The Bioscan
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
20(2): S2: 498-508, 2025 www.thebioscan.com

Socio-economic Effects of Flood Among Rural and Urban Farm Families in Flood-prone Areas of Imo State, Nigeria

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DOI: 10.63001/tbs.2025.v20.i02.S2.pp498-508

KEYWORDS
Floods, environment, socio-economic, farm families

Received on:
20-03-2025

Accepted on:
25-04-2025

Published on:
28-05-2025

ABSTRACT

This study investigated the socio-economic damages caused by floods in Imo State, Nigeria. A total of 650 farm families were selected randomly and purposively from Flood-prone communities of Imo State, Nigeria. The questionnaire was used to collect information on the causes of floods, damages, control measures, and challenges to the control of floods. Descriptive tools of measurement were used to analyze data. It was found that floods occurred concurrently in most communities from 1999 till year 2024. Floods occur due to two factors: natural causes and human causes of floods. Natural causes include prolonged heavy rainfall (M=3.80), climate change (M=2.78), low-lying topography (M=2.76), among others. The human causes include poor land use (M=3.25), increased urbanization (M=2.44), and blockade of waterways (M=3.05), among other causes. Flood control measures adopted include the construction of embankments (98%), tree planting (88.3%), digging trenches (92.9%), and relocation to safer places (98.6%), among other measures. However, they faced challenges adopting flood control measures, such as fear of being carried by water, low education, and lack of financial support, among other issues. Heavy flood has numerous life-threatening effects classified as environmental, infrastructural, and socio-economic. The infrastructural effects are destruction of utility works and social amenities (98.4%), homelessness and temporary dislocation (96.1%), interruption of the transport system (99.6%), damages to schools' buildings (81.1%) and hospitals, loss of properties, damage to rural and urban roads and many more. The environmental effects of floods include loss of soil nutrients (93.8%), pollution of the environment (96.1%), loss of biodiversity (92.6%), leads to epidemics (89.3%), soil infiltration (76.6%), damages to water quality and quantity (94.9%) and many more. Socio-economic effects include loss of farm crops and farmland (99.5%), hunger and starvation (98.2%), poverty (90.2%), poor health status (94.1%), death of farm animals, damages to aquatic life, and the ultimate loss of human lives.

INTRODUCTION

Agriculture is a fundamental pillar of Nigeria's economy, providing essential employment, food, and income for many Nigerians, especially those living in rural areas (Komolafe et al., 2022). A significant challenge faced by farming livelihoods in Sub-Saharan Africa is the negative effects of floods (Balgah et al., 2023; Mwakyusa et al., 2023). Floods rank among the most prevalent and serious weather events globally. The occurrence of floods is linked to global warming and variations in annual rainfall (Adedapo et al., 2020; Tanoue et al., 2021). Over the years, the global rise in flooding incidents has largely contributed to the impacts of natural disasters on livelihood outcomes and overall human well-being (Agbadaga et al., 2021; Suhr & Steinert, 2022). From 2000 to 2019, floods were the leading cause of global disasters, resulting in more fatalities than any other natural disaster, except droughts (Tanoue et al., 2021). Some significant consequences of floods on farming households include loss of life, loss of livestock, destruction of property, damage to crops, and increased food insecurity (Okeleye et al., 2016).

Nigeria has faced numerous devastating floods attributed to climate variability, displacing millions and causing significant financial losses (Agbadaga et al., 2021; Okeleye et al., 2016). According to Nemine (2015), flooding disasters have severely damaged over one and a half million hectares of land and reduced food production in affected areas. This problem has become recurrent, especially in flood-prone regions where farmers rely on rivers for irrigation during the dry season but are confronted with floods during the rainy season. As noted by Agbadaga et al. (2021), farmers' reliance solely on rainfall is increasingly uncertain due to the negative impacts of climate variability. The consequences of the recent flooding events in Nigeria continue to raise concerns regarding food security, particularly for rural farmers who have limited financial means to adopt various adaptation measures (Nkwunonwo et al., 2015).

Flooding is a natural disaster defined by the overflow of water from a source, particularly a water body, which threatens lives and property (World Food Programme, 2009). It is a prevalent disaster occurring throughout various regions of the world, leading to the loss of a third of lives, property damages, and injuries resulting from natural disasters (Askew, 2007; UNISDR, 2012). In Nigeria, the situation is similar, with numerous instances of flooding reported in major towns and cities. The causes of these floods often include heavy rainfall, careless waste disposal, and human activities in flood-prone areas (Fadairo and Olarewaju, 2009). Additionally, other factors such as dam failures can also lead to flooding. An example is the flood of October 2013, which had widespread national implications. This disaster displaced approximately 111,255 and 50,715 individuals in Taraba and Ebonyi States, respectively, resulting in two fatalities in Ebonyi (Nkeki, Henah, and Ojeh, 2013; SEMA, 2017). The increased rainfall over recent decades has exacerbated the flooding issue globally, particularly in Nigeria, where flooding has become an annual occurrence (Onokerhoraye, 2008; Nwaubani, 2010). Despite the dangers posed by flooding, local inhabitants in flood-prone areas have been hesitant to leave permanently. This reluctance stems from the knowledge, experiences, and practices they have developed over centuries, passed down through generations to achieve subsistence and sustainably manage their environment (Ajibade, 2003).

The Intergovernmental Panel on Climate Change (IPCC) indicated in 2007 that the increase in flooding and other severe weather events is linked to the rise in the global average temperature. Over time, researchers monitoring global temperatures have noted a subtle, consistent rise in the average temperature around the world (IPCC, 2007; Harvey, 2008). This increase in global temperatures leads to warmer oceans, the melting of glaciers, and rising sea levels (Gulledge, 2012; Ogbanga, 2015), which all amplify the likelihood of flooding in communities, particularly those situated near coastlines, rivers, and creeks, such as the Niger Delta region, home to the Orashi River. Human activities like improper waste disposal, dam construction, burning fossil fuels, deforestation, and development in flood-prone areas also play a role in both the frequency of flooding and the community's susceptibility to it. Flooding, as described by Asthana and Asthana (2013), can either be confined to specific neighborhoods or communities or be widespread, impacting entire river basins and several states or countries, as witnessed during the flooding events in Nigeria in 2012. No matter the extent, flooding can be lessened by managing human activities.

In Nigeria, approximately 20% of the population is at risk of experiencing different types of flooding (Hula and Udoh, 2015). The impact of flooding is most pronounced in coastal and river-adjacent areas, such as Lokoja, Lagos, Port Harcourt, Benue, and Bayelsa. Floods in Nigeria primarily take the form of three types: coastal flooding, river flooding, and urban flooding (Folorunsho and Awosika, 2001). Additional factors that exacerbate flooding include rising global temperatures, which result in heavier rainfall, the melting of polar ice and glaciers, and the thermal expansion of oceans. In 2017, significant flooding was reported across Lagos, Imo, Abia, Uyo, Calabar, Benue, and nearly all major cities in Nigeria, resulting in malfunctioning drainage systems, damage to homes, and the displacement of people. Around a year ago, a catastrophic and life-threatening flooding incident occurred in Houston, Texas (the fourth-largest city in the United States), rendering numerous individuals homeless and causing billions in property damage. Climate change and global warming have been consistently recognized as major contributors to rising sea and ocean levels, which leads to an uptick in the frequency of flooding events.

Flooding can occur in flat or low-lying areas when the ground becomes saturated, and water cannot run off quickly enough, resulting in accumulation. This accumulation of water is often observed in various locations across Imo State during and sometimes after rainfall in the rainy season. Typically, the areas prone to flooding are characterized by flat or low-lying terrain situated near a river system. In Imo State, the specific locations affected by flooding have not been identified. In light of this, this paper aims to pinpoint the different areas that experience the challenges associated with flooding in the region

Some floods happen during specific seasons, linked to monsoon rains, inundating extensive floodplains or delta areas. Others tend to occur predictably during heavy rainfall or when winter snow begins melting. Flooding can also take place when water rises quickly, preventing it from draining away fast enough. Additionally, floods can develop when a river is unable to manage the volume of water entering its channel, which is typically known as a floodplain. In coastal areas, flooding can occur due to meteorological conditions and tides, causing sea levels to rise. It has been noted that some of these events contribute to the flooding observed in Imo State. What remains uncertain, and is therefore the main focus of this paper, is identifying regions within the State that are vulnerable to floods and understanding the factors leading to flooding in this area. According to the biblical narrative of Earth's creation by God, it is believed that the whole planet once experienced flooding. This is supported by Genesis 1:9, which states, "Let the waters under the heaven be gathered together into one place and let the dry land appear" (New World Translation, 2013; Gideon's International, 1982). The flooding in Imo State has persisted for many years; however, there has been a lack of sufficient documentation regarding the specific years that experienced severe flooding, especially in recent and significant incidents. This paper will also aim to investigate and record the years that have faced flooding, as well as the extent of the resulting damage. Ultimately, flooding leaves a legacy that can be either positive, negative, or a combination of both in any impacted area. In this context, the paper will also examine and identify the wider socioeconomic impacts of flooding in Imo State.

Methodology

Imo State was created in 1976, with 27 Local Government Areas. This state is located in the Southeastern part of Nigeria. Imo lies between the latitudes of 5O10'N-6O00'N and longitudes of 6O40'E-7O23'E of the Greenwich Meridian. Based on information from the Federal Office of Statistics, its total landmass is around 5,530 square kilometers. To the east, it shares a border with Abia State; to the west, it is bordered by Rivers State; to the south, it meets Delta State; and to the north, it is adjacent to Anambra State. Imo State is organized into three zones: Orlu, Owerri, and Okigwe. According to Koppen's classification, the climate in this region is categorized as tropical monsoon (AM). The average yearly rainfall ranges from 2,250mm to 2,500mm. Temperatures throughout the month typically lie between 28°C and 35°C, while the annual average minimum air temperature ranges from 19°C to 24°C. During the rainy season, humidity levels are elevated, averaging around 80-85%, and they decrease to about 60% during the dry season (Duru, 2008). These climatic factors lead to significant rainfall that usually starts in March or later and ends in October. The research centers on Imo State, divided into three senatorial zones, with an emphasis on six local government areas: Orlu and Oguta in the Orlu zone, Owerri Municipal and Ikeduru in the Owerri zone, and Okigwe and Isiala Mbano in the Okigwe zone. The study collected data from both primary and secondary sources. A variety of survey techniques were utilized, including questionnaires, oral discussions, direct observations, official documents, personal papers, online sources, journals, library resources, and textbooks. A purposive random sampling method was used to choose respondents from floodplain areas of the State for data collection (Fig. 1 and Table 1). A total of 650 participants were randomly selected from a larger group of 6,500 individuals, and 650 questionnaires were issued to collect information. The gathered data is presented through frequency tables, means, and percentages.

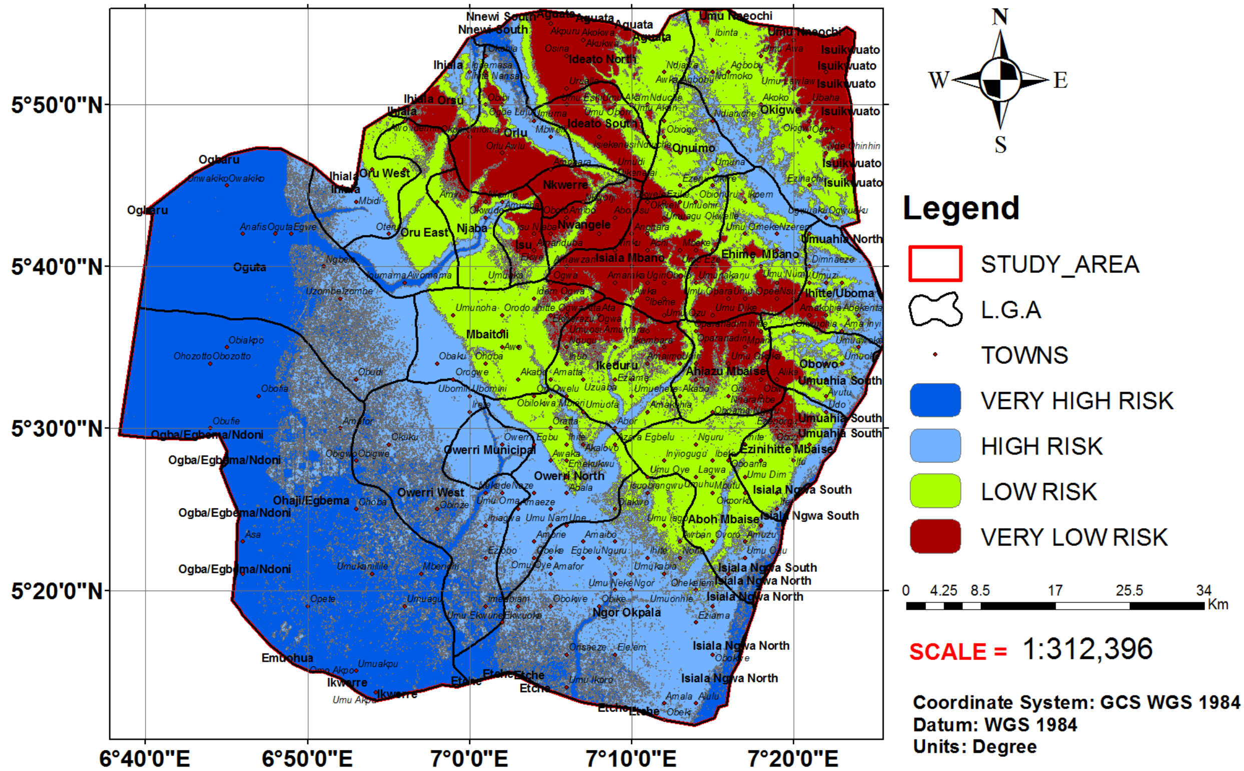

Figure 1: Flood Vulnerability Assessment Model Map of Imo State

Table 1; Flood Vulnerability Risk Class in Imo State

Elevation Above Sea Level (Meters)	**Flood Vulnerability Risk Class**	**Local Government Areas within the Risk Class**
1 - 55	Very High	Ohaji/Egbema, Oguta
55.1 - 143	High	Ezinihite, Ihite Uboma, Ngor Okpala, Obowo, Njaba, Onuimo, Owerri North, Owerri Urban, Owerri West, Oru West, Aboh Mbaise, Mbaitolu
143.01 -208	Low Risk	Ahiazu Mbaise, Ehime Mbano, Isu, Nwangele, Orsu, Isiala Mbano
208.01 - 408	Very Low	Ideato North, Ideato South, Nkwerre, Okigwe, Orlu

Source; Okoroafor et al.,(2021)

Results and Discussion

Locations Affected by Flood in the Study Area

Table 2 indicates that between 1999 and 2024, numerous regions in Imo state have been severely impacted by floods, particularly the areas classified as Flood Vulnerability Risk (FVR) (refer to Table 1). Such regions include Ohaji/Egbema, which comprises communities like Assah, Obile, Obiakpu, Olotu, and Abacheke. In Oguta, areas such as Orsu Obodo, Eziorsu, and Opuma experienced flooding throughout the years from 1999 to 2024. Many farming families were displaced and left without homes. The Owerri-west Area also faced flooding, affecting communities like Amakohia Ubi, Ndegwu, Umuguma, Okuku, and Ohiim. The Works layout, New Owerri, and Aladinma neighborhoods were submerged in the urban region of Owerri in Imo State. Onuimo Local Government Area dealt with significant flooding, as Okwelle, Obinulo, and Ikwuato communities suffered damage, including the destruction of schools, markets, roads, and residential structures. Thousands of individuals were displaced as a result.

This implies that after significant and prolonged rainfall, the resulting runoff will naturally flow toward lower elevations, transitioning from 353 meters above sea level to areas around 10 meters above sea level. This means that zones with low to moderately low elevation levels are prone to extended flooding, functioning as valleys where runoff from higher ground converges and settles. Additionally, runoff generally travels from elevated areas to lower regions according to the slope's steepness. As observed by Njoku et al. in 2013 and Essien et al. in 2018, flooding is more severe in areas positioned at low elevations above sea level, categorizing these regions as floodplains where river channels and runoff gather after substantial rain events. Consequently, the digitized contour map of the study area indicates that the contours (lines on a map representing equal elevation points) reflect similar relief patterns to the Digital Elevation Model (DEM), highlighting the same conclusions regarding water runoff dynamics. Analyzing the various elevation ranges within the study area, Oguta and Ohaji/Egbema Local Government Areas present the highest flood risk due to their lower elevation (1-55m), whereas Ideato North, Ideato South, Nkwerre, Orlu, and Okigwe Local Government Areas demonstrate the lowest flood risk because of their higher elevation (208-408m) above sea level. Other Local Government Areas are positioned between these extremes of high and low flood risk, respectively

Table 2: Locations affected by Flood in Imo State and the Dates of Occurrence.

L. G. A/ Communities	Communities	Year of occurrence
Ohaji/Egbema	Assah, Obile Obiakpu Abacheke Olotu	1999, 2000,2002, 2004,2005,2018,2022, and 2024
Oguta	Orsu obodo Ezi orsu Opuoma	2018, 2002, 2004, 2005, 2022, 2024
Owerri West	Amakohia ubi Ndegwu Umugoma	2000, 2002, 2003,2005, 2018, 2012, 2022
Owerri-Urban	Works - Layout New owerri Aladinma	2000, 2002,2003,2005, 2018, 2022, 2012
Onuimo	Okwelle Obunilo Ikwuato	1999,2000,2002,2003,2004, 2005,2018,2022,2024.

Source: Field Survey Data 2024.

Perceived causes of flooding in the study area

Table 3 shows the distribution of respondents by what they perceived to be the causes of flooding in the study area. The causes were both human and natural. With a discriminating mean index of 2.50, the following natural causes of flooding were identified; prolonged /heavy rainfall (M=3.80), climate change (M=2.98), low lying topography (M=2.76), ocean /river surges and heavy tides (M=3.10) and fluvial floods (M=3.45), silting occasioned by long term erosion menace (M=2.79). The perceived human causes of flooding were increased urbanization (M=2.94), poor land use planning (M=3.25), absence of functional drainage (M=2.95), blockage of waterways with refuse (M=3.05), building houses/physical structures on river banks (M=3.18), Lack of adequate sanitation measures (M=3.74), non-enforcement of existing laws(M=2.84) and inability to comply with environmental laws (M=3.35). In a study by Osuji (2024) regarding flooding issues in Imo State, it was emphasized that different types and causes of flooding affect the region. Urban areas in Imo State experience flooding in 30.5 percent of instances, with 116 participants identifying this as the most prevalent situation. Coastal flooding is not a major concern in the state, as it was observed in only one local government area, where 14 respondents (3.7 percent of the survey population) acknowledged its occurrence. This particular flooding type is found solely in the Oguta local government area (Orlu zone), likely due to its proximity to the coast. Flash flooding constitutes 27.4 percent of the responses (104 respondents). River flooding was reported by 98 respondents, making up 25.8 percent of those interviewed. Seasonal flooding accounts for 48 respondents, or 12.6 percent of the overall total. The flooding of numerous urban areas in the state is primarily attributed to the construction of roads lacking adequate drainage systems, the building of homes near riverbanks, and in areas prone to flooding. The most significant cause of flooding in the region, cited by 57 percent of respondents, is heavy and prolonged rainfall, followed by fluvial flooding (11.6 percent), low-lying terrain, and insufficient water absorption (12.6 percent). Additionally, silting caused by increased erosion accounts for 7.8 percent, with the same percentage linked to climate change, and 3.2 percent associated with ocean surges and tidal waves. It was observed that the disposal of solid waste into natural waterways represents 40 percent, making it the primary human factor contributing to flooding in the region. Other contributing factors include urbanization and population pressure combined with slum development (14.2 percent), inadequate or nonexistent drainage systems (13.7 percent), a lack of adherence to and enforcement of current regulations (10.5 percent), the construction of residences on riverbanks and in flood-prone areas (13.7 percent), insufficient land use planning (7.4 percent), and significant pipe bursts (5.8 percent).

Osuji (2024) pointed out that different regions of Imo State exhibit varying geographical features, and each environment in the area has unique environmental characteristics. This results in diverse types and causes of flooding in different locations. According to feedback from respondents, various flooding types are affecting the study area, and coastal flooding is not a major issue in the state, as only one local government area reported it, with 20 respondents identifying it, which constitutes 4.1 percent of the sample population. This particular flooding type, observed exclusively in the Oguta Local Government area, can likely be linked to its proximity to the coast. Flooding in urban areas of Imo State accounts for 28 percent of the cases, based on responses from 135 participants. River flooding was cited by the most respondents, with a total of 136 individuals or 28.1 percent of the sample population, while seasonal flooding was mentioned by only 62 respondents, representing roughly 12.8 percent. It was also highlighted that the flooding affecting numerous urban locations in the state is chiefly due to the construction of roads without adequate drainage systems, building on waterways, and covering most open areas with concrete, resulting in flooding even after light rainfall.

Table 3: Perceived causes of flooding in the state.

Causes of flood	Mean	SD
Prolonged/heavy rainfall	3.80	0.98
Climate change	2.98	0.78
Low lying topography	2.76	0.64
Ocean surges and heavy tides…….	3.10	0.75

Fluvial floods	3.45	0.84
Silting occasioned by long term erosion	2.79	0.67
Increased urbanization	2.94	0.69
Poor land use planning	3.25	0.67
Absence of functional drainages	2.95	0.70
Blockade of water way with refuse	3.05	0.69
Building houses/physical structures on river banks	3.18	0.14
Lack of adequate sanitation measures	3.74	0.82
Non-enforcement of existing laws	2.84	0.72
Inability to comply with environmental laws	3.35	0.84

Accepted mean=2.50

General Socio-Economic Effects of Floods in the Study Area

Table 4 and Figs 2-5 illustrate that the impacts of flooding are extensive and significant. The various responses indicated the following socio-economic consequences: Loss of agricultural land/crops (99.5%), increased hunger and malnutrition (98.2%), displacement of agricultural workers (90.2%), heightened poverty levels (93.4%), deteriorating health conditions among farmers (94.9%), loss of human lives (92%), loss of harvested goods (93.8%), death of livestock (95.3%), mortality of aquatic life (91.3%), and destruction of homes, markets, and marketing structures (98%). Floods also have substantial repercussions on infrastructure, including the destruction of utilities and social facilities (98.4%), homelessness and temporary displacements (96.1%), disruption of transportation systems (99.6%), damage to communication systems/networks (90.3%), destruction of educational institutions and healthcare facilities (81.1%), harm to rural and urban roads (99.1%), and loss of personal property (98.1%). Regarding environmental damage, the following effects were noted: loss of soil nutrients (93.8%), environmental contamination (96.1%), degradation of water quality and availability (94.9%), loss of biodiversity and ecosystems (92.6%), reduced groundwater recharge (84.3%), potential for epidemics (92.7%), and soil nutrient infiltration (76.6%).

The above is consistent with the studies conducted by Adewuyi and Olofin (2014; Ibrahim et al., 2020), which pointed out that farmers experience extensive crop losses amounting to millions of naira each year due to flooding. The agricultural industry is crucial for alleviating hunger and achieving Sustainable Development Goal (SDG) 2, yet it faces significant challenges from flooding in Nigeria (Echendu, 2020). The analysis revealed that floods have a negligible effect on livestock rearing in the area, as indicated by the majority of respondents. This illustrates that the destruction caused by floods to housing in the area is quite severe. On average, the analysis suggested that flood disasters have a pronounced impact on agriculture in the region, with farmlands and crop yields experiencing considerable harm. Isma'il & Kersha (2018) observed that damage to livestock in Makurdi LGA is minimal compared to other aspects of agriculture. This may be because livestock can be moved to safer locations during extreme weather events, while crops and farmlands remain stationary. Additionally, it's important to note that most community members are engaged in crop farming, with only a small percentage involved in livestock production, which likely accounts for the higher levels of reported damage to farmlands and crops in comparison to livestock farming. Overall, this finding supports Shabu & Emmanuel's (2013) observation that floods typically inflict significant harm on the socio-economic activities of those living in affected areas. Since Makurdi is known as the nation's food basket, it's essential to highlight that the negative impacts of flooding on agriculture are severely affecting food production, which raises serious concerns for food security in the country (Peter et al., 2020; Boniface and Ekperi, 2019). An informal interview revealed that flooding in marketplaces ranks second among the activities adversely affected by floods in Imo State. The regions impacted by market flooding in this area include Onuimo, particularly the communities of Obinulo and Ikwuato. Furthermore, the flooding of commercial and residential areas, as well as roads, is also significantly impacted by floods in Imo State. Flooding can cause physical harm, illnesses, and even loss of life. Deep, swift, or rapidly rising floodwaters present serious dangers. For example, shallow water moving at just 2 meters per second can easily knock over both children and many adults. Water only 1 foot deep can move vehicles. The risks intensify when floodwaters are mixed with debris. Some effects may be immediate, with the most critical being drowning or injuries from being swept away by flooding (Osuji, 2024). Floodwaters contaminated with sewage or other pollutants, such as chemicals from garages or businesses, can lead to health issues through either direct contact or residual harmful sediments. Those most at risk include individuals residing in single-story homes or basements, as well as those outdoors, whether on foot or in vehicles, and those in tents or caravans. In addition to immediate dangers, the psychological impact of flooding, including stress and trauma experienced by individuals and communities, can be profound. Long-term consequences may arise from persistent health problems and the stress associated with flooding and the extended recovery period. People's ability to respond to and recover from a flood can vary widely. Vulnerable groups, including the elderly, individuals with disabilities, or those with chronic health conditions, often find it more difficult to cope with the effects of floods compared to others. Some may struggle to replace lost household items and may not have the financial means to recover or maintain a decent standard of living after a flood (IOM/NEMA, 2024). Flooding affects not only individuals but also entire communities, leading to temporary or sometimes prolonged interruptions in community services or infrastructure such as schools, healthcare facilities, community centers, and local amenities.

The damage caused by flooding to businesses and infrastructure, including transportation networks and vital utilities such as water, electricity, and gas, can significantly impact individuals and businesses, as well as local and regional economies. Flooding that affects major roads or railways can limit access to large areas beyond those directly affected by the flood, in addition to damaging the infrastructure itself. When water systems, like pumping stations or electricity facilities, are inundated, it can result in a loss of water or power supply across extensive regions (WMO, 2006; Grey et al., 2020). This can magnify the effects of flooding well beyond the immediate area. Flooding has both positive and negative impacts. On the negative side, floodwaters usually carry debris and pollutants. Debris may include objects like stones, trees, or even parts of buildings. Pollutants in floodwaters, such as pesticides and bacteria, can travel over long distances. Increased turbidity and sedimentation can lead to the growth of algae and phytoplankton blooms that jeopardize water quality. On the positive side, however, floodwaters can also transport vital nutrients and minerals, promoting plant growth and enhancing overall ecosystem health (WMO, 2006; Grey et al., 2020). Over time, the nutrients, organic materials, and sediments deposited by floodwaters can improve soil fertility. Moreover, flooding can contribute to replenishing groundwater, while the soil and sediments displaced by floodwaters can help prevent erosion and maintain the stability of river deltas.

Fig 2: A flooded area in Imo State © IOM/NEMA, Nigeria, 2024

Fig 3: Flooded farmland in Ohaji/Egbema, Oguta Axis

Fig 4: A section of the State ravaged by flood in Owerri

Figure 5: Residential area and farmland damaged by flood

Table 4: Socioeconomic Effects of Flood on Rural Residents in the Study Area

Statement on Effects of Flood	*Frequency	Percentage
Loss of farm crops/farm land	647	99.5
Hunger and starvation	638	98.1
Displacement of farm labour	586	90.1
High incidence of poverty	607	93.4
Poor health status of rural dwellers	617	94.9
Loss of human lives	**598**	92.0
Loss of stored produce	610	93.8
Death of farm/domestic animals	620	95.3
Death of aquatic animals	594	91.3
Destruction of markets and marketing system	637	98.0
Destruction of utility works and social amenities	**625**	96.1
Homelessness and temporary dislocation	648	99.6

Interruption of the transport system	587	90.3
Destruction of communication systems	527	81.1
Destruction of schools and hospitals	644	99.1
Loss of physical properties	**638**	98.1
Loss of nutrients to erosion	610	93.8
Environmental pollution	625	96.1
Damage to water quality and quantity	617	94.9
Loss of biodiversity/ecosystem	602	92.6
Groundwater recharge	581	89.3
Leads to the outbreak of epidemic	603	92.7
Leads to soil water infiltration	498	76.6

***Multiple response**

Flood Control/Adaptation Strategies Used by Respondents

Table 5 shows the various control measures undertaken by respondents to manage floods. The measures include construction of embankment (98%), land elevation (88.3%) using sand mounds and sandbags, tree planting (94.6%), clearing of drainage (89.8%), digging trenches (97.9%), removing buildings on waterways (97.8%), heeding early warning signs (91.3%), not dumping refuse in gutters (96.8%), early crop harvesting (96.8%), this is done before the rains causing flood comes. Relocation to a safe place (98.6%) and planting early (76%) are safe practices employed to contain the flood menace. Osuji (2024) noted that a significant preventive/control strategy employed by the residents of Imo state is the elevation of land and the construction of barriers such as dwarf fences, dams, and the use of sandbags. These two strategies account for 20.3 percent and 37.4 percent of the respondents, respectively. Together, they constitute over 50 percent of the flood control measures in place. However, the study also found that in instances of extreme flooding, these two methods may not effectively mitigate the impacts of flooding in the region.

Based on the findings from the Focus Group Discussion (FGD) and observations made by Olorunlana and Ogunade (2022), local innovations and manufacturing skills were applied during the flood. They devised canoes and wooden rafts to ferry individuals and their belongings to safety. Moreover, techniques for purifying water from nearby sources, including filtration, boiling, and charcoal usage for decontamination, provided an alternative drinking water supply, particularly for those who opted not to evacuate. The FGD indicated that the preservation, enhancement, and management of fish stocks in the fishing ponds located within the Orashi wetland forests were effectively handled during the 2012 flood, thanks to local technological practices. The ponds functioned as reservoirs for floodwater while still fulfilling their primary role as fish farms. Local fishing nets were used to protect the aquatic life in these ponds, ensuring that fish and other seafood were not swept away by the floodwaters. The Orashi residents took advantage of the forests and rich vegetation in the area to act as a watershed, retaining or storing some of the floodwater by clearing drainage systems of debris and digging trenches to redirect and channel floodwater away from their homes into the absorbing forests.

In the context of agriculture, the focus group discussion (FGD) revealed the creative strategies employed by the indigenous community of Orashi. To mitigate damage from flooding, residents harvested crops such as cassava, yam, and plantain earlier than usual. This proactive approach not only provided food but also generated income through the sale of produce for families impacted during the flood period. Furthermore, the community implemented delayed planting methods and grew flood-resistant crops to help offset the reduction in food production caused by the flooding (Olorunlana and Ogunade, 2022). Humanitarian support was rendered by governments, caring individuals, NGOs, and various social and religious organizations, which supplied food, necessities, and medicine to ease the food shortages that arose from the flood disaster. Economically, residents sought new business ventures, including trading, at least temporarily, to make up for their disrupted income streams. The FGD indicated that people began selling personal items and property, such as household goods, jewelry, and clothing, to generate funds essential for family upkeep. The dire circumstances forced individuals to adjust their spending patterns, reducing social activities and non-essential purchases while focusing on necessities, flood mitigation, and recovery efforts. Another adaptive economic strategy that community members embraced was a communal credit system, where individuals borrowed money or food items from one another interest-free. For instance, a neighbor in need might borrow a measure of garri, which they would later repay by returning the same quantity once they were able to do so.

Table 5: Flood Control/Adaptation Used by Respondents

Flood control measures	***Frequency**	**Percentage**
Construction of embankment	637	98.0
Land elevation	574	88.3
Tree planting	615	94.6
Cleaning of the drainage	584	89.8
Removing a building on the waterway	633	97.3
Heeding early warning signs	594	91.3
Not dumping refuse in the gutter	625	96.5
Early crop harvesting	581	96.8
Relocation to a safe place	641	98.6
Digging trenches/gutters	604	92.9

Planting early	498	76.6

***Multiple response**

Constraints to Farmers' Adoption of Flood Control Measures

Rural and Urban farmers affected by flood are eager and ready to adopt measures for flood control, but are prevented or constrained by the following factors; risk of being carried away by water (92.9%), inadequate support (97.5%), low level of awareness of flood (91.8%), low level of education (84.1%), inadequate income/savings (100%), inadequate availability of information (96.9%), Lack of farm credit facilities (96%), lack of technical know-low (91.3%), complexity of control measures (93.8%), and high list of materials /equipment (90.1%). In a study investigating the obstacles faced by farmers in adopting agricultural technology in Kebbi State, Nigeria, Idowu (2021) discovered that technological challenges (94.3%), including a shortage of power tillers for land preparation, inadequate skills for selecting land and sites, and complexities related to water management, are among the difficulties that Sawah farmers encounter in Kebbi State. The research's results revealed that land tenure problems (80.9%), which involve poor soil fertility, insufficient road connectivity from farms to urban areas, and challenging farm topography resulting in high leveling expenses for Sawah basins, affect the region's Sawah farmers. Furthermore, the study emphasized production and on-farm issues (79.4%) that include difficulties relating to water management, flooding, drought, weeds, pests, and diseases that Sawah farmers in the region face. The research also identified information and training difficulties (75.1%), which pertain to limited access to extension services and a lack of technical expertise regarding Sawah farming, particularly concerning water management. Additionally, the study highlighted market-related challenges (61.7%) such as the absence of effective financial institutions to aid their farming endeavors, a shortfall of capital for agricultural activities, and the unavailability of loans to support farmers. Lastly, the study uncovered issues with input availability (52.3%), which encompass poor seed varieties, increased demands for fertilizers and manure, a lack of chemicals for weed and pest control, labor shortages, inadequate processing facilities, and elevated input costs that Sawah farmers in the region experience.

Table 6: Constraints to Rural and Urban Farmers' Adoption of Flood Control

Constraints faced	Frequency	Percentage
Risk of being carried by water	604	92.9
Inadequate income/savings	650	100
Low level of education	547	84.1
Inadequate support	634	97.5
Low level of awareness of floods	597	91.8
Inadequate information availability	630	96.9
Lack of farm credit facilities	624	96.0
Lack of technical know-how	594	91.3
Complexity of control measures	610	93.8
High cost of materials/equipment	586	90.1

***Multiple responses**

CONCLUSION

The region in question, being part of the tropical rainforest zone, experiences a high level of rainfall, which is a primary factor contributing to flooding in the area and generates runoff that leads to significant harm to both life and property. While Oguta and Ohaji/Egbema LGAs are classified as the most flood-prone regions, over 60% of the study area remains vulnerable to flooding unless appropriate measures are taken to protect the environment. In addition to the effects of excessive rainfall, other common factors contributing to flooding in the region include the deterioration of existing drainage systems due to urban development, the construction of inadequately designed channels that cannot cope with the runoff, the accumulation of sediment and silt in current drainage pathways, building structures on designated drainage routes, ineffective urban and town planning, indiscriminate disposal of waste in drainage areas, and general human activities that disrupt existing vegetation, thereby increasing the susceptibility of more areas to the damaging effects of floods. To address the ongoing flood issues, it is essential to prioritize

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