodes farmlands, contaminates water sources, disrupts livelihood activities, and exposes residents to water-borne diseases. These environmental consequences, representing the central outcome variable of concern, are shaped by key causal factors such as extreme rainfall, unregulated land use, inadequate drainage infrastructure, and poor waste disposal practices. Despite some governmental and community-level attempts to address flooding in Lafia, Angwan Nungu remains highly vulnerable, suggesting that existing mitigation strategies are either insufficient, poorly enforced, or unsustainable. The persistence of severe flooding reveals an urgent knowledge gap: the lack of community-specific empirical documentation that links these underlying drivers to the environmental effects experienced by residents.

Without a clear understanding of how climate dynamics, urban development patterns, and drainage deficiencies combine

to shape flood impacts in Angwan Nungu, policy interventions cannot be effectively designed. The continuing displacement, environmental degradation, and health risks faced by residents illustrate the importance of targeted research that not only describes the environmental effects of flooding but also connects them to their proximate and structural causes. This study responds to that need by examining the environmental effects of flooding on residents of Angwan Nungu, thereby offering evidence that can inform more effective mitigation and resilience strategies.

AIM AND OBJECTIVES

The main aim of this study is to assess the environmental effects of flooding on the residents of Angwan Nungu, Lafia Local Government Area of Nasarawa State. The specific objectives are to;

1. determine the socio-demographic characteristics of the respondents in Angwan Nungu, Lafia, Nasarawa State.
2. identify causes of flooding in Angwan Nungu, Lafia, Nasarawa State
3. determine the environmental effects of flooding on the residents of Angwan Nungu, Lafia, Nasarawa State

RESEARCH QUESTIONS

1. What are the socio-demographic characteristics of the respondents in Angwan Nungu, Lafia, Nasarawa State?
2. What are the causes of flooding in Angwan Nungu, Lafia, Nasarawa State?
3. What are the effects of flooding on the residents of Angwan Nungu, Lafia, Nasarawa State?

THEORETICAL FRAMEWORK

This study is anchored on the Pressure and Release (PAR) Model, developed by Wisner, Blaikie, Cannon, and Davis (2004). The PAR model explains disasters as the outcome of the interaction between natural hazards and socially constructed vulnerability. Its core elements include root causes (such as weak governance and poverty), dynamic pressures (rapid urbanization, poor planning, and inadequate infrastructure), and unsafe conditions (settlement on floodplains, blocked drainage, and poor waste management), which together determine the severity of hazard impacts. The major argument of the theory is that flooding becomes disastrous not merely because of heavy rainfall or river overflow, but because social, economic, and environmental pressures increase people's exposure and reduce their capacity to cope. In relation to this study, flooding represents the hazard, while poor drainage systems, construction on water channels, and weak land-use control constitute the pressures and unsafe conditions, with environmental effects on residents serving as the outcome. The PAR model is relevant because it provides a clear explanatory link between human-induced environmental mismanagement and the observed health, social, and land-use impacts of flooding in Angwan Nungu, thereby guiding the assessment of vulnerability and informing sustainable flood mitigation and resilience strategies.

LITERATURE REVIEW

The Concept of Flooding

Flooding is the abnormal accumulation of water over normally dry land, caused by natural or human-induced processes. It is considered an extreme hydrological event with the potential to cause significant environmental and socio-economic disruption (IPCC, 2022). In

Nigeria, floods typically occur as coastal, riverine, or urban events, influenced by rainfall intensity, land use, drainage capacity, and terrain characteristics. Urban flooding is often driven by inadequate or blocked drainage systems, poor waste management, and unplanned settlements that hinder the natural flow of stormwater (Olanrewaju *et al.*, 2019; World Bank, 2023). Globally, the frequency and magnitude of floods have increased due to climate variability, intense rainfall, and the growing exposure of human settlements to hydrological hazards ((United Nations Office for Disaster Risk Reduction (UNDRR) 2019). While normal flooding can replenish soil and support ecosystems, destructive flooding occurs when water exceeds the coping capacity of the environment and built infrastructure.

The Concept of Sustainable City Development

Sustainable city development is an urban planning approach that balances economic growth, social well-being, and environmental protection. It emphasizes resilient urban spaces that meet present needs without compromising the ability of future generations to meet theirs, through efficient land use, adequate infrastructure, and environmental management integration (World Bank, 2024). In rapidly expanding cities, sustainability requires coordinated physical planning, protection of natural drainage systems, and adoption of green infrastructure, such as sustainable urban drainage systems. Failure to implement these principles exacerbates climate-related hazards, including flooding. Sustainable urban development promotes integrated planning, disaster-risk reduction, and equitable access to urban services, strengthening resilience and ensuring functional, healthy settlements (Adelekan, 2018).

Causes of Flooding

Flooding in urban areas results from both natural and human-induced factors. Natural drivers include heavy rainfall, topography, and climate variability, while anthropogenic causes involve rapid urbanization, poor planning, and construction on natural flood paths. The replacement of permeable surfaces with concrete increases runoff, making settlements more vulnerable to stormwater accumulation. Other contributing factors include inadequate drainage networks, waste dumping in waterways, deforestation, and encroachment on river channels (Mbah & Yakubu, 2021). Weak urban governance and insufficient investment in drainage infrastructure further exacerbate flooding, particularly when cities expand without corresponding infrastructural upgrades, leading to recurrent and often severe flood events.

Effects of Flooding

Flooding has significant environmental, economic, and social consequences. It destroys homes, farmlands, infrastructure, and public utilities, while disrupting transportation, electricity, education, and health services. Floods can result in loss of life, displacement of households, and outbreaks of waterborne diseases. Low-income communities are particularly affected due to poverty, overcrowding, and inadequate urban services (World Bank, 2024). Floods also disrupt livelihoods, close businesses, and degrade environmental quality, creating long-term vulnerabilities for affected populations (UNDRR, 2024).

Social Effects on Communities and Individuals

Flooding disrupts social structures by displacing families, damaging property, and interrupting daily activities such as work, schooling, and business operations. The

psychological impact can be severe, especially for those who lose homes, relatives, or livelihoods. Communities often face heightened stress, reduced purchasing power, and long-term trauma. Flood-related damage to public infrastructure—roads, bridges, schools, markets, and communication lines—affects broader populations beyond those directly inundated, creating economic and social ripple effects (Mbah & Yakubu, 2021).

METHODOLOGY

The study adopted a descriptive cross-sectional survey design to assess the environmental effects of flooding on the residents of Angwan Nungu in Gayam Ward, Lafia Central, Nasarawa State. The design was considered appropriate because it enables data collection at a single point, allowing the researcher to describe prevailing environmental conditions and community experiences associated with flooding. Angwan Nungu, a flood-prone settlement with an estimated population of 2,148 residents, formed the geographical focus of the study. The target population comprised all residents of the community, from which a sample of 110 respondents was drawn. A simple random sampling technique was applied to ensure that every household had an equal representation and to minimize bias making the sample adequately representative for quantitative analysis.

Data were collected exclusively through structured questionnaires, which captured demographic characteristics and specific environmental impacts of flooding in households. The instrument validity was established through expert review by Environmental Health specialist and research supervisors to ensure content and construct accuracy. To ensure reliability, a pilot test was conducted among 20 residents in a nearby community, and a Cronbach Alpha coefficient of 0.82 confirmed the internal consistency of the questionnaire. Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics such as frequencies, percentages, and means were used to summarize and present the findings in a clear and interpretable form. This analytical approach ensured that the results objectively reflected the extent and pattern of flooding effects within the community.

RESULTS

Table 1: Socio-Demographic Characteristics of Respondents

Category	Frequency	Percentage (%)
Sex		
Male	67	60.9
Female	43	39.1
Age		
16–25	16	14.5
26–35	30	27.3
36–45	34	30.9
46 and above	30	27.3
Marital Status		
Single	51	46.4
Married	55	50
Divorced	4	3.6
Educational Qualification		
SSCE	20	18.2
National Diploma	30	27.3
NCE	23	20.9
Degree	27	24.5
Others	10	9.1
Occupation		
Student	24	21.8
Farmer	18	16.4
Trader	20	18.2
Civil Servant	48	43.6

Source: Researchers' fieldwork (2025)

Table 1 shows that 60.9% of the respondents are male, while 39.1% are female, indicating that men constituted a larger proportion of the study, age distribution reveals that 36–45 years age bracket reflects majority of the respondents with matured adult in their economically productive age. Marital status shows that 50% of respondents are married, 46.4% are single, and 3.6% are divorced, this indicated that the community comprises mainly married and single individuals. The dominance of National Diplomas education (27.3%) indicating a relatively educated community. With respect to occupation, the largest group is civil servants, representing 43.6% of the respondent, this revealed that the community is largely composed of salaried workers, supplemented by individuals engaged in trading, farming, and schooling.

Table 2: Causes of Flooding

Cause of Flooding	SA (%)	A (%)	U (%)	D (%)	SD (%)
Heavy rainfall	32.7	23.6	7.3	20	16.4
Overflow of riverbanks	60	25.5	6.4	3.6	4.5
Poor drainage systems	70	20.3	9.1	0	0
Dumping of refuse	39.1	37.3	0	11.8	11.8
Building on water channels	79.1	11.8	5.5	3.6	0

Source: Researchers' fieldwork (2025)

Table 2 shows that the highest proportion of respondents (79.1%) strongly agreed that building on water channels is a major cause of flooding, this indicates that encroachment on waterways is a critical driver of flooding in the community. Poor drainage systems (70% strongly agreed), indicating that inadequate drainage infrastructure as a major contributor to flood events. The overflowing riverbanks (60% strongly agreed), this reveal that riverbank is significant but slightly less dormant factor compared to drainage –related. Indiscriminate waste dumping also contributed substantially, as 76.4% agreed that dumping refuse blocks water pathways, this implies that waste accumulation blocks drainage channels and waterways reducing their capacity and exacerbating flood events. Heavy rainfall is recognized as a cause with (32.7%) respondents strongly agree indicating that while rainfall is a key factor, some respondents believe other causes play a greater role.

Table 3: Effects of Flooding on Residents

Effect of Flooding	SA (%)	A (%)	U (%)	D (%)	SD (%)
Affects physical health	60.9	31.8	7.3	0	0
Psychological effects	40.9	26.4	15.5	13.6	3.6
Social disruption	35.5	24.5	19.1	20.9	0
Disrupts essential services	53.6	30	16.4	0	0
Land-use & zoning implications	32.7	30.9	20.9	9.1	6.4

Source: Researchers' fieldwork (2025)

Table 3 titles effects of flooding on residents revealed that (92.7%) agreed that flooding negatively affects physical health and well-being, this indicates the widespread recognition that flooding contribute to health challenges while 67.3% acknowledged psychological effects showing that many experience stress, anxiety associated with flooding event. . The perception of social disruption was more mixed. While 35.5% strongly agreed and 24.5% agreed that flooding disrupts social activities, 19.1% were undecided, and 20.9% disagreed, this indicates that residents have varied experiences regarding how flooding affects mobility, community interactions, and daily routines. 83.6% respondents agreed that flooding interferes with access to essential services, this reflects the extent to which flood undermine daily life of the community. Regarding the land-use and zoning, 63.6% agreed that flooding affects land use patterns and settlement planning, this shows that respondents recognized the role of poor land-use practices and weak zoning regulations in worsening environmental vulnerability.

DISCUSSION OF THE FINDING

The findings of this study reveal that flooding in Angwan Nungu, Lafia Local Government Area, is influenced by a combination of natural and human-induced factors. The socio-demographic data indicated that the majority of respondents were economically active adults aged 36–45 years (30.9%), with a higher proportion of males (60.9%) than females (39.1%). Civil servants formed the largest occupational group (43.6%), suggesting that the community consists predominantly of individuals with formal employment who are actively engaged in economic activities. This demographic distribution implies that economically productive households are most exposed to flood hazards, consistent with findings from Adelekan (2018) and Danjuma and Musa (2022), who reported similar patterns in flood-prone Nigerian communities. The causes of flooding, respondents identified construction on water channels (79.1%), poor drainage systems (70%), overflow of riverbanks (60%), and improper waste disposal (76.4% including agree and strongly agree) as key contributors. While heavy rainfall (56.3% agreed/strongly agreed) was recognized as a natural trigger, the high percentages for human-induced causes highlight the role of environmental mismanagement in exacerbating floods. These findings are consistent with studies by Ezekiel and Adesina (2020) and Adenekan *et al.*,2021), which emphasized that urban flooding in Nigerian cities is largely worsened by unplanned construction, inadequate drainage infrastructure, and indiscriminate waste disposal. The Intergovernmental Panel on Climate Change (IPCC, 2022) also noted that climate variability increases rainfall intensity, but human activities significantly amplify flood risk.

The effects of flooding on residents were substantial. Physical health was impacted in 92.7% of respondents, including exposure to waterborne diseases, corroborating WHO (2023), which identifies floods as key drivers of malaria, diarrhea, and typhoid outbreaks. Psychological effects were reported by 67.3%, indicating anxiety and stress due to recurrent flooding, consistent with Eze and Okoro (2022). Social disruption was experienced by 60% of respondents, while 83.6% reported interruptions to essential services, highlighting the multi-dimensional nature of flood impacts (Ocheche & Daniel, 2021). Furthermore, 63.6% of respondents identified poor land-use practices and weak zoning regulations as contributing to flood vulnerability, reflecting the link between socio-environmental pressures and disaster risk described by the Pressure and Release (PAR) model (Wisner, Blaikie, Cannon, & Davis, 2004). Flooding in Angwan Nungu is predictable and largely preventable. The findings underscore the need for integrated mitigation measures, including effective drainage systems, proper waste management, enforcement of zoning regulations, and community engagement, which are essential for enhancing resilience and reducing flood-related environmental and socio-economic hazards (Adelekan, 2018; NEMA, 2022).

CONCLUSION

The study shows that flooding in Ungwan Nungu is caused by both natural and human factors, with poor drainage systems and construction on water channels identified as the most significant contributors. Heavy rainfall, riverbank overflow, and indiscriminate waste disposal also play major roles. The effects of flooding are substantial, affecting residents' physical health,

psychological well-being, social activities, essential services, and land-use patterns. These findings indicate that the community remains highly vulnerable to flooding, and addressing the identified causes is essential for reducing its impacts.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations were made:

1. The Nasarawa State Government should conduct regular repair and clearing of drainage channels in Ungwan Nungu to facilitate the effective flow of storm-water and mitigate flooding.
2. State Government should ensure that drainage construction projects must be executed by qualified contractors to replace inadequate surface drainage with robust systems that mitigate property damage.
3. Awareness campaigns should be organized to educate residents on the causes and environmental implications of flooding, as well as personal and household preparedness strategies such as clearing drains, using sandbags, and raising building foundations
4. Monthly sanitation initiatives must be reintroduced to eliminate accumulated refuse, and a dependable early flood warning system should be implemented to deliver prompt notifications, so augmenting community readiness and mitigating the effects of floods.
5. Ministry of environment should strictly enforce environmental and building regulations to prevent construction on waterways, wetlands, and flood-prone zones. Relocation or modification of buildings situated on high-risk floodplains should be considered where necessary.

REFERENCES

Adelekan, I. (2018). Urban exposure to climate hazards: Flooding in Nigerian cities. Natural Hazards, 94(1), 1–22. https://doi.org/10.1007/s11069-018-3310-6

Adenekan, I. A., Adegun, O., & Ajayi, A. (2021). Urban flooding and climate variability in West Africa. Environmental Research Letters, 16(7), 1–12. https://doi.org/10.1088/1748-9326/ac0e8f

Danjuma, M., & Musa, L. (2022). Flood vulnerability assessment in Lafia metropolis, Nasarawa State. Nigerian Journal of Environmental Studies, 15(2), 44–56.

Eze, C., & Okoro, E. (2022). Flooding and public health risks in low-income settlements. African Journal of Public Health, 9(3), 122–129.

Ezekiel, A., & Adesina, O. (2020). Urban growth, drainage failures, and flood risk in Nigerian cities. Journal of Urban Environmental Management, 12(4), 89–101.

IPCC. (2022). Sixth assessment report: Impacts, adaptation and vulnerability. Intergovernmental Panel on Climate Change. https://www.ipcc.ch/report/ar6/wg2/

Mbah, C., & Yakubu, H. (2021). Environmental consequences of recurrent flooding in North-Central Nigeria. African Journal of Environmental Management, 29(3), 112–125.

NEMA. (2022). Annual flood impact assessment report for Nigeria. National Emergency Management Agency.

NSEMA. (2023). Flood situation report for Nasarawa State. Nasarawa State Emergency Management Agency.

Ocheche, P., & Daniel, E. (2021). Health consequences of urban floods in Nigeria. International Journal of Environmental Health Research, 31(5), 603–612. https://doi.org/10.1080/09603123.2020.1862369

Olanrewaju, D., Popoola, A., & Ojo, T. (2019). Environmental and public health impacts of flooding in Nigerian communities. International Journal of Environmental Health, 24(2), 55–67.

UNDRR. (2019). Global assessment report on disaster risk reduction 2019. United Nations Office for Disaster Risk Reduction. https://www.undrr.org/publication/global-assessment-report-2020

UNDRR. (2024). Global assessment report on disaster risk reduction 2024. United Nations Office for Disaster Risk Reduction.

WHO. (2023). Waterborne diseases and climate-related health risks. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/waterborne-diseases

World Bank. (2023). Urban flood management and climate adaptation in Nigeria. World Bank Group. https://documents.worldbank.org

World Bank. (2024). Nigeria climate and disaster risk profile: Flooding, climate impacts, and community vulnerability. World Bank Group. https://documents.worldbank.org

Wisner, B., Blaikie, P., Cannon, T., & Davis, I. (2004). At risk: Natural hazards, people's vulnerability and disasters (2nd ed.). Routledge.