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Types, causes and effects of flooding in Nigeria

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Abstract
Flooding is a prevalent and recurring natural hazard in Nigeria, posing significant socio-economic and environmental challenges. This abstract provides an overview of the various types, causes, and effects of flooding in Nigeria. Firstly, the types of flooding prevalent in the country are explored, including riverine, urban, coastal, and flash floods, each with distinct characteristics and impacts. Next, the underlying causes of flooding in Nigeria are examined, encompassing factors such as heavy rainfall, inadequate drainage systems, deforestation, urbanization, and climate change. These causes often interact and exacerbate flooding, leading to widespread devastation and disruption of livelihoods. Finally, the effects of flooding on communities, infrastructure, agriculture, health, and the environment are outlined, emphasizing the magnitude of the socio-economic and environmental consequences. Understanding the types, causes, and effects of flooding in Nigeria is crucial for the development of effective mitigation and adaptation strategies to minimize risks and enhance resilience in the face of this recurrent natural hazard.

Keywords: Flood, Rainfall, Urbanization,

Introduction

According to the World Health Organization (2022) [20], floods stand as the most common form of natural calamity, arising when an excess of water inundates typically dry land. They are often triggered by intense rainfall, swift snowmelt, or the surge of a tropical cyclone or tsunami in coastal regions. Floods can be described as a substantial amount of water covering normally dry terrain. This phenomenon occurs when water temporarily spreads over an area due to rainfall surpassing the capacity of soil and vegetation to absorb it. The surplus water then flows off the land in quantities exceeding the containment capacity of rivers, streams, ponds, and wetlands. Intense rainfall events periodically lead to rivers breaching their banks, flooding the adjacent floodplains. Floods are a natural occurrence influenced not only by precipitation levels but also by the topography of the region and prior moisture conditions. These events have resulted in the displacement of populations, loss of life, and extensive property damage (Berezi O. K. *et al*., 2019) [8].

Fig 1: (Sotunde, A., 2018). A man makes his way through flood waters in Kogi State, Nigeria

Flooding stands as a significant environmental challenge of our century, particularly affecting many wetlands worldwide (Bariweni *et al*., 2012) [7]. This is largely attributed to the global rise in sea levels driven by climate change, compounded by the already saturated conditions of Nigeria's wetlands. Regular floods occur along numerous rivers, creating what is known as floodplains. These floods are triggered by factors such as heavy rainfall. However, a positive aspect of river overflow is the deposition of sand, silt, and debris onto adjacent land. Once the floodwaters recede and the river returns to its normal course, these deposited materials enrich the soil, making it more fertile. The organic matter and minerals left behind by the floodwaters contribute to soil fertility and productivity (Abowei and Sikoki, 2005) [1].

Floods are typically categorized into various types, including fluvial (riverine), pluvial (ponding), flash, coastal, and urban floods. Fluvial floods occur when rivers overflow their banks due to excessive rainfall. Pluvial floods, on the other hand, happen when intense rainfall saturates natural drainage systems, preventing proper water discharge. Flash floods occur suddenly and rapidly, often with minimal warning, as a result of intense rainfall over a small area. Urban floods stem from inadequate drainage systems in developed areas, where impermeable surfaces replace permeable soil, causing increased runoff and subsequent flooding of rivers, roads, and parks. Coastal floods occur when coastal areas are inundated by the sea, which can breach flood defenses like sea walls due to factors such as storms, high tides, tsunamis, or a combination of these factors (Berezi O. K. *et al*., 2019) [8].

The flooding in Yenagoa, Bayelsa State, Nigeria in 2022 had severe repercussions for its residents, with significant damage inflicted on various properties such as televisions, radios, furniture, and appliances like refrigerators. Among these, beds and rugs suffered the most, likely due to their propensity to absorb and retain water. Additionally, the flooding contaminated the drinking water sources, particularly affecting those reliant on rivers, open wells, and boreholes, which were left unprotected and vulnerable.

According to a study conducted by Ajumobi *et al*. (2023) [4], a considerable portion (71%) of respondents experienced building collapses, necessitating temporary relocation to drier areas until their residences could be repaired post-flooding. This displacement placed substantial stress on affected individuals due to increased costs associated with finding alternative accommodations and transportation during the flood period. Furthermore, the destruction of agricultural produce led to a notable spike in food prices.

The flooding also exacerbated health concerns, with prevalent issues including diarrhea, measles, coughs, and malaria (Ajumobi *et al*., 2023) [4]. Adeboyejo *et al*. (2022) [2] emphasized the significance of a healthy environment in urban settings to enhance the quality of life for residents.

Types of Flooding

According to (Maddox, 2014) [11] some types of flooding and their characteristic include the following:

1. Coastal (Surge Flood)

Coastal flooding, occurring in areas bordering seas or oceans, is typically caused by severe weather conditions leading to extreme tidal effects. The primary culprit behind such flooding is storm surge, generated when powerful winds from hurricanes or other storms force water onto the shore. This phenomenon poses a significant threat during tropical storms, often resulting in substantial loss of life and property damage as low-lying lands are inundated.

The severity of coastal flooding is classified into three levels:

- Minor: Characterized by slight beach erosion with no significant damage expected.
- Moderate: Involves noticeable beach erosion and damage to some residential and commercial properties.
- Major: Presents a grave danger to both life and property, with extensive beach erosion, widespread road flooding, and substantial structural damage. Residents are advised to heed safety measures and prepare for potential evacuation.

Various factors influence the severity of coastal flooding, including the intensity, size, speed, and trajectory of the storm, as well as the geographical features both onshore and offshore. Coastal flood models utilize this information along with historical storm data and the density of nearby development to assess the likelihood and impact of storm surges.

Fig 2: (Von Radowitz, J. 2013) Coastal flooding

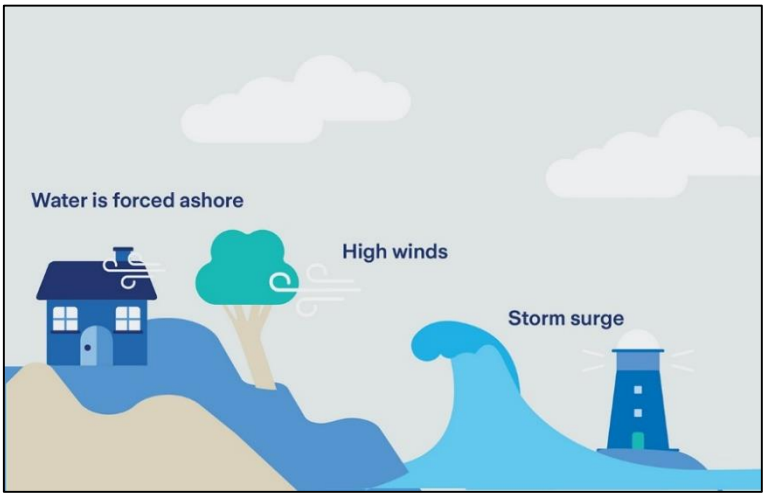

Fig 3: Coastal flooding (Zurich Resilience Solutions 2023)

2. Fluvial (River Flood)

Fluvial or riverine flooding arises when prolonged heavy rainfall or rapid snowmelt surpasses a river's capacity, potentially leading to widespread damage. This overflow can result in breaches of dams and dikes, affecting downstream areas. There are two primary forms of riverine flooding: overbank flooding, where water spills over a river or stream's edges, and flash flooding, characterized by sudden, powerful torrents of water within river channels, often with minimal warning and carrying dangerous debris.

The severity of such floods depends on factors like precipitation levels, duration of accumulation, soil saturation, and terrain. Floodwater may rise gradually in flat areas, persisting for days, while in hilly or mountainous regions, flooding can occur rapidly, sometimes within minutes of heavy rainfall. Predicting river flooding involves assessing past and forecasted precipitation, current river levels, and temperatures (adapted from Maddox, 2014) [11].

Fig 4: (Schmidt, K. 2019). Spring-Flooding-Mississippi-River

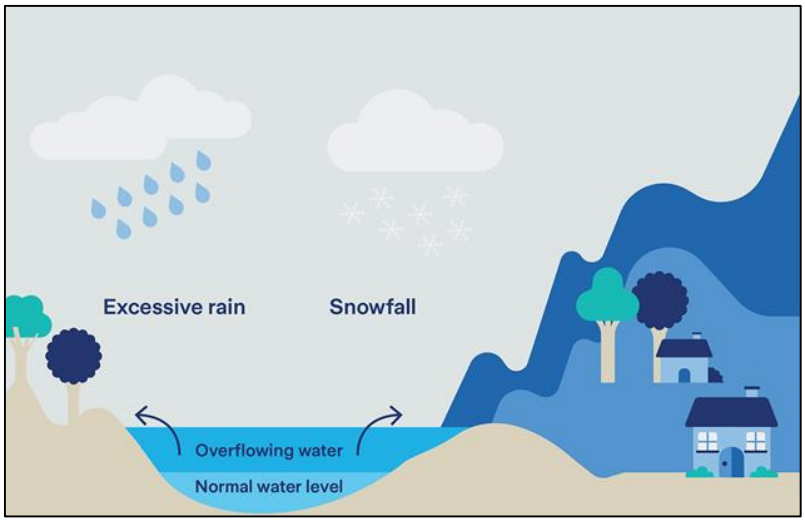

Fig 5: Fluvial flooding (Zurich Resilience Solutions, 2023)

Pluvial (Surface Flood)

Pluvial flooding, also known as surface water flooding, occurs when heavy rainfall leads to a flood event independently of overflowing water bodies. Contrary to popular belief, flood risk isn't confined to areas near bodies of water. Pluvial flooding can happen in any urban setting, including higher elevation regions above coastal and river floodplains (Maddox, 2014) [11].

There are two main types of pluvial flooding

1. Intense rainfall overwhelms urban drainage systems, causing water to overflow into streets and nearby structures.
2. Rainwater runoff from hillsides, unable to be absorbed, contributes to flooding. Hillsides affected by recent forest fires and suburban communities on hillsides are particularly susceptible.

Pluvial flooding often combines with coastal and fluvial flooding. Despite typically being only a few centimeters deep, pluvial floods can result in significant property damage.

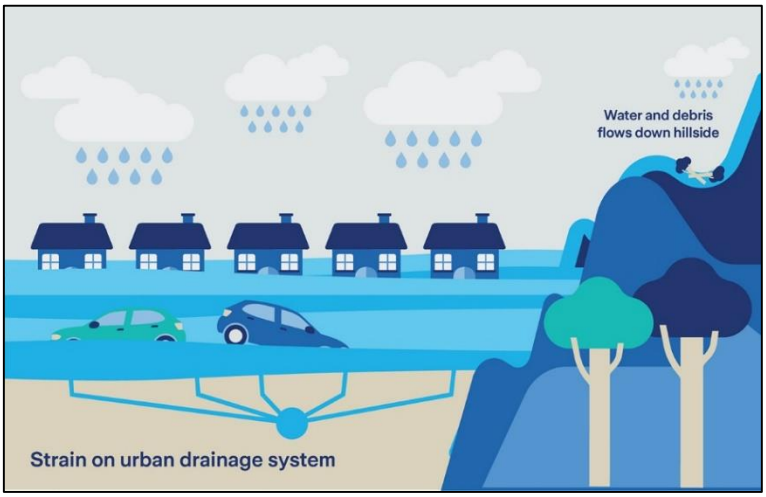

Fig 6: Pluvial flooding (Zurich Resilience Solutions, 2023)

Effects of Flooding

Flooding presents numerous severe adverse effects across social, economic, and environmental domains (Apan *et al*., 2010) [6]. Among the detrimental consequences are property, crop, and livestock damage, loss of human life, health complications, and infrastructure destruction such as roads, bridges, and power plants. Furthermore, flooding disrupts economic pursuits and the livelihoods of affected individuals (Ajayi, 2012) [3]. Despite these drawbacks, flooding also serves significant environmental functions. It replenishes groundwater systems, replenishes wetlands, facilitates nutrient transfer within ecosystems, enhances fishing opportunities, and stimulates dispersal, migration, and breeding processes (Jeffrey, 2010; Iwena, 2015) [10, 9].

(Bariweni *et al*., 2012) [7] Stated that there are several factors which determine how severe flood impacts would be, they include:

1. **The degree of foreseeability:** This impacts the timing, precision, and communication of warnings issued prior to a flood occurrence.
2. **The speed at which flooding occurs**: The swiftness with which water inundates an area and the pace at which it rises determine the window for preparedness and effective response.
3. **The velocity and depth of inundation:** These factors determine the degree of vulnerability for individuals and property during a flood event. Negotiating even moderately shallow, swiftly moving water can be challenging. Floodwaters often carry debris, including large objects like trees, especially in depths exceeding 1 meter, which can pose significant risks. Rapidly flowing water can exert immense pressure on structures and other elements.
4. **The duration of flooding:** This aspect significantly influences the scale of impact, particularly on individuals and communities affected by the disaster.

Mfon *et al*. (2022) [12] conducted research in Oyo State, Nigeria, where incidences of flooding, as reported by Okeleye *et al*. (2016) [15], were investigated. The researchers gathered data through interviews, structured questionnaires, focused group discussions, and portable GPS devices. Analysis of the data involved both descriptive and inferential statistics. The study revealed several factors contributing to farmers' vulnerability to flood disasters, including the close proximity of farmlands to rivers/streams, inadequate drainage systems, frequent heavy rainfall, and limited support from external entities during flooding events. Although flooding significantly affected farmlands, its impact on houses was comparatively limited. The research also highlighted the farmers' low coping mechanisms, attributed to the lack of access to insurance facilities, timely and accurate flood early warning systems, local flood signs, and community flood management committees. Moreover, a significant relationship was observed between farmers' vulnerabilities and their livelihoods. To mitigate these vulnerabilities and improve farmers' livelihoods, the study recommended that the government and relevant agencies should focus on providing adequate drainage systems, weather forecasts, insurance facilities, and timely flood early warning systems.

Ani *et al*. (2020) [5] demonstrated that floods have profound impacts on the economic activities of individuals, the environment, and both human and animal populations. Nnodim and Ezekiel (2020) [13] investigated the perceived effects of recurrent flooding on the livelihoods of rural

residents in the Orashi Region of Rivers State. Employing a descriptive survey approach, they gathered data from rural inhabitants in flood-affected communities within the Orashi region. Through simple random sampling, they selected 150 individuals for their study. Their findings indicated that the causes of flooding in rural areas of the Orashi region include prolonged rainfall, river overflow, ongoing discharge of surplus water from man-made reservoirs, and climate change, among other factors. Additionally, they discovered that flooding inundates farmlands, damages crops and irrigation infrastructure, ruins harvested produce, and adversely affects fish farming by facilitating the spread of diseases among fish populations. Furthermore, flooding leads to river and stream pollution, resulting in the destruction of fish and other aquatic organisms. They suggested that planning authorities should implement and enforce regulations aimed at flood prevention. Flooding has been recognized as profoundly detrimental to human livelihoods due to its destructive impact. According to Ojikpong *et al*. (2016) [14], flooding results in loss of life, damage to property, and disruption of socio-economic activities. However, the extent of damage caused by floods varies depending on factors such as the timing and season of the floods, geographical location, condition of embankments and roads, river encroachment, state of drainage systems, and past experiences with floods and their management strategies. Consequently, flooding affects the livelihoods of both rural and urban residents in numerous ways. For example, it can lead to the collapse of buildings and bridges, inundation of farmlands and markets, and destruction or washing away of crops.

(Oruonye *et al*., 2017) [16]. Investigated the impact of flood disasters on rural livelihoods and coping strategies in the Lau Local Government Areas of Taraba State, Nigeria. Their results demonstrated that floods have detrimental effects on the socio-economic status and means of living of the local populace. They pointed out that flood occurrences significantly damaged the economy of the rural communities in Taraba. Specifically, they observed that agricultural lands were inundated, leading to the destruction of crops and subsequently affecting the environment through severe gully erosion.

Conclusions and Recommendations

In Nigeria, flooding is a serious problem that claims millions of lives and seriously damages ecosystems, agriculture, and infrastructure. A multifaceted strategy is needed to address this problem, one that includes recognizing the different types, figuring out the underlying reasons, and minimizing the negative effects. The following suggestions are meant to address the intricacies of floods in Nigeria:

1. Enhance Early Warning Systems

Implement and strengthen early warning systems across all regions of Nigeria, utilizing advanced technology such as weather monitoring satellites, radar systems, and community-based alert mechanisms. This will enable timely dissemination of information to vulnerable communities, allowing them to take proactive measures in response to impending flood events.

2. Improve Infrastructure Resilience

Invest in the construction and maintenance of resilient infrastructure, including drainage systems, levees, dams, and flood barriers. Infrastructure upgrades should be designed to withstand extreme weather events, considering the diverse geographical and climatic conditions across Nigeria. Additionally, promote nature-based solutions such as wetland restoration and afforestation to enhance natural flood mitigation.

3. Enhance Urban Planning and Land Use Management

Revise urban planning policies to prioritize flood risk management and resilience. Implement zoning regulations that restrict development in flood-prone areas and promote sustainable land use practices. Encourage the adoption of green building techniques, such as rainwater harvesting and permeable pavements, to reduce surface runoff and alleviate pressure on drainage systems in urban areas.

4. Strengthen Environmental Conservation Efforts

Preserve and restore natural ecosystems, including wetlands, forests, and river basins, which play a crucial role in regulating water flow and mitigating flood risk. Implement strict enforcement of environmental laws to prevent deforestation, illegal mining, and land degradation, which exacerbate soil erosion and increase the likelihood of flash floods.

5. Enhance Community Resilience and Capacity Building

Empower local communities through education, training, and capacity-building initiatives on disaster preparedness, response, and recovery. Foster community-led initiatives for sustainable water resource management, flood risk mapping, and livelihood diversification to enhance resilience to flooding impacts.

6. Promote Cross-Sectoral Collaboration and Governance

Establish multi-stakeholder platforms involving government agencies, civil society organizations, academia, and the private sector to foster collaboration and coordination in flood risk management efforts. Develop integrated policies and strategies that address the interconnectedness of water, land, and climate-related issues to build a more resilient and adaptive society.

References

1. Abowei JFN, Sikoki FD. Water Pollution Management and Control. Port Harcourt: Double Trust Publications Co.; 2005. p. 236.
2. Adeboyejo, Boluwaduro, Kure Miracle, Onamade Akintunde, Gbolade Oreoluwa, Archibong Sharon. Inclusive and Healthy Urban Environment in the Global South: Definition, Characteristics and Benefits. Asian Journal of Geographical Research. 2022; 5:44-51. doi:10.9734/ajgr/2022/v5i4170.
3. Ajayi O, Agboola SB, Olokesusi BF. Hydrology for disaster management. Special publication of the Nigerian Association of Hydrological Sciences. [Internet]. [cited December 2012]. Available from: http://www.unaab.edu.ng.
4. Ajumobi V, Womboh S, Ezem S. Impacts of the 2022 Flooding on the Residents of Yenagoa, Bayelsa State, Nigeria. [Internet]. 2023 [cited January 2nd, 2024]. Available from: [link not provided].
5. Ani CN, Ezeagu CA, Nwaiwu NK, Ekenta EO. Analysis of factors influencing flooding and vulnerability assessment of Awka and its environs. Am J Eng Res. 2020; 9(5):34-45.

6. Apan A, Keogh DU, King D, Thomas M, Mushtaq S, Baddiley P. The 2008 floods in Queensland: a case study of vulnerability, resilience and adaptive capacity. Report for the National Climate Change Adaptation Research Facility. Gold Coast. [Internet]. 2010. Available from: http://www.nccarf.edu.au/node/216.
7. Bariweni PA, Tawari CC, Abowei JFN. Some Environmental Effects of Flooding in the Niger Delta Region of Nigeria. Int J Fish Aquat Sci. 2012; 1(1):35-46.
8. Berezi, Obafemi Andrew, Nwankwoala Hycienth. Flood Vulnerability Assessment of Communities in the Flood Prone Areas of Bayelsa State, Nigeria. [Internet]. 2019. p. 5-19. Available from: [link not provided].
9. Iwena OA. Essential geography for senior secondary schools. Port Harcourt: Tonad Publishers Limited; 2015.
10. Jeffrey HJ. Paris under water: How the city of light survived the great flood of 1910. New York: Palgrave Macmillan; 2010.
11. Maddox I. Three Common Types of Flood Explained. [Internet]. 2014. Available from: https://www.intermap.com/risks-of-hazard-blog/three-common-types-of-flood-explained. Retrieved on February 15th, 2024.
12. Mfon IE, Oguike MC, Eteng SU, Etim NM. Causes and Effects of Flooding in Nigeria: A Review. Int J Soc Sci Hum Res. 2022; 5(10):4526–4533. doi:10.47191/ijsshr/v5-i10-16
13. Nnodim AU, Ezekiel C. Perceived Impact of Perennial Flooding on Livelihood Activities of Rural Dwellers of Orashi Region of Rivers State. Int J Innov Human Ecol Nature Stud. 2020; 8(2):12-18.
14. Ojikpong BE, Ekeng EE, Obongha UE, Emri SI. Flood risk assessment of residential neighbourhoods in Calabar Metropolis, Cross River State, Nigeria. Environ Nat Resour Res. 2016; 6(2):115-127.
15. Okeleye SO, Olorunfemi FB, Sogbedji JM, Aziadekey M. Impact assessment of flood disaster on livelihoods of farmers in selected farming communities in Okeogun Region of Oyo State, Nigeria. Int J Sci Eng Res. 2016; 7(8):2067-2083.
16. Oruonye ED, Ahmed MY, Yakubu D, Wui VC, Ejati TDH. Effects of flood disaster on rural livelihood and coping mechanism in Lau Local Government Area, Taraba State, Nigeria. Agric Sci Res J. 2017; 7(3):111–122.
17. Schmidt K. Spring-Flooding-Mississippi-River. [Internet]. 2019. Available from: https://www.gannett-cdn.com/-mm-/849af7f3d3fe9147eaea395074fbae0e08869fe3/c=0-110-3000-1805/local/-/media/2019/05/03/USATODAY/USATODAY/636924740919157801-10-11-AP-APTOPIX-Spring-Flooding-Mississippi-River.JPG?width=3200&height=1680&fit=crop. Retrieved on 15th February, 2024.
18. Sotunde A. A man makes his way through flood waters in Kogi State, Nigeria 768x512.jpg (768×512). [Internet]. 2018. Available from: https://d2c13moo8u717n.cloudfront.net/wp-content/uploads/sites/11/2018/10/10124059/2018-10-10T165310Z_2_LYNXNPEE991I7_RTROPTP_4_NIGERIA-FLOODS-768x512.jpg. Retrieved on 15th February, 2024.
19. Von Radowitz J. Coastal city flooding "could cost more than £600bn a year." The Independent. [Internet]. 2013, August 19. Available from: http://www.independent.co.uk/news/science/coastal-city-flooding-could-cost-more-than-600bn-a-year-8773359.html. Retrieved on 15th February, 2024.
20. World Health Organization. Floods. [Internet]. 2022. Available from: https://www.who.int/health-topics/floods/#tab=tab_1. Retrieved on 15th February 2024.
21. Zurich Resilience Solutions. infographic-coastal-floods-and-storm-surge.jpg (1200×769). [Internet]. 2023. Available from: https://www.zurich.com/-/media/project/zurich/dotcom/industry-knowledge/flood-and-water-damage/images/infographic-coastal-floods-and-storm-surge.jpg?rev=15516d0e2de54752bdfd4af189003661&hash=DAD4DAB64291350A0EB5AFF7A2384B06. Retrieved on 15th February, 2024.
22. Zurich Resilience Solutions. infographic-fluvial-or-river-flood.jpg (1200×769). [Internet]. 2023. Available from: https://www.zurich.com/-/media/project/zurich/dotcom/industry-knowledge/flood-and-water-damage/images/infographic-fluvial-or-river-flood.jpg?rev=e4ae117a400c412a883a3a48e8128cff&hash=C1E289D4E20B11D0E0F676889DA64845. Retrieved on 15th February, 2024.
23. Zurich Resilience Solutions. infographic-pluvial-floods-flash-floods-and-surface-water.jpg (1200×769). [Internet]. 2023. Available from: https://www.zurich.com/-/media/project/zurich/dotcom/industry-knowledge/flood-and-water-damage/images/infographic-pluvial-floods-flash-floods-and-surface-water.jpg?rev=a46c1ad275d046269f7d56bfef5857ea&hash=0FAFA17DADCA25442FA115C7927691C3. Retrieved on 15th February, 2024.