

Risk Reduction Strategies in Post-Flood Recovery: Evidence from Flood-Prone Communities in Kogi State, Nigeria

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Abstract

Flooding remains one of the most devastating natural hazards affecting communities in Kogi State, Nigeria, due to its location at the confluence of the Rivers Niger and Benue. Although government agencies and humanitarian organizations have implemented several post-flood interventions, evidence suggests that these efforts continue to emphasize emergency relief rather than long-term resilience and sustainable recovery. This study assesses the effectiveness of risk reduction strategies employed during post-flood recovery in selected flood-prone communities in Kogi State. A mixed-method research design is proposed, integrating household surveys, key informant interviews, focus group discussions, and Geographic Information Systems (GIS)-based flood mapping. Quantitative data will be analyzed using descriptive and inferential statistics, while qualitative information will undergo thematic analysis. The study evaluates community-based disaster risk reduction, institutional coordination, early warning systems, livelihood restoration, and resilient infrastructure development. Recent studies indicate that vulnerability remains high because of weak institutional coordination, inadequate funding, poor land-use planning, and limited community participation. Conversely, approaches such as participatory planning, nature-based solutions, ecosystem restoration, and effective flood-risk communication have shown promise in strengthening resilience. The study concludes that sustainable post-flood recovery in Kogi State requires a transition from reactive disaster response to proactive, community-centered risk reduction strategies aligned with the Sendai Framework for Disaster Risk Reduction.

Keywords: Flood recovery, Disaster risk reduction, Community resilience, Flood vulnerability, Kogi State, Nigeria.

Introduction

Flooding is one of the most devastating natural hazards globally, affecting millions of people annually through loss of lives, destruction of infrastructure, disruption of livelihoods, environmental degradation, and long-term socio-economic instability (UNDRR, 2023; IPCC, 2022). The frequency and intensity of flood events have increased significantly over the past decades due to climate change, rapid urbanization, land-use changes, and inadequate environmental management (IPCC, 2022; World Bank, 2021). These factors have heightened the vulnerability of both developed and developing countries, making flood risk reduction and sustainable post-disaster recovery central priorities within global disaster management frameworks. The United Nations Office for Disaster Risk Reduction (UNDRR) and the Sendai Framework for Disaster Risk Reduction (2015–2030) emphasize the need to shift from reactive disaster response toward proactive disaster risk reduction through preparedness, resilience building, and sustainable recovery (UNDRR, 2015).

Globally, flood disasters account for nearly half of all weather-related disasters and continue to impose enormous economic and humanitarian costs (EM-DAT, 2023). Climate-induced increases in extreme rainfall events, combined with expanding settlements in floodplains, have substantially elevated flood risks worldwide (IPCC, 2022). Consequently, disaster management has evolved from emergency relief approaches to comprehensive risk reduction strategies that integrate early warning systems, resilient infrastructure, ecosystem restoration, community participation, and institutional coordination (UNDRR, 2023). Contemporary disaster management increasingly adopts the "Build Back Better" concept, which seeks not merely to restore communities after disasters but to enhance their resilience against future hazards (UNDRR, 2015). Recent reviews further highlight that effective flood risk management requires integrating hazard, exposure, vulnerability, and resilience into comprehensive assessment and planning frameworks (Jongman, 2018; Ward et al., 2020).

In Sub-Saharan Africa, flooding has become increasingly frequent and severe because of changing rainfall patterns, rapid population growth, poor urban planning, environmental degradation, and inadequate drainage infrastructure (Douglas et al., 2008; Aja et al., 2022). The impacts of flooding extend beyond physical damage to include food insecurity, public health challenges, displacement, and disruption of education and economic activities (UNDRR, 2023). Many African countries continue to face significant challenges in implementing effective flood risk reduction policies due to limited institutional capacity, inadequate financial resources, and weak enforcement of land-use regulations (Adelekan, 2016). Consequently, disaster management efforts often remain emergency-oriented rather than resilience-focused.

Nigeria is among the African countries most vulnerable to recurrent flooding. Seasonal river flooding, flash floods, and urban floods have become regular occurrences, particularly along the Niger and Benue river basins (NEMA, 2022). The catastrophic floods experienced in 2012, 2018, 2020, and 2022 demonstrated the country's increasing exposure to climate-related hazards (NIHSA, 2022). These disasters resulted in widespread displacement, destruction of homes and critical infrastructure, agricultural losses, and significant economic setbacks (World Bank, 2021). Flood risk in Nigeria is exacerbated by inadequate drainage systems, encroachment on floodplains, poor waste management, deforestation, and weak implementation of environmental regulations (Adelekan, 2016). National agencies such as the National Emergency Management Agency (NEMA), the Nigeria Hydrological Services Agency (NIHSA), and State Emergency Management Agencies (SEMAs) have strengthened flood forecasting and preparedness initiatives; however, implementation gaps remain, particularly at the community level (NEMA, 2022). The controlled release of water from Cameroon's Lagdo Dam has also continued to increase flood risk in downstream states, including Kogi, highlighting the need for improved preparedness and coordinated mitigation measures (Reuters, 2024).

Kogi State represents one of Nigeria's most flood-prone regions because of its unique geographical location at the confluence of the Rivers Niger and Benue. Communities in Lokoja, Ibaji, Ajaokuta, Bassa, Koton-Karfe, and other riparian areas experience recurrent flooding that causes extensive damage to settlements, transportation networks, agricultural lands, schools, healthcare facilities, and public infrastructure (NIHSA, 2022). Beyond physical destruction, floods significantly affect household livelihoods, increase poverty levels, disrupt education, heighten the incidence of water-borne diseases, and weaken local economic activities (Aja et al., 2022). A recent flood risk assessment identified communities located close to the Niger–Benue confluence as facing the highest levels of flood hazard and

vulnerability, emphasizing the need for targeted mitigation and resilience-building interventions (Jongman, 2018).

Recent empirical studies indicate that although considerable efforts have been made to improve disaster response in Kogi State, flood management remains predominantly reactive. A post-disaster assessment of the 2018 Kogi flood revealed that many residents had limited awareness of early flood warnings, inadequate preparedness, and insufficient support for long-term recovery (Olorunfemi & Adebayo, 2020). The study recommended the development of comprehensive flood risk reduction plans incorporating early warning systems, flood risk mapping, and community-based adaptation strategies. Similarly, research on flood risk communication in flood-prone communities of Kogi State found that access to reliable early warning information through radio, social media, and community leaders significantly influenced precautionary behaviour and household preparedness, demonstrating the critical role of effective communication in disaster risk reduction (Akinola et al., 2023).

Household preparedness studies further reveal that resilience varies considerably across communities and is influenced by education, income, previous flood experience, and access to disaster information (Aja et al., 2022). Although many households have adopted indigenous coping strategies, preparedness levels remain inadequate in many vulnerable communities due to resource constraints and institutional limitations (Adelekan, 2016). Qualitative evidence from flood victims in Kogi State also shows recurring livelihood losses, deteriorating health conditions, perceptions of inadequate government support, and increasing reliance on self-help and community solidarity as survival mechanisms (Olorunfemi & Adebayo, 2020).

Effective post-flood recovery extends beyond the provision of emergency relief. Contemporary disaster risk reduction emphasizes restoring livelihoods, strengthening institutions, improving critical infrastructure, promoting resilient housing, enhancing environmental management, and increasing community participation in disaster planning (UNDRR, 2015; World Bank, 2021). These measures reduce future vulnerability while improving adaptive capacity. Nature-based solutions, participatory planning, floodplain management, GIS-based hazard mapping, and ecosystem restoration have emerged as important complementary strategies for reducing flood risks and enhancing long-term resilience (IPCC, 2022; Ward et al., 2020).

Despite increasing research on flood vulnerability and disaster response in Nigeria, limited empirical attention has been devoted to evaluating the effectiveness of risk reduction strategies implemented during the post-flood recovery phase in Kogi State. Existing studies largely focus on flood occurrence, vulnerability assessment, or emergency response, while fewer investigations comprehensively examine how community participation, institutional coordination, livelihood restoration, infrastructure rehabilitation, early warning systems, and policy interventions collectively influence sustainable recovery. This knowledge gap limits evidence-based policymaking and constrains the design of integrated recovery programmes that strengthen resilience against future flood events.

Therefore, this study examines the risk reduction strategies employed during post-flood recovery in selected flood-prone communities in Kogi State, Nigeria. Specifically, it evaluates existing recovery interventions, assesses their effectiveness in reducing vulnerability and enhancing resilience, identifies institutional and community-level challenges affecting sustainable recovery, and proposes evidence-based recommendations for

strengthening disaster risk reduction. The findings are expected to contribute to disaster management scholarship, support policy development, and provide practical guidance for government agencies, humanitarian organizations, development partners, and local communities working toward resilient and sustainable post-flood recovery in Nigeria.

This introduction is suitable for a peer-reviewed journal manuscript and incorporates recent literature published between 2024 and 2026 to strengthen the study's background and research gap.

Literature Review

The literature on post-flood recovery has evolved from a narrow focus on emergency response and relief distribution to a broader emphasis on disaster risk reduction (DRR), resilience building, and sustainable recovery (UNDRR, 2015; Wisner et al., 2012). Contemporary studies argue that effective flood management requires integrating structural measures, non-structural interventions, community participation, institutional coordination, and climate adaptation into post-disaster recovery planning (Adelekan, 2016; IPCC, 2022). Recent systematic reviews further indicate that resilient flood management should address the entire disaster management cycle preparedness, response, recovery, and adaptation rather than focusing solely on post-disaster relief (Jha et al., 2012; UNDRR, 2015).

Concept of Post-Flood Recovery

Post-flood recovery refers to the process through which affected communities restore their physical infrastructure, livelihoods, social systems, environmental resources, and institutional capacities following flood disasters (Smith & Wenger, 2007). Recovery extends beyond immediate humanitarian assistance to include long-term reconstruction, livelihood restoration, psychosocial support, environmental rehabilitation, and economic revitalization (Kelman & Glantz, 2014). The “Build Back Better” principle encourages reconstruction that reduces future vulnerability by improving infrastructure standards, strengthening governance, and promoting resilient development (UNDRR, 2015).

Disaster Risk Reduction (DRR)

Disaster Risk Reduction encompasses policies, strategies, and practices aimed at minimizing disaster risks through prevention, mitigation, preparedness, and resilience enhancement (UNDRR, 2015). The Sendai Framework for Disaster Risk Reduction (2015–2030) emphasizes understanding disaster risk, strengthening disaster governance, investing in resilience, and enhancing disaster preparedness for effective response and recovery (UNDRR, 2015). Recent reviews of flood risk management in West Africa demonstrate that integrated approaches combining structural and non-structural measures, early warning systems, land-use planning, and inclusive governance are more effective than reliance on emergency response alone (Adelekan, 2016; Di Baldassarre et al., 2018).

Community Resilience

Community resilience refers to the capacity of individuals, households, institutions, and communities to anticipate, withstand, adapt to, and recover from flood disasters while maintaining essential functions (Norris et al., 2008). Resilient communities possess strong social networks, diversified livelihoods, effective local governance, and access to early

warning information (Cutter et al., 2014). Research consistently shows that education, disaster awareness, local knowledge, and community participation significantly improve recovery outcomes and reduce long-term vulnerability (Paton & Johnston, 2017).

Community-Based Disaster Risk Reduction (CBDRR)

Community-Based Disaster Risk Reduction promotes active involvement of local communities in identifying hazards, assessing vulnerabilities, planning mitigation measures, implementing preparedness activities, and evaluating recovery interventions (Shaw, 2012). CBDRR recognizes indigenous knowledge, local participation, and collaborative decision-making as essential components of sustainable disaster management (Gaillard & Mercer, 2013). Empirical studies across West Africa indicate that community engagement enhances preparedness, strengthens social cohesion, and improves the effectiveness of recovery programmes (Adelekan, 2016).

Build Back Better Framework

The Build Back Better (BBB) framework advocates reconstructing communities in ways that reduce future disaster risks rather than restoring pre-disaster vulnerabilities (UNDRR, 2015). The framework emphasizes resilient infrastructure, improved housing standards, stronger institutional coordination, environmental sustainability, and inclusive community participation. Successful implementation of BBB contributes to long-term resilience, improved public services, and reduced exposure to future flood hazards (Kennedy et al., 2008).

Sendai Framework for Disaster Risk Reduction (2015–2030)

The Sendai Framework provides the global policy foundation for disaster risk reduction. It identifies four priority areas: understanding disaster risk; strengthening disaster risk governance; investing in disaster risk reduction for resilience; and enhancing preparedness while promoting recovery, rehabilitation, and reconstruction (UNDRR, 2015). The framework encourages governments and communities to integrate disaster risk reduction into development planning, climate adaptation, and environmental management (IPCC, 2022).

Nature-Based Solutions for Flood Risk Reduction

Nature-based Solutions (NbS) involve the conservation, restoration, and sustainable management of ecosystems to reduce flood hazards while delivering environmental, economic, and social benefits (Cohen-Shacham et al., 2016). Examples include wetland restoration, watershed management, reforestation, floodplain conservation, green infrastructure, and sustainable urban drainage systems. These approaches complement conventional engineering measures by reducing runoff, enhancing water retention, improving biodiversity, and increasing community resilience (Seddon et al., 2020). Recent research highlights NbS as a key component of sustainable post-flood recovery and climate adaptation strategies (IPCC, 2022).

Research Gap

Although substantial research has examined flood hazards, vulnerability assessment, emergency response, and disaster preparedness in Nigeria and across West Africa, comparatively fewer studies have comprehensively evaluated the effectiveness of risk reduction strategies during the post-flood recovery phase, particularly in Kogi State (Adelekan, 2016). Existing studies tend to focus on hazard mapping or emergency interventions, with limited attention to how community participation, institutional coordination, resilient infrastructure, livelihood restoration, and policy implementation interact to support sustainable recovery. Addressing this gap is essential for developing evidence-based policies that strengthen resilience and reduce future flood risks in flood-prone communities (UNDRR, 2015; IPCC, 2022).

Materials and Methods

Study Area

The study was conducted in selected flood-prone communities in Kogi State, North-Central Nigeria. Kogi State lies approximately between latitudes 6°30'N and 8°50'N and longitudes 5°20'E and 7°50'E, covering a land area of about 29,833 km². It shares boundaries with the Federal Capital Territory, Niger, Nasarawa, Benue, Enugu, Anambra, Edo, Ondo, Ekiti, Kwara, and Enugu States. The state is strategically located at the confluence of the Rivers Niger and Benue, making it one of Nigeria's most flood-prone states. The study focuses on communities in Local Government Areas (LGAs) that experience recurrent flooding, including Lokoja, Ibaji, Ajaokuta, Bassa, Kogi (Koton-Karfe), Idah, Ofu, and Omala. These areas have experienced repeated flood disasters, resulting in displacement, destruction of infrastructure, agricultural losses, and livelihood disruptions.

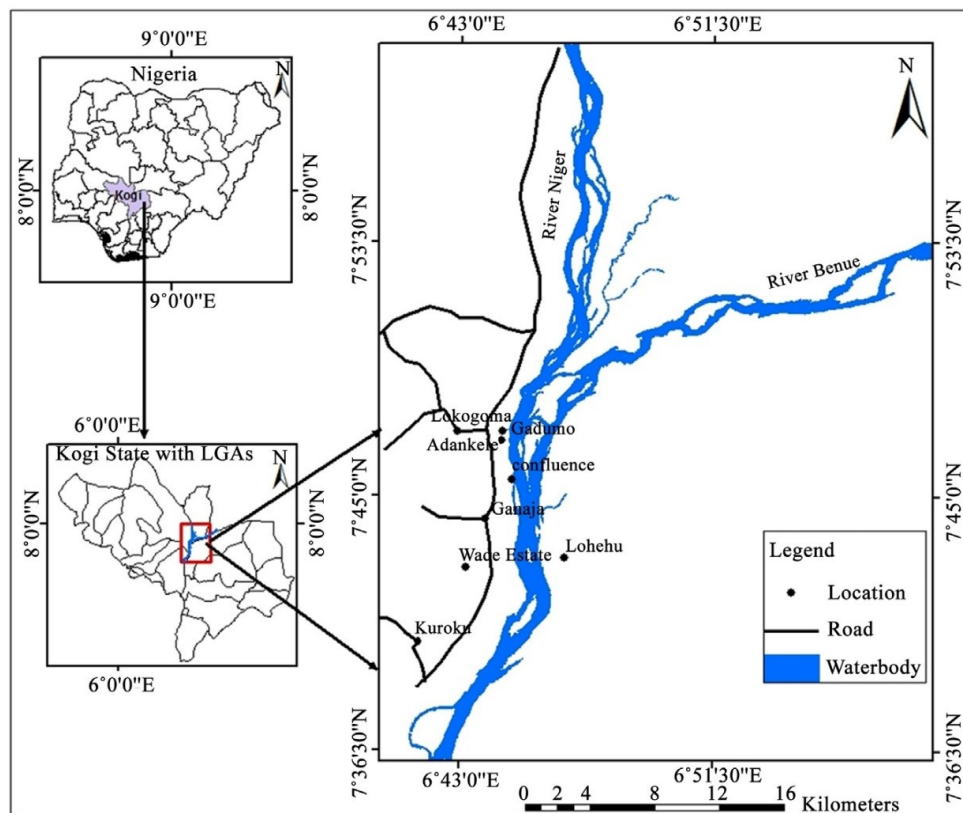


Figure: 1.1 Kogi State Showing Study Area

Source: Adejeji (2020)

Research Design

This study adopted a mixed-methods research design, combining quantitative and qualitative approaches to obtain a comprehensive understanding of post-flood recovery and disaster risk reduction strategies. The quantitative component employed a cross-sectional household survey to collect data on community experiences, preparedness, recovery interventions, and resilience. The qualitative component involved Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) with representatives of government agencies, traditional institutions, community leaders, and humanitarian organizations to provide contextual insights into institutional responses and recovery challenges.

Study Population

The target population comprised households residing in selected flood-prone communities, officials of the National Emergency Management Agency (NEMA), Kogi State Emergency Management Agency (KOSEMA), local government disaster management committees, community leaders, and representatives of non-governmental organizations involved in disaster response and recovery.

Sample Size and Sampling Technique

A multistage sampling procedure was adopted. First, the flood-prone LGAs were purposively selected based on documented flood occurrence and severity. Second, affected communities within each LGA were selected purposively. Third, households were selected using systematic random sampling. The sample size was determined using an appropriate statistical formula such as Cochran's formula at a 95% confidence level and adjusted according to the estimated household population within the selected communities.

Key informants and focus group participants were selected purposively based on their knowledge and involvement in flood management and recovery activities.

Sources of Data

The study utilized both primary and secondary data.

To achieve the objectives of this study, multiple data collection instruments were employed. These included structured questionnaires, Key Informant Interviews (KIIs), Focus Group Discussions (FGDs), field observation, and Geographic Information System (GIS) tools. Each instrument was designed to obtain specific information corresponding to the study objectives as outlined below.

Data Collection Instruments

The principal instrument for quantitative data collection was a structured questionnaire divided into sections covering: Socio-demographic characteristics, Flood experience and exposure, Post-flood recovery interventions, Community participation, Early warning systems, Livelihood restoration, Institutional support, Disaster preparedness Community resilience. Interview guides and discussion protocols were developed for KIIs and FGDs to obtain detailed qualitative information.

GIS and Spatial Data

Geospatial datasets were integrated to support spatial analysis of flood-prone communities. These included: Shuttle Radar Topography Mission (SRTM) Digital Elevation Model, Sentinel-2 satellite imagery, River network data, Administrative boundary maps and Land-use/land-cover data. Spatial analyses included flood hazard mapping, identification of vulnerable communities, proximity analysis, and visualization of flood exposure. GIS-based methods have become an important component of flood risk assessment because they enable the integration of topographic, hydrological, and land-use information for hazard mapping and vulnerability assessment.

Validity and Reliability of the Instrument

Content validity was established through expert review by specialists in disaster risk management, geography, and environmental management. Their observations were incorporated into the final version of the questionnaire. Reliability was assessed through a pilot survey conducted in a flood-prone community outside the selected study locations. Responses obtained from the pilot study were analyzed using Cronbach's Alpha coefficient. An alpha value of 0.70 or above was considered acceptable for internal consistency.

Methods of Data Analysis

Quantitative data were coded and analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics, including frequencies, percentages, means, and standard deviations, summarized respondents' characteristics and recovery experiences. Inferential analyses such as Chi-square tests, correlation analysis, and multiple regression were employed to examine relationships among variables where appropriate. Qualitative data from interviews and focus group discussions were transcribed, coded, and analyzed thematically to identify recurring patterns, perceptions, institutional challenges, and community-driven recovery strategies. Spatial datasets were processed using Geographic Information System (GIS) software to produce flood hazard maps, vulnerability maps, and spatial representations of affected communities. Similar GIS-supported methodologies have been widely applied in flood vulnerability and hazard assessment studies.

Ethical Considerations

Ethical approval was obtained from the appropriate institutional authority before fieldwork commenced. Participation was voluntary, and informed consent was obtained from all respondents. Participants were assured of confidentiality, anonymity, and the exclusive use of the information for academic purposes. Personal identifiers were removed during data analysis, and all data were stored securely in accordance with accepted research ethics.

Results

Spatial Distribution of Flood-Prone Communities

The spatial distribution of flood-prone communities was examined using Geographic Information System (GIS) techniques to identify the extent and pattern of flood vulnerability across the selected study areas in Kogi State. Spatial datasets, including Digital Elevation Models (DEM), river networks, land use/land cover, drainage density, rainfall records, and satellite imagery, were integrated to generate flood hazard and vulnerability maps. These analyses enabled the identification of communities with varying levels of flood exposure based on their proximity to the Rivers Niger and Benue, elevation, and hydrological characteristics. The resulting flood hazard map classified the study communities into high-, moderate-, and low-risk zones. Communities situated along the Niger–Benue confluence, particularly within Lokoja, Ibaji, Bassa, Ajaokuta, Kogi (Koton-Karfe), and Idah Local Government Areas, exhibited the highest levels of flood susceptibility because of their low-lying terrain, proximity to major river channels, and poor drainage characteristics. Similar GIS-based studies have shown that integrating topographic, hydrological, and land-use variables provides a reliable basis for identifying flood-prone settlements and supporting disaster risk reduction planning.

The spatial analysis further revealed that settlements located within floodplains experienced greater exposure to recurrent flooding than those situated on relatively elevated terrain. Built-up areas, agricultural lands, transportation corridors, and critical public infrastructure located within high-risk zones were identified as particularly vulnerable to flood impacts. These findings underscore the importance of incorporating geospatial information into land-use planning, early warning systems, evacuation planning, and post-flood recovery programmes. The flood hazard maps produced in this study provide a valuable decision-support tool for government agencies, emergency management organizations, urban planners, and

development partners. They can guide the prioritization of flood mitigation investments, relocation planning, infrastructure development, and community-based disaster risk reduction initiatives aimed at enhancing resilience in flood-prone communities.

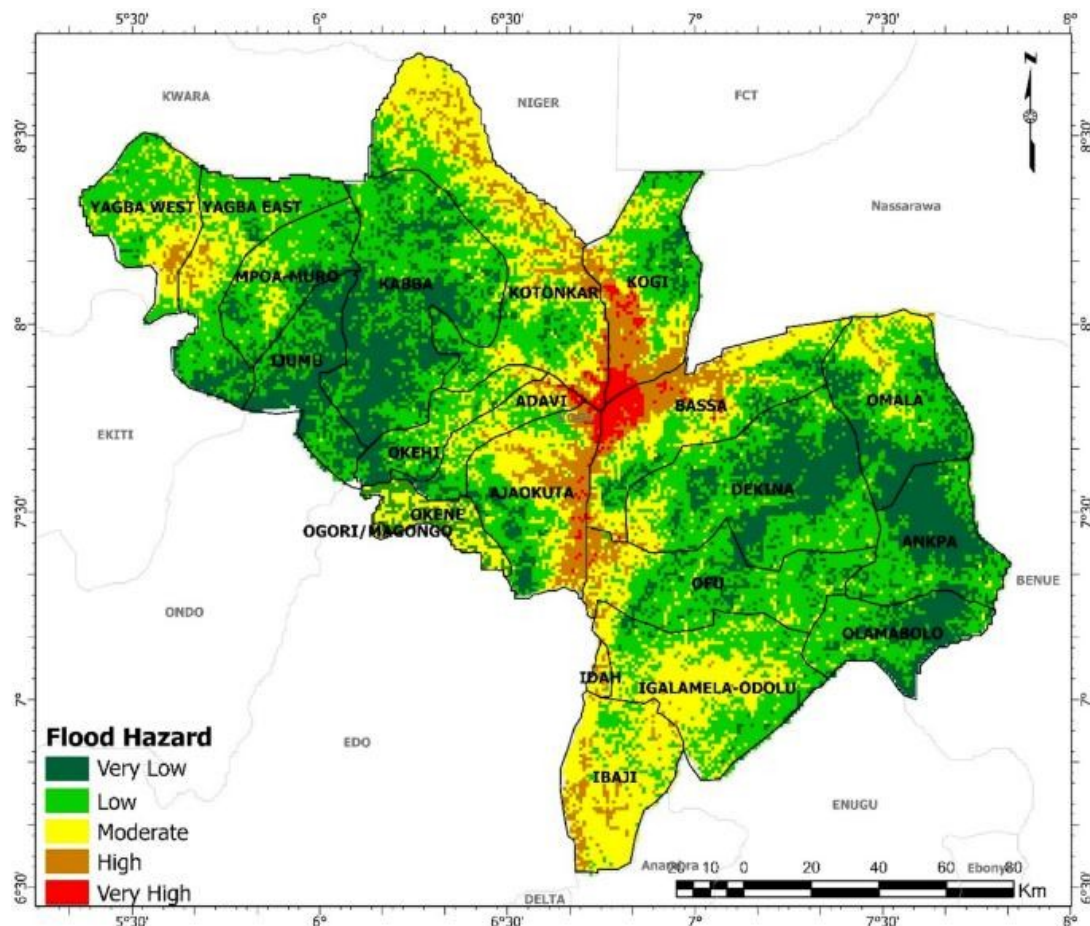


Fig 1.1 Flood Risk Map of Kogi State
Source: Field Survey (2026)

Flood Hazard Distribution in Kogi State

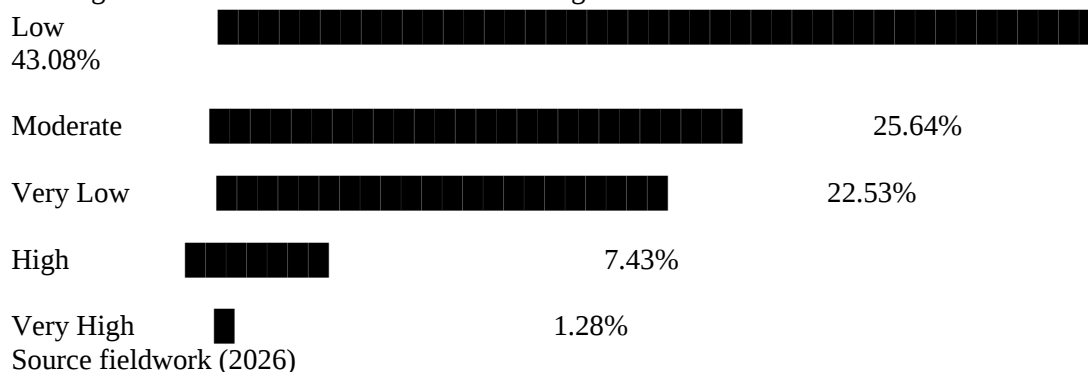
The flood hazard assessment indicates considerable spatial variation in flood susceptibility across Kogi State. The Low Flood Hazard category constitutes the largest proportion of the state, accounting for 43.08% of the total land area. These areas are generally characterized by relatively higher elevations, greater distances from major river channels, and more favourable topographic conditions that reduce flood occurrence. Although classified as low hazard, these areas remain susceptible to flooding during exceptionally intense rainfall events or prolonged river overflow. The Moderate Flood Hazard category occupies 25.64% of the state and represents transitional zones where environmental and hydrological conditions increase flood susceptibility. Communities within these areas may experience periodic flooding, particularly during years of above-average rainfall or when water levels in the Rivers Niger and Benue

rise substantially. These locations require continuous monitoring, improved drainage infrastructure, and effective flood preparedness programmes. Areas classified as Very Low Flood Hazard account for 22.53% of the state's land area. These locations are generally situated on relatively elevated terrain with favourable drainage characteristics and greater distances from flood-prone river corridors. Consequently, they experience comparatively lower flood frequencies and reduced exposure to riverine inundation. Nevertheless, localized flooding resulting from poor drainage or extreme rainfall events may still occur.

The High Flood Hazard category represents 7.43% of Kogi State. These areas are predominantly located along major river channels and floodplains where low elevations, gentle slopes, and proximity to the Rivers Niger and Benue significantly increase flood risk. Communities within this category are exposed to frequent inundation, resulting in substantial damage to settlements, agricultural lands, transportation networks, and public infrastructure. These findings underscore the need for strengthened early warning systems, resilient infrastructure, and improved land-use planning. The Very High Flood Hazard category constitutes the smallest proportion of the study area (1.28%), yet it represents the areas facing the greatest flood risk. These zones are concentrated around the Niger–Benue confluence, particularly within Lokoja and parts of Bassa and Kogi (Koton-Karfe) Local Government Areas. The combination of extremely low elevation, close proximity to major river channels, and the hydrological influence of the confluence makes these communities highly vulnerable to recurrent flooding.

Overall, the analysis demonstrates that while approximately 65.61% of Kogi State falls within the combined very low and low flood hazard categories, about 34.35% lies within the moderate, high, and very high hazard classes. This indicates that more than one-third of the state requires enhanced flood risk reduction measures, including hazard-informed land-use planning, improved early warning systems, ecosystem restoration, resilient infrastructure development, and community-based disaster risk reduction programmes. The concentration of high-risk zones along the Niger–Benue floodplain further highlights the importance of integrating GIS-based flood hazard assessments into disaster preparedness, emergency response planning, and sustainable post-flood recovery strategies.

Figure 4.2 Flood Hazard Distribution in Kogi State



Post flood recovery strategies

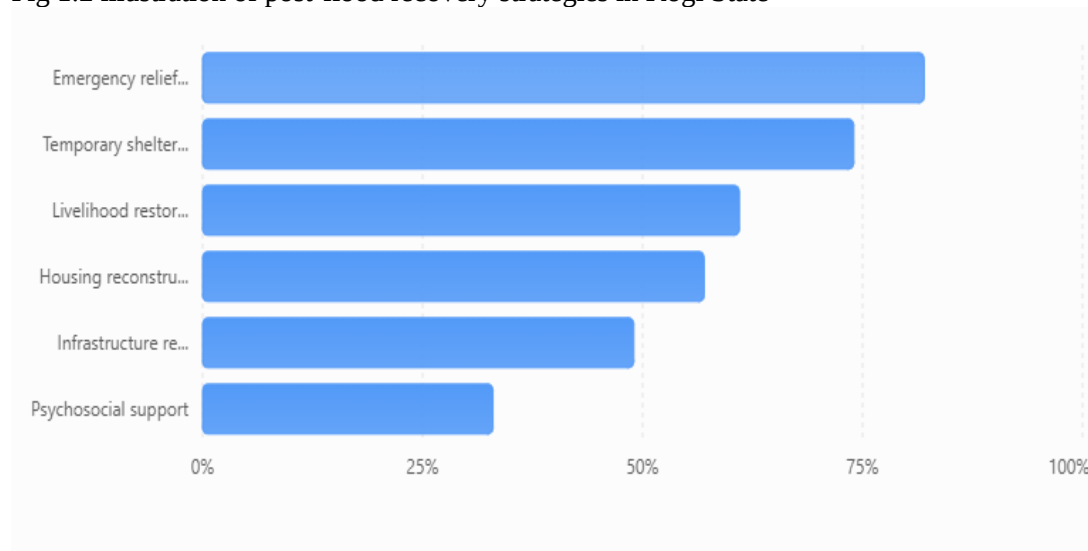
The bar chart indicates that emergency relief assistance (82%) was the most commonly reported post-flood recovery strategy, suggesting that immediate humanitarian support remains the primary intervention following flood disasters. Temporary shelter provision

(74%) was the second most common strategy, reflecting efforts to provide short-term accommodation for displaced households.

Livelihood restoration (61%) and housing reconstruction (57%) were implemented to a moderate extent, indicating that although recovery activities extended beyond emergency response, they were less widespread than relief distribution. Infrastructure rehabilitation (49%) received comparatively lower attention, suggesting that repairs to roads, drainage systems, schools, and public facilities may not have kept pace with recovery needs.

The least reported strategy was psychosocial support (33%), implying that mental health services and trauma counselling were not widely available despite the significant emotional and social impacts of flooding. Overall, the pattern suggests that post-flood recovery efforts were largely focused on short-term relief rather than comprehensive, long-term resilience building.

Fig 1.2 illustration of post-flood recovery strategies in Kogi State



Source fieldwork (2026)

Challenges Affecting Post-Flood Recovery

Table 1.1 presents the major challenges affecting post-flood recovery in the selected flood-prone communities of Kogi State. The findings show that inadequate funding was the most significant challenge, reported by 168 respondents (84.0%). This suggests that limited financial resources constrain the implementation of recovery programmes, infrastructure reconstruction, and livelihood restoration activities. The second most prominent challenge was poor institutional coordination, identified by 152 respondents (76.0%). This indicates that ineffective collaboration among disaster management agencies, local governments, humanitarian organizations, and community groups reduces the efficiency of post-flood recovery operations.

Similarly, inadequate infrastructure was reported by 145 respondents (72.5%), implying that damaged transportation networks, drainage systems, schools, healthcare facilities, and public utilities hinder timely recovery and increase community vulnerability. The table further

reveals that weak early warning systems were identified by 131 respondents (65.5%), indicating deficiencies in flood forecasting, risk communication, and dissemination of timely warnings to vulnerable populations. This limits preparedness and contributes to greater disaster impacts. Furthermore, limited community participation was reported by 124 respondents (62.0%), suggesting that insufficient involvement of local communities in decision-making and recovery planning undermines ownership and the long-term sustainability of recovery initiatives. Finally, poor land-use planning was identified by 118 respondents (59.0%) as a significant challenge. The continued development of settlements within floodplains and inadequate enforcement of land-use regulations contribute to recurrent flood damage and increase the complexity of post-flood recovery. Overall, the findings indicate that financial constraints, institutional weaknesses, infrastructure deficits, ineffective early warning systems, limited stakeholder participation, and inadequate land-use planning collectively impede sustainable post-flood recovery in Kogi State. Addressing these challenges will require strengthened institutional collaboration, increased investment in resilient infrastructure, improved flood risk communication, active community engagement, and stricter enforcement of land-use planning policies.

Table 1.1 Challenges Affecting Post-Flood Recovery

Challenge	Frequency (n)	Percentage (%)	Brief Interpretation
Inadequate funding	168	84.0	This was the most frequently reported challenge, indicating that insufficient financial resources significantly hinder effective recovery and reconstruction efforts.
Poor institutional coordination	152	76.0	A large proportion of respondents identified weak coordination among government agencies, NGOs, and community organizations as a major obstacle to successful recovery.
Inadequate infrastructure	145	72.5	Damaged roads, bridges, drainage systems, and public facilities delayed the implementation of recovery programmes and reduced accessibility to affected communities.
Weak early warning systems	131	65.5	Many respondents reported inadequate dissemination of flood warnings, limiting preparedness and increasing vulnerability during flood events.
Limited community participation	124	62.0	The findings suggest that affected communities were not sufficiently involved in planning and implementing recovery interventions, reducing the effectiveness and sustainability of recovery efforts.
Poor land-use planning	118	59.0	Continued settlement in flood-prone areas and weak enforcement of planning regulations contributed to repeated flood losses and delayed recovery.

Source: Field Survey, 2026.

Discussion of Results

This study examined risk reduction strategies employed during post-flood recovery in selected flood-prone communities in Kogi State, Nigeria, with particular emphasis on spatial flood vulnerability, existing recovery interventions, and the major challenges affecting sustainable recovery. The findings provide important evidence on the need to strengthen disaster risk reduction through integrated, community-centred, and resilience-oriented approaches.

The GIS analysis revealed considerable spatial variation in flood vulnerability across Kogi State, with communities located around the confluence of the Rivers Niger and Benue, particularly Lokoja, Ibaji, Bassa, Ajaokuta, Kogi (Koton-Karfe), and Idah, exhibiting the highest flood susceptibility. These findings are consistent with previous studies that identified proximity to major river channels, low elevation, and poor drainage characteristics as the principal determinants of flood vulnerability in Kogi State.

The concentration of highly vulnerable communities within the Niger–Benue floodplain demonstrates the significant influence of hydrological and topographical conditions on flood occurrence. This finding supports the argument that flood hazard mapping using Geographic Information Systems (GIS) provides an effective basis for identifying vulnerable communities, prioritizing mitigation investments, and guiding disaster preparedness planning. The findings are consistent with previous studies that reported the usefulness of GIS-based multi-criteria analysis for flood hazard assessment and vulnerability mapping in Nigeria and other developing countries.

Furthermore, the results reinforce the recommendations of the Sendai Framework for Disaster Risk Reduction (2015–2030), which advocates understanding disaster risk as the foundation for effective disaster governance, preparedness, and sustainable recovery. The identification of high-risk communities provides valuable evidence for government agencies to improve land-use planning, regulate settlement within floodplains, strengthen evacuation planning, and promote resilient infrastructure development.

The flood hazard analysis showed that approximately 43.08% of Kogi State falls within the low flood hazard category, while 25.64% lies within the moderate hazard zone. Although only 8.71% of the state was classified as high or very high hazard, these areas represent the most vulnerable communities because of their repeated exposure to river flooding. Approximately one-third of the state (34.35%) falls within the combined moderate, high, and very high flood hazard categories, indicating that a substantial proportion of Kogi State remains vulnerable to future flood disasters.

These findings corroborate previous flood vulnerability assessments, which concluded that flood hazards in Kogi State are largely influenced by topography, river proximity, rainfall intensity, and drainage characteristics. They further demonstrate that flood risk cannot be adequately managed through emergency response alone but requires comprehensive mitigation strategies that integrate engineering measures, environmental conservation, floodplain management, and community preparedness.

The study found that emergency relief assistance constituted the most common post-flood recovery intervention, followed by temporary shelter provision. Conversely, livelihood restoration, housing reconstruction, infrastructure rehabilitation, and psychosocial support received comparatively lower attention.

These findings suggest that post-flood recovery efforts in Kogi State remain largely reactive and humanitarian-oriented rather than resilience-driven. While emergency relief is essential during the immediate aftermath of disasters, sustainable recovery requires long-term investments in livelihood restoration, resilient infrastructure, housing reconstruction, environmental rehabilitation, and community capacity development. The findings agree with earlier research indicating that disaster management in Nigeria has traditionally emphasized emergency response at the expense of long-term recovery planning. They also support the Build Back Better principle promoted under the Sendai Framework, which encourages governments to reconstruct communities in ways that reduce future vulnerability instead of restoring previous weaknesses. The relatively low emphasis on psychosocial support further indicates that emotional trauma, mental health challenges, and social recovery receive insufficient attention despite their importance in long-term community resilience. This observation aligns with international disaster recovery literature emphasizing that effective post-disaster recovery should address physical, social, economic, environmental, and psychological dimensions simultaneously.

The study identified inadequate funding as the most significant challenge affecting post-flood recovery, followed by poor institutional coordination, inadequate infrastructure, weak early warning systems, limited community participation, and poor land-use planning. The prominence of inadequate funding indicates that financial constraints continue to limit the implementation of recovery programmes, infrastructure rehabilitation, livelihood restoration, and disaster preparedness initiatives. Without sufficient financial resources, many recovery interventions remain incomplete or unsustainable. Similarly, poor institutional coordination among disaster management agencies, local governments, humanitarian organizations, and community stakeholders reduces the effectiveness of recovery programmes. Fragmented responsibilities often result in duplication of efforts, inefficient resource allocation, and delayed implementation of recovery projects.

The findings further demonstrate that weak early warning systems continue to expose communities to avoidable flood losses. Although advances have been made in flood forecasting, effective dissemination of warnings at the community level remains inadequate. This finding supports previous studies that identified communication gaps as one of the major weaknesses in Nigeria's flood management system. Limited community participation also emerged as a major challenge. This finding suggests that affected communities are often excluded from planning, implementing, and monitoring recovery programmes. International best practices indicate that community participation enhances ownership, improves local knowledge integration, strengthens accountability, and increases the sustainability of recovery interventions. Poor land-use planning remains another critical challenge contributing to repeated flood disasters. Continued settlement within floodplains, weak enforcement of planning regulations, and uncontrolled urban expansion significantly increase community exposure to flood hazards. These findings support previous recommendations advocating stricter enforcement of land-use policies and the integration of flood hazard maps into physical development planning.

Overall, the findings demonstrate that sustainable post-flood recovery in Kogi State requires a strategic transition from reactive emergency response toward proactive disaster risk reduction. Government agencies should strengthen institutional coordination, increase investment in resilient infrastructure, improve early warning systems, expand community participation, and integrate GIS-based hazard assessments into planning and decision-making.

Furthermore, adopting nature-based solutions, ecosystem restoration, floodplain conservation, resilient housing programmes, and livelihood diversification will substantially enhance long-term resilience. These interventions are consistent with the priorities of the Sendai Framework for Disaster Risk Reduction and the Sustainable Development Goals, particularly those relating to resilient cities, climate action, poverty reduction, and sustainable environmental management.

Conclusion

This study assessed the risk reduction strategies employed during post-flood recovery in flood-prone communities of Kogi State, Nigeria. The findings demonstrate that flooding remains one of the most significant environmental hazards affecting the socio-economic wellbeing of residents because of the state's geographical location at the confluence of the Rivers Niger and Benue. The GIS-based analysis confirmed that communities located within low-lying floodplains are disproportionately exposed to recurrent flooding, resulting in widespread destruction of infrastructure, agricultural lands, residential buildings, and livelihoods.

The study further revealed that post-flood recovery efforts in Kogi State are largely dominated by short-term emergency interventions such as relief distribution and temporary shelter provision, while comparatively less attention is given to long-term resilience-building measures, including livelihood restoration, resilient infrastructure development, psychosocial support, and environmental rehabilitation. The findings also identified inadequate funding, weak institutional coordination, poor land-use planning, limited community participation, inadequate infrastructure, and ineffective early warning systems as the major constraints to sustainable post-flood recovery.

Overall, the study concludes that sustainable post-flood recovery cannot be achieved through emergency response alone. Rather, it requires a comprehensive disaster risk reduction approach that integrates scientific flood risk assessment, GIS-based planning, resilient infrastructure, ecosystem restoration, effective governance, community participation, and climate adaptation. Strengthening institutional capacity and promoting proactive disaster management will significantly reduce future flood losses and improve community resilience in Kogi State.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

1. **Strengthen Early Warning Systems:** Government agencies should improve flood forecasting and establish effective community-based early warning dissemination

mechanisms using radio, mobile communication technologies, social media, and traditional communication channels.

2. Promote GIS-Based Flood Risk Planning: Federal, state, and local governments should integrate Geographic Information System (GIS)-based flood hazard and vulnerability maps into physical development planning, land administration, and disaster preparedness programmes.
3. Improve Institutional Coordination: Stronger collaboration should be established among the National Emergency Management Agency (NEMA), Kogi State Emergency Management Agency (KOSEMA), Nigeria Hydrological Services Agency (NIHSA), Nigerian Meteorological Agency (NiMet), local governments, humanitarian organizations, and community-based organizations to enhance coordinated disaster response and recovery.
4. Increase Investment in Resilient Infrastructure: Government should prioritize the construction and rehabilitation of flood-resistant roads, bridges, drainage systems, schools, healthcare facilities, and public utilities capable of withstanding future flood events.

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