WASCAL
West African Science Service Centre on Climate Change and Adapted Land Use

Federal Ministry of Education and Research

POLICY BRIEF

CLIMATE CHANGE AND THE RIVER NIGER:
IMPACTS AND POLICY IMPERATIVES FOR LOKOJA AND NIAMEY

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EXECUTIVE SUMMARY

Lokoja (Nigeria) and Niamey (Niger) are increasingly exposed to rising flood risks due to the impacts of climate change, characterised by intensified rainfall and extreme hydrological events. This research assessed the effects of these changes on flood dynamics, using household surveys, Landsat satellite imagery and a multi-criteria analysis based on GIS. The research proposed adaptation strategies, including resilient infrastructure, risk zone mapping, and ecosystem-based solutions, to strengthen community resilience and mitigate the socio-economic impacts of flooding in these cities.

INTRODUCTION

The increasing frequency of floods in recent decades, particularly in West Africa, has left many regions facing unusual and recurring floods (Nouhou et al, 2025). Communities living in flood-prone areas face increased insecurity, material losses and, in some cases, serious injury or death. The proposed research investigated the impact of climate change and human activities on flood dynamics in Niamey and Lokoja, and explores potential adaptation strategies to mitigate these risks. To this end, the research attempted to assess and model the effect of climate change on the flood dynamics of the Niger River and adaptation strategies in Lokoja and Niamey, West Africa, focusing on flood risk analysis and mitigation.

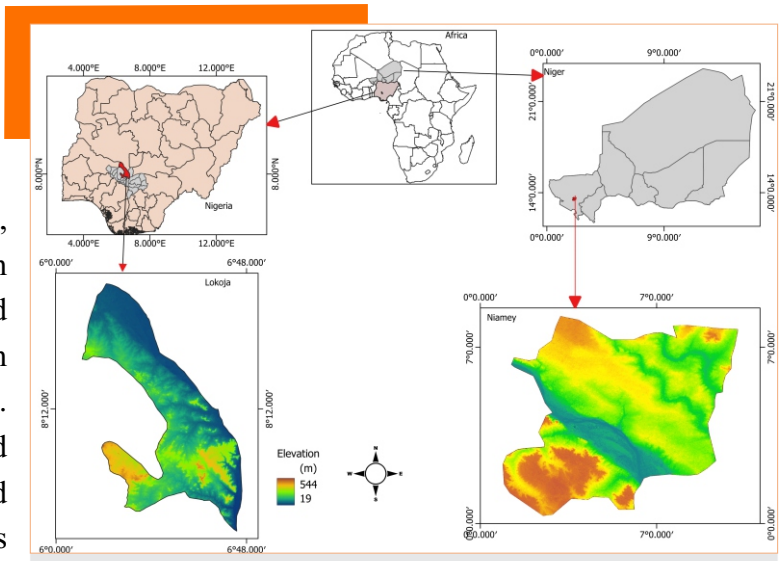

Figure 1. Location of the Study Area

RESEARCH APPROACH

To support evidence-based flood policy in West Africa, this study integrated primary household survey data (768 respondents) with climate records, hydrology datasets, and Landsat imagery from 1991–2021. Land cover dynamics were analysed using Random Forest, while flood risk zones were identified via GIS-based multi-criteria analysis and AHP. HEC-RAS 2D simulations modelled flood extent under multiple rainfall scenarios. Community perceptions were captured using Likert scales and SWOT analysis. This robust methodological framework supports data-driven decision-making for flood mitigation and land use regulation, strengthening institutional capacity to manage climate risks in transboundary river basins like the Niger.

KEY RESEARCH FINDINGS

1. Land Use and Land Cover Change (LULCC)

Over 30 years, **Niamey's** built-up area quadrupled, reducing green spaces by 45.6% (Figure 2). **Lokoja** expanded moderately, with minimal vegetation loss (Figure 3). The findings stress the urgency of regulating urban sprawl and preserving vegetation to mitigate environmental degradation and strengthen resilience against climate-related risks like flooding

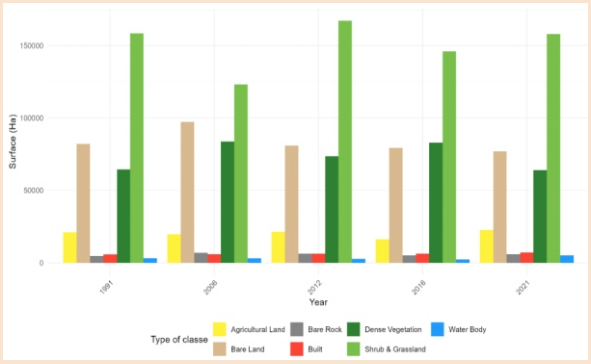

Figure 2. LULC in Niamey from 1988 to 2022

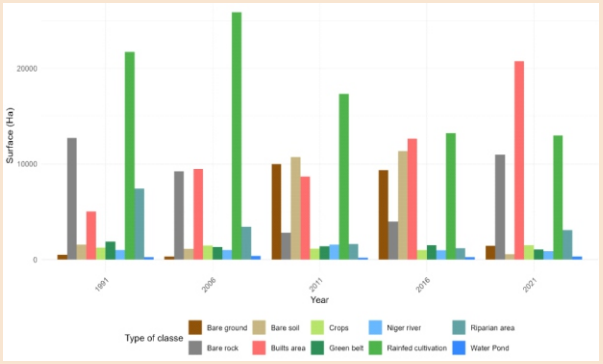

Figure 3. LULC change in Lokoja between 1991 and 2021

2. Assess Flood Vulnerability and Risk Patterns

Flood risk analysis shows 32% of **Niamey** is highly exposed, concentrated near rivers and lowlands, while 31% of city centre areas are moderately risky (Figure 4). **Lokoja** presents a lower 15% high-risk zone near rivers, moderate risk (28%) citywide, and clearly defined north-south vulnerability gradients crucial for zoned interventions. (Figure 5).

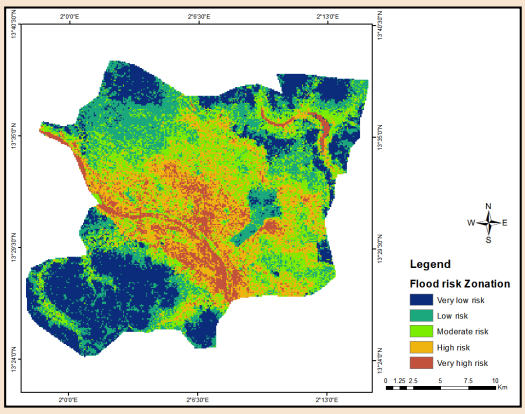

Figure 4. Flood risk zonation of Niamey

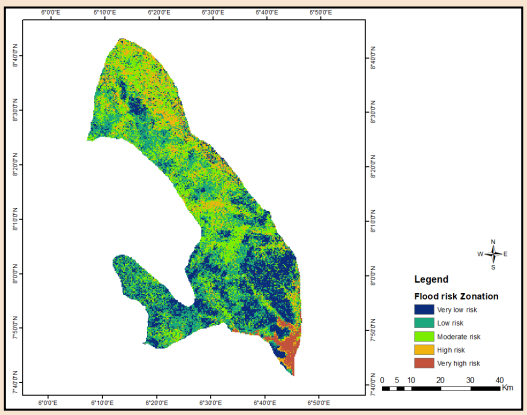

Figure 5. Flood risk zonation of Lokoja

3. Flood scenarios under varying climate change projections

Extreme rainfall causes widespread flooding in **Niamey**, where 95% of areas are highly exposed, largely due to rapid urbanisation and sealed surfaces (Figure 6). Similarly, **Lokoja** faces 92% vulnerability, driven by slope-related runoff (Figure 7). These results underscore the need for nature-based solutions, enhanced urban drainage, and enforcement of land-use regulations.

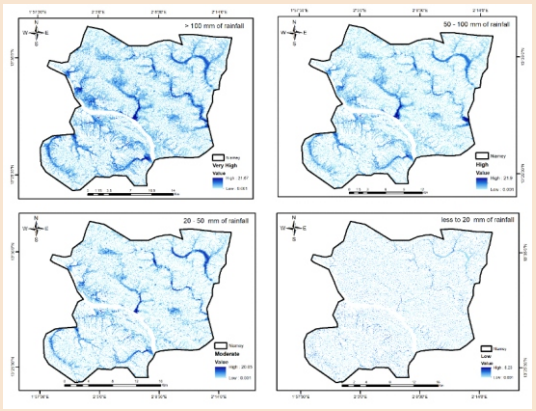

Figure 6: Distribution of Rainfall-Runoff in Niamey as a function of Rainfall Intensity

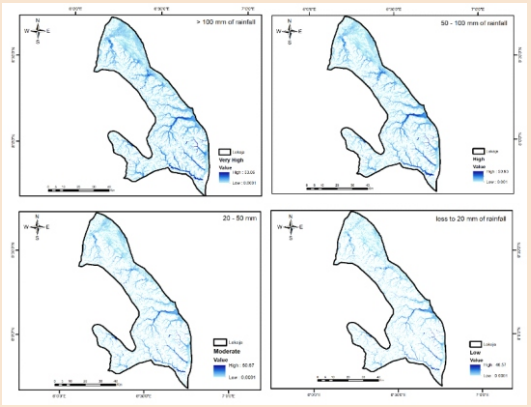

Figure 7: Distribution of Rainfall-Runoff in Lokoja as a function of Rainfall Intensity

4. Development of flood risk management or adaptation strategies

Lokoja residents emphasise proactive government support and early warnings but distrust technical flood solutions. **Niamey** households favour structural and nature-based approaches, yet weak institutional performance hinders effectiveness. MCDA highlights infrastructure (35.46%) and alerts (19.49%) as top priorities. Both cities require hybrid solutions and strengthened governance to bridge policy–implementation gaps.

IMPLICATION OF FINDINGS

This research underscores the inadequacy of current flood strategies amid rising urban vulnerability. Policymakers must shift toward integrated, nature-based solutions—including wetland restoration and spatial planning reforms—paired with real-time monitoring and early warnings. Such adaptive frameworks are vital for protecting urban populations in flood-prone zones of Lokoja and Niamey.

CONCLUSION

This research highlighted how climate-induced extreme events, coupled with uncontrolled urbanisation and land-use shifts, are reshaping flood dynamics in Lokoja and Niamey. It called for proactive, climate-informed adaptation strategies that combine flood modelling, ecological restoration, and resilient urban planning to manage River Niger's evolving flood risks effectively.

POLICY RECOMMENDATION

A comprehensive strategy is essential to improve flood resilience in Lokoja and Niamey. Integrated flood risk management, coupled with cross-border cooperation and institutional coordination, facilitated by the Niger Basin Authority and national agencies, ensures harmonised mitigation through data sharing and policy alignment. Infrastructure improvements and urban planning must enforce land use regulations to avoid high-risk areas, invest in flood control structures such as dykes, and integrate green infrastructure such as permeable surfaces for sustainable urban development. Early warning systems (EWS) and disaster preparedness are essential and require integrated flood and drought alerts, real-time climate services, and community training to enable rapid response.

Nouhou, Y. D., Otache, M. Y., Illiassou, S. A., Okunola, O. H., Okhimamhe, A. A., & Nguyen, T. T. (2025). Flood Risk Assessment and Zoning for Niamey and Lokoja Metropolises in Niger and Nigeria. Hydrology, 12(1), Article 1. https://doi.org/10.3390/hydrology12010017

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