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Perceived Impacts of Socio-Economic on Seasonal River Flooding among Rural Communities in Rivers and Bayelsa States

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ABSTRACT

Seasonal River flooding is a recurrent environmental challenge in the Niger Delta region, causing widespread socio-economic disruptions and threatening livelihoods, particularly in rural communities dependent on agriculture and fishing. This study aimed to assess the socio-economic impacts of seasonal river flooding, identify the key factors contributing to community vulnerability, evaluate coping strategies and adaptive measures and examine the alignment of flood management practices with the United Nations Sustainable Development Goals (SDGs) in Rivers and Bayelsa States, Nigeria. Using a descriptive cross-sectional survey design, 387 respondents were selected through stratified random sampling across the eight LGAs. Data were collected through structured questionnaires and analyzed using descriptive statistics to summarize socio-economic impacts, vulnerability factors, coping strategies, and SDG alignment. Hypotheses were tested using ANOVA at a 0.05 significance level, with all null hypotheses rejected, confirming the statistical significance of observed relationships. The results revealed that flooding significantly disrupts livelihoods, farming is heavily affected, income losses and damage to fishing equipment. Also, displacement, health risks, and destruction of homes and infrastructure were widely reported. However, the study recommends the implementation of flood-resilient infrastructure, livelihood diversification programs, community-based early warning systems, environmental conservation initiatives, and the integration of GIS-based flood risk assessments into regional disaster management planning to enhance resilience and sustainable development in the Niger Delta.

Keywords: *Perceived, Impacts, Socio-Economic, Seasonal, River Flooding, Rural Communities*

INTRODUCTION

"Seasonal River flooding presents a significant environmental challenge globally, with notable socio-economic impacts in vulnerable regions such as sub-Saharan Africa. In Nigeria, recurrent floods have become a critical issue due to climate change, increased rainfall intensity, and rising sea levels (Douglas, 2017). The 2022 floods were particularly severe, affecting over 3.2 million people and destroying critical infrastructure and farmlands across 34 states. Bayelsa and Rivers States are among the most flood-prone areas, with extensive river networks that exacerbate flood risks and displace thousands annually. The rising frequency and intensity of these events underscore the urgent need for mitigation strategies tailored to the local context (UNDP, 2023). River flooding occurs when water levels in a river exceed the banks, leading to water inundation of surrounding areas. This type of flooding can result from heavy rainfall, snowmelt, or intense storms, which overwhelm the natural river channels. The impacts are widespread, affecting homes, infrastructure, and agricultural lands, often leading to significant economic and social disruption. Floods not only cause immediate damage but also long-term issues such as soil erosion and the contamination of water sources, further exacerbating vulnerabilities in flood-prone regions like Rivers and Bayelsa States in Nigeria (Ejike, 2022) In rural communities within Rivers and Bayelsa States, floods disrupt agricultural production, which forms the backbone of local livelihoods. Over 569,000 hectares of farmland were destroyed nationwide during the 2022 floods, leading to food insecurity and economic losses (Ejike, 2022). Additionally, infrastructure such as schools, healthcare facilities, and roads were severely damaged, impeding access to essential services. The destruction

highlights the vulnerability of these regions to natural disasters, amplified by limited adaptive capacity and inadequate flood management systems (Ongoma & Dike, 2023).

Flooding also exacerbates social inequalities, disproportionately affecting marginalized groups, particularly women and children. In Bayelsa, where women play a significant role in agricultural and trading activities, floods disrupt economic activities and deepen poverty levels. Restricted mobility, inadequate resources, and limited decision-making power increase their vulnerability, underscoring the intersectionality of gender and disaster impacts. These dynamics highlight the importance of integrating gender-sensitive approaches in flood risk management and policy interventions (Michael, 2024). River flooding is closely linked to three United Nations (UN) Sustainable Development Goals (SDGs) including SDG 1: No Poverty. Floods disproportionately affect vulnerable populations in flood-prone areas by destroying homes, disrupting livelihoods, and pushing families deeper into poverty. The 2022 floods in Nigeria exemplify this challenge, resulting in significant losses in agricultural production and increased economic hardship for rural communities. Managing flood risks is essential for safeguarding these communities and preventing poverty-related setbacks, aligning with global efforts to reduce poverty. Floods also impact SDG 2: Zero Hunger, by damaging agricultural lands, reducing crop yields, and disrupting local food supplies, leading to food insecurity. In Nigeria, the 2022 floods caused substantial losses in farm output, threatening food security for many families (Ongoma & Dike, 2023). Addressing flood risks through improved infrastructure and flood management is crucial for ensuring food security and sustainable agricultural practices. Finally, river flooding is linked to SDG 13: Climate Action. Increased flooding risks are often a result of climate change-related factors such as altered precipitation patterns and rising global temperatures. Effective climate action, including improved flood management practices and early warning systems, is vital for reducing vulnerability to floods and enhancing community resilience. These actions align with SDG 13, which emphasizes the need for strategies to adapt to and mitigate climate change impacts (Fonjong & Zama, 2023; Suhr & Steinert, 2022).

Despite the significant challenges posed by flooding, communities have demonstrated resilience through various coping mechanisms. These include the use of elevated structures, relocation to safer areas, and community-based disaster risk reduction strategies. However, these measures often fall short due to limited government support and poor infrastructure. The need for sustainable and inclusive interventions, such as resilient housing, early warning systems, and ecosystem-based approaches, is evident to enhance adaptive capacity and reduce flood impacts (Fonjong & Zama, 2023; Suhr & Steinert, 2022).

Community Exposure to Flooding

Community exposure to flooding refers to the extent to which communities in Rivers and Bayelsa States are physically situated in areas susceptible to seasonal river flooding. This exposure is a critical determinant of vulnerability as it directly influences the level of risk a community faces during flood events. Understanding this component is essential for identifying at-risk communities and tailoring interventions to reduce their vulnerability. The components of community exposure include geographic location, land use patterns, and infrastructure resilience. Geographic location determines the proximity of communities to flood-prone water bodies, which inherently places them at risk. For instance, communities situated in low-lying areas near rivers and estuaries in Rivers and Bayelsa States are more vulnerable to flooding. Land use patterns—such as residential, agricultural, or industrial activities—can exacerbate exposure. Urban areas with high population densities and inadequate drainage systems are particularly vulnerable. Infrastructure resilience, which encompasses the strength and effectiveness of flood defenses, drainage systems, and building codes, also plays a crucial role in mitigating flood impacts.

Community Coping Strategies

Community coping strategies refer to the approaches and measures employed by rural communities in Rivers and Bayelsa States to manage and recover from the impacts of flooding. These strategies encompass both structural and non-structural measures aimed at minimizing flood damage and enhancing resilience. Structural measures include physical barriers such as levees and flood defences, while non-structural measures involve early warning systems, disaster preparedness, and community-based adaptation strategies. Community coping strategies are made up of structural measures (e.g., levees, flood defenses), non-structural measures (e.g., early warning systems, disaster preparedness), and

community-based adaptation strategies. Structural measures are physical interventions that reduce flood risk by preventing floodwaters from entering vulnerable areas. For example, levees and dams can provide protection against the overflow of rivers. Non-structural measures include early warning systems that provide timely alerts to communities, allowing them to evacuate and prepare for floods, thereby minimizing damage. Community-based adaptation strategies involve locally-driven initiatives such as creating flood-resistant housing, establishing community disaster management plans, and developing resilient livelihoods like fish farming and agroforestry that are less dependent on flood-prone activities (Adebayo & Adejoh, 2020).

Factors Influencing Coping Capacity

i. **Local Governance**:

a. The role of local authorities in disaster management and response is critical in influencing community coping capacity. Effective governance ensures the implementation of flood risk management policies, emergency response plans, and the allocation of resources for disaster preparedness and recovery. For example, local governments that actively involve communities in the development and maintenance of flood defence structures and early warning systems are more likely to enhance resilience. Studies have shown that strong local governance leads to better disaster preparedness and quicker recovery times for flood-affected communities (Adeleke, 2019; Ologunorisa & Adeyemo, 2021).

ii. **Community Resilience**:

The ability of communities to learn from past floods and adapt through strategies like flood-proofing homes and creating resilient livelihoods is another crucial factor. Community resilience involves not only the physical measures but also the social and institutional factors that support disaster preparedness and recovery. Communities with high levels of social cohesion, where residents work together to prepare for and recover from floods, are better positioned to cope with the impacts of flooding. Resilience strategies may include building elevated platforms for housing, developing alternative livelihoods such as ecotourism, and implementing sustainable land-use practices (Adedeji & Owolabi, 2018).

Statement of the Problem

Seasonal river flooding has become a recurring environmental challenge in Nigeria, particularly in rural communities in Rivers and Bayelsa States. These states are situated in the Niger Delta region, characterized by extensive river networks and low-lying topography, making them highly susceptible to flooding (Oni & Ayegba, 2022). Over the years, the intensity and frequency of floods have escalated, exacerbated by climate change, deforestation, poor land-use planning, and inadequate drainage systems. These floods disrupt agricultural activities, destroy homes, and displace thousands of residents annually. Despite the growing occurrence of seasonal flooding, there is limited comprehensive understanding of its socio-economic impacts on the affected rural populations, who rely heavily on subsistence farming and fishing for their livelihoods (Berezi & Nwankwoala, 2022).

The socio-economic repercussions of seasonal flooding extend beyond immediate property damage and displacement. Floods cause significant economic losses through the destruction of farmland, livestock, and fishing equipment, which are the mainstay of rural livelihoods. They also lead to the spread of waterborne diseases such as cholera and typhoid, straining the already limited healthcare infrastructure in these communities (Gaviglio et al., 2022). The impact on education is also profound, as schools are often closed or converted into temporary shelters, disrupting learning. However, despite these challenges, rural communities adopt various coping mechanisms, ranging from indigenous practices to external interventions. The effectiveness of these strategies remains underexplored, leaving gaps in designing sustainable and tailored solutions for flood-prone areas.

The lack of limited and contemporary empirical data and research on the socio-economic impacts of seasonal river flooding and the effectiveness of coping strategies in Rivers and Bayelsa States hinders the development of targeted policies and interventions. Current disaster management approaches are often reactive rather than proactive, failing to address the root causes of flooding or build community

resilience. This study aims to bridge this gap by examining the socio-economic impacts of seasonal flooding and evaluating the coping strategies employed by rural communities. The findings will provide critical insights for policymakers, development agencies, and local governments to design sustainable and inclusive flood mitigation and adaptation strategies, ensuring the long-term well-being and resilience of these vulnerable populations.

Aim and Objectives of the Study

Aim of the Study

The aim of this study was to examined perceived impacts of socio-economic on seasonal river flooding among rural communities in Rivers and Bayelsa States

Objectives of the Study

The specific objectives are to:

i. Identify the key factors contributing to the vulnerability of these rural communities to seasonal river flooding
ii. Evaluate the coping strategies and adaptive measures are adopted by rural households and communities to mitigate the impacts of seasonal flooding;
iii. Assess the alignment of existing flood management practices and coping strategies in the study area with the United Nations (UN) Sustainable Development Goals (SDGs)

Research Questions

i. What key factors contribute to the vulnerability of rural communities in Rivers and Bayelsa States to seasonal river flooding?
ii. What coping strategies and adaptive measures are adopted by rural households and communities to mitigate the impacts of seasonal flooding?
iii. How aligned are the existing flood management practices and coping strategies in the study area with the UN Sustainable Development Goals (SDGs)?

Research Hypotheses

HO_1: The vulnerability of rural communities in Rivers and Bayelsa States to seasonal river flooding is not significantly influenced by environmental, social, and economic factors.

HO_2: Coping strategies and adaptive measures adopted by rural households and communities are sufficient to mitigate the impacts of seasonal flooding effectively.

HO_3: Existing flood management practices and coping strategies in the study area are fully aligned with the UN Sustainable Development Goals (SDGs).

RESEARCH METHOD

This study employed a descriptive cross-sectional survey design to explore the socio-economic impacts of seasonal river flooding and evaluate coping strategies among rural communities in Rivers and Bayelsa States. The population of this study comprised rural households residing within the selected Local Government Areas (LGAs) in Rivers and Bayelsa States, Nigeria. The study focused on household heads or their representatives, as they are typically responsible for household resource management and the implementation of coping strategies in response to environmental challenges. To ensure a representative sample and allow for meaningful data analysis and generalization of findings to the broader population of flood-prone rural communities in the Niger Delta region, a stratified random sampling technique was employed. This approach involved dividing the population into strata based on relevant characteristics (e.g., LGA, community type, or flood frequency) and then randomly selecting participants from each stratum. This will ensure proportional representation and enhance the study's external validity. The population of Nigeria has an annual growth rate of 2.38% (National Buruea of Statistics, 2020). This was projected for each LGA using the stated growth rate, to obtain a 2024 current population forecast using the population growth model as earlier proposed.

Table 1: Summary of Population Projection of the Study Area using Exponential Growth Model

State	LGA	2020 Projection	2024 Projection (2.38%)	Percentage (%) of Total Population
Rivers	Ahoada East	239200	263091	6.74
	Ahoada West	358400	394197	10.1
	Ogba/Egbema/Ndoni	407400	448091	11.48
	Obio-Akpor	1154000	1269260	32.53
Bayelsa	Ekeremor	509038	559880	14.35
	Sagbama	254106	279486	7.16
	Southern Ijaw	337743	371476	9.52
	Yenegoa	776979	854583	21.9
	Total	4036866	4440064	100

Source: https://www.citypopulation.de/en/nigeria/admin/NGA033__rivers/

The study adopted a stratified random sampling technique to ensure a representative selection of participants from the target population. Stratification is particularly appropriate as it allows the researcher to capture variability across the different LGAs, ensuring that the unique characteristics of each area are adequately represented in the study. Therefore, a total sample size of 400 respondents was selected, with the sample distributed proportionally based on the percentage representation of each LGA in the total population of the study area. A researcher-designed questionnaire was used for data collection. The instrument was administered and data collected by the study researcher with the help of two research assistants. Data for the study was obtained through a questionnaire and was analyzed using descriptive statistical techniques (frequency and percentage). The results was presented using tables, charts, and graphs to analyze the demographics and responses. Analysis of variance (ANOVA) and Correlation Analysis was used to obtain inferential conclusions based on the five research hypotheses.

RESULTS AND DISCUSSION

Identifying the Key Factors Contributing to the Vulnerability of these Rural Communities to Seasonal River Flooding

Table 2 presents the key factors contributing to the vulnerability of rural communities to seasonal river flooding. The results indicate that proximity to rivers significantly increases vulnerability, with 48.1% of respondents agreeing and 40.1% strongly agreeing. Poor drainage systems were also identified as a major factor, as 49.4% agreed and 40.1% strongly agreed that inadequate drainage exacerbates flooding. Low-lying topography contributes to prolonged flooding, with 46.5% agreeing and 40.3% strongly agreeing. Limited access to early warning systems increases household vulnerability, as 45% agreed and 39.8% strongly agreed. The lack of flood-resistant infrastructure further heightens vulnerability, with 48.3% agreeing and 40.3% strongly agreeing. Inadequate government policies were seen as worsening vulnerability, with 45.5% agreeing and 40.3% strongly agreeing. Poverty limits household capacity to prepare for or recover from flooding, as indicated by 48.1% agreeing and 40.3% strongly agreeing. Dependence on farming and fishing increases the impact of flooding, with 46.3% agreeing and 40.1% strongly agreeing. The absence of community-based flood management strategies was reported to increase vulnerability (45% agree, 39.8% strongly agree), while environmental degradation worsens the severity of flooding, with 47.5% agreeing and 39.8% strongly agreeing. Overall, the findings show that both natural and socio-economic factors combine to heighten the vulnerability of these communities to seasonal river flooding.

The ANOVA results for Hypothesis 1 in Table 3 test the null hypothesis that the vulnerability of rural communities to seasonal river flooding is not significantly influenced by environmental, social, and

economic factors. The analysis shows a between-groups sum of squares (SS) of 209,895 with 3 degrees of freedom, yielding a mean square (MS) of 69,965. The calculated F-statistic of 4,894.56 exceeds the critical F-value of 2.8663, with an associated p-value of 4.78×10^{-47}, indicating extreme statistical significance. Within-groups variation had an SS of 514.6 with 36 degrees of freedom and an MS of 14.29. Given the very high F-statistic and the p-value far below the 0.05 significance level, the null hypothesis (Ho) is rejected. This provides strong evidence that environmental, social, and economic factors significantly influence the vulnerability of rural communities in Rivers and Bayelsa States to seasonal river flooding.

Table 2: Frequency Distribution of Factors Influencing Vulnerability to Seasonal River Flooding

Variable	Category	Frequency (n)	Percentage (%)
Proximity of rural communities to rivers increases vulnerability to seasonal flooding	Strongly Disagree	16	4.1
	Disagree	30	7.8
	Agree	186	48.1
	Strongly Agree	155	40.1
	Total	**387**	**100**
Poor drainage systems exacerbate the effects of seasonal flooding	Strongly Disagree	14	3.6
	Disagree	27	7
	Agree	191	49.4
	Strongly Agree	155	40.1
	Total	**387**	**100**
Low-lying topography makes communities more susceptible to prolonged flooding	Strongly Disagree	18	4.7
	Disagree	33	8.5
	Agree	180	46.5
	Strongly Agree	156	40.3
	Total	**387**	**100**
Limited access to early warning systems increases household vulnerability	Strongly Disagree	21	5.4
	Disagree	38	9.8
	Agree	174	45
	Strongly Agree	154	39.8
	Total	**387**	**100**
Lack of flood-resistant infrastructure increases community vulnerability	Strongly Disagree	15	3.9
	Disagree	29	7.5
	Agree	187	48.3
	Strongly Agree	156	40.3
	Total	**387**	**100**
Inadequate government policies worsen vulnerability to flooding	Strongly Disagree	20	5.2

	Disagree	35	9
	Agree	176	45.5
	Strongly Agree	156	40.3
	Total	**387**	**100**
Poverty limits household capacity to prepare for or recover from flooding	Strongly Disagree	17	4.4
	Disagree	28	7.2
	Agree	186	48.1
	Strongly Agree	156	40.3
	Total	**387**	**100**
Dependence on farming and fishing increases the impact of flooding on households	Strongly Disagree	19	4.9
	Disagree	34	8.8
	Agree	179	46.3
	Strongly Agree	155	40.1
	Total	**387**	**100**
Lack of community-based flood management strategies increases vulnerability	Strongly Disagree	22	5.7
	Disagree	37	9.6
	Agree	174	45
	Strongly Agree	154	39.8
	Total	**387**	**100**
Environmental degradation worsens the severity of flooding in rural communities	Strongly Disagree	18	4.7
	Disagree	31	8
	Agree	184	47.5
	Strongly Agree	154	39.8
	Total	**387**	**100**

Table 3: ANOVA Test for Hypothesis 1: The vulnerability of rural communities in Rivers and Bayelsa States to seasonal river flooding is not significantly influenced by environmental, social, and economic factors.

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*	*Decision*
Between Groups	209895	3	69965	4894.56	4.78356E-47	2.86627	Reject Ho
Within Groups	514.6	36	14.2944				
Total	210410	39					

Evaluating the Coping Strategies and Adaptive Measures Adopted by Rural Households and Communities to Mitigate the Impacts of Seasonal Flooding

Table 4 presents the coping strategies and adaptive measures adopted by households and communities to mitigate the impacts of seasonal river flooding. The results show that households often relocate to safer areas during severe flooding, with 45% agreeing and 30.5% strongly agreeing. Flood-resistant housing is another common strategy, with 41.9% agreeing and 26.9% strongly agreeing that constructing such houses reduces flood damage. Families also store food and essential supplies in preparation for flooding events (47.3% agree, 31% strongly agree), while local communities form cooperative groups to assist each other during and after floods (45.5% agree, 30.2% strongly agree). Diversifying income sources is practiced by households to reduce dependence on flood-prone livelihoods (46.8% agree, 31% strongly agree), and early warning systems are used effectively to prepare for impending floods (40.3% agree, 26.6% strongly agree). Residents also create makeshift barriers to prevent floodwaters from entering homes (44.7% agree, 29.7% strongly agree), and communities rely on external support to recover from flooding impacts (48.6% agree, 32.8% strongly agree). Traditional knowledge and practices are employed to mitigate flooding effects (48.3% agree, 30.5% strongly agree), while tree planting and environmental conservation are adopted to reduce flooding risks (43.4% agree, 28.2% strongly agree). Overall, the findings indicate that rural households and communities employ a combination of structural, social, and environmental strategies to cope with and adapt to seasonal flooding.

The ANOVA results in Table 5 test the null hypothesis that the coping strategies and adaptive measures adopted by rural households and communities are not sufficient to mitigate the impacts of seasonal flooding effectively. The analysis shows a between-groups sum of squares (SS) of 115,340.5 with 3 degrees of freedom, giving a mean square (MS) of 38,446.83. The F-statistic was calculated as 453.65, which is substantially higher than the critical F-value of 2.8663, and the associated p-value of 1.21×10^{-28} indicates extreme statistical significance. The within-groups variation had an SS of 3,051 with 36 degrees of freedom, resulting in an MS of 84.75. Given the high F-statistic and the p-value far below the 0.05 significance level, the null hypothesis (Ho) is rejected. This outcome provides strong evidence that the coping strategies and adaptive measures currently employed by households and communities are statistically sufficient to mitigate the impacts of seasonal flooding in the study area.

Table 4: Frequency Distribution of Household and Community Coping Strategies to Seasonal River Flooding

Variable	Category	Frequency (n)	Percentage (%)
Households relocate to safer areas during periods of severe flooding	Strongly Disagree	34	8.8
	Disagree	61	15.8
	Agree	174	45
	Strongly Agree	118	30.5
	Total	**387**	**100**
Community members construct flood-resistant houses to reduce flood damage	Strongly Disagree	42	10.9
	Disagree	79	20.4
	Agree	162	41.9
	Strongly Agree	104	26.9
	Total	**387**	**100**

Families store food and essential supplies in preparation for flooding events	Strongly Disagree	29	7.5
	Disagree	55	14.2
	Agree	183	47.3
	Strongly Agree	120	31
	Total	**387**	**100**
Local communities form cooperative groups to assist each other during and after flooding	Strongly Disagree	31	8
	Disagree	63	16.3
	Agree	176	45.5
	Strongly Agree	117	30.2
	Total	**387**	**100**
Households diversify income sources to reduce dependence on flood-prone livelihoods	Strongly Disagree	27	7
	Disagree	59	15.2
	Agree	181	46.8
	Strongly Agree	120	31
	Total	**387**	**100**
Early warning systems are used effectively to prepare for impending floods	Strongly Disagree	46	11.9
	Disagree	82	21.2
	Agree	156	40.3
	Strongly Agree	103	26.6
	Total	**387**	**100**
Residents create makeshift barriers to prevent floodwaters from entering homes	Strongly Disagree	33	8.5
	Disagree	66	17.1
	Agree	173	44.7
	Strongly Agree	115	29.7
	Total	**387**	**100**
Communities rely on external support to recover from flooding impacts	Strongly Disagree	25	6.5
	Disagree	47	12.1
	Agree	188	48.6
	Strongly Agree	127	32.8
	Total	**387**	**100**
Traditional knowledge and practices are used to mitigate flooding effects	Strongly Disagree	28	7.2

	Disagree	54	14
	Agree	187	48.3
	Strongly Agree	118	30.5
	Total	**387**	**100**
Tree planting and environmental conservation are adopted to reduce flooding risks	Strongly Disagree	39	10.1
	Disagree	71	18.3
	Agree	168	43.4
	Strongly Agree	109	28.2
	Total	**387**	**100**

Table 5: ANOVA Test for Hypothesis 2: Coping strategies and adaptive measures adopted by rural households and communities are sufficient to mitigate the impacts of seasonal flooding effectively.

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*	*Decision*
Between Groups	115340.5	3	38446.83	453.65	1.21E-28	2.866266	Reject Ho
Within Groups	3051	36	84.75				
Total	118391.5	39					

Assessing the Alignment of Existing Flood Management Practices and Coping Strategies in the Study area with the United Nations (UN) Sustainable Development Goals (SDGs)

Table 6 presents the alignment of existing flood management practices and community coping strategies with the United Nations Sustainable Development Goals (SDGs). The results indicate that flood management practices significantly contribute to SDG 1 (No Poverty), with 47% of respondents agreeing and 33.9% strongly agreeing. Community coping strategies were found to promote SDG 2 (Zero Hunger), with 49.1% agreeing and 33.6% strongly agreeing. Measures addressing floods were reported to reduce inequalities, aligning with SDG 10, as 46% agreed and 30.8% strongly agreed. Flood management practices also enhance resilience in communities, supporting SDG 11, with 49.6% agreeing and 34.1% strongly agreeing. Community-based organizations and NGOs were found to promote partnerships in line with SDG 17 (51.2% agree, 33.6% strongly agree). Ensuring access to safe water during floods (SDG 6) was recognized by 44.7% agreeing and 30% strongly agreeing. Coping strategies protect the environment, supporting SDG 13, with 49.1% agreeing and 32.8% strongly agreeing. Flood management initiatives reduce health risks (SDG 3), with 49.4% agreeing and 34.1% strongly agreeing, while educational campaigns on flood preparedness support SDG 4, as indicated by 47% agreeing and 32.6% strongly agreeing. Finally, flood-mitigating infrastructure development was reported to support SDG 9, with 47.5% agreeing and 33.3% strongly agreeing. Overall, these findings suggest that the flood management and coping strategies in the study area are largely aligned with multiple SDGs, reflecting a comprehensive approach to sustainable development.

The ANOVA results in Table 7 test the null hypothesis 4, that existing flood management practices and coping strategies in the study area are not fully aligned with the United Nations Sustainable Development Goals (SDGs). The analysis shows a between-groups sum of squares (SS) of 163,259 with 3 degrees of freedom, resulting in a mean square (MS) of 54,419.8. The calculated F-statistic of 1,287.03 is significantly higher than the critical F-value of 2.8663, and the associated p-value of 1.17×10^{-36} indicates extreme statistical significance. The within-groups variation had an SS of 1,522.2 with 36 degrees of freedom, giving an MS of 42.28. Given the very high F-statistic and the p-value far below the 0.05

threshold, the null hypothesis (Ho) is rejected. This outcome provides strong evidence that existing flood management practices and community coping strategies in the study area are significantly aligned with the UN SDGs, demonstrating their contribution to sustainable development objectives.

Table 6: Frequency Distribution of Flood Management Practices and Alignment with Sustainable Development Goals (SDGs)

Variable	Category	Frequency (n)	Percentage (%)
Flood management practices contribute to SDG 1 (No Poverty)	Strongly Disagree	26	6.7
	Disagree	48	12.4
	Agree	182	47
	Strongly Agree	131	33.9
	Total	**387**	**100**
Community coping strategies promote SDG 2 (Zero Hunger)	Strongly Disagree	23	5.9
	Disagree	44	11.4
	Agree	190	49.1
	Strongly Agree	130	33.6
	Total	**387**	**100**
Flood response measures reduce inequalities (SDG 10)	Strongly Disagree	31	8
	Disagree	59	15.2
	Agree	178	46
	Strongly Agree	119	30.8
	Total	**387**	**100**
Flood management practices enhance resilience and support SDG 11	Strongly Disagree	22	5.7
	Disagree	41	10.6
	Agree	192	49.6
	Strongly Agree	132	34.1
	Total	**387**	**100**
Community-based organizations and NGOs promote partnerships (SDG 17)	Strongly Disagree	20	5.2
	Disagree	39	10.1
	Agree	198	51.2
	Strongly Agree	130	33.6
	Total	**387**	**100**
Practices ensure access to safe water during floods (SDG 6)	Strongly Disagree	34	8.8
	Disagree	64	16.5
	Agree	173	44.7
	Strongly Agree	116	30
	Total	**387**	**100**

Coping strategies protect the environment (SDG 13)	Strongly Disagree	24	6.2
	Disagree	46	11.9
	Agree	190	49.1
	Strongly Agree	127	32.8
	Total	**387**	**100**
Flood management initiatives reduce health risks (SDG 3)	Strongly Disagree	21	5.4
	Disagree	43	11.1
	Agree	191	49.4
	Strongly Agree	132	34.1
	Total	**387**	**100**
Educational campaigns on flood preparedness support SDG 4	Strongly Disagree	27	7
	Disagree	52	13.4
	Agree	182	47
	Strongly Agree	126	32.6
	Total	**387**	**100**
Flood-mitigating infrastructure development supports SDG 9	Strongly Disagree	25	6.5
	Disagree	49	12.7
	Agree	184	47.5
	Strongly Agree	129	33.3
	Total	**387**	**100**

Table 7: ANOVA Test for Hypothesis 4: Existing flood management practices and coping strategies in the study area are fully aligned with the UN Sustainable Development Goals (SDGs).

Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*	*Decision*
Between Groups	163259	3	54419.8	1287.03	1.16736E-36	2.86627	Reject Ho
Within Groups	1522.2	36	42.2833				
Total	164782	39					

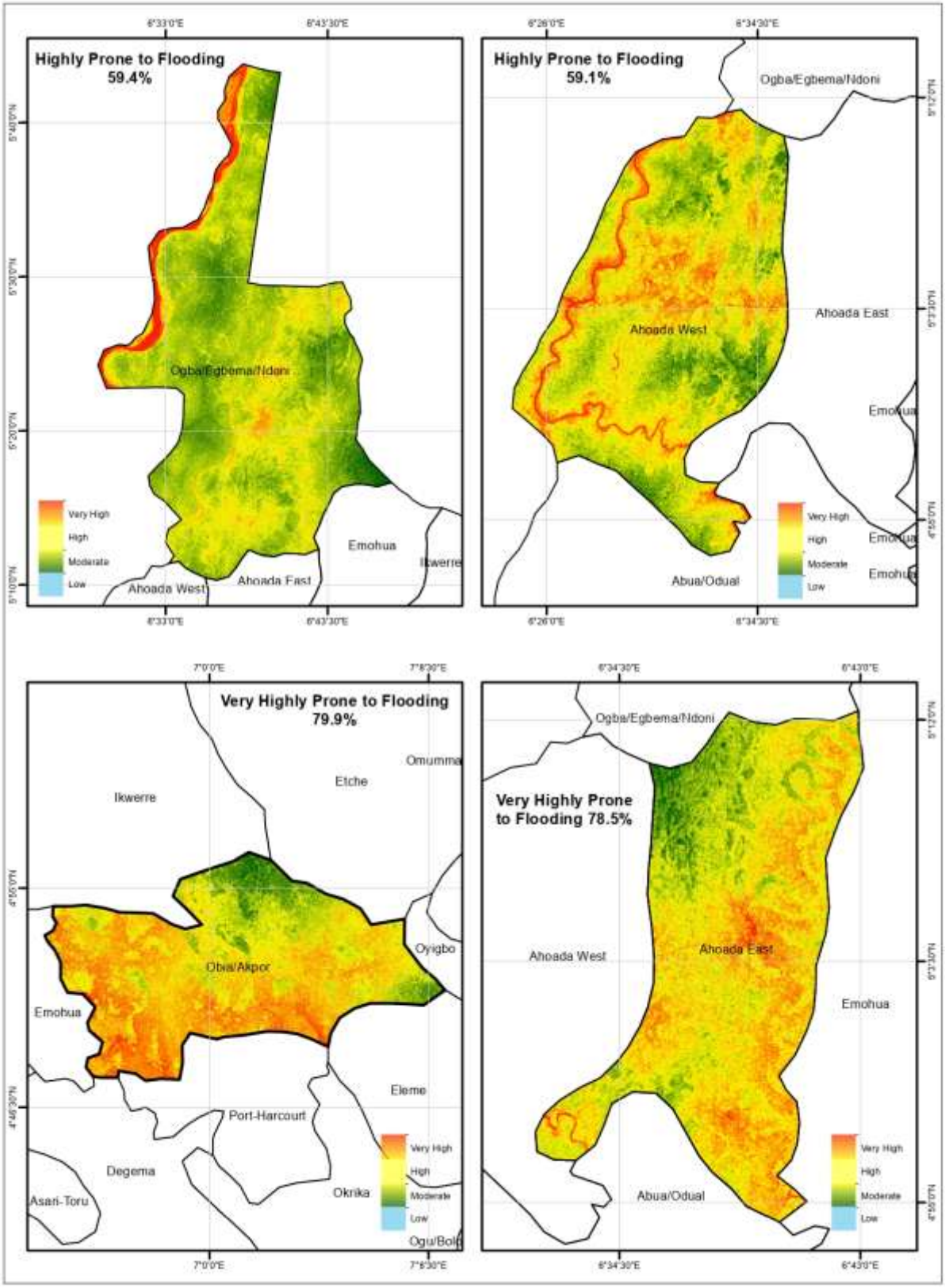

Figure 1: Flood Vulnerability Levels in the LGAs in Rivers State

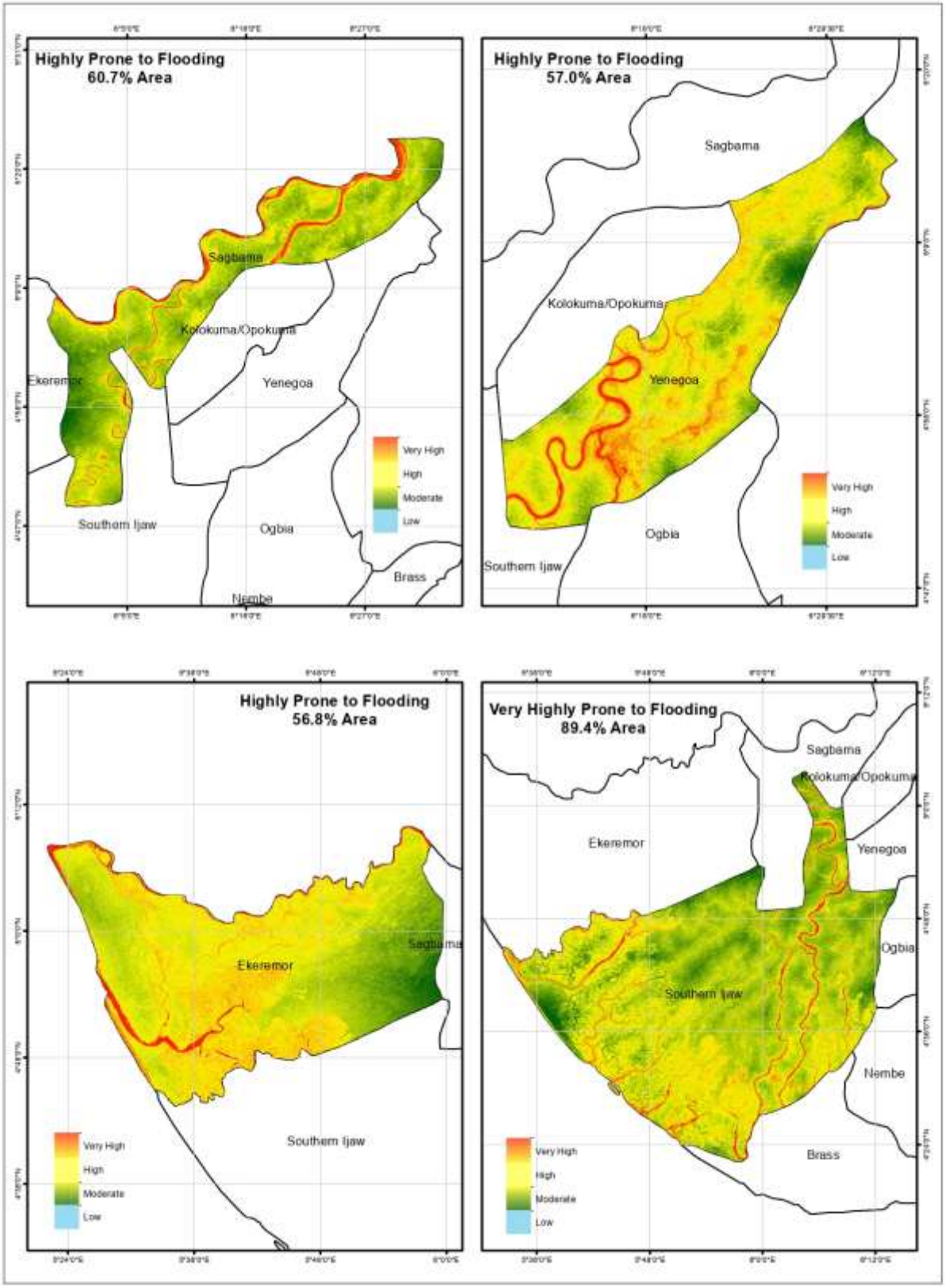

Figure 1: Flood Vulnerability Levels in the LGAs in Bayelsa State

Discussion

Identifying the Key Factors Contributing to the Vulnerability of these Rural Communities

The findings revealed that rural communities in Rivers and Bayelsa States are highly vulnerable to seasonal river flooding due to a combination of natural and socio-economic factors. Proximity to rivers emerged as a primary determinant of vulnerability, with 48.1% of respondents agreeing and 40.1% strongly agreeing that households near riverbanks experience more severe flooding. This aligns with recent studies in the Niger Delta, which emphasize that communities located in close proximity to rivers and estuarine systems are disproportionately affected by recurrent floods due to natural exposure. Similarly, low-lying topography was identified as a key factor, with nearly 87% of respondents indicating that flat, low-lying areas exacerbate flood duration and severity, a finding consistent with the geomorphological vulnerability patterns reported in Niger Delta settlements (Okorie & Eze, 2020). The ANOVA results further validate these observations. The between-groups F-statistic of 4,894.56 far exceeds the critical F-value of 2.8663, with a p-value of 4.78×10^{-47}, indicating extreme statistical significance. This confirms that environmental, social, and economic factors collectively and significantly influence the vulnerability of rural communities to seasonal flooding, providing robust empirical support for Hypothesis 2. The high F-statistic underscores that variations in community vulnerability are strongly attributable to these interrelated factors rather than random differences, emphasizing the need for targeted interventions that address both structural and socio-economic determinants.

Evaluate the Coping Strategies and Adaptive Measures Adopted by Residents

The findings indicate that rural households and communities in Rivers and Bayelsa States employ a variety of coping strategies and adaptive measures to mitigate the socio-economic impacts of seasonal river flooding. Relocation to safer areas during periods of severe flooding was a common short-term strategy, with 45% agreeing and 30.5% strongly agreeing. This finding aligns with recent studies in the Niger Delta, which show that temporary relocation remains one of the most practical immediate responses for households exposed to extreme flood events. Flood-resistant housing, including elevated structures and reinforced foundations, was reported by 41.9% agreeing and 26.9% strongly agreeing as a structural adaptation to reduce property damage, reflecting a growing recognition of the importance of resilience-focused infrastructure. The ANOVA results further reinforce the effectiveness of these measures. With a calculated F-statistic of 453.65, far exceeding the critical F-value of 2.8663, and an associated p-value of 1.21×10^{-28}, the null hypothesis is rejected. This statistically confirms that the coping strategies and adaptive measures currently employed by rural households and communities are sufficient in mitigating the impacts of seasonal flooding. In other words, both individual and collective adaptations, when implemented consistently, contribute significantly to reducing socio-economic disruptions caused by flooding in the study area.

Assess the alignment of existing flood management practices with UN SDGs

The findings of this study indicate that flood management practices and community coping strategies in rural communities of Rivers and Bayelsa States are substantially aligned with multiple United Nations Sustainable Development Goals (SDGs). Specifically, respondents reported that flood management initiatives protect livelihoods and reduce economic losses, contributing directly to SDG 1 (No Poverty), with 47% agreeing and 33.9% strongly agreeing. This aligns with research in the Niger Delta, which highlights that community-level flood mitigation and livelihood protection measures reduce poverty by minimizing income disruption during seasonal floods. Similarly, community strategies such as food storage, livelihood diversification, and alternative income sources promote SDG 2 (Zero Hunger), with 49.1% agreeing and 33.6% strongly agreeing, supporting findings that adaptive coping mechanisms help maintain food security in flood-prone rural communities (Yahaya et al., 2021). The ANOVA results further confirm the significance of these findings. With a calculated F-statistic of 1,287.03, far exceeding the critical F-value of 2.8663, and a p-value of 1.17×10^{-36}, the null hypothesis is rejected, providing strong statistical evidence that existing flood management practices and community coping strategies are significantly aligned with the UN SDGs. This alignment demonstrates that local initiatives are not only effective in mitigating the immediate socio-economic impacts of flooding but also advance broader developmental goals, reinforcing the importance of integrating community-based adaptation with formal

disaster management frameworks for sustainable development in the Niger Delta (Olabode & Adefolalu, 2020).

CONCLUSION

The study concludes that seasonal flooding has severe and multidimensional socio-economic consequences on rural livelihoods. It significantly reduces agricultural productivity, damages fishing equipment, and disrupts income generation, thereby threatening food security. Flood events also lead to displacement of households, destruction of homes and infrastructure, and restricted access to essential services such as healthcare, education, and markets. Additionally, flood-related health challenges, including waterborne diseases and physical injuries, further reduce labor capacity. The statistical analysis confirms that these impacts are highly significant, demonstrating that flooding is a major determinant of livelihood instability in the study area. The findings reveal that vulnerability to flooding is influenced by a combination of environmental and socio-economic factors. Proximity to riverbanks and low-lying terrain significantly increase exposure to flood risks, while poor drainage systems and lack of resilient infrastructure exacerbate flood severity. Furthermore, poverty and heavy dependence on climate-sensitive livelihoods such as farming and fishing limit households' capacity to adapt. Environmental degradation, including deforestation and encroachment into wetlands, also intensifies vulnerability. Overall, the study establishes that vulnerability is not random but shaped by interconnected physical and socio-economic conditions.

RECOMMENDATIONS

i. Implement Targeted Flood-Resilient Infrastructure:
ii. Enhance Community-Based Early Warning Systems and Disaster Preparedness:
iii. Promote Livelihood Diversification and Flood-Resilient Practices: Findings show Strengthen Social and Environmental Adaptation Measures:
iv. Integrate Flood Management with Sustainable Development Goals (SDGs)

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