Assessing Climate Change Elements Affecting Coastal Housing Infrastructure in Ayetoro, Ondo State, Nigeria (2012-2022)

Oluwatunmise Esther Iwayemi[1*], Samuel Adedeji Daramola[2], Abraham Adeniyi Taiwo[3]

[1,2]Department of Architecture, Caleb University, Lagos, Nigeria

[3]Department of Architecture, Federal University of Technology, Akure, Ondo State, Nigeria

***Corresponding author**

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ABSTRACT

Over the past decade, the coastal community of Ayetoro in Ondo State, Nigeria, has increasingly faced threats from climate change, including rising sea levels, flooding, and coastal erosion, which have significantly impacted local housing. This study investigates the climate change factors affecting residential buildings in Ayetoro from 2012 to 2022. Utilising satellite imagery analysis, field observations, and interviews with long-term residents, the research documents both the physical damage to homes and the experiences of those affected. Data were collected using a pre-tested, self-administered questionnaire divided into three sections, comprising 27 items with a Cronbach's Alpha Coefficient of 0.878. The following hypotheses were tested: 1. No significant difference exists in climate-related impacts, such as increased indoor temperatures, across building foundations in Ayetoro from 2012 to 2022. 2. No significant difference exists in vulnerability to permanent flooding between building locations (dry land vs. swampy land) in Ayetoro from 2012 to 2022. 3. No significant difference exists in vulnerability to climate-related impacts, such as soil erosion from increased rainfall, across different building ages in Ayetoro from 2012 to 2022. The study employed a mixed-methods, cross-sectional, and inferential design, achieving a 92.9% response rate with a non-response rate of 7.1%. Analyses were conducted using counts, simple percentages, bar charts, pie charts, funnel charts, cross-tabulations, t-tests, analysis of variance, chi-square tests, relative risk, and relative effectiveness indices, utilising the Statistical Package for the Social Sciences (SPSS) and Microsoft Excel. The findings reveal significant differences in housing resilience based on foundation type and location, with swampy areas and plank foundations being more susceptible to vulnerability. Strategies such as temporary relocation and raising floors were identified by respondents as the most effective. The study highlights a consistent pattern of structural decline, particularly in low-lying and poorly constructed buildings, alongside a lack of sustained intervention or adaptive policy. It underscores the environmental risks and socio-economic pressures that hinder effective adaptation. In conclusion, the study calls for the urgent implementation of climate-resilient building standards and localised support strategies to safeguard the remaining housing stock and enhance long-term community resilience.

Keywords: Climate change, Coastal housing, Sea level rise, Infrastructure vulnerability

INTRODUCTION:

Climate change is one of the most pressing challenges we face today, affecting many aspects of our lives, including where and how we live. Coastal communities, in particular, are on the front lines, grappling with threats like rising sea levels, increased flooding, and stronger windstorms. For these communities, understanding the impacts of climate change and developing effective local adaptation strategies is essential for building resilience and ensuring a safe future.

In Nigeria, coastal regions such as the Niger Delta are especially vulnerable. Here, rising sea levels and frequent flooding have severely impacted housing conditions, leaving residents at greater risk (Ede et al.,

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2020; Olakunle et al., 2021). This study focuses on Ayetoro, a coastal community in Ondo State, which embodies these urgent challenges. Despite various research efforts and initiatives aimed at addressing climate impacts on housing in Nigeria (Ibama & Wocha, 2017; Federal Ministry of Environment, 2015), progress has been slow. There is still a significant gap in developing and implementing sustainable, locally appropriate solutions for the informal housing that is common in areas like Ayetoro.

Adaptation, defined as the adjustments we make in response to climate impacts to reduce harm or capitalise on new opportunities (IPCC, 2014), presents unique challenges in Ayetoro. The community is characterised by informal construction practices, limited resources, and specific environmental pressures. Adapting buildings in this context means retrofitting or redesigning existing homes, many of which are not equipped to withstand ongoing climate stressors, such as sea-level rise, flooding, and windstorms. While previous research has highlighted the importance of adaptation, it often struggles to translate theoretical frameworks into practical, context-specific solutions that address the socio-economic and environmental realities faced by communities like Ayetoro.

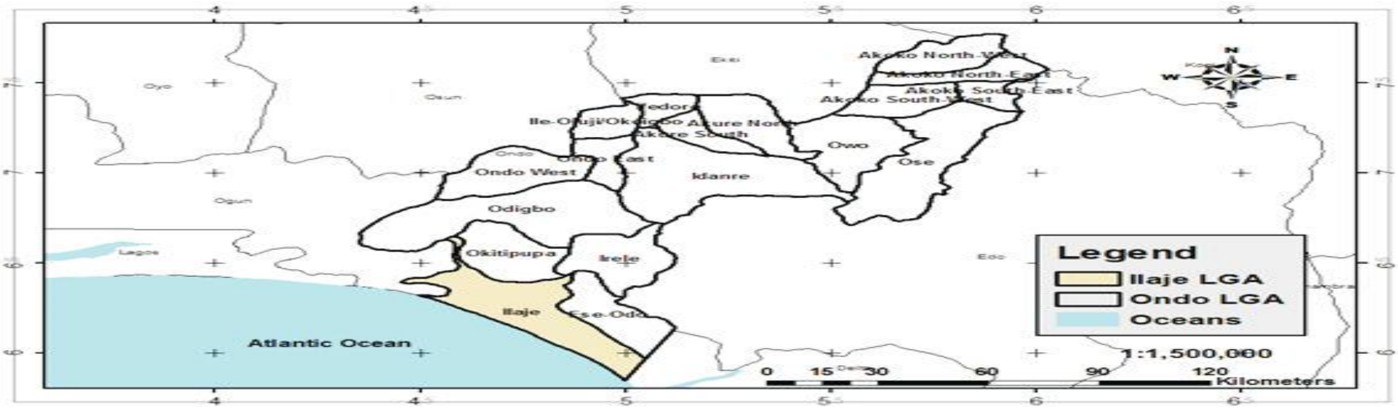

Figure 1.1: Map of Ondo State showing Ilaje local government.

Source: Extracted from ESRI Data, 2016.

Figure 3.4: Satellite Imagery of Ayetoro Coastal Community

Source: Researcher’s work, 2025

This study aims to assess the structural vulnerability of housing in Ayetoro to specific climate change impacts, namely, sea-level rise, flooding, and windstorms, and to propose locally viable adaptation strategies. It will examine how these factors influence housing quality, infrastructure integrity, and community resilience, focusing on existing occupied dwellings, whether completed or still under construction. By critically analysing vulnerabilities and identifying effective adaptation measures tailored to the local context, this research seeks to provide actionable insights that can enhance the sustainability and resilience of coastal housing in Ayetoro and similar communities.

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MATERIALS AND METHODS

The Study Area

Ayetoro is a coastal community located in the Ilaje Local Government Area (ILGA) of Ondo State, Nigeria, at approximately 6°13.785' N latitude and 4°38.975' E longitude (see Figure 3.1). It lies about 160 km east of Lagos and is notably cut off from the mainland by roughly 40 km of swampy terrain typical of the Niger Delta region. This area is home to the Ilaje people, a subgroup of the Yoruba, and is surrounded by neighbouring communities, including Ugbo, Mahin, Etikan, and Aheri, with the ILGA headquarters situated in Igbokoda (Figure 3.2). This geographical context makes Ayetoro particularly vulnerable to environmental threats: its low-lying position along the Atlantic coast increases the risk of sea-level rise (SLR) and saltwater intrusion; the surrounding swamp heightens the risk of flooding, especially permanent inundation; and its exposure to the open Atlantic leaves buildings susceptible to windstorms, storm surges, and coastal erosion.

Ayetoro was established on January 11, 1947, by followers of the Cherubim and Seraphim (Aladura) movement, led by Holy Apostle Ogeleyinbo, who sought refuge from traditional practices (Adegbola, 2024). Known as "Happy City," it was created as a utopian, theocratic Christian community on a remote estuarine mudbank. This unique historical background has significantly influenced its built environment. From the beginning, residents adapted to the challenging landscape by using a distinctive construction method: lightweight bungalows elevated on sturdy hardwood piles, known as "omeghen," which are driven deep into the swampy ground and can last over 20 years (Figure 3.3). The buildings primarily consist of lightweight materials like planks, plywood, and zinc (corrugated metal) roofing, with the size and sturdiness of structures often depending on the resources available to the owner.

This construction approach reflects a communal spirit and the constraints of available materials, representing a historical adaptation to the environment. However, this legacy also contributes to Ayetoro's current vulnerability to climate hazards, which are the focus of this study. While the pile foundation was a necessary response to the waterlogged conditions, the reliance on lightweight materials such as planks, plywood, and zinc creates structural weaknesses against stronger windstorms, ongoing flooding that can lead to decay, and erosion. Additionally, the community's isolation, surrounded by 40 km of swamp, complicates access to resilient construction materials, emergency services, and large-scale infrastructure improvements, making adaptation efforts more difficult. Ongoing resource limitations, rooted in the community's historical context, often restrict investments in more durable construction methods. The close arrangement of houses can also increase risks, leading to potential cascading failures during extreme weather events. As a result, Ayetoro serves as a compelling case study: a coastal settlement that is geographically exposed to specific climate hazards, such as sea-level rise, flooding, and windstorms, while facing the challenges of a unique built environment characterised by historically adaptive yet structurally vulnerable informal construction methods, all within a context of significant isolation and limited resources.

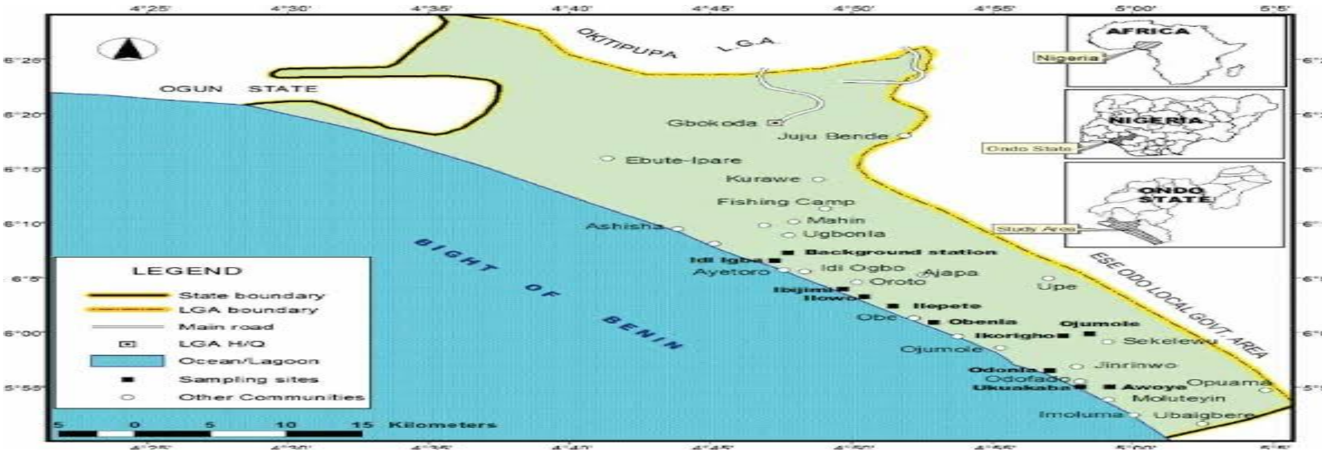

Figure 3.3 Ilaje Map Showing Ayetoro

Source: Olaniyan, 2019

Research Design

This study employed a mixed-methods approach (Creswell & Clark, 2017), integrating quantitative (structured questionnaire surveys) and qualitative methods (semi-structured interviews and field observations). This design was selected to address the research's complex socio-environmental dimensions by capturing both statistical patterns and contextual lived experiences. Conducted as a cross-sectional study, data collection took place between June and December 2023 as part of a PhD program..

Research Population

This study focuses its research population on Ayetoro's physical infrastructure, specifically, buildings (residential, religious, civic, and commercial), streets, and environmental features vulnerable to climate impacts. This focus stems directly from the research objective: to assess the effects of climate change elements on coastal housing and infrastructure. Demographic context is derived from Ayetoro's provisional 2006 census population of 20,070 (National Population Commission [NPC], 2006). Applying Nigeria's recommended 3% annual growth rate (United Nations, 2022) yields a projected 2023 population of 33,173 residents, representing the community experiencing these infrastructure vulnerabilities.

Participants (e.g., residents interviewed about structural conditions) are not themselves the research population, but rather provide insight about the primary population through qualitative methods. Their perspectives form a critical sampling frame contextualising the physical assessment.

Sampling Techniques and Sample Size

Sampling Techniques

To ensure representativeness while maintaining feasibility, this study employed systematic sampling methods. Twenty-three of Ayetoro's 54 streets (42.6%) were systematically selected at regular intervals along Broad Street, the community's primary thoroughfare. Buildings were then sampled using systematic random sampling with a fixed interval of 5, determined through preliminary density surveys showing 60-70 structures per street. Between 12 and 14 buildings were surveyed per street (approximately 20% coverage), adjusted proportionally to the street length. Within each selected building, one adult occupant (aged 21 years or older) with knowledge of the residency was interviewed. This approach balanced spatial coverage with practical constraints, aligning with the principles of systematic sampling for field research (Cochran, 1977).

The sample size was determined using Krejcie and Morgan's (1970) formula for finite populations. With a projected population of 33,173 (based on a 3% annual growth rate from the 2006 census), a 95% confidence level, and a 5% margin of error, a minimum sample size of 379 buildings was calculated. Surveys were completed for 352 structures (92.9% response rate), providing robust data for analysis.

Sample Frame

The sampling frame comprised exclusively occupied residential buildings in Ayetoro. Unoccupied or uninhabited structures were excluded because it was not possible to provide occupancy experience data. Respondents were purposively selected as knowledgeable informants, namely owners or long-term occupants (≥21 years) residing in the sampled buildings, who could reliably report on structural conditions and climate impacts.

Method of Data Analysis

The study employed integrated statistical and qualitative approaches to capture both quantitative patterns and contextual insights. Quantitative data from 352 valid responses (a 92.9% completion rate) were analysed using SPSS and Excel. Initial descriptive statistics summarised socio-demographic variables and perceptions through frequency counts, percentages, and visualisations including bar and pie charts. Subsequent inferential analyses included: Chi-square tests to identify associations between structural features (e.g., foundation types) and climate damage, Independent t-tests and ANOVA to compare differential climate impacts across housing

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categories, Pearson's "r" correlation to quantify material-durability relationships, Relative Risk (RR) and Relative Effectiveness Index (REI) calculations to evaluate adaptation strategy performance. Qualitative data from focus group discussions underwent systematic thematic analysis. Transcripts were coded line by line to identify recurring experiential themes, with the findings triangulated against survey patterns to validate the interpretations.

Table 1: Results of Reliability Test of the Instrument of the Questionnaire

Reliability Statistics	
Cronbach's Alpha	N of Items
.846	57

Below are the outputs of the analyses:

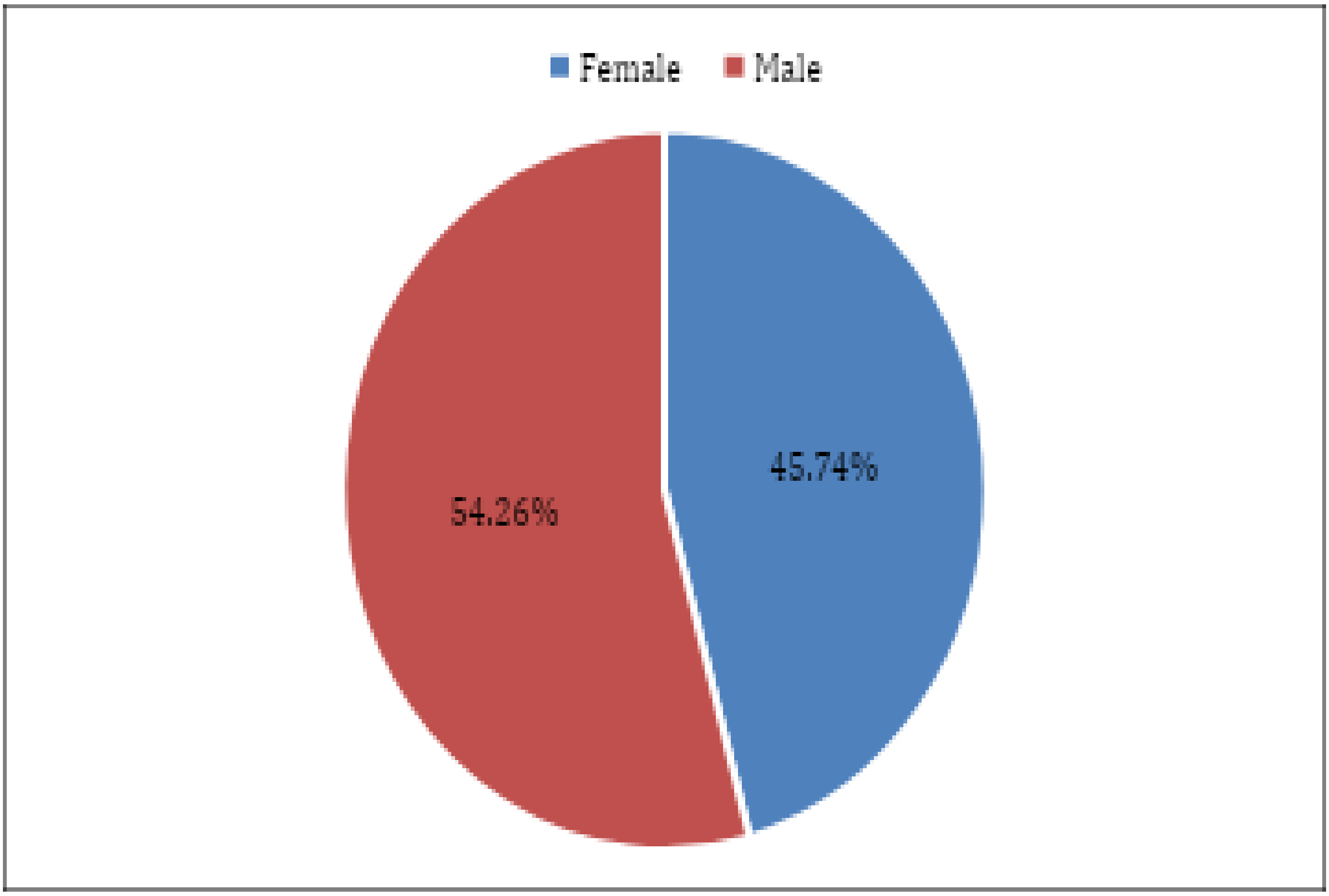

Figure 1: Gender distribution

The figure illustrates the gender composition of the respondents who participated in the study. There was a fairly even distribution between male and female participants, which indicated that the data collected had a high level of inclusiveness. This balance strengthened the credibility of the findings by ensuring that the perspectives of both genders were taken into account. A diverse representation of genders proved important, particularly in terms of how different groups experienced housing challenges linked to climate change. Since men and women often faced varying social roles, responsibilities, and access to resources, including both viewpoints allowed for a broader and more accurate understanding of their needs and vulnerabilities.

As a result, the study's adaptation planning was better positioned to reflect gender-specific concerns. This meant that future strategies for improving housing resilience could be more responsive and fairer, offering solutions that addressed the unique challenges faced by all members of the community.

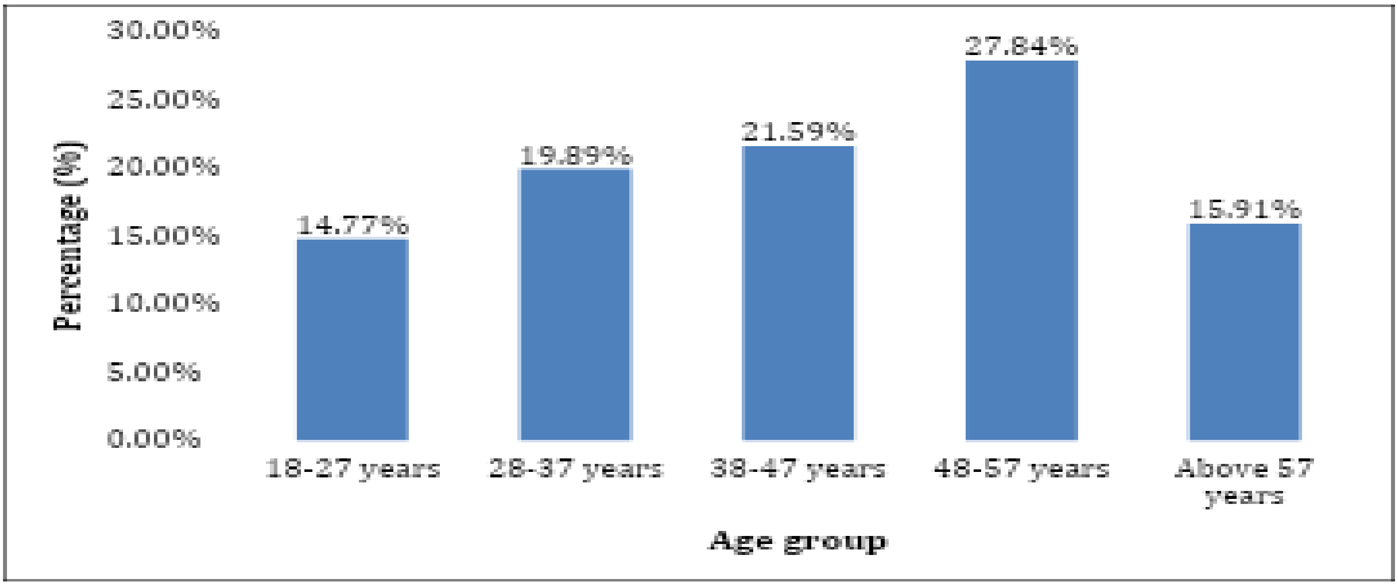

Figure 2: Age distribution

Figure 2 presents the age distribution of respondents in Ayetoro Coastal Community, highlighting a blend of both younger and older age groups. This demographic diversity provided valuable insight into how different generations experience and respond to climate-related housing challenges. Younger adults may be more physically resilient and open to relocation or adopting new building technologies, while older residents might prioritise stability, familiarity, and cost-effective in-place solutions. The presence of a wide age range also suggested varying levels of risk perception, adaptation behaviour, and access to resources. For instance, middle-aged respondents, likely homeowners and family heads, may have the highest stake in protecting property, making them key players in local resilience planning. In contrast, elderly respondents might face mobility challenges or financial limitations, making them more vulnerable during extreme weather events or floods. This implies that any effective climate adaptation strategy in Ayetoro must be age-inclusive, addressing the specific vulnerabilities, needs, and capacities of different age groups to ensure equitable and sustainable housing resilience across the community.

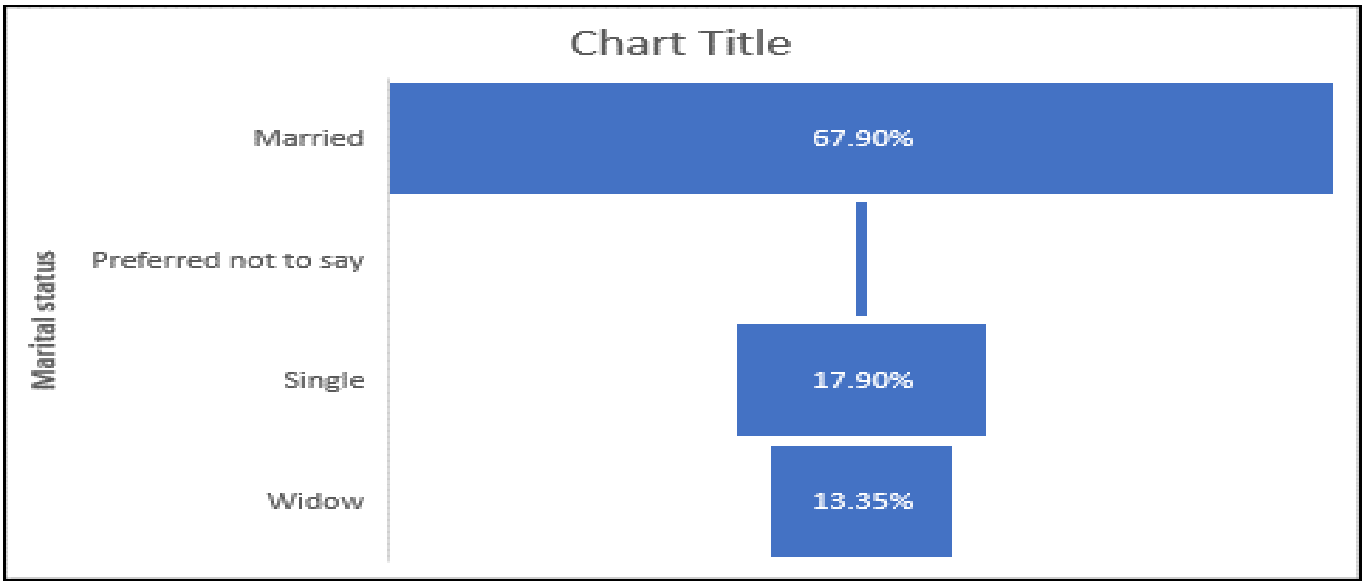

Figure 3: Marital status distribution

Figure 3 presents the marital status of respondents in Ayetoro Coastal Community. The data revealed that a significant majority, approximately 67%, of respondents were married, while about 23% were single, and the remaining 10% were either widowed, separated, or divorced.

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This distribution highlighted that most households in the community were family-based, with multiple dependents likely sharing the same housing space. Married individuals are typically responsible not only for themselves but also for children and possibly extended family members. This increases the stakes when it comes to housing quality and climate-related vulnerabilities, as any disruption (e.g., flooding, damage, or relocation) affects more than just the household head.

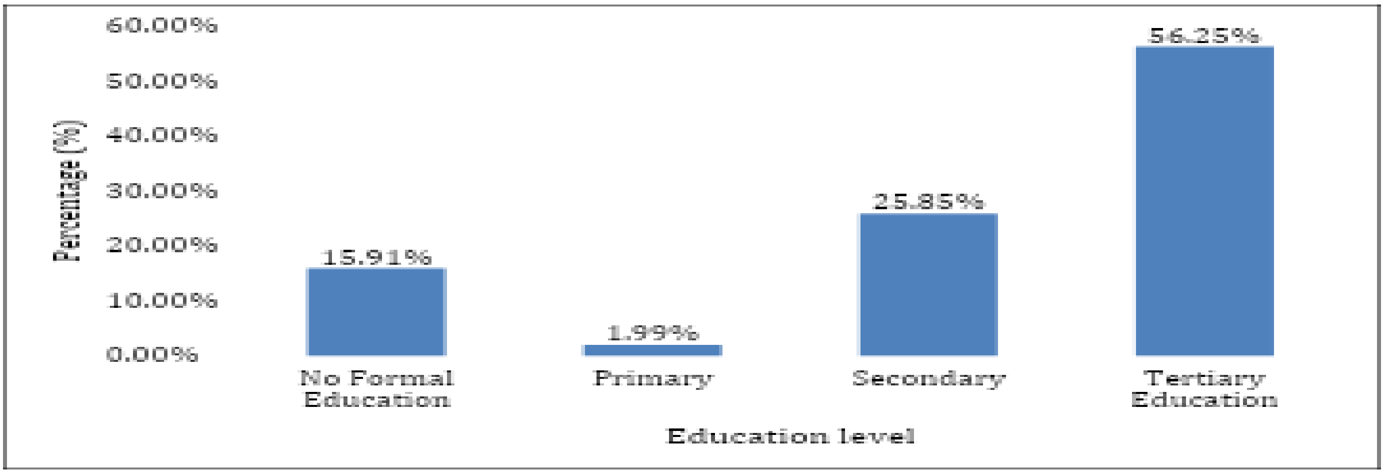

Figure 4: Education distribution

The chart showed that 56.25% of respondents had tertiary education, indicating a highly literate population capable of engaging with climate adaptation strategies. Secondary education was followed by 25.85%, while 15.91% had no formal education, and only 1.99% stopped at the primary level. This suggested a strong potential for information dissemination and policy uptake. However, the uneducated minority must still be considered in inclusive planning. Overall, the community appeared well-positioned for climate resilience efforts through education-based engagement.

Table 2: Employment distribution

Employment	**Count**	**Percent**
Government Employee	65	18.47%
Not Employed	32	9.09%
Private-Sector Employed	9	2.56%
Self-Employed	246	69.89%
Grand Total	**352**	**100.00%**

This table captures the occupational status of respondents in Ayetoro Coastal Community. A significant 69.89% of the respondents were self-employed, followed by 18.47% who worked in government roles. The dominance of informal employment reflected a community that relied heavily on unstable income sources. This implied that housing investment capacity was constrained, as self-employed individuals often lacked access to institutional loans or long-term savings, thereby limiting the adoption of climate-resilient construction techniques.

Table 3: Climate change elements that impacted housing infrastructure in the Ayetoro coastal community from 2012 to 2022.

Climate Element	**Agree**	**Disagree**	**Neutral**	**Agreement (%)**	**Decision**
Collapse of a building due to extreme weather	346	6	0	98.30	Majorly agree

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conditions					
Erosion of supporting soils caused by an increase in rainfall	346	3	3	98.30	Majorly agree
Surges of saltwater intrusion into our waterways and roadways near the coasts due to sea level rise	335	3	14	95.17	Majorly agree
Permanent flooding in the low-lying areas.	346	4	2	98.30	Majorly agree
Increase in the extent and depth of tidal permanent flooding	346	0	6	98.30	Majorly agree
Increasing temperatures, particularly room temperature	320	4	28	90.91	Majorly agree
Wet concrete due to a flood breeds bacteria and mould, causing microbial effects like skin inflammation	333	3	16	94.60	Majorly agree
Disruption of the movement of humans and vehicles due to permanent flooding	340	0	12	96.59	Majorly agree
Increase in the attraction of filthiness and dirt in the surroundings	342	0	10	97.16	Majorly agree
Climate change has caused the destruction of residents' belongings between 2012 and 2022.	349	0	3	99.15	Majorly agree
Permanent flooding caused by climate change has prevented access to the residents' building	330	0	22	93.75	Majorly agree
Permanent flooding caused by climate change has damaged important infrastructure in the community	339	3	10	96.31	Majorly agree
There have been extreme weather conditions that have brought a threat to the lives of residents of the community	342	0	10	97.16	Majorly agree

Table 3 presents the respondents' perceptions of how various climate elements have impacted housing infrastructure in Ayetoro Coastal Community. The data revealed overwhelming consensus across all listed climate-related stressors, with nearly all elements receiving agreement rates above 90 per cent.

The highest level of agreement was observed for property damage, indicating that residents widely recognised the destructive impact of climate change on their belongings and home structures. Building collapse, permanent flooding, and tidal flooding also ranked among the most unanimously acknowledged effects, with minimal disagreement or neutrality. These responses reflect the community's lived experience of severe structural deterioration, especially in vulnerable low-lying areas.

Soil erosion and saltwater intrusion also drew strong agreement, underscoring how shifting environmental conditions, particularly increased rainfall and sea-level rise, have led to the gradual degradation of building support systems and roadways. Similarly, mould exposure and filth accumulation were widely acknowledged, pointing to the rise of health-related risks stemming from persistent dampness, wet concrete, and unhygienic surroundings caused by flooding.

Functional disruptions, such as movement obstruction and blocked access to homes, were also highlighted by respondents. These underscore how climate change is not only undermining physical structures but also compromising daily life, mobility, and emergency response capacity. Additionally, rising indoor temperatures received strong agreement, reflecting thermal discomfort and energy inefficiencies that further diminish housing quality.

The high agreement percentages across all variables suggested that residents perceive climate change as a direct and multifaceted threat to their homes, health, and quality of life. This implies a profound understanding of both structural and functional vulnerabilities, underscoring the necessity for prompt and multifaceted adaptation interventions within the community.

Table 4: Resultant effect of the impacts in Table 4.3.1

Resultant effect	**Count**	**Percent**
Displacement from dwelling	186	52.84%
Economic problems	124	35.23%
Security and Safety problems to properties	99	28.13%
Displacement from dwelling	82	23.30%
Restriction of movement	58	16.48%
Discouragement and depression	46	13.07%
Restriction of movement	31	8.81%
Security and Safety problems to properties	11	3.13%
Grand Total	**352**	**100.00%**

Table 3 revealed that the most common effect of climate change on residents was displacement from their homes, showing the severity of structural damage and unlivable conditions caused by environmental impacts. Economic hardship followed, as many residents faced repair costs, loss of income, and general financial instability. Other frequent consequences included security and safety risks to properties, restricted movement, and emotional distress, such as discouragement and depression. This implies that climate change in Ayetoro has disrupted both the physical and emotional stability of households, demanding responses that go beyond infrastructure to include social and psychological support.

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Table 5: Chi-square Correlation of Building Foundation and its Condition

		Correlation	P-value
Nominal by Nominal	Phi	0.302	0.000
	Cramer's V	0.302	0.000
N of Valid Cases		352	

This table revealed a statistically significant relationship between foundation type and housing condition, with moderate correlation strength (Cramer's V = 0.302). This implied that the structural foundation had a measurable and impactful role in the resilience of buildings under climate stress.

Table 6: T-test: Two-Sample on climate change impact by foundation

	Building Foundation	
	Block	Plank
Mean	4.28	4.03
Variance	0.36	0.27
Observations	53	299
Pooled Variance	0.282	
Hypothesised Mean Difference	0	
df	350	
t Stat	3.24	
P(T<=t) one-tail	0.000653	
t Critical one-tail	1.65	
P(T<=t) two-tail	0.00131	
t Critical two-tail	1.97	

H_{01}: There is no significant difference in climate-related impacts, such as increased indoor temperatures, across building foundations in Ayetoro from 2012 to 2022.

- Mean (Block): 4.28
- Mean (Plank): 4.03
- t-Statistic: 3.24
- p-Value (two-tail): 0.0013
- t Critical (two-tail): 1.97

Conclusion: Since the p-value (0.0013) is less than 0.05, the null hypothesis is rejected.

This implies that there was a statistically significant difference in the perceived climate-related impacts (e.g., indoor heat) between buildings with concrete block foundations and those with wooden plank foundations. Specifically, buildings with block foundations reported greater resilience, suggesting they were better insulated or structurally adapted to rising temperatures over the period under review.

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Table 7: T-test: Two-Sample on climate change impact by location

	Building location	
	Dry	Swamp
Mean	3.7	4.26
Variance	0.23	0.30
Observations	10	289
Pooled Variance	0.293	
Hypothesised Mean Difference	0	
df	297	
t Stat	-3.56	
P(T<=t) one-tail	0.00257	
t Critical one-tail	1.81	
P(T<=t) two-tail	0.00515	
t Critical two-tail	2.23	

H_{02}: There is no significant difference in vulnerability to permanent flooding across building locations (dry land vs. swampy land) in Ayetoro from 2012 to 2022.

- Mean (Dry Land): 3.70
- Mean (Swamp): 4.26
- t-Statistic: -3.56
- p-Value (two-tail): 0.0052
- t Critical (two-tail): 2.23

Conclusion: Since the p-value (0.0052) is less than 0.05, the null hypothesis is rejected.

This study assessed the severity of climate impacts, including flooding (98.3%), building collapse, soil erosion, and displacement. Tables 4.3.3 to 4.3.8 confirmed significant differences in housing resilience based on foundation type and location, with swampy areas and plank foundations more vulnerable. Table 4.3.9 showed that strategies such as temporary relocation (mean = 4.32) and raising floors (mean = 4.28) were rated as the most effective by respondents.

Table 8: ANOVA result

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	10.3501	4	2.587524	9.38817	3.25E-07	2.397678
Within Groups	95.63854	347	0.275615			
Total	105.9886	351				

H_{03}: There is no significant difference in vulnerability to climate-related impacts, such as soil erosion due to increased rainfall, across different building ages in Ayetoro from 2012 to 2022.

- **F-Statistic:** 9.39
- **F Critical:** 2.40
- **p-Value:** 3.25×10^{-7}

Conclusion: Since the p-value is extremely small (<< 0.05) and F > F-critical, the null hypothesis is rejected.

This implies that there were significant differences in climate-related vulnerabilities across buildings of different ages. Notably, buildings aged 6–15 years had the highest average impact score (4.82), suggesting that they might be structurally vulnerable due to design limitations or inadequate retrofitting. This age group may represent structures that are no longer new but have not yet been renovated to withstand worsening climate conditions.

DISCUSSION OF FINDINGS

This study comprehensively examined the impacts of climate change on housing quality in Ayetoro Coastal Community, Ondo State, Nigeria. The analysis revealed significant linkages between environmental factors, socio-economic dynamics, and the structural attributes of buildings, offering insights into how these variables interact to shape vulnerability and adaptation outcomes over time.

The demographic data indicated a relatively high level of educational attainment among respondents, with the majority having completed secondary or tertiary education (Figure 1). Despite this, Figure 8 revealed that a considerable proportion of these individuals resided in buildings requiring major or minor repairs. This suggested that education, while important for awareness, did not necessarily translate to structural resilience in the absence of financial or technical resources.

Economic findings further demonstrated that the majority of residents earned modest incomes and primarily relied on personal savings to finance housing construction (Table 2; Table 6). Formal financing options, such as housing loans and mortgage services, were seldom utilised. This limited financial capacity constrained residents' ability to invest in resilient construction materials or building technologies, contributing to the prevalence of incremental and cost-driven housing practices.

The housing typology was dominated by single-storey bungalows used for residential purposes (Tables 4 and 5). These buildings, although affordable and easier to construct, were found to be more vulnerable to ground-level climate hazards such as flooding. Figure 5 shows that many of these houses had been in use for over a decade, making them increasingly susceptible to structural wear due to persistent climatic stress.

Structural Adaptation Strategies

The use of Reinforced Foundations (Concrete Piles, Fibre Cement Panel) is justified with Quantitative analysis in Tables 5 and 6, which show that plank foundations are correlated with higher climate-induced impacts. Thematic analysis (FGDs) revealed a reliance on informal methods, including stilt plants, embankments, trenching, and local materials. It confirmed local interest in stronger alternatives, as supported by Biswas et al. (2015) and recent studies by See et al. (2024), which advocate for flood-resilient materials for coastal communities.

Construction of Community Embankments and Trenches. FGD participants emphasised the ongoing use of embankments despite maintenance issues. This is also supported by the studies of Ward et al. (2017) and Yamamoto et al. (2021), which validate the effectiveness of community-led embankment projects in flood adaptation.

Subsidised Climate-Resilient Housing Policy. The inadequacy of self-funded strategies was noted in focus group discussions (FGDs). Castaño-Vázquez (2022) argued that informal, self-funded housing is unsustainable under worsening climate conditions: Early Warning Systems & Risk Communication. Movement restrictions (96.59%) and life-threatening weather (97.16%) in Table 3 indicate a need for improved alerts. This finding is supported by Nhamo et al. (2021), who advocate for community-based early warning systems in Africa's coastal zones. Community Housing Cooperatives. Displacement effects, at 52.84%, as shown in Table 3, necessitate the implementation of economic resilience measures. McNamara (2016) highlights the risks of unsupported relocations in vulnerable areas, as well as policy-backed enforcement of building standards. Table 2 confirms infrastructure damage (96.31% agreement). Adegun & Olusoga (2020) recommend that local planning authorities enforce material and location-based building codes in flood-prone settlements. The developed framework reflects a data-driven, community-sensitive, and practically feasible strategy to improve housing resilience in Ayetoro. Grounded in empirical evidence, it combines both immediate coping strategies and long-term resilience-building measures. The findings confirm the urgent need for integrated physical and institutional interventions that prioritise local context and socio-economic realities.

This study identified intense rainfall and permanent flooding as primary climate hazards impacting housing in Ayetoro (2012–2022). Increased rainfall intensity contributed to soil erosion, characterised by steep-sided channels from concentrated runoff (Agyarko et al., 2012; Morgan, 2005). Observed erosion caused infrastructure damage and displacement. Projections indicate that rising extreme climate events threaten coastal settlements globally, including West Africa (Seabrook, 2021; Olakunle et al., 2021). Intense rainfall accelerated roofing deterioration (Alchapar et al., 2016), while higher temperatures reduced concrete durability through accelerated cement setting (Robert, 2017). Flooding, exacerbated by sea-level rise (Olakunle et al., 2021), disproportionately affected structures with wooden foundations. Floodwaters induced foundation settlement (Balasubramanian, 2017), with high-velocity flows eroding soils and displacing lightweight buildings (Adeyemi, 2012).

Building foundation type correlated with indoor temperature variations (2012–2022), contrasting with Koranteng et al. (2015) on orientation but aligning with materials-focused studies (Robert, 2017; Vikneswaran et al., 2015). Earth block walls improved thermal comfort (Vincelas et al., 2017), while clay bricks reduced heat flow versus sand bricks (Vikneswaran et al., 2015). Older structures lacked erosion-resistant foundations. Roofing and flooring materials have a significant impact on indoor temperatures. Soil floors maintained lower temperatures than those of tile or cement (Galabada et al., 2021), and material selection significantly affects thermal comfort (Haruna et al., 2018). Light-coloured roofs and palm-fibre materials reduced heat gain (Carrasco-Tenezaca et al., 2021; Tiara, 2019).

Erosion and Flooding Vulnerability

Older buildings were more vulnerable to rainfall-induced erosion. Slope gradient amplifies erosion risk (Morgan, 2005), with frequent flooding increasing the susceptibility to sheet erosion. Residents mitigated erosion using local materials.

Structures in swamp zones face higher flooding risks due to their low elevation and inadequate drainage (Pujari & Wayal, 2023), a pattern consistent with those observed in Nigerian urban flooding (Ede et al., 2015).

Adaptation Strategies

Residents employed relocation, fortification, and drainage management. Indigenous meteorological knowledge informed flood forecasting (Fabiyi, 2013). Effective strategies included temporary relocation and fortification, aligning with West African flood responses (Owusu et al., 2023). Relocation involved socio-economic complexities (King et al., 2014), while successful resettlement required community agency (Lei et al., 2017). Drainage management reflected foundational water governance (Lienou et al., 2014).

CONCLUSION AND RECOMMENDATIONS

The study identified and then examined the climate change elements that have impacted housing infrastructure in the Ayetoro coastal community, Ondo State, Nigeria, from 2012 to 2022. Between 2012 and 2022, rising seas, floods, and intense storms steadily degraded Ayetoro's housing, with homes on swampy ground or wooden foundations being hit hardest. However, beyond diagnosing the problem, the findings suggest potential solutions. Residents themselves have rated temporary relocation and raising floors as the most effective measures, and recommendations include: Localised building codes requiring elevated, reinforced foundations in flood zones, mangrove restoration along the 40km coastal buffer to absorb storm surges, community-run early warnings for incoming floods or storms, and planned resettlement options for the most exposed households.

These aren't abstract ideas; they're concrete steps grounded in what works in Ayetoro Coastal Community, Ondo State, Nigeria.. Without them, Ayetoro's struggle against the elements will only deepen.

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