
| RESEARCH ARTICLE**Climate Change, Food Security and the Challenges of the Mangrove Ecosystems of the Niger Delta****Joseph U. Akiang¹ ✉ Fidelis L. Ishaq² and Margaret-Mary U. Akiang³**¹²*Department of Geography, Federal College of Education, Obudu, Cross River State*³*Department of Home Economics, Federal College of Education, Obudu, Cross River State***Corresponding Author:** Joseph U. Akiang, **E-mail:** emmanuelngwu904@gmail.com

| ABSTRACT

Climate change poses a significant threat to food security in the mangrove ecosystems of the Niger Delta, Nigeria, where coastal communities depend on fisheries, agriculture, and forest resources for their livelihoods. This paper examines the impacts of climate change on food production systems by exploring key challenges, including sea-level rise, flooding, saltwater intrusion, erratic rainfall, mangrove degradation, and declining fish stocks. It further analyzes the socioeconomic vulnerabilities of mangrove-dependent households, which are exacerbated by environmental degradation, poverty, and limited adaptive capacity. Drawing on existing literature, the paper highlights how these interacting stressors undermine food availability, access, utilization, and stability. It concludes that strengthening the resilience of mangrove ecosystems is essential for achieving sustainable food security in the Niger Delta. The paper recommends climate-smart agriculture, sustainable fisheries management, mangrove restoration, improved flood-control infrastructure, stronger environmental governance, and community-based adaptation strategies to enhance livelihood resilience and ensure long-term food security under changing climatic conditions.

| KEYWORDS

Climate change; food security; mangrove ecosystems; Niger Delta; adaptation strategies

| ARTICLE INFORMATION**ACCEPTED:** September 08, 2026 **PUBLISHED:** October 12, 2026 **DOI:** <https://doi.org/10.61424/bjaes.v3i1.1089>

1. Introduction

Climate change has emerged as one of the most significant threats to global food security, particularly in fragile coastal ecosystems where livelihoods depend directly on natural resources. The mangrove ecosystem of the Niger Delta, Nigeria, provides critical ecosystem services, including fisheries, soil stabilization, carbon sequestration, and shoreline protection, while supporting the livelihoods and food security of millions of people.

However, increasing temperatures, sea-level rise, erratic rainfall, flooding, coastal erosion, and saltwater intrusion are degrading these ecosystems and reducing agricultural productivity and fishery yields (Intergovernmental Panel on Climate Change [IPCC], 2023). These climate-related pressures are compounded by oil pollution, gas flaring, deforestation, and unsustainable resource exploitation, thereby increasing the vulnerability of coastal communities (Food and Agriculture Organization [FAO], 2023).

This paper examines the challenges posed by climate change to food security in the mangrove ecosystems of the Niger Delta, analyzes the socioeconomic and ecological vulnerabilities of dependent communities, and evaluates adaptation strategies for enhancing resilience. Although various studies have examined climate change, environmental degradation, and food security separately, relatively few have integrated these dimensions within the context of the Niger Delta's mangrove ecosystems using an ecosystem-based resilience perspective. This gap limits the development of holistic policies capable of addressing the interconnected nature of climate risks and livelihood insecurity.

This paper contributes to knowledge by synthesizing current evidence on climate-induced food security challenges in the Niger Delta, identifying key vulnerability pathways, and proposing integrated adaptation strategies that combine ecosystem restoration, climate-smart agriculture, sustainable fisheries management, and community-based governance. The findings provide a useful framework for researchers, policymakers, and development practitioners seeking to strengthen climate resilience and promote sustainable food systems in Nigeria's coastal environments.

2. Theoretical Framework

This paper is anchored in the Social-Ecological Systems (SES) framework developed by Elinor Ostrom and subsequently refined for climate resilience and sustainability research. The SES framework conceptualizes human societies and ecosystems as interconnected systems in which ecological changes directly influence social and economic outcomes, while human activities simultaneously shape ecosystem conditions (Ostrom, 2019).

In the context of the Niger Delta, mangrove ecosystems provide essential ecosystem services, including fisheries, shoreline protection, carbon sequestration, and nutrient cycling, which underpin the food security and livelihoods of coastal communities. Climate change disrupts these ecosystem functions through sea-level rise, flooding, saltwater intrusion, rising temperatures, and altered precipitation patterns, thereby increasing the vulnerability of mangrove-dependent households (IPCC, 2023).

The framework further emphasizes resilience, adaptive capacity, and institutional governance as critical determinants of how communities respond to environmental change. Food security in the Niger Delta depends not only on the availability of natural resources but also on the capacity of households, institutions, and governments to implement adaptive measures such as mangrove restoration, climate-smart agriculture, sustainable fisheries management, and disaster risk reduction (UNFCCC, 2021). The SES framework is therefore appropriate for the study because it explains the dynamic interactions among climate change, ecosystem degradation, human vulnerability, and adaptation strategies. It also provides a holistic lens for understanding how integrated environmental governance and community participation can enhance ecosystem resilience, safeguard ecosystem services, and promote food security in the Niger Delta under changing climatic conditions.

3. Methodology

The study adopted a qualitative desk review design to examine the relationship between climate change and food security in the mangrove ecosystems of the Niger Delta, Nigeria. A systematic review of published and grey literature was conducted to synthesize current knowledge on climate-induced challenges, community vulnerabilities, and adaptation strategies.

Relevant literature was identified through electronic databases, including Scopus, Web of Science, ScienceDirect, Google Scholar, and SpringerLink, using combinations of keywords such as climate change, food security, mangrove ecosystems, Niger Delta, adaptation, vulnerability, and Nigeria.

The review focused primarily on peer-reviewed journal articles published between 2015 and 2025, supplemented by reports from international organizations such as the Intergovernmental Panel on Climate Change (IPCC), Food and Agriculture Organization (FAO), United Nations Environment Programme (UNEP), and the World Bank. Publications were selected based on their relevance, methodological rigor, and contribution to understanding climate impacts on food systems and ecosystem resilience in the Niger Delta.

Data extracted from the selected sources were subjected to thematic content analysis. The analysis identified recurring themes related to climate change impacts, food security dimensions, livelihood vulnerability, ecosystem degradation, and adaptation strategies. Findings from diverse sources were synthesized to establish patterns, identify knowledge gaps, and develop evidence-based recommendations. This methodological approach provides a comprehensive and up-to-date assessment of climate change and food security in the mangrove ecosystems of the Niger Delta while offering a robust foundation for policy formulation, future empirical research, and sustainable ecosystem management.

4. Findings and Discussion

4.1 Climate Change and the Mangrove Ecosystems of the Niger Delta

The Niger Delta is one of the largest mangrove ecosystems in Africa, covering approximately 10,000 km² of mangrove forests and associated wetlands. The ecosystem supports exceptionally high biodiversity and provides essential ecosystem services, including carbon sequestration, shoreline stabilization, nutrient cycling, fisheries production, flood regulation, and habitat for numerous aquatic and terrestrial species (IPCC, 2023; FAO, 2023). Beyond its ecological significance, the mangrove ecosystem underpins the livelihoods of millions of people through artisanal fishing, crop cultivation, fuelwood collection, aquaculture, and the harvesting of non-timber forest products. Consequently, the sustainability of the mangrove ecosystem is closely linked to food security, poverty reduction, and socioeconomic development in the Niger Delta.

Climate change has become one of the principal drivers of ecosystem degradation in the region. Rising atmospheric temperatures, increasing sea-levels, changes in rainfall distribution, frequent storm surges, and more intense flooding have significantly altered the ecological functioning of mangrove forests (IPCC, 2022). These climate changes have accelerated shoreline erosion, increased saline water intrusion into freshwater systems, and reduced the regenerative capacity of mangrove vegetation. Such environmental changes threaten the ecological integrity of the Niger Delta and diminish the ecosystem services upon which local communities depend.

Sea-level rise remains one of the most visible manifestations of climate change in the Niger Delta. Low-lying coastal communities are increasingly exposed to tidal inundation, resulting in the loss of agricultural land, destruction of settlements, and degradation of freshwater resources. Saltwater intrusion into rivers and groundwater systems reduces soil fertility and limits the cultivation of staple crops such as cassava, maize, vegetables, and plantain. Salinity also alters aquatic habitats, affecting fish breeding grounds and reducing fish abundance (Friess et al., 2019).

The ecological impacts of climate change are further intensified by anthropogenic pressures. Decades of oil exploration, gas flaring, pipeline failures, and crude oil spills have caused widespread environmental degradation in the Niger Delta. Oil contamination damages mangrove roots, inhibits seed germination, reduces biodiversity, and diminishes fish productivity (UNEP, 2021). Gas flaring contributes to greenhouse gas emissions while exposing surrounding vegetation and agricultural lands to elevated temperatures and acid deposition. The interaction between climate change and industrial pollution creates cumulative environmental stress that exceeds the adaptive capacity of many coastal ecosystems.

Mangrove forests also play a critical role in climate change mitigation because they are among the world's most efficient natural carbon sinks. Their capacity to store "blue carbon" in vegetation and sediments contributes significantly to greenhouse gas mitigation (UNEP, 2022). However, continued degradation reduces carbon storage capacity and transforms mangrove ecosystems from carbon sinks into potential carbon sources. Protecting and restoring mangrove forests therefore delivers dual benefits by enhancing climate mitigation while strengthening local food systems and livelihoods.

Biodiversity loss represents another important consequence of climate change. According to Zhao *et al* (2021) alteration in water temperature, salinity, and hydrological conditions affects species composition, migration patterns, and reproductive cycles of fish, crustaceans, and molluscs. Declining biodiversity weakens ecosystem resilience and reduces the availability of food resources for local populations. Since fisheries provide the principal source of animal protein for many households, declining fish stocks directly threaten nutritional security.

Climate change also affects socioeconomic systems through its influence on ecosystem services. Reduced agricultural yields and declining fisheries lower household incomes, increase unemployment, and encourage migration, particularly among young people seeking alternative livelihoods in urban centers. Women, who are heavily involved in fishery processing, marketing, and small-scale agriculture often experience disproportionate economic impacts because of reduced access to productive resources and financial capital (FAO, 2022).

Addressing these challenges requires integrated ecosystem management that combines climate adaptation with sustainable natural resource governance. Nature-based solutions, including mangrove restoration, wetland conservation, integrated coastal zone management, and community participation in ecosystem protection, have demonstrated considerable potential for strengthening resilience. Similarly, climate-smart agriculture, sustainable fisheries management, improved environmental regulation, and investment in resilient infrastructure are essential for reducing vulnerability and ensuring the long-term sustainability of food systems in the Niger Delta. (Nwankwoala, 2019).

Overall, the evidence demonstrates that climate change is not merely an environmental problem but a multidimensional challenge affecting ecological integrity, food production, public health, livelihoods, and sustainable development. Understanding these interactions provides the foundation for examining how climate change translates into food security challenges and why effective adaptation strategies must integrate ecological conservation with socioeconomic development.

4.2 Climate Change and Food Security Challenges in the Mangrove Ecosystems of the Niger Delta

Food security in the Niger Delta is closely linked to the ecological health of mangrove ecosystems because coastal communities depend substantially on fisheries, small-scale agriculture, and mangrove resources for food production and income generation. The four dimensions of food security availability, access, utilization, and stability are increasingly threatened by climate-induced environmental changes. Climate variability, ecosystem degradation, and socioeconomic pressures have combined to reduce the capacity of mangrove-dependent communities to produce, obtain, and sustain adequate food supplies to meet their needs (World Bank, 2021).

One of the major pathways through which climate change affects food security is through declining agricultural productivity. Farming systems in the Niger Delta are predominantly small-scale and dependent on climatic conditions. Increasing flooding, unpredictable rainfall patterns, and rising temperatures disrupt planting calendars, reduce crop yields, and increase the frequency of crop failures. Flood events destroy farmlands, agricultural inputs, and stored food products, thereby reducing household food availability and increasing dependence on food purchases. Studies in Delta State have shown that climate-related agricultural losses are largely associated with farmland degradation, crop failure and flooding, which contribute significantly to food shortages among rural households (Atedhor & Odjugo, 2020).

Saltwater intrusion represents another critical challenge affecting food production. The Niger Delta's low-lying coastal environment is highly exposed to seawater encroachment resulting from sea-level rise and coastal erosion. Increased soil salinity reduces the productivity of agricultural lands and limits the cultivation of important food crops. Freshwater resources used for domestic purposes and irrigation are also affected, creating additional challenges for household nutrition and health. The vulnerability of mangrove communities is particularly high because many households have limited access to improved agricultural technologies, irrigation systems, and alternative livelihood opportunities (Balogun & Onokernoraye, 2022).

Fisheries, which represent a major source of animal protein and income in the Niger Delta, are also under increasing pressure. Mangrove forests serve as important nursery grounds for fish, shellfish, and other aquatic organisms. Climate-induced changes in water temperature, rainfall patterns, salinity levels, and hydrological processes affect fish reproduction, distribution, and abundance. Consequently, declining fish catches reduces protein availability, household income, and local economic stability. These challenges are intensified by overfishing, habitat destruction, oil contamination, and unsustainable coastal development. Recent assessments of the Niger Delta mangrove ecosystem highlight the combined impacts of pollution, resource exploitation, and environmental change on ecosystem productivity and biodiversity (Aransiola et al., 2024).

The degradation of mangrove forests further threatens food security by reducing ecosystem services that support coastal livelihoods. Mangroves provide breeding habitats for aquatic species, protect shorelines from erosion, regulate water quality, and support nutrient cycling. However, significant changes in mangrove cover have been observed in the Niger Delta due to anthropogenic activities and environmental pressures. Recent remote-sensing studies indicate that mangrove loss in the region is associated with increased land surface temperatures and reduced ecosystem capacity for climate regulation (Jonah et al., 2025). The decline of mangrove ecosystems therefore creates a feedback mechanism whereby habitat loss increases climate vulnerability while simultaneously reducing the natural resources required for adaptation.

Beyond ecological impacts, climate change has significant socioeconomic consequences for food security. Many households in the Niger Delta have limited adaptive capacity due to poverty, inadequate infrastructure, limited access to financial resources, and dependence on climate-sensitive livelihoods. Climate shocks such as floods and coastal erosion can result in income losses, displacement, and increased vulnerability among fishing and farming communities. Women and other marginalized groups are particularly affected because they often rely on informal food-processing and trading activities that are highly sensitive to environmental disruptions (Balogun & Onokerhoraye, 2022).

The interaction between climate change and existing environmental degradation creates a complex food security challenge. Oil exploration and industrial pollution have historically damaged aquatic ecosystems and agricultural lands in the Niger Delta. Contaminated soils and waterways reduce agricultural productivity and fisheries potential, limiting the ability of communities to recover from climate-related shocks. The combined effects of climate change and pollution therefore create cumulative pressures that exceed the coping capacity of many local populations (Yadav & Sharma, 2023).

Addressing food security challenges in the mangrove ecosystems requires approaches that recognize the interconnected relationship between environmental sustainability and human well-being. Adaptation measures must move beyond short-term responses and focus on strengthening ecosystem resilience, improving livelihood diversification, and enhancing community capacity. Climate-smart agricultural practices, improved fisheries management, restoration of degraded mangroves, flood-resilient infrastructure, and effective environmental regulation are essential components of a sustainable food security strategy for the Niger Delta (Sowunmi & Adebayo, 2021).

4.3 Vulnerabilities of Mangrove-Dependent Communities in the Niger Delta.

Mangrove-dependent communities in the Niger Delta are among the most vulnerable populations to climate change because their livelihoods, food systems, and cultural practices are closely connected to climate-sensitive ecosystems. The vulnerability of these communities is shaped by the interaction of exposure to climate hazards, sensitivity of livelihood systems and limited adaptive capacity. The social-ecological systems perspective emphasizes that environmental changes cannot be separated from social and economic conditions because ecosystem degradation directly affects human welfare and resilience (Roberts et al., 2020). In the Niger Delta, climate change interacts with poverty, environmental pollution, inadequate infrastructure, and weak institutional capacity to intensify food insecurity and livelihood risks.

A major dimension of vulnerability is the high dependence on natural resources. Many coastal households rely on artisanal fishing, subsistence farming, fish processing and harvesting of mangrove products as primary sources of food and income. This dependence increases exposure to climate-related shocks because changes in rainfall, flooding patterns, water salinity and ecosystem productivity directly affect household livelihoods. Limited diversification of income sources means that when fisheries decline or agricultural lands are damaged by flooding and saltwater intrusion, households have few alternative options for maintaining food supplies and economic stability (FAO, 2023).

Small-scale fisheries are particularly vulnerable because climate change affects both the availability and accessibility of aquatic resources. Mangrove forests serve as breeding grounds and nursery habitats for commercially important fish and shellfish species. Degradation of these habitats reduces fish recruitment and alters species distributions,

forcing fishers to travel longer distances and spend more resources to obtain declining catches. Rising fuel costs, inadequate fishing equipment, and limited access to credit further reduces the ability of fishing households to adapt to changing ecological conditions.

Agricultural communities also face significant vulnerabilities. Farming in the Niger Delta is constrained by increasing flood frequency, soil salinization and saltwater intrusion. Farmers often lack access to climate-resilient crop varieties, irrigation facilities, extension services and financial support. As a result, repeated climate-related crop losses reduce household food availability and increase dependence on food markets. This situation is particularly challenging in rural areas where household incomes are low and food prices are affected by transportation difficulties and market disruptions (World Bank, 2022).

Gender inequality represents another important vulnerability factor. Women participate in major socio-economic activities such as fish processing, trading, small-scale farming and household food management. However, they often have less access to land ownership, financial resources, technology, and decision-making processes. Climate-related disruptions to fisheries and agricultural production disproportionately affect women's economic opportunities and their ability to support household nutrition. Strengthening gender-inclusive adaptation approaches is essential for improving community resilience and food security outcomes.

Environmental pollution increases the vulnerability of communities by reducing the ability of ecosystems to recover from climate pressures. The Niger Delta has experienced decades of oil exploration activities that have contributed to contamination of soils, rivers and mangrove forests. The United Nations Environment Programme (UNEP, 2021) reported that extensive environmental degradation in Ogoniland, including impacts on vegetation, fisheries, and agricultural productivity. Such degradation reduces ecosystem resilience and limits the effectiveness of climate adaptation interventions.

Institutional and governance challenges also influence vulnerability. Effective climate adaptation requires coordinated environmental management, reliable information systems, infrastructure investment and community participation. However, many coastal communities experience limited access to climate services and government-supported adaptation programmes. Weak enforcement of environmental regulations and inadequate monitoring of industrial activities have contributed to continued ecosystem degradation.

Climate change also creates risks of displacement and social instability. Sea-level rise, coastal erosion and repeated flooding threaten settlements located in low-lying coastal areas. Loss of homes, farmland and fishing grounds may force affected households to migrate, creating additional socio-economic pressures on receiving communities. Climate-induced migration can weaken traditional social networks and increase competition over limited resources (Akiang, et al., 2026).

Despite these vulnerabilities, Niger Delta communities possess important indigenous knowledge and adaptive practices. Local knowledge of fishing patterns, seasonal changes, wetland management and traditional resource conservation can contribute to climate adaptation when combined with scientific knowledge and institutional support. Community-based adaptation approaches that involve local stakeholders in decision-making are increasingly recognized as effective strategies for improving resilience (Friess et al., 2022).

Building resilience among mangrove-dependent communities requires addressing both environmental and socio-economic drivers of vulnerability. Adaptation strategies should include livelihood diversification, restoration of degraded mangroves, sustainable fisheries management, climate-smart agricultural practices, improved access to finance and stronger local governance systems. Without addressing these underlying issues, climate change will continue to undermine food security and sustainable development in the Niger Delta.

4.4 Adaptation and Resilience Strategies for Sustainable Food Security in the Niger Delta Mangrove Ecosystems

Enhancing food security in the mangrove ecosystems of the Niger Delta requires adaptation strategies that address both climate-related risks and the underlying socio-economic factors that increase community vulnerability. Adaptation involves adjustments in ecological, social and economic systems in response to actual or expected

climatic impacts. In highly vulnerable coastal environments, effective adaptation must combine ecosystem conservation, livelihood diversification, institutional strengthening and community participation. The Intergovernmental Panel on Climate Change (IPCC, 2023) emphasizes that climate resilience depends on integrated approaches that reduce exposure to hazards while improving the adaptive capacity of affected populations.

One of the most important ecosystem-based adaptation strategies is the restoration and sustainable management of mangrove forests. (Zhang et al., 2020). Mangroves provide natural protection against coastal erosion, storm surges and flooding while supporting fisheries productivity and carbon storage. Restoration of degraded mangrove areas can improve habitat availability for fish and other aquatic organisms, thereby strengthening local food systems. Nature-based solutions including mangrove rehabilitation, wetland conservation and sustainable coastal management are increasingly recognized as cost-effective approaches for improving climate resilience and supporting biodiversity conservation (UNEP, 2022). In the Niger Delta, community-led mangrove restoration programmes can provide employment opportunities while rehabilitating ecosystem services essential for food security.

Climate-smart agricultural practices offer opportunities to reduce the vulnerability of farming systems to climate change. Adaptation measures include the use of flood- and salt-tolerant crop varieties, improved soil management practices, integrated farming systems and sustainable water management. Agricultural extension services should support farmers with climate information, improved technologies and training on resilient farming methods. Diversification into crops and livestock activities that are less sensitive to climate extremes can also improve household food stability.

Livelihood diversification is particularly important because many Niger Delta households depend on climate-sensitive activities such as fishing and small-scale farming. Expanding alternative opportunities in aquaculture, eco-tourism, small-scale enterprises, vocational training and alternative income-generating activities can reduce dependence on vulnerable natural resources. Diversified livelihoods enable households to recover more quickly after climate shocks and reduce the likelihood of food insecurity.

Improving climate information systems and early warning mechanisms is another essential adaptation measure. Access to reliable information about rainfall patterns, floods, storms and coastal changes enables communities to make informed decisions about farming, fishing and disaster preparedness. Strengthening collaboration between meteorological agencies, local governments, research organizations and community organizations can improve the delivery and accessibility of climate information.

Infrastructure development is also necessary to strengthen resilience. Investments in flood-control measures, improved drainage systems, resilient housing, transportation networks and safe water supplies can reduce the impacts of climate-related disasters. However, infrastructure interventions should be environmentally sustainable and consistent with the need to avoid further damage to wetlands ecosystems.

Effective governance remains central to successful adaptation. Environmental regulations must be strengthened to reduce oil pollution, illegal waste disposal and activities that contribute to mangrove destruction. Climate adaptation policies should integrate local knowledge and ensure meaningful participation of communities in planning and decision-making processes. Participatory governance improves the relevance and acceptance of adaptation interventions because local communities possess valuable knowledge of ecosystem dynamics and resource management practices.

Financial support and institutional collaboration are also required to enhance adaptive capacity. Many vulnerable households lack the resources needed to adopt climate-resilient practices. Access to microfinance, insurance schemes, government support programmes and climate adaptation funds can enable communities to invest in sustainable livelihoods. Partnerships among government institutions, research organizations, non-governmental organizations and local communities are essential for implementing effective adaptation programmes.

Education and awareness creation are additional components of climate resilience. Environmental education programmes can improve understanding of climate risks, promote sustainable resource use and encourage

community participation in conservation activities. Empowering women and youth through training and access to resources is particularly important because these groups play significant roles in household food production and natural resource management.

Overall, adaptation in the Niger Delta must move beyond isolated interventions and adopt an integrated socio-ecological approach. Protecting mangrove ecosystems, improving food production systems, strengthening governance and supporting vulnerable communities are interconnected actions. A resilient Niger Delta requires policies that recognize the relationship between ecosystem health and human well-being, ensuring that climate adaptation contributes simultaneously to environmental sustainability, food security and socio-economic development.

5. Conclusion and Recommendations

Climate change presents a complex and growing challenge to food security in the mangrove ecosystems of the Niger Delta, Nigeria. The region's dependence on climate-sensitive resources, combined with environmental degradation from pollution and unsustainable resource exploitation, has increased the vulnerability of coastal communities. Rising sea levels, flooding, saltwater intrusion, changing rainfall patterns and ecosystem degradation are reducing agricultural productivity, fisheries and weakening the natural systems that support local livelihoods.

This paper demonstrates that climate change impacts in the Niger Delta are not only ecological but also socio-economic, affecting food availability, access, utilization and stability. The vulnerability of mangrove-dependent communities is intensified by poverty, limited livelihood alternatives, weak infrastructure, and inadequate institutional support. Addressing these challenges requires a transition from reactive responses to proactive resilience-building strategies.

The study recommends increased investment in mangrove restoration and ecosystem-based adaptation approaches to protect coastal resources and enhance fisheries productivity. Climate-smart agricultural practices, sustainable aquaculture, improved fisheries governance and livelihood diversification should be promoted to reduce dependence on vulnerable resources. Strengthening climate information systems, flood management infrastructure, and community-based adaptation programmes is essential for improving preparedness and resilience.

Furthermore, stronger enforcement of environmental regulations is required to reduce oil pollution and other activities that undermine ecosystem recovery. Policies should prioritize inclusive governance by involving local communities, women and youth in climate adaptation planning. Improved access to financial resources, technical support and climate adaptation funding will enable vulnerable households to adopt resilient livelihood strategies.

In conclusion, safeguarding food security in the Niger Delta requires an integrated approach that recognizes mangroves and wetlands as both environmental assets and foundations of human well-being. Sustainable management of these ecosystems, combined with effective climate adaptation policies, is essential for building resilient coastal communities and ensuring long-term food security under future climate conditions.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

Publisher's Note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers

Artificial Intelligence (AI) Use Disclosure: The authors declare that no artificial intelligence tools were used in the preparation of this manuscript.

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