

FORESTRY-BASED FLOOD MITIGATION AND RESIDENTS' WELL-BEING IN SOUTH-WESTERN NIGERIA



Adebayo Samson Adeoye^{1*}, Ismail Olabisi Azeez²⁾

¹Department of Agricultural Extension and Management Federal College of Forest Ibadan PMB 5087
Jericho Hills Ibadan Nigeria; ²Department of Social and Environmental Forestry
University of Ibadan Nigeria

*Corresponding author: samalaba77@gmail.com

To cite this article:

Adeoye, A. S., & Azeez, I. O. (2025). Forestry-Based Flood Mitigation and Residents' Well-Being in South-Western Nigeria. *International Journal of Agricultural Social Economics and Rural Development (Ijaserd)*, 5(1), 1–18. <https://doi.org/10.37149/ijaserd.v5i1.1680>

Received: December 06, 2024; **Accepted:** May 03, 2025; **Published:** May 04, 2025

ABSTRACT

Flooding's impacts are well-known, but environmental consequences in South-Western Nigeria and alternatives to costly engineering solutions must be examined. Hence, assessing residents' perception of flooding on social well-being and forestry-based mitigation approaches in flood-prone communities of South-Western Nigeria. A four-stage sampling approach was adopted for the study. The first three stages involved strategic selection in the Nigerian states of Oyo, Ogun, and Lagos, where two Local Government Areas (LGAs) were chosen in each state, leading to 22 communities in each of the LGAs, based on past flood incidences. In stage four, a household listing was used to select 250 households for questionnaire administration in 2021 systematically. Using the following analytical tools, data were analysed using descriptive statistics, ranking, and chi-square at $\alpha 0.05$. Findings revealed that majority of residents (72.8%) were indigene, have been resident in the flood-prone locality for at least 16 years (52.4%), married (74.4%), aged between 21 and 50 years (78.4%) and living in households of between 5 and 8 persons (62.8%). Furthermore, residents' well-being indicators reveal significant shortcomings, except for positive social connections, education, and sanitation facilities trends. The study also identified tree planting, tree conservation in the upland areas, sustenance of the natural environment, and stabilisation of stream banks using vegetation as a nature-based solution to flood mitigation, depending on residents' indigeneity, years of residing in the study community, and marital status. To ensure sustainable forestry practices that mitigate floods in the study area, it is crucial to have environmental and forestry agencies involved.

Keywords: flooding; forestry-based approaches; South-Western Nigeria; well-being perception.

INTRODUCTION

As a result of climate change and other anthropogenic activities, flooding has become a pivotal disaster worldwide and is expected to grow more frequent in the years to come (Tempest et al., 2017). Nigeria is not an exception to the widespread floods that many nations experience nowadays. Flooding has become an ongoing issue, reversing years of progress and requiring millions of dollars for repair and restoration each time. Flooding negatively impacts human survival with infrastructure decadence, residences, and agricultural land, which results in significant financial losses and the eviction of locals (Balgah et al., 2023). One of Nigeria's worst floods ever struck in 2012, killing millions of people and costing the country billions of dollars in damages (Oyedele et al., 2022). These are unanticipated but anticipated events that have frequently resulted in fatalities or injuries. Flooding is one of Nigeria's most serious environmental problems (Onwuka et al., 2015). The persistent heavy rains brought about climate variation and sea-level rise as a cause of flooding, which exposes infrastructure to a serious threat, livelihoods, the existence of man, and properties in flood-prone parts (Ndimele et al., 2024).

Furthermore, despite the mitigation efforts to lessen its occurrence in south-west Nigeria, flooding is still a problem for many families. This was supported by Oladokun & Proverbs (2016), who



noted that previous flood mitigation strategies in Nigeria, such as structural dredging and channelisation of river banks, upland flood abatement, and building structure demolition, were government interventions that had no beneficial results. The flood control measures identified in South-Western Nigeria, such as effective waste management, functional drainage, demolition of buildings on floodplains, and re-channelisation of water bodies, were also unsustainable (Echendu, 2023). This was substantiated by Mfon *et al.* (2022), who stated that inadequate channelization of water courses and non-evaluation of stream basins in the flood-prone areas have led to unsustainable flood management in Nigeria. Gangani (2018) argues that established structural mitigation measures such as reservoirs, levees, floodwalls, and rain harvesting were equally unsustainable.

On the other hand, the continuously occurring floods in the low-lying areas of south-west Nigeria are catastrophic for the environment and the people's health. Land use change (urbanisation and deforestation) has made low-lying areas more vulnerable to flooding, according to Ige-Olumide & Salami (2018). In the south-west region of Nigeria, floods are a severe and destructive natural calamity that have impacted houses, farms, and people's general well-being (Emeribeole, 2015). Perennial floods in 2011–2012 and 2013 caused irreversible damage in a state in south-west Nigeria, depriving millions of dollars worth of goods, livelihoods, and properties (Aladelokun *et al.*, 2014). According to Odelola & Akinola (2015), between 1980 and 2011, the river Ogunpa in Ibadan, Oyo State, Nigeria, caused the death of thousands of people, with many others separated from their means of subsistence. Although flash floods are common in Nigeria during the rainy season (May to October), the 2012 floods were deemed the most catastrophic and destructive in the nation's history (Hula and Udoh, 2015). This is evident in two significant events that changed the face of flooding in Nigeria between September and October 2012: the floods in Adamawa State caused by the deluge of the Ladgo Dam, and the floods in neighbouring states of Benue and Niger. The floods flooded houses and many conveying channels throughout the affected zones throughout the country, and in total, about 431 people lost their lives, and many hectares of farmland were damaged (Mfon *et al.*, 2022). Despite the government's aggressive civil engineering interventions, such as river dredging and drainage/river channelisation, flooding remains a persistent problem due to engineering structures failing to yield the desired results.

This highlights the necessity of comprehending how those exposed to flooding view their circumstances on a large scale. Dissecting how people view flooding is important because it can help develop strategies for reducing the constant floods that negatively impact the residents of flooded communities in south-west Nigeria. Most importantly, it is impossible to overlook the necessity of acknowledging the integration of nature-based techniques with the current government initiatives to manage flooding (Balgah *et al.*, 2023). Furthermore, understanding how vulnerable individuals perceive flooding can help policymakers create communication plans to effectively include communities in addressing widespread flooding and create action plans for flooding mitigation (Toan *et al.*, 2014). Additionally, Nwanosike *et al.* (2021) provided information regarding perception as a reliable source for the willingness of vulnerable residents to implement mitigation strategies and their support for government action to prevent flooding. Forestry-based land use approaches help reduce peak flows, regulate water cycles, offer cost-effective and sustainable nature solutions, and support community livelihoods and climate change mitigation. The utilisation of forestry-based solutions exemplifies the role of the natural ecosystem services in mitigating flood risk, rather than relying solely on traditional engineering solutions. This innovative approach can offer a more economical, sustainable, and environmentally friendly solution to flood management. Therefore, this study examines how flooding affects residents' well-being and explores the potential of forestry-based approaches in mitigating flood risks in South-Western Nigeria. The research paper's objectives were to investigate the socio-economic traits of residents in flooded communities in South-Western Nigeria, as well as their perceptions of their well-being and the use of forestry-based mitigation strategies by these communities. The forestry-based mitigation strategies and socio-economic variables are unrelated.

MATERIALS AND METHODS

The research, which focused on home residents in flood-prone areas, was conducted in South-Western Nigeria in 2021. Nigeria's south-west is a geopolitical zone home to indigenous people and spans 114,271 km². Oyo, Osun, Ogun, Lagos, Ondo, and Ekiti are the six (6) states that make up the south-west area of Nigeria. The Yoruba, who speak various dialects, are the prominent tribe in this geopolitical zone. Other ethnic groups in Nigeria include the Hausa, Igbo, and others. The three primary types of vegetation found in south-west Nigeria are the Guinea savannah, tropical rain forest, and mangrove forest. The research area's household population was chosen using a multistage

random sampling technique. As per Nnodim (2023) and Cirella et al. (2018), the first stage procedure was the selection of Oyo, Ogun, and Lagos States based on the frequency of floods and their volume. Local Government Areas (LGAs) and the wards within LGAs with water bodies and a high frequency of flooding in the chosen states were also purposefully chosen for the second stage. Ido and Oluyole were selected in Oyo State, Obafemi Owode and Abeokuta South were selected in Ogun State, while Alimosho and Ikorodu were selected in Lagos State. The following number of wards were selected LGAs in all: Ido comprises 10 wards, Oluyole comprises 10 wards, Obafemi Owode comprises 12 wards, Abeokuta South comprises 15 wards, Alimosho comprises 11 wards, and Ikorodu comprises 19 wards, respectively. See Nnodim (2023); and Ibid. Cirella et al. (2018). The third stage also purposefully sampled highly flood-prone villages from each chosen ward. The settlements chosen were Odo-ona Elewe/Ikereku, Odo-Ona Kekere, and Odo-Ona Nla in Oluyole LGA in Oyo state; Apete/Awotan, Omi-Adio, and Idi-Iya in Ido; Ofada/Mokoloki, Mowe, Ibafo, and Asese in Obafemi Owode; Obantoko, Igbore/Itori/Ago-Oba, and Ago-Ijesha/Ijeun Titun in Abeokuta South LGA of Ogun state; while Shasha/Akowonjo, Egbe/Agodo, and Ikotun/Ijegun in Alimosho; Ijede II, Ibeshe, Odogunyan, Agura/Iponmi, Isiu and Ipakodo in Ikorodu LGA. The fourth stage was to list households in the chosen communities to create a sample population. Next, using a systematic random selection procedure, every fifth household in the selected communities was chosen to determine the sample size. Two hundred fifty respondents were chosen as the sample size. A structured questionnaire with an interview section was used to gather data from respondents. Data analyses used frequencies, simple percentages, chi-square, and mean score ranking.

Conceptual Framework for the Study

The conceptual framework shows schematic interactions and relevance between the variables of this research paper. This indicates the sequence of inter-relationships among variables of utilisation of forestry-based mitigation approaches, socio-economic characteristics of residents, and residents' well-being perception in the flood-prone communities. Attention must be at the heart of the well-being structure since stimuli could impact people's feelings differently based on the observation level (Dolan *et al.*, 2021). Well-being is essential for an individual's overall progress and is regarded as a benchmark of societal progress (Zaffar, 2021). The proposed framework recognizes that the effectiveness of forestry-based flood mitigation approaches in South-Western Nigeria is shaped by the socio-economic profiles of residents and their well-being perception (Lechowska, 2022). Therefore, the research aimed to investigate how residents in flood-prone villages in south-west Nigeria respond to and perceive the effects of floods. The intervening factors that affect the relationships between inhabitants' socio-economic profile and their impression of their well-being of residents and forestry-based mitigation approaches were the government policy, environmental factors, institutional bureaucracy, competitiveness of various land use, and the environment within which households subsist and operate are expected to impact their response to forestry-based mitigation approaches in South-Western Nigeria.

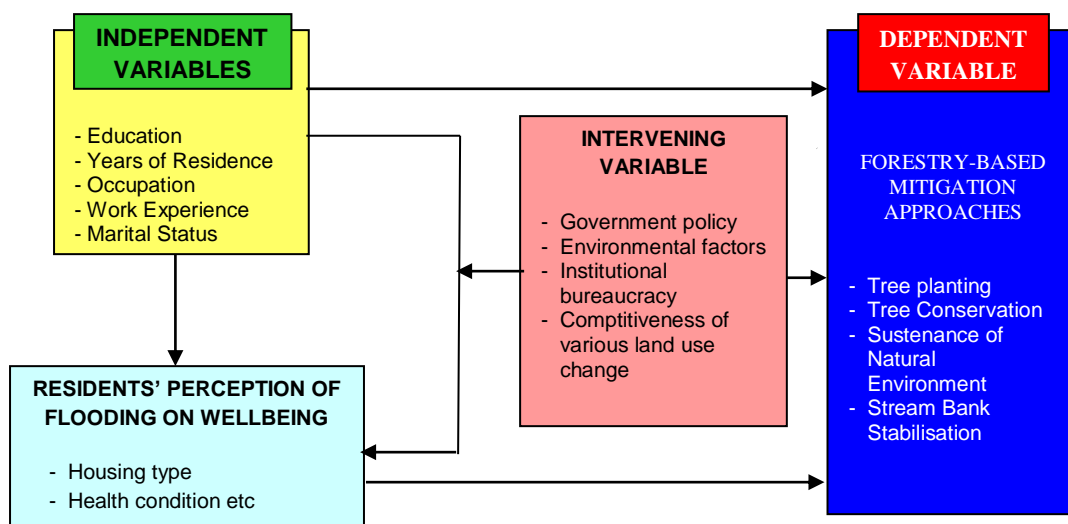


Figure 1. Conceptual framework of the study: the arrows reveal interrelationships

The challenge experienced in the study explicates difficulty in data collection for forestry-based flood mitigation in South-Western Nigeria, which was affected by constraints on accessibility issues, confrontation by residents, language barriers and interpretation, and financial, time, and technical/enumerators limitations.

Chi-Square Analysis

The Chi-square analytical tool was employed to test the relationship between the demographic profiles of respondents and forestry-based mitigation approaches

$$\chi^2 = \sum \left[\frac{(f_o - f_e)^2}{f_e} \right]$$

1

Where: χ^2 = Chi-Square, Σ = Summation, f_o = frequencies of socio-economic characteristics such as sex, religion, marital status, and others, f_e = anticipated occurrence frequencies derived from response categories.

Ranking of Mean Scores

Residents were asked to indicate their perception of well-being in the flood-prone parts of South-Western Nigeria using a 5-point scale of “Strongly Agree”, “Agree”, “Undecided”, “Disagree”, and “Strongly Disagree”. The scores for Strongly Agree (SA) = 5, Agree (A) = 4, Uncertain (U) = 3, Disagree (D) = 2, and Strongly Disagree (SD) = 1, respectively. Benchmark for the 5-point scale was obtained thus: 5+4+3+2+1 = 15 divided by five equals 3.0. Hence, a cut-off mean point of ≥ 3.0 implies a high score for residents’ well-being, while a mean < 3.0 implies a low score for residents’ well-being, and the mean scores were ranked. This was used to operationalise the perception of well-being in South-Western Nigeria.

Residents’ utilisation of forestry-based approaches was operationalized on a 4-point scale of “Never Used”, “Used but stopped”, “Partially in Use”, and “Fully in Use”. Never Used = 0, Used but Stopped = 1, Partially in Use = 2, and Fully in Use = 3, respectively. Cut-off scale was obtained as: 0+1+2+3 = 6 divided by 4 = 1.5. Therefore, a decision rule indicates < 1.5 = Low score for forestry-based mitigation approaches and ≥ 1.5 = High score for forestry-based mitigation approaches. Hence, the mean scores ranking explained well-being perception and the utilisation of forestry-based mitigation approaches.

RESULTS AND DISCUSSION

Demographic Characteristics of Residents in the Flood-prone Communities of South-Western Nigeria

The demographic characteristics of residents in flood-prone communities of South-Western Nigeria play a critical role in shaping their vulnerability, adaptive capacity, and overall resilience to recurring flood events

Table 1. Distribution of residents’ socio-economic characteristics in the study area

Demographic Characteristics	Frequencies	Percentages	Mode	Mean
State of Residence				
Lagos	91	36.4		
Ogun	75	30.0		
Oyo	84	33.6		
Local Government Area				
Alimosho	31	12.4		
Ikorodu	60	24.0		
Abeokuta South	45	18.0		
Obafemi Owode	30	12.0		
Ido	48	19.2		
Oluyole	36	14.4		
Sex				
Male	79	31.6		
Female	171	*68.4	Female	

Table 1. Distribution of residents' socio-economic characteristics in the study area

Demographic Characteristics	Frequencies	Percentages	Mode	Mean
Age (years)				
≤ 20	10	4.0		
21-30	68	*27.2		
31-40	65	*26.0	21-50	39±12.3
41-50	63	*25.2		
51-60	33	13.2		
≥ 61	11	4.4		
Nativity				
Native of the locality	182	*72.8	Indigene	
Non-native	68	27.2		
Years of residing in the locality				
3-5	38	15.6		
6-10	35	14.0	≥ 16	
11-15	45	18.0		
≥ 16	131	*52.4		
Literacy				
Informal education	15	6.0		
Adult education	5	2.0		
Primary school	16	6.4	Higher degree	
Secondary school	58	22.3		
Post-secondary education	64	25.6		
Postgraduate education	92	*36.8		
Marital Status				
Unmarried residents	60	24.0		
Married residents	186	*74.4		
Married but separated residents	4	1.6		
Religion				
Islam	96	38.4	Christianity	
Christianity	150	*60.0		
Traditional worship	4	1.6		
Family size				
≤ 4	86	34.4		
5-8	157	*62.8	5-8	
≥ 9	7	2.8		
Major Occupation				
Farming	43	17.2		
Fishing	3	1.2		
Trading	54	21.6	Civil Servant	
Artisan	50	20.0		
Civil Servant	100	*40.0		
Secondary Occupation				
Farming	67	26.8		
Livestock	27	10.8		
Trading	106	*42.4	Trading	
Processing of produce	4	1.6		
Fishing	15	6.0		
Hired labour	1	0.4		
Hunting	2	0.8		
Artisan	28	11.2		
Work Experience				
1-5	43	17.2		
6-10	37	14.8		
11-15	27	10.8		
16-20	38	15.2	21-25	
21-25	48	*19.2		
26-30	19	7.2		
≥ 30	38	15.2		

Table 1 of the study revealed Lagos State as having the highest population proportion (36.4%), followed by Oyo State (33.6%) and Ogun State (30.0%), respectively. In addition, the LGAs' population proportions showed Alimosho and Ikorodu having 12.4% and 24.0%, Ido (19.2%), Oluyole (14.4%), Abeokuta South (18.0%), and Obafemi Owode (12.0%). Also, the results revealed that females were the most common residents (68.4%). Implicitly, more residents in flood-vulnerable areas of South-Western Nigeria are women. Fortunately, women have been identified by UNIDO (2015) as having a better understanding of their immediate environment, being more concerned about social well-being, and making tangible decisions for their households. Thus, they were thought to make better judgements for their homes and enterprises since they knew more about the ecosystems in their communities (UNIDO, 2015).

Also, about 52.4% of the inhabitants have lived in flood-prone parts of south-west Nigeria for over 16 years, with most of them (72.8%) being indigene. The bulk of respondents were implied to be in their prime working years. The findings concur with the submission of Akinbile et al. (2018), who classify respondents in Oyo State who were engaged in environmental adaptation measures as being of active age. Additionally, the population's educational background showed that most had higher education (36.8%), with those with a Bachelor of Science or Higher National Diploma Certificate coming in second (25.6%). Given that education significantly influences the knowledge needed to practise forestry land use techniques, this could significantly affect the study. Science and technology education can strengthen environmental flood measures and impose land use control in flood-prone areas, according to Terungwa and Tokwase (2013).

On marital status, married people made up around 74.4% of the population. This suggests that communities' responsiveness and dedication to using forestry land use practices for flood management may also be influenced by marriage. Further, the findings corroborate Akinbile et al. (2018), who submit that marriage may influence people's propensity to employ environmental adaptation techniques. Also, the results show that about 62.8% of households contain 5-8 persons. This indicates that most residents had a relatively large family size, which could benefit household well-being and management of the incidence of floods in their communities. This corroborates the submission of Henri-Ukoha (2020) that energy and strength from a large family help combat the effects of climate change.

Furthermore, the findings reveal that about 40.0% of the residents were civil servants, followed by 21.6% engaged in trading as a primary occupation. This implies that most residents engaged in non-farm occupations, which could impact their commitment to forestry-based land use strategies. This concurs with Danso-Abbeam *et al.* (2021), who submitted the engagement of most household members in at least one or more non-farm economic activities as key to adaptation strategies for combating the impact of climate change. Additionally, the findings indicate that people with 21–25 years of job experience (19.2%), followed by those with 1–5 years (17.2%), and those with 16–20 years of experience (15.2%). This suggests that locals have worked in the study region for a long time, which may have given them the necessary expertise to implement practical forestry land use methods for flood control. This aligns with Danso-Abbeam *et al.* (2021), who submit that years of job experience influence adaptation tactics for mitigating climate change-related environmental problems.

Residents' Perception of their Housing Well-being in the Flood-prone Communities of South-Western Nigeria

Examining residents' views of housing as an index of well-being in flood-prone areas in Table 2, residents reported an increase in degradation of brick houses (mean = 4.2). The volume and frequent occurrence of floods in the communities most at risk may be linked to the rise in brick home deterioration. These results corroborate past studies of Tapsell and Tunstall (2008), Carroll *et al.* (2009), and Sims *et al.* (2009), who found that floods have a detrimental effect on people's attachment to their homes, communities, and local areas. They may also harm building maintenance in communities that are vulnerable to flooding. Residents also believed that even with forestry land use flood-mitigation strategies, the maintenance cost of brick houses has not improved (mean = 3.0). This implies that forestry-based mitigation has minimal effect in mitigating floods from dilapidating houses in South-Western Nigeria, as the maintenance cost of residents is still on the rise. This corroborates Nkwunonwo *et al.* (2024), who submitted that ecosystem-based flood management in Ogun State has little impact due to the high annual flood frequency, prompting costly maintenance measures like house elevation, culvert, and bridge construction. There is difficulty in upgrading mud to brick houses (mean = 3.0), and mud houses are getting dilapidated (mean = 3.0). This indicates that despite forestry-based mitigation, maintenance of mud houses could remain poor in flood-prone areas of South-Western Nigeria. This corroborates the submission of Ndububa & Mukaddas (2016) that mud

houses in flood-prone areas are vulnerable to deterioration and collapse during floods, despite natural options, due to high maintenance needs.

Table 2. Residents' perception of housing well-being

Housing Well-being	SA	A	U	D	SD	Mean	Rank
There is a significant increase in the dilapidation of my brick house.	132 (52.8)	94 (37.6)	-	-	24 (9.6)	4.2	1 st
The maintenance cost of a brick house has not improved after land use strategies.	68 (27.2)	78 (31.2)	-	15 (6.0)	89 (35.6)	3.0	2 nd
Severe difficulty in upgrading the mud house to a brick house	67 (26.8)	78 (31.2)	-	15 (6.0)	90 (36.0)	3.0	2 nd
The maintenance cost of a mud house is much affordable.	2 (0.8)	73 (29.2)	-	15 (6.0)	160 (64.0)	2.0	3 rd
The brick house we live in before the land use strategies has become worse	157 (62.8)	74 (29.6)	-	11 (4.4)	8 (3.2)	1.6	4 th
Living in an unimproved mud house is the same as when land use strategies were practiced.	-	-	12 (4.8)	68 (27)	170 (68.0)	1.4	5 th

Note: SA = Strongly Agreed, A = Agreed, U = Uncertainty, D = Disagreed SD = Strongly Disagreed
Figures in parentheses are in percentages

Source: Ground Truthing, 2021

1. Residents' Well-being of Food Utilities

Regarding Food, results found in Table 3 show that most households cannot afford adequate meals (mean = 5.0). Furthermore, most household residents reported difficulties in providing daily meals (mean = 4.8) while past interventions in combating flooding were perceived as having no impact on access to food products (mean = 4.6). These results imply that flooding has severely impacted the residents' food security, making it challenging for them to afford daily meals, despite previous interventions, and, implicitly, there may be a need to consider a change in approach to combating floods in the study area. These corroborate Echendu (2022), who submitted that flooding threatens food security, disrupting the system despite Nigeria's existing flood risk management measures. Some residents could afford to source scarce Food due to a high source of income despite flooding in their community. However, unimproved food intake (mean = 4.3) and affordability of a balanced diet three times daily (mean = 4.1) were also popular perceptions among residents.

Table 3. Residents' well-being of food utilities

Food Utilities Well-being	SA	A	U	D	SD	Mean	Rank
Many households cannot afford adequate meals.	-	-	-	-	250 (100.0)	5.0	1 st
Difficulty in the provision of daily meals	-	-	-	46 (18.4)	204 (81.6)	4.8	2 nd
Food production and accessibility are still the same as before, and land use strategies are	154 (61.6)	95 (38.0)	1 (0.4)	-	-	4.6	3 rd
No improvement in food intake after land use strategies	168 (67.2)	-	82 (32.8)	-	-	4.3	4 th
I can afford a balanced diet three times daily	106 (42.4)	104 (41.6)	-	39 (15.6)	1 (0.4)	4.1	5 th
The affordability of Food has become much worse	14 (5.6)	102 (40.8)	-	-	134 (53.6)	3.6	6 th
Reduced access to food production has affected food intake	81 (32.4)	-	-	46 (18.4)	123 (49.2)	3.5	7 th

Note: SA = Strongly Agreed, A = Agreed, U = Uncertainty, D = Disagreed SD = Strongly Disagreed;
Percentages in brackets

Source: Ground Truthing, 2021

Thus, residents of flood-prone areas in South-Western Nigeria generally perceive their well-being as inadequate, with food insecurity being a key indicator. Food was linked to achieving social and environmental wellness by Fanzo (2019). Thus, the works of Ahmad *et al.* (2022), which posited flooding as one of the factors linked to food insecurity, support the study area being food-insecure. Akukwe *et al.* (2018) also submitted flooding as negatively impacting agriculture, while Musa and Shabu (2019) reported floods as covering 56% and 51% of farmlands in Adamawa state, Nigeria, in 2012 and 2014, respectively.

2. Perception of Health Facilities

Assessing residents' perception of health facilities in flooded communities of South-Western Nigeria, the results in Table 4 reveal residents' consent to access affordable government hospitals (mean = 5.0) even though transportation to the hospital was viewed as expensive (mean = 4.9). This indicates that despite having access to affordable government hospitals, residents' healthcare is still hindered by high transportation costs, creating barriers to seeking medical care. This concurs with the assertion of Cochran *et al.* (2022) that transportation challenges hinder healthcare access, causing delayed or missed care, with low-income individuals facing greater barriers and worse health outcomes due to their socio-economic disadvantage. The latter might partly explain their perception of the cost of orthodox medicine as high (mean = 4.7) and that of traditional health care as easily accessible and affordable (mean = 3.1). Thus, though orthodox medicine might be available in the flood-prone communities, its affordability raises a big question about residents' health as an indicator of their well-being. In addition to direct health effects like deaths and injuries, flooding is also indirectly linked to the spread of waterborne diseases, life-threatening sicknesses like cholera, dysentery, and enteric fever (Okaka and Odhiambo, 2018; Rieckmann *et al.*, 2018), parasite-borne illnesses like malaria (Echendu, 2020), and physical and psychological trauma (Alderman *et al.*, 2012; Tong, 2017). The long-term impacts of floods are stress, depression, and loss of lives, as explicated by previous findings of Tapsell and Tunstall's (2008).

Table 4. Residents' perception of health facilities and access

Perception of Health Facilities	SA	A	U	D	SD	Mean	Rank
Accessibility to and affordability of government hospitals	250 (100.0)	-	-	-	-	5.0	1 st
The cost of transportation to the government hospital is expensive.	-	-	-	25 (10.0)	225 (90.0)	4.9	2 nd
The cost of orthodox medicine is high for my family.	-	-	-	78 (31.2)	172 (68.8)	4.7	3 rd
Healthy life in my family now due to access to good health facilities	214 (85.6)	-	-	36 (14.4)	-	4.6	4 th
Sometimes my health status and my family become worrisome.	-	45 (18.0)	-	-	205 (82.0)	4.5	5 th
Qualitative medical treatment for every health problem encountered	130 (52.0)	45 (18.0)	-	50 (20.0)	25 (10.0)	3.5	6 th
Easy access and affordability of traditional healthcare for malaria, typhoid, and worm treatment	1 (0.4)	102 (40.8)	108 (43.2)	-	39 (15.6)	3.1	7 th

Note: SA = Strongly Agreed, A = Agreed, U = Uncertainty, D = Disagreed SD = Strongly Disagreed
 Percentages in brackets

Source: Ground Truthing, 2021

3. Sanitation Facilities

Further, residents' perception of their toilet system in Table 5 revealed that they viewed the water-cistern toilet as much better because it is void of cholera (mean = 4.4), and the system was in use in most households (mean = 4.3) in the flood-prone communities. Also, residents view the alternative pit latrine (see Figure 1) as exposing users to health hazards like cholera (mean = 1.7) while those using it desire improving to a water-cistern type (mean = 1.6). Implicitly, the toilet system as an index of well-being in the study area could be considered good despite flooding in the study area. Flood events have been directly linked to disease outbreaks, such as gastroenteritis, by Alderman *et al.* (2012). Echendu (2020) also reported that overflowing private septic tanks and wells with polluted water during flood events is standard in Nigeria. This, the author stressed, harbours

diseases and infections in flood-prone areas. Thus, steps must be taken to encourage the use of a safe toilet system in the study area to forestall environmental and public health problems.



Figure 1. shows the pit latrine and bucket type in flood-prone areas of South-Western Nigeria.

Table 5. Residents' perception of sanitation facilities in the study area

Perception Statements of Sanitation Facilities	SA	A	U	D	SD	Mean	Rank
The water-cistern toilet is much better because it is void of cholera	199 (79.6)	15 (6.0)	-	-	36 (14.4)	4.4	1 st
The water-cistern type has been in use in my household	175 (70.0)	39 (15.6)	-	-	36 (14.4)	4.3	2 nd
Pit latrine has health hazards due to cholera	204 (81.6)	-	-	-	46 (18.4)	1.7	3 rd
Improvement from pit to water- cistern type	6 (2.4)	39 (15.6)	-	-	205 (82.0)	1.6	4 th
The pit latrine type is being maintained in my household	36 (14.4)	-	-	3 (1.2)	211 (84.4)	1.6	4 th
The bucket type is used in my household.	-	-	-	-	250 (100.0)	1.0	5 th
"Shot-put" type is the type of toilet in my household.	-	-	-	-	250 (100.0)	1.0	5 th
Use of the bush and refuse dump site.	-	-	-	-	250 (100.0)	1.0	5 th

Note: SA = Strongly Agreed, A = Agreed, U = Uncertainty, D = Disagreed SD = Strongly Disagreed
Percentages in brackets

Source: Ground Truthing, 2021

4. Power Sources and Supply

Further, the impression of the availability of power as a measure of well-being was examined. However, the government's energy supply is equally accessible (mean = 3.7), as in Table 6, where people strongly agreed that their home's electricity supply could be made affordable with a generating set (mean = 4.7). The intermittent supply from the government's power source and its unaffordability, even when accessible, are the main reasons for their opinion (mean = 1.7). Electricity is essential for raising people's living standards and productivity. Additionally, it facilitates the dissemination of information to a large audience. However, when flooding interrupts the supply, leading to epilepsy, people often turn to electric generating sets, which may not be sustainable for livelihood progression. From the DEA (2017) perspective, power outages are synonymous with flooding and affect food storage, which has profound implications for human health. Furthermore, epileptic power supply also limits access to information on flood mitigation measures.

Table 6. Power sources and supply functionality

Power Sources and Supply	SA	A	U	D	SD	Mean	Rank
Affordable power supply to my house through a generator	169 (67.6)	81 (32.4)	-	-	-	4.7	1 st
Access to the government's source of power	169 (67.6)	-	-	-	81 (32.4)	3.7	2 nd
A rare supply of electricity from the government's generating company	169 (67.6)	-	-	-	81 (32.4)	2.3	3 rd
Unaffordable power supply from the government's source	164 (65.6)	-	86 (34.4)	-	-	1.7	4 th
There is a cheap and constant supply of electricity.	-	1 (0.4)	-	81 (32.4)	168 (67.2)	1.3	5 th

Note: SA = Strongly Agreed, A = Agreed, U = Uncertainty, D = Disagreed SD = Strongly Disagreed
Percentages in brackets

Source: Ground Truthing, 2021

5. Water Sources

Findings on the sourcing of water as an index of residents' well-being, as found in Table 7, revealed residents to have accessed a supply of 'sachet-water' for consumption and supply from tankers, both unaffordable (mean = 5.0). However, they can afford healthy water in their households (mean = 4.5). Some inhabitants choose to utilise stream water for domestic purposes because they believe it is free of chemicals and contaminants (mean = 1.0), while others do not have access to boreholes because of the high cost of sinking them (mean = 2.0). From the foregoing, water sources serve as constraints to residents, so quality water access as an index of well-being is poor in the flood-prone parts of South-Western Nigeria. However, the perception of residents about the purity of stream water in the study area could be attributed to the sieving of flooding and rain run-offs by the vegetation's adjoining streams. This will affect residents' adoption of nature-based flood mitigation approaches to improve their well-being. Water quality is one of the direct health effects of floods, according to Alderman et al. (2012), and Oriji (2015) reported that sewage, fertilisers, animal and human waste, pesticides, and other pollutants contaminate water in flooded areas. According to Raimi et al. (2018), 80% of diseases worldwide are associated with inadequate hygiene and contaminated water, and an estimated 63 million Nigerians lack access to drinkable water. The work of Olanrewaju et al. (2019) also supported findings from this study that there is a reduction in access to potable water due to water bodies' contamination.

Table 7. Residents' perception of water sources

Water Sources	SA	A	U	D	SD	Mean	Rank
'Sachet water' is exorbitant for my family.	-	-	-	-	250 (100.0)	5.0	1 st
Pipe-borne Water supply by tanker to the household is costly.	-	-	-	-	250 (100.0)	5.0	1 st
Digging a well is affordable	155 (62.0)	81 (32.4)	-	-	14 (5.6)	4.5	2 nd
The borehole is not accessible due to the cost of sinking it	169 (67.6)	-	-	-	81 (32.4)	2.0	3 rd
A preference for stream water for domestic use because it is void of chemicals	-	-	-	1 (0.4)	249 (99.6)	1.0	4 th
My household prefers water from a stream for domestic sanitation.	-	-	-	-	250 (100.0)	1.0	4 th

Note: SA = Strongly Agreed, A = Agreed, U = Uncertainty, D = Disagreed SD = Strongly Disagreed
Percentages in brackets

Source: Ground Truthing, 2021

6. Cooking Utilities

Examining cooking utilities as an index of well-being by residents, as found in Table 8, revealed that the cost of maintaining gas cookers for cooking in households was high, although most residents preferred gas cookers (mean = 5.0). However, gas cookers were not accessible for cooking in most households (mean = 4.8), which explains why many residents prefer firewood (mean = 4.7).

This implies that despite a preference for gas cookers, the high maintenance cost makes them inaccessible to most households, leading to widespread reliance on firewood for cooking. This corroborates Jeuland *et al.* (2015), who state that rural Indian households predominantly use biomass fuels (fuel wood), despite using other alternative stoves. Also worthy of note is that using a charcoal pot was not a popular alternative (mean = 5.0), though they had access to a kerosene stove, maintenance was unaffordable (mean = 3.7). This indicates charcoal pots and kerosene stoves are underutilized because of high maintenance costs, limiting household energy options. This concurs with Olugbire *et al.* (2016), who assert that income, employment status, and vulnerability to climate change drive household cooking energy choices. Implicitly, cooking utilities as an index of well-being in the study area are inadequate, and residents' preference for using firewood is an excellent threat to using nature-based approaches to combating flooding and improving well-being. Interest in tree planting, for example, may be for the wrong reasons if using firewood for cooking utility is not discouraged.

Table 8. Cooking utilities

Cooking Utilities	SA	A	U	S	SD	Mean	Rank
A gas cooker is not sustainable for my family due to the exorbitant prices.	-	-	-	-	250 (100.0)	5.0	1 st
Time-saving makes a gas cooker preferable for my family	249 (99.6)	1 (0.4)	-	-	-	5.0	1 st
My family does not have access to a gas cooker.	-	-	-	61 (24.4)	189 (75.6)	4.8	2 nd
Fuel wood is preferable due to the special aroma it gives to the meal	169 (67.6)	-	-	-	81 (32.4)	4.7	3 rd
The charcoal pot is inadequate for my household.	-	42 (16.8)	-	54 (21.6)	154 (61.6)	4.3	4 th
Fuel wood creates pollution and slows down the cooking duration.	-	39 (15.6)	-	-	211 (84.4)	4.5	4 th
A kerosene stove is not sustainable for my home	47 (18.8)	42 (16.8)	-	-	161 (64.4)	3.7	5 th

Note: SA = Strongly Agreed, A = Agreed, U = Uncertainty, D = Disagreed SD = Strongly Disagreed
Percentages in brackets

Source: Ground Truthing, 2021

7. Social Participation

Assessing participation in social activities like welfare and cooperative organisations as an index of well-being among residents, the study (Table 9) revealed a high participation in social activities among residents of flood-prone areas of South-Western Nigeria due to the welfare support derived from such participation (mean = 5.0). Participation in social activities was also perceived as an avenue for meeting needs apart from giving members the ability to cope with flood hazards, such as deploying flood barriers like sandbags and logs of timber (mean = 4.7). This implies that residents were immersed in social welfare activities that can help curb flooding. This contradicts Wahab and Falola (2022), who stated that most flood-prone populations could not access Ibadan, south-west Nigeria's recovery and welfare package. Further, some residents identified participation in socials as an avenue for raising environmental and cultural development funds (mean = 4.0) apart from being sources of information on social and environmental issues (mean = 2.0). This implies that residents' social participation would encourage partnership and community efforts to secure finance to manage environmental challenges. This concurs with Harifuddin *et al.* (2024) that social capital supports flood mitigation due to the necessity to strengthen the *collaboration between* community stakeholders and government institutions on *flood management*. Implicitly, social participation could arouse residents' interest in well-being improvement issues and facilitate sustainable synergy of their resources (human and material) with that of government agencies in curbing flooding and other environmental menaces in South-Western Nigeria. However, there is no doubt that social participation as an index of well-being is good in the study area and could be a helpful tool for curbing the flooding menace. Evidence of the beneficial effects of social capital, such as close family ties, management of environmental challenges at individual and community levels is abundant as found in past studies of Adger, (2003); Aldrich, (2012); Wind and Komproe, (2012); Wickes *et al.*, (2015); Paul *et al.*, (2016).

Table 9. Residents' perception of extant social participation

Perception of Social Participation	SA	A	U	D	SD	Mean	Rank
High preference for social function because of the welfare support it gives	250 (100.0)	-	-	-	-	5.0	1 st
Attendance at social functions is expensive to maintain	-	-	-	-	250 (100.0)	5.0	1 st
Social function is worse because of the loss of the quantum of money.	-	-	-	-	250 (100.0)	5.0	1 st
Social functions are Helpful sometimes in meeting other needs.	169 (67.6)	81 (32.4)	-	-	-	4.7	2 nd
Social connection engenders the ability to cope with environmental and flood hazard experiences.	169 (67.6)	81 (32.4)	-	-	-	4.7	2 nd
They are an avenue for meeting important personalities.	169 (67.6)	81 (32.4)	-	-	-	4.7	2 nd
Social functions are sources of funding for environmental and cultural development.	169 (67.6)	-	-	81 (32.4)	-	4.0	3 rd
Serve as sources of information on social and environmental issues.	-	81 (32.4)	-	-	169 (67.6)	2.0	4 th

Note: SA = Strongly Agreed, A = Agreed, U = Uncertainty, D = Disagreed SD = Strongly Disagreed Percentages in brackets

Source: Ground Truthing, 2021

8. Access to Quality Education

On education as an index of well-being, Table 10 revealed that most residents view quality education as available for their children and could afford the enrolment of their wards in school, though they viewed school enrolment as cheaper outside their communities (mean = 5.0). Also, some residents perceived a paucity of funds as limiting the affordability of higher education (mean = 4.7), which may explain why they preferred technical education. Residents who preferred and accessed higher forms of education for their wards due to affordability, though tangible (mean = 3.6), were not as high as those who could not (mean = 5.0).

Table 10. Access to quality education

Access to Quality Education	SA	A	U	D	SD	Mean	Rank
Availability of quality education to my children	250 (100.0)	-	-	-	-	5.0	1 st
Accessible and affordable quality education	250 (100.0)	-	-	-	-	5.0	1 st
School enrollment is low-cost outside my community	250 (100.0)	-	-	-	-	5.0	1 st
School entry for my wards is preferable outside my community.	-	-	-	-	250 (100.0)	5.0	1 st
Unaffordable school entry for wards	-	-	-	47 (18.8)	203 (81.2)	4.8	2 nd
Limitation to access higher education as a result of inadequate funds	-	-	-	86 (32.4)	164 (65.6)	4.7	3 rd
Preference for technical education due to low cost	21 (8.4)	189 (75.6)	-	-	40 (16.0)	3.6	4 th
Accessible higher education for my children	40 (16.0)	-	-	96 (38.4)	114 (45.6)	2.0	5 th
Households conversant with ecosystem-based approaches	-	-	-	-	250 (100.0)	5.0	5 th

Note: SA = Strongly Agreed, A = Agreed, U = Uncertainty, D = Disagreed SD = Strongly Disagreed Percentages in brackets

Source: Ground Truthing, 2021

This implies that awareness about the impact of education as an index of well-being, though high among residents, access to it is poor in the study area. This was not too far from Mudavanhu (2014), who stated that flooding disasters undermine children's education rights. Erica *et al.* (2018) reported evidence of general education disadvantages in flood zones even into adulthood. This may not be unconnected with that schools in Nigeria are usually converted into emergency shelters during disasters like flooding, which override their primary education function (Echendu, 2020).

9. Transport System

The results of the transportation system as found in Table 11, revealed that most residents acknowledge the usefulness of motor vehicles for the conveyance of goods (mean = 5.0), access to roads daily for livelihood activities (mean = 4.8) and the sales of most farm products within their community (mean = 3.6). This indicates that motor vehicles are essential for residents' livelihoods, enabling transportation of goods, daily activities, and farm product sales, while forestry-based mitigation measures help alleviate flooding, collectively supporting the community's economic and environmental resilience. This supports the argument made by Kaiser & Barstow (2022) that establishes transportation structure as an essential motivation for driving economic and environmental progress while intersecting with other key sectors. They also believed that motorcycles are essential for daily livelihood activities in flood-prone areas of South-Western Nigeria (mean = 2.0). This implies that reliable motorcycle transportation enables residents to maintain daily economic productivity and stability despite flood challenges. This concurs with Deppuh & Ng'ang'a (2022), who submitted that commercial motorcycle transportation fosters social and economic stability, empowering residents in the global south. Implicitly, the importance of motor vehicles and motorcycles to everyday living in flood-prone communities of South-Western Nigeria underscores the limitation of transportation to the well-being of residents.

Table 11. Transportation system

Transportation System	SA	A	U	D	SD	Mean	Rank
High preference for motor vehicles	250 (100.0)	-	-	-	-	5.0	1 st
Motor vehicles are germane for conveying my harvested products to the market.	250 (100.0)	-	-	-	-	5.0	1 st
I prefer long-distance transport by road due to the enormous loss from waterways.	250 (100.0)	-	-	-	-	5.0	1 st
Access to the road is necessary for our livelihood activities.	188 (75.2)	62 (24.8)	-	-	-	4.8	2 nd
Most of my farm products are They are sold in the community	163 (65.2)	-	-	-	87 (34.8)	3.6	3 rd
A motorcycle is handy and practical for my daily activities.	-	81 (32.4)	-	-	169 (67.6)	2.0	4 th
A motorcycle is better for my farming activities.	-	81 (32.4)	-	-	169 (67.6)	2.0	4 th
A bicycle is also valuable for my household to pack fuel wood and non-timber products collected.	-	-	-	-	250 (100.0)	1.0	5 th

Note: SA = Strongly Agreed, A = Agreed, U = Uncertainty, D = Disagreed SD = Strongly Disagreed
Percentages in brackets

Source: Ground Truthing, 2021

Feasible Forestry-Based Mitigation Approaches

Results in Table 12 investigated the utilisation of forestry-based approaches in mitigating flooding in the study area. Tree planting (Mean = 1.8) was the most popular of the identified forestry-based mitigation approaches, as advanced by 98.4% of respondents of flooded communities in the South-west region of Nigeria. This indicates that the most popular perceived approach among the forestry-based approaches is tree planting, with the highest proportions in Lagos, followed by Oyo and Ogun states, respectively, but it is partially utilized. This corroborates Kareem (2023), who reported that the 2022 Budget Implementation Reports (BIRs), Nigerian States hit by floods in 2022, implemented three initiatives, including planting trees. In addition, conservation of trees and shrubs in

upland areas (mean = 1.6) was another approach attracting 14.4%, 33.6%, and 30.0% of residents' interests, respectively. This indicates that tree conservation in upland areas is highly effective in mitigating flooding among partial users, with the highest proportion of users in Oyo state, Ogun, and the lowest in Lagos state. This concurs with Matthews (no date), who established that trees planted in upland areas or hillsides can slow water flow into valleys and prevent downstream flooding. Srivastava *et al.* (2023) further exemplify that conservation measures have been shown to successfully manage peak flows and enhance field and watershed water quality, which helps mitigate flooding. This was followed by stream banks stabilisation through re-vegetation (mean = 1.6), which attracted 14.0% of residents in Lagos State, 33.6% in Oyo State, and 30.0% in Ogun State. Also, desilting of streams and rivers (mean = 1.0) pooled 8.0% of the residents' votes in Lagos State, 22.0% in Oyo State, and 20.4% in Ogun State. This indicates that stream bank stabilization was perceived at the same level of use as conservation for mitigating flooding, with Oyo state still having the highest proportion of partial users, followed by Ogun and Lagos states being the least used. This corroborates Russell *et al.* (2021) that stabilization projects are increasingly used to mitigate flooding from the effects of anthropogenic activities, yet the effectiveness of stabilization measures has been insufficient.

Furthermore, sustenance of natural environment (mean = 0.7) was perceived by 6.4% of residents in Lagos State, 16.4% of those in Oyo State and 12.4% in Ogun State as partly used forestry-based flood mitigation method while planning landscape and beautification of the environment (mean = 0.7) attracting 5.6%, 16.4% and 12.4% of residents in Lagos, Oyo and Ogun State, respectively also fall in this category as land use strategy. This finding implies that tree planting, tree conservation, and stream bank stabilization were the most widely used forestry land use strategies with high utilisation. In contrast, other approaches, such as desilting of streams, sustenance of the natural environment, and landscaping, had low utilisation in South-Western Nigeria.

Table 12. Residents' utilisation of forestry-based approaches for flood management

Forestry Land Use Strategies	Category of Utilisation				Mean	Rank
	NU	US	PU	FU		
Involvement in tree planting	4 (1.6)	-	246 (98.4)	-	1.8	1 st
Conservation of trees and shrubs in the upland areas and floodplains	55 (22.0)	-	195 (78.0)	-	1.6	2 nd
Stream banks stabilisation by re-vegetation	56 (22.4)	-	194 (77.6)	-	1.6	2 nd
De-silting of streams and rivers in the floodplain areas	123 (49.2)	-	126 (50.4)	1 (0.4)	1.0	3 rd
Sustenance of the natural environment	162 (64.8)	-	82 (35.2)	-	0.7	4 th
Landscaping and beautification planning of the environment	164 (65.6)	-	86 (34.4)	-	0.7	4 th

Note: NU = never used, US = used but stopped, PU = partially in use, FU = fully in use. Percentages in brackets

Source: Ground Truthing, 2021

Chi-square Testing of Residents' Demographic Profiles with Forestry-based Mitigation Approaches

The impact of some residents' socio-economic background on using some identified forestry-based flooding mitigation approaches was also analysed using a Chi-square test statistic at $\alpha_{0.05}$ (Table 13). The study found that residents' involvement in tree planting depended on their local government area ($\chi^2 = 29.81, p = 0.0001$) and forestry-based mitigation approaches. Also, conservation of trees in upper land areas of flood-prone communities was dependent on residents' state ($\chi^2 = 123.20, p = 0.0001$), indigene of locality ($\chi^2 = 5.69, p = 0.05$), years of residing in the study community ($\chi^2 = 15.91, p = 0.003$) and marital status ($\chi^2 = 10.61, p = 0.01$). Furthermore, re-vegetation towards stream banks stabilisation is dependent residents' state ($\chi^2 = 126.09, p = 0.0004$), local government area ($\chi^2 = 190.17, p = 0.0001$), experience of flooding ($\chi^2 = 89.73, p = 0.0002$), being indigene of locality ($\chi^2 = 6.36, p = 0.04$), years of residing in the community ($\chi^2 = 16.03, p = 0.0003$) and marital status ($\chi^2 = 12.24, p = 0.01$). However, the feasibility of adopting tree planting as a flooding mitigation measure in South-Western Nigeria is not statistically dependent on residents'

experience of flooding, indigene of the study locality, years of residing in the community, and marital status.

Table 13. Chi-square analysis of residents' socio-economic characteristics with forestry-based mitigation approaches

Identified Forestry land use strategies	Selected Demographic Characteristics of Residents					
	State of Residence	LGA	Experience of a flood	Indigene of locality	Yrs. of residing in a community	Marital status
Tree planting	7.10 (0.69) ^{ns}	29.81 (0.0001)*	8.18 (0.0004)*	4.67 (0.096) ^{ns}	3.69 (0.449) ^{ns}	0.694 (0.995) ^{ns}
Conservation of trees in upland areas	123.20 (0.0001)*	185.22 (0.002)*	86.81 (0.0001)*	5.69 (0.05)*	15.91 (0.003)*	10.61 (0.01)*
Sustaining the natural environment	23.54 (0.0003)*	43.77 (0.0001)*	15.98 (0.0002)*	0.63 (0.73) ^{ns}	16.75 (0.002)*	7.99 (0.05)*
Stream banks stabilisation by re-vegetation	126.09 (0.0004)*	190.17 (0.0001)*	89.73 (0.0002)*	6.36 (0.04)*	16.03 (0.003)*	12.24 (0.01)*
De-silting of streams and rivers in the floodplains	47.97 (0.0002)*	96.54 (0.01)*	32.44 (0.0001)*	4.06 (0.398) ^{ns}	10.07 (0.261) ^{ns}	2.69 (0.847) ^{ns}
Landscape and beautification of the environment	27.04 (0.0002)*	53.44 (0.0001)*	19.33 (0.003)*	0.724 (0.696) ^{ns}	16.39 (0.003)*	7.39 (0.060) ^{ns}

Note: χ^2 - values without parentheses, p-values in brackets, p^{ns} = not significant and p* = Significant $\alpha_{0.05}$

Source: Ground Truthing, 2021

CONCLUSION AND SUGGESTION

Research findings showed that most residents were female in the vulnerable communities of South-Western Nigeria. It was observed that most residents were indigenous to the flood-prone communities, married, educated, and mostly civil servants and traders, with their primary occupation being their primary occupation. The volume and frequent occurrence of flooding also resulted in huge dilapidation of brick houses, and data also showed that flooding could interrupt their food bank and source of income, resulting in food insecurity. Lastly, most socio-economic indicators and forestry-based techniques for tree protection and stream bank stabilisation through re-vegetation were significantly correlated. Therefore, this research paper recommends that tree conservation in the upland areas, sustenance of the natural environment, and stream bank stabilisation by vegetation be given utmost attention and rejuvenation, as these approaches stand as the most prolific approaches in combating flooding in South-Western Nigeria. More so, the inclusivity of environmental and forestry-based agencies is germane in educating the vulnerable residents on the importance and utilisation of forestry-based mitigation approaches for flood management.

REFERENCES

- Adger, W. N. (2003). Social capital, collective action, and adaptation to climate change. *Economic Geography*, 79(4), 387–404. <https://www.google.com/search?q=Adger%2C+W.N.+%282003%29.+Social+capital%2C>
- Ahmad, D., Ali Shah, S. Z., & Afzal, M. (2022). Flood hazards vulnerability and food security risk in Bait community flood-prone areas of Punjab, Pakistan: A threat to SDGs achievement. *Research Square*, 1(1), 1–26. <https://doi.org/10.21203/rs.3.rs-1337210/v1>
- Akinbile, L. A., Aminu, O. O., & Kolade, R. I. (2018). Perceived effect of climate change on forest-dependent livelihoods in Oyo State, Nigeria. *Journal of Agricultural Extension*, 22(2), 169–179. <http://journal.aesonnigeria.org>
- Akukwe, T., Krhoda, G., & Oluoko-Odingo, A. (2018). Principal component analysis of the effects of flooding on food security in agrarian communities of South-Eastern Nigeria. *International Journal of Hydrogen Energy*, 2(2), 205–212.

- Aladelokun, A. O., & Ajayi, C. F. (2014). An appraisal of the socio-economic impacts of urban floods in Ado Ekiti Metropolis in Ekiti State. *International Journal of Asian Social Science*, 4(2), 1027–1034. <http://www.aessweb.com/journals/5007>
- Alderman, K., Turner, L. R., & Tong, S. (2012). Floods and human health: A systematic review. *Environment International*, 47, 37–47. <https://doi.org/10.1016/j.envint.2012.06.003>
- Aldrich, D. P. (2012). *Building resilience: Social capital in post-disaster recovery*. University of Chicago Press.
- Balgah, R. A., Ngwa, K. A., Buchenrieder, G. R., & Kimengsi, J. N. (2023). Impacts of floods on agriculture-dependent livelihoods in Sub-Saharan Africa: An assessment from multiple geo-ecological zones. *Land*, 12(2), 334. <https://doi.org/10.3390/land12020334>
- Carroll, B., Morbey, H., Balogh, R., & Araoz, G. (2009). Flooded homes, broken bonds: The meaning of home, psychological processes, and their impact on psychological health in a disaster. *Health & Place*, 15, 540–547.
- Cirella, G. T., & Iyalomhe, F. O. (2018). Flooding conceptual review: Sustainability-focused best practices in Nigeria. *Applied Sciences*, 8(9), 1558. <https://doi.org/10.3390/app8091558>
- Cochran, A. L., McDonald, N. C., Prunkl, L., Vinella-Brusher, E., Wang, J., Oluyede, L., & Wolfe, M. (2022). Transportation barriers to care among frequent health care users during the COVID pandemic. *BMC Public Health*, 22, 1783. <https://pmc.ncbi.nlm.nih.gov/articles/PMC9486769/>
- Danso-Abbeam, G., Ojo, T. O., Baiyegunhi, L. J. S., & Ogundeji, A. A. (2021). Climate change adaptation strategies by smallholder farmers in Nigeria: Does non-farm employment play any role? *Heliyon*, 7, e07162. <https://doi.org/10.1016/j.heliyon.2021.e07162>
- Doctors for the Environment Australia (DEA). (2017). *Severe storms, floods, and your health*. https://www.dea.org.au/wp-content/uploads/2017/03/DEA-Storms-Flood-Fact-Sheet_web.pdf
- Deppuh, C. O., & Ng'ang'a, P. (2022). Effect of commercial motorcycle transport on socio-economic empowerment among Kwale County, Kenya youths. *International Academic Journal of Arts and Humanities*, 1(2), 482–505. https://iajournals.org/articles/iajah_v1_i2_482_505.pdf
- Dolan, P., Laffan, K., & Kudrna, L. (2021). The Welleye: A conceptual framework for understanding and promoting well-being. *Frontiers in Psychology*, 12, 716572. <https://doi.org/10.3389/fpsyg.2021.716572>
- Echendu, A. J. (2020). The impact of flooding on Nigeria's sustainable development goals (SDGs). *Ecosystem Health and Sustainability*, 6(1), 1791735. <https://doi.org/10.1080/20964129.2020.1791735>
- Echendu, A. J. (2022). Flooding, food security, and the sustainable development goals in Nigeria: An assemblage and systems thinking approach. *Social Sciences*, 11(2), 59. <https://doi.org/10.3390/socsci11020059>
- Echendu, A. J. (2023). Flooding and waste disposal practices of urban residents in Nigeria. *GeoHazards*, 4(4), 350–366. <https://doi.org/10.3390/geohazards4040020>
- Emeribeole, A. C. (2015). Managing flood disasters in Nigerian cities: Issues and strategies towards meeting the challenges in the modern world (A case study of Owerri Metropolis). *FIG Working Week 2015*. <https://www.fig.net/>
- Erica, C., Jessie, P., & Stephanie, P. (2018, January 23). How natural disasters undermine schooling. *Brookings: Education Plus Development Blog*. <https://www.brookings.edu/blog/education-plus-development/2018/01/23/how-natural-disasters-undermine-schooling/>
- Fanzo, J. (2019). Healthy and sustainable diets and food systems: The key to achieving Sustainable Development Goal 2? *Food Ethics*, 4, 159–174. <https://doi.org/10.1007/s41055-019-00052-6>
- Gangani, E. A. (2018). Types of floods and flood mitigation/management techniques—Damages. *Tips on Flood Management*. <https://dokumen.tips>
- Harifuddin, H., Azaz, F., Apriningsih, A., Hayat, A. N., Yuldashev, A. A., & Kuraesin, A. D. (2024). Flood risk reduction: A government and community collaboration perspective in urban communities. *Journal of Techno-Social*, 16(1), 54–65. <https://publisher.uthm.edu.my/ojs/index.php/jts>
- Henri-Ukoha, A. (2020). Assessment of the viability of climate adaptation strategies of cassava-based farmers in southern Nigeria. *Journal of Agriculture and Food Sciences*, 18(1), 105–117. <https://www.researchgate.net/publication/3439>
- Hula, M. A., & Udoh, J. C. (2015). Assessment of the impact of flood events in Makurdi, Nigeria. *Civil and Environmental Research*, 7(10), 53–60. <https://www.semanticscholar.org>
- Ige-Olumide, O. O., & Salami, A. T. (2018). Implications of land use change on flood vulnerability in urban watershed of Ibadan, South-west Nigeria. *Journal of Geography, Environment and Earth Science International*, 14(1), 1–17. <http://www.sciencedomain.org/review-history/23497>

- Jeuland, M. A., Bhojvaid, V., Kar, A., Lewis, J. J., Patange, O., Pattanayak, S. K., Ramanathan, N., Rehman, I. H., Tan Soo, J. S., & Ramanathan, V. (2015). Preferences for improved cook stoves: Evidence from North Indian villages. *Duke Environmental and Energy Economics Working Paper Series, EE 14-07*. Nicholas Institute for Environmental Policy Solutions & Duke University Energy Initiative.
- Kaiser, N., & Barstow, C. K. (2022). Rural transportation infrastructure in low- and middle-income countries: A review of impacts, implications, and interventions. *Sustainability, 14*(4), 2149. <https://doi.org/10.3390/su14042149>
- Kareem, A. (2023). Nigerian states prioritise tree planting to curb flooding. *Dataphyte Reports*. <https://dataphyte.com>
- Lechowska, E. (2022). Approaches in research on food risk perception and their importance in food risk management: A review. *Natural Hazards, 111*, 2343–2378. <https://doi.org/10.1007/s11069-021-05140-7>
- Matthews, F. P. (n.d.). The roles of trees in preventing and managing flooding. <https://www.frankpmatthews.com>
- Mfon, I. E., Oguike, M. C., Eteng, S. U., & Etim, N. M. (2022). Causes and effects of flooding in Nigeria: A review. *East Asian Journal of Multidisciplinary Research, 1*(9), 1777–1792.
- Mudavanhu, C. (2014). The impact of flood disasters on child education in Muzarabani District, Zimbabwe. *Jambá: Journal of Disaster Risk Studies, 6*(1), 1–8. <https://doi.org/10.4102/jamba.v6i1.138>
- Mumuni, A. (2013). *Flooding and diarrhoeal disease incidence in urban poor communities in Accra, Ghana: Investigating the effects of risk perception measures* (Doctoral dissertation). University of Ghana.
- Musa, S. D., & Shabu, T. (2019). A geographic information system will evaluate land use and land cover affected by flooding in Adamawa State, Nigeria. *Jambá: Journal of Disaster Risk Studies, 11*(1), 1–11. <https://doi.org/10.4102/jamba.v11i1.494>
- Ndimele, P. E., Ojewole, A. E., Mekuleyi, G. O., Badmos, L. A., Agosu, C. M., Olatunbosun, E. S., Lawal, O. O., Shittu, J. A., Joseph, O. O., Ositimehin, K. M., Ndimele, F. C., Ojewole, C. O., Abdulganiy, I. O., & Ayodele, O. T. (2024). Vulnerability, resilience, and adaptation of Lagos coastal communities to flooding. *Earth Systems and Environment, 4*, 10087. <https://doi.org/10.3389/esss.2024.10087>
- Ndububa, E., & Mukaddas, A. (2016). Mud house failures and mitigation options in Bauchi, North East Nigeria. *FUOYE Journal of Engineering and Technology, 1*(1). <https://engineering.fuoye.edu.ng/journal>
- Nkwunonwo, U. C., Tobore, A., & Nwaka, O. C. (2024). Ecosystem-based approach to local flood risk management in Ogun State, Nigeria: Knowledge and pathway to actualisation. *Natural Hazards Research, 4*, 357–373.
- Nnodim, O. (2023, August 11). Flood hits Edo, Adamawa, Ekiti, and 17 others: National Emergency Management Agency report. *Punch Newspaper*. <https://punchng.com/floodhits-edu>
- Nwanosike, S. O., Mmom, P. C., & Weli, V. E. (2021). Flood risk perceptions and preparedness of residents in the Niger Delta, Nigeria. *International Journal of Advanced Engineering and Management, 3*(12), 310–321. https://ijaem.net/issue_dcp/Flood%
- Odelola, J. O., & Akinola, C. O. (2015). Assessment of factors contributing to flood disaster in Ibadan metropolis: Implications for environmental health education. *African Journal for the Psychological Study of Social Issues, 18*(2), 11–20.
- Okaka, F. O., & Odhiambo, B. (2018). Relationship between flooding and outbreak of infectious diseases in Kenya: A literature review. *Journal of Environmental and Public Health, 2018*, 5452938. <https://doi.org/10.1155/2018/5452938>
- Oladokun, V. O., & Proverbs, D. (2016). Flood risk management in Nigeria: A review of the challenges and opportunities. *International Journal of Safety and Security Engineering, 6*(3), 485–497. <https://www.witpress.com/Secure/ejournals/papers/SSE060304f.pdf>
- Olanrewaju, C. C., Chitakira, M., Olanrewaju, O. A., & Louw, E. (2019). Impacts of flood disasters in Nigeria: A critical evaluation of health implications and management. *Jambá: Journal of Disaster Risk Studies, 11*(1), 1–9. <https://doi.org/10.4102/jamba.v11i1.872>
- Onwuka, E., Ugwu, K., Ejike, D., Chukwuma, & Dibua, E. (2015). Implications of youth unemployment and violent crime on the economic growth: A case study of Anambra State, Nigeria.
- Orij, C. C. (2015). What to do about climate change-caused flooding and the associated diseases in Rivers State, Nigeria. *Global Journal of Human-Social Science Research*.

- Oyedele, P., Kola, E., Olorunfemi, F., & Walz, Y. (2022). Understanding flood vulnerability in local communities of Kogi State, Nigeria, using an index-based approach. *Water*, 14(17), 2746. <https://doi.org/10.3390/w14172746>
- Paul, C. J., Weinthal, E. S., Bellemare, M. F., & Jeuland, M. A. (2016). Social capital, trust, and adaptation to climate change: Evidence from rural Ethiopia. *Global Environmental Change*, 36, 124–138.
- Raimi, M., Vivien, O. T., Odipe, O. E., & Owobi, O. E. (2018). Water supply sources, sanitation facilities, and hygiene practices in oil-producing communities in the Central Senatorial District of Bayelsa State, Nigeria. *MedCrave Online Journal of Public Health*, 7(6), 337–345.
- Rieckmann, A., Tamason, C. C., Gurley, E. S., Rod, N. H., & Jensen, P. K. M. (2018). Exploring droughts and floods and their association with cholera outbreaks in sub-Saharan Africa: A register-based ecological study from 1990 to 2010. *The American Journal of Tropical Medicine and Hygiene*, 98(5), 1269–1274. <https://doi.org/10.4269/ajtmh.17-0778>
- Sims, R., Medd, M., Mort, M., & Twigger-Ross, C. (2009). When a “home” becomes a “house”: Care and caring in the flood recovery. *Space and Culture*, 12(3), 303–316.
- Tapsell, S. M., & Tunstall, S. M. (2008). I wish I had never heard of Banbury: The relationship between ‘place’ and the health impacts from flooding. *Health & Place*, 14(2), 133–154.
- Srivastava, S., Basche, A., Traylor, E., & Roy, T. (2023). The efficacy of conservation practices in reducing floods and improving water quality. *Frontiers in Environmental Science*, 11, 1136989. <https://doi.org/10.3389/fenvs.2023.1136989>
- Tempest, E. L., Carter, B., Beck, C. R., & Rubin, G. J. (2017). Secondary stressors are associated with probable psychological morbidity after flooding: A cross-sectional analysis. *European Journal of Public Health*, 27(6), 1042–1047.
- Terungwa, U. C., & Torkwase, I. C. (2013). Current issues in flood disaster: Challenges and implications for science and technology to enhance environmental education. *Academic Journal of Interdisciplinary Studies*, 2(6), 61–65. <https://www.richtmann.org/journal/index.php/ajis/article/view/1808>
- Toan, D. T., Kien, V. D., Giang, K. B., Van Minh, H. V., & Wright, P. (2014). Perceptions of climate change and its impact on human health: An integrated quantitative and qualitative approach. *Global Health Action*, 7(1), 23025. <https://doi.org/10.3402/gha.v7.23025>
- Tong, S. (2017). Flooding-related displacement and mental health. *The Lancet Planetary Health*, 1(4), e148. [https://doi.org/10.1016/S2542-5196\(17\)30062-1](https://doi.org/10.1016/S2542-5196(17)30062-1)
- United Nations Industrial Development Organisation. (2015). *Guide on gender mainstreaming: Environmental management projects*. Vienna, Austria: UNIDO. <https://www.unido.org/resources/publications>
- Wahab, B., & Falola, O. (2022). Vulnerable households in flood-prone communities in Ibadan: Measures to improve their status within the inclusive Ibadan City framework. *Journal of Inclusive Cities and Built Environment*, 2(1), 21–27. <https://journals.ukzn.ac.za/index.php/JICBE>
- Wickes, R., Zahnow, R., Taylor, M., & Piquero, A. R. (2015). Neighborhood structure, social capital, and community resilience: Longitudinal evidence from the 2011 Brisbane flood disaster. *Social Science Quarterly*, 96(2), 330–353.
- Wind, T. R., & Komproe, I. H. (2012). The mechanisms that associate community social capital with post-disaster mental health: A multilevel model. *Social Science & Medicine*, 75(9), 1715–1720. <https://doi.org/10.1016/j.socscimed.2012.06.032>
- Zaffar, I. (2021). Well-being: A conceptual framework. *International Journal of Enhanced Research in Management & Computer Applications*, 10(2), 1–7.