Journal of Basics and Applied Sciences Research (JOBASR)
ISSN (print): 3026-9091, ISSN (online): 1597-9962
Volume 3(3) May 2025
DOI: https://dx.doi.org/10.4314/jobasr.v3i3.34

Community Perceptions of Climate Change and Its Impact on the Baturiya Wetlands in Hadejia National Park, Nigeria

Jibrin Gambo[1*], Abubakar Ahmed[2], Umar Ali Madaka[1], Abdulmajid Abubakar[3], Yusuf Ahmed Yusuf[4], Bashir Sabo Babura[1] and Suleiman Muktari Muhammad[1]

[1]School of Forestry Technology, Binyaminu Usman Polytechnic, Hadejia, Jigawa, Nigeria.
[2]Department of Geography, Faculty of Social and Management Science, Sule Lamido University, Jigawa, Nigeria.
[3]Department of Geography, Faculty of Earth and Environmental Science, Bayero University, Kano, Nigeria.
[4]Department of Environmental Management, Faculty of Earth and Environmental Science, Bayero University, Kano, Nigeria.
*Corresponding Author Email: j.gambo@bupoly.edu.ng

ABSTRACT

Understanding local climate change sensitivities is essential to develop effective adaptation strategies, particularly in environmentally sensitive areas such as wetlands. This study explores the community's views on climate change and its impact on the Baturiya Wetlands, with five neighbouring communities. Using a mixed methodology, data were collected from 100 respondents via structured questionnaires and interviews.The findings show that 94% of the respondents depend on wetlands for agriculture, fisheries and access to water, underlining their environmental and economic value. However, perceptions of climate change vary 63% accept its effects, 22% have limited awareness and 15% have no opinion. Reported impacts on climate included reduced water levels (69%), falling fish stocks (56%) and fewer migratory birds (41%). These changes have affected livelihoods, with 66% reporting a loss of crop and 52% reporting a decrease in fishing income.Communities adopted different adaptation strategies, such as adjusting planting dates (44%), using irrigation (30%) and planting drought tolerant crops (25%). The chi square analysis revealed significant differences in climate awareness and adaptation capacity between the communities, with Baturiya and Musari showing more resilience due to exposure to non-governmental and awareness-raising initiatives. The study stresses the importance of integrating local knowledge into climate change adaptation planning and calls for inclusive policies that link scientific approaches to community-based experience. The findings support progress towards the Sustainable Development Goals, SDG 13, SDG 15 and SDG 6. Effective wetland management must give priority to the needs and voices of local communities most affected by environmental change.

Keywords:
Climate change,
Wetlands,
Community perception,
Baturiya,
Adaptation,
Hadejia.

INTRODUCTION

Climate change is one of the most pressing global challenges of the 21st century, with far-reaching implications for the environment, economic development and human welfare. It refers to long-term changes in temperature, precipitation patterns and other atmospheric conditions, often caused by human activities such as burning fossil fuels, deforestation and industrial emissions (Abbass *et al.*, 2022; Shivanna, 2022). Wetlands are among the most vulnerable ecosystems affected by climate change, due to their vulnerability to hydrological and temperature changes (Ramsar, 2016). Wetlands play a key role in global biodiversity, carbon sequestration, water purification and hydrological cycle regulation (Ramsar Convention Secretariat *et al.*, 2018). In Africa, particularly in the semi-arid and semi-arid regions of Nigeria, wetlands are a lifeline for millions of rural people, who rely on them for fishing, agriculture, grazing and other livelihood activities (Agbeko *et al.*, 2024; Landscapes, 2021; Olalekan, 2014). The Baturiya wetlands, located in the Hadejia National Park in Jigawa State, constitute one of the most important and economically valuable wetland systems in northern Nigeria. Recognised as an internationally important Hadejia-Nguru wetland and a Ramsar site, Baturiya supports biodiversity, regulates flooding and sustains

the local economy. However, over the past two decades, these wetlands have been under increasing pressure from climate change, including irregular precipitation, rising temperatures and extended droughts (Hadiza *et al.*, 2019; Olalekan, 2014; Ramsar Convention Secretariat *et al.*, 2018). Understanding how communities dependent on these ecosystems experience and respond to climate change is crucial to designing locally relevant and sustainable adaptation strategies. Perception studies are increasingly recognised as a key element in climate change adaptation planning, as they provide insight into how people perceive environmental change and how their responses may exacerbate or mitigate climate vulnerability (Bamidele & Erameh, 2023; Glover & Elsiddig, 2012; Yu & Huang, 2021). Local communities are often the first responders to environmental changes and their lived experiences provide valuable input for scientific and policy integration (Marschütz *et al.*, 2020; Salimi *et al.*, 2021). In the context of the Baturiya wetlands, local residents, particularly farmers, fishermen and pastoralists, are increasingly concerned about the decreasing water availability, dwindling fish stocks, poor harvests and changing migratory patterns (Karkarna & Danjuma, 2020; Ujih & Adoka Ibrahim, 2020). However, the extent of their understanding, the sources of their knowledge and the nature of their adaptive responses are not well documented. This gap in literature is particularly worrying, given that the success of any environmental policy or climate action strategy depends on the acceptance and participation of the community (Abbass *et al.*, 2022; Eriksen *et al.*, 2021).

In the semi-arid north of Nigeria, the social and economic vulnerability of the communities - marked by poverty, illiteracy and limited access to basic services - complicates adaptation efforts. Women and young people are disproportionately affected by marginalisation in decision-making and by unequal access to resources. However, these groups often play a key role in environmental management and management of resources, especially in wetlands where water management, fishing and plant harvesting are a gender-specific task (Araneda *et al.*, 2025; Magwegwe *et al.*, 2024; Oladokun & Proverbs, 2016). Several studies have highlighted the importance of integrating indigenous knowledge into climate change adaptation strategies. Indigenous and local knowledge systems are often rooted in long-term observation and practical involvement with nature, which make them crucial for monitoring the environment and building resilience (Leal Filho *et al.*, 2022; Membele *et al.*, 2022; Shayamano & Dzingirayi, 2025). In many rural African communities, traditional calendars, seasonal indicators, and folk wisdom have historically been used to predict and manage environmental changes. However, these systems are increasingly threatened by rapid environmental change and declining intergenerational knowledge transfer (Takazira *et al.*, 2024; Yang *et al.*, 2019). Accordingly, the Nigerian government has committed to strengthen community-based adaptation as part of its nationally determined contributions under the Paris Agreement. However, implementation at local level remains poor due to poor coordination, insufficient funding and limited awareness among rural populations (Okeke, 2024). In addition, wetlands such as the Baturiya are subject to additional pressures from human activities such as overgrazing, land conversion and the construction of upstream dams, which add to climatic pressures (Hadiza *et al.*, 2019; Karkarna & Danjuma, 2020; Ujih & Adoka Ibrahim, 2020). The resulting environmental degradation reduces the ability of wetlands to protect against climate impacts, which affects biodiversity and human livelihoods. These stresses require an integrated management approach combining environmental rehabilitation, sustainable livelihoods and resilience to climate change (Babanawo *et al.*, 2023; Birkmann *et al.*, 2022).

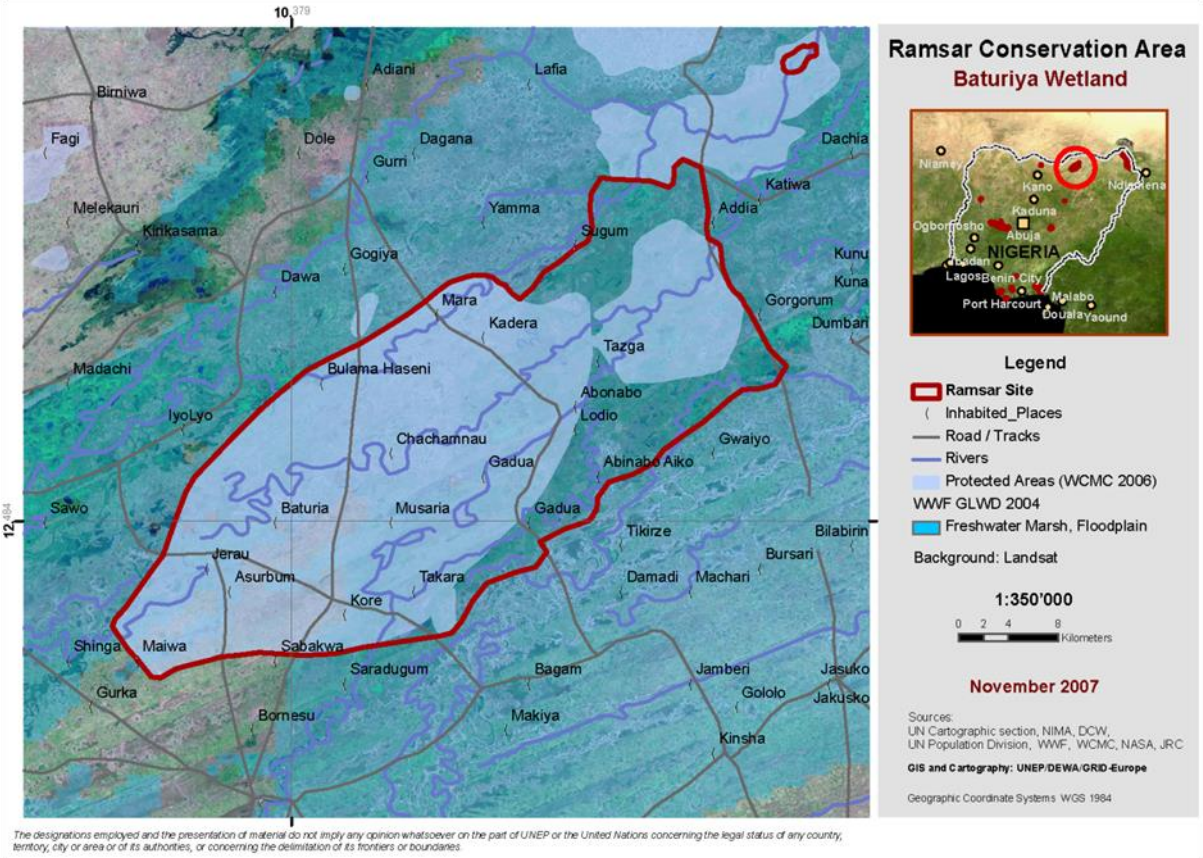
The relevance of this research is not only to contribute to the academic discourse on climate change and resilience, but also to inform practical policy measures for the protection of wetlands and climate change adaptation in Nigeria. The results will be of interest to stakeholders, including the Parks Authorities, NGOs, local governments and development agencies working in the fields of biodiversity, sustainable agriculture and disaster risk reduction. In addition, this research supports global environmental commitments such as the Sustainable Development Goals (SDGs), in particular SDG 13 (climate action), SDG 15 (life on earth) and SDG 6 (clean water and sanitation), by promoting inclusive, participatory and ecosystem-based strategies for adaptation (Gambo *et al.*, 2020; UNCCD, 2017; United Nations Resolution, 2020). It is in line with international conventions such as the Ramsar Convention and the UNFCCC, which emphasise the importance of involving local communities in ecosystem and resilience planning. An understanding of the concerns of the community regarding the impact of climate change is not only a scientific imperative, but also a humanitarian imperative. Watercourses like Baturiya are not only environmental assets, but also the social and economic foundations of the communities that depend on them. Protecting them and managing them in the face of climate change requires the voice, knowledge and active participation of the most affected (Ringler *et al.*, 2022). The aim of this study is therefore to fill a critical gap in the knowledge of how local communities around the Baturiya Wetlands are experiencing climate change and responding to it. The survey, which is focused on five communities in a 25-kilometre radius - Kadera, Abunabo, Musari, Baturiya and Chachamauga aims to obtain a detailed and contextual understanding of local

perceptions, environmental changes observed and informal adaptation practices. The study uses a mixed methodology, combining statistical analysis with qualitative insight to provide a comprehensive overview.

MATERIALS AND METHODS

Study Area

The Baturiya wetlands are located in the Hadejia National Park in the northeastern part of Jigawa State, part of the larger Hadejia-Nguru wetland complex. This Ramsar site supports diverse flora and fauna and provides essential ecosystem services, including flood protection, groundwater recharge and fisheries habitats. The park covers more than 32 000 hectares and contains river forests, wetlands and seasonal flood plains. The communities within a 25 km radius - including Kadera, Abunabo, Musari, Baturiya and Chachamauga - depend heavily on the wetlands for their livelihoods.



The designations employed and the presentation of material do not imply any opinion whatsoever on the part of UNEP or the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Figure 1: Baturiya Wetland (Source: UN Cartographic section, NIMA, DCW, UN Population Division, WWF, WCMC, NASA, JRC, GIS and Cartography: UNEP/DEWA/GRID-Europe)

Methods

This study used mixed methods combining both quantitative and qualitative approaches to collect in-depth data on public perception of climate change and its impact on biodiversity. This approach has enabledtriangulation of findings and improved the validity and richness of the analysis.A cross-sectional survey wascarried out in five communities - Kadera, Abunabo, Musari, Baturiya and Chachamnau - located within a 25 km radius of the wetlands of the Baturiya. These communities have been selected because of their dependence on wetland resources and their vulnerability to climate change. The study area is in a semi-arid region of Nigeria, characterised by seasonal floods, erratic rainfall and high temperatures, which make it an appropriate environment to study local climate change.

Figure 2: Author during questionnaire distribution and interview

Sampling Technique and Respondent Selection

A random sample approach was used to select a total of 100 respondents (20 from each community). The purpose of the sample was to ensure gender balance, and the inclusion of stakeholders involved in wetland-related livelihoods such as agriculture, fisheries and pastoralism. In order to ensure a wide range of views, the participants included heads of households, young people, women and elderly.

Data Collection, Validation and Pilot Testing Methods

Data were collected by means of structured questionnaires and semi-structured interviews. The questionnaire included closed and open-ended questions on topics such as awareness of climate change, perceptions of environmental change, impacts on livelihoods and adaptation strategies. Interviews were carried out with local leaders, farmers, fishermen and women who are particularly dependent on wetlands. Before full deployment, research tools were pre-tested in a neighbouring community that was not part of the final study sample. Feedback from the pilot study has helped to improve the clarity and relevance of the questions. Local Hausa-speaking research assistants were trained in the use of tools to ensure language availability and cultural sensitivity.

Data Analysis Techniques

Quantitative data from the questionnaires were coded and entered in Microsoft Excel for analysis by the SPSS. Descriptive statistics such as frequency, percentages and cross-tabulations were used to summarise the data. The Chi-square () test, which measures the significance at 0.05, was used to test for differences in awareness and adaptation strategies between communities (Karkarna & Danjuma, 2020). The formula used is the following:

$$x^2 = \sum \frac{(E-O)^2}{E} \quad (1)$$

where:

O = Observed frequency

E = Expected frequency

$\sum$ = Summation over all categories

The qualitative data from the interviews were re-recounted, translated where necessary, and subjected to a thematic content analysis. The responses were coded into categories such as observed climatic patterns, environmental changes, gender impacts and local coping strategies. Triangulation was used to compare and cross-validate the qualitative and quantitative findings.

RESULTS AND DISCUSSION

Results

Socio-Economic Profile of the Respondents

The respondents were mostly men (75%), with the majority working in agriculture (62%), followed by fishing (18%), retail trade (12%) and the minority unemployed (8%). The age range of participants was 20-65 years. Education levels were generally low, with 47 percent having no formal education, 38 percent having had primary education and only 15 percent having had secondary or tertiary education. This distribution reflects the semi-literate character of the

rural populations surveyed, which affects both their access to information and their ability to adapt to climate risks. The predominance of agriculture shows the direct dependence of livelihoods on natural resources and ecosystem stability.

Table 1: Socio-Economic Characteristics of Respondents

Variable	Frequency	Percentage (%)
Gender (Male)	75	75
Gender (Female)	25	25
Farming	62	62
Fishing	18	18
Petty Trading	12	12
No Employment	8	8
No Education	47	47
Primary Education	38	38
Secondary+ Education	15	15

Knowledge of Importance of Wetlands

Almost all respondents (94%) recognised the vital importance of wetlands for supporting livelihoods. Communities reportedusing wetlands for fishing, agriculture, fodder gathering, grazing, and as a water source. Respondents recognised the ecological roles of maintaining soil fertility, preserving biodiversity and preventing flooding. 6% who were unaware were mostly elderly or illiterate, showing how awareness varies by education level.

Table 2: Knowledge of Wetland Importance

Perceived Benefit	Frequency	Percentage (%)
Source of Water	90	90
Fishing and Aquatic Resources	82	82
Agricultural Productivity	75	75
Biodiversity Habitat	65	65
Flood Regulation	60	60
No Knowledge	6	6

Attitudes of Local Communities Towards Wetlands

Most respondents (70%) were supportive of wetland protection. Some (20%) were indifferent, often due to immediate survival pressures, while 10% viewed wetlands as resources for exploitation. This demonstrates the tension between conservation and livelihood needs.

Table 3: Attitudes Towards Wetlands

Attitude Category	Frequency	Percentage (%)
Strongly Supportive	70	70
Indifferent	20	20
Prioritize Exploitation	10	10

Relationship Between Gender, Education, and Economic Status Towards Perceived Uses and Values of Wetlands

The analysis revealed significant differences in wetland productivity between men and women according to their religion. Men (60%) and more educated respondents (66) prioritised conservation, while women (70%) and less educated respondents (72) emphasised direct utilitarian benefits. These findings reflect the impact of education on environmental awareness and how gender roles shape the interaction with natural resources.

Table 4: Perceived Use of Wetlands by Gender and Education

Category	Conservation (%)	Immediate Use (%)
Male (n=75)	60	40
Female (n=25)	30	70
Educated (n=53)	66	34
Non-Educated (n=47)	28	72

Attitudes of Local Communities Towards Climate Change

Most respondents (63%) were aware and concerned about climate change, mainly due to perceived changes in rainfall and temperature. Some (22%) were aware but confused, while 15% denied or were unaware of any climate change impact. Misconceptions included divine causation or normal seasonal variation.

Table 5: Community Attitudes Towards Climate Change

Response Category	Frequency	Percentage (%)
Aware and concerned	63	63
Aware but confused	22	22
Denial/Unaware	15	15

Awareness of Climate Change

Respondents mostly got information via radio (42%), followed by local leaders (30%), NGOs (20%), and schools/media (8%), underscoring theimportance of informal communication channels.

Table 6: Sources of Climate Change Awareness

Source of Information	Frequency	Percentage (%)
Radio	42	42
Local Leaders	30	30
NGOs/Extension Agents	20	20
Schools/Media	8	8

Local Communities' Perceptions on Climate Change Impacts on Wetlands

In table 7 the main perceived impacts includedlower water levels (69%), reduced fish stocks (56%), delayed bird migration (41%), andweed infestation (25%).These observations support the wider scientific evidence of climate-induced degradation of wetlands in the region.

Table 7: Perceived Climate Change Impacts on Wetlands

Observed Impact	Frequency	Percentage (%)
Lower Water Levels	69	69
Decline in Fish Stocks	56	56
Delayed Bird Migration	41	41
Invasive Vegetation	25	25

Climate Change Impacts on Community Livelihood

Respondents reported lower crop yields (66%), reduced fish yield (52%), and labour migration (31%) as direct consequences of environmental change in table 8.

Table 8: Livelihood Impacts of Climate Change

Impact Type	Frequency	Percentage (%)
Crop Failure	66	66
Reduced Fish Yield	52	52
Labor Migration	31	31

Communities' Adaptive Strategies on Climate Change Impacts

Local adaptation measures included changing planting times (44%), irrigation (30%), planting drought resistant crops (25%) and seasonal labour migration (20%). These strategies were largely informal and lacked technical and institutional support, which suggests the need for structured adaptation programmes.

Table 9: Adaptive Strategies Used by Communities

Strategy	Frequency	Percentage (%)
Shift Planting Dates	44	44
Irrigation Use	30	30
Drought-Resistant Crops	25	25
Seasonal Migration	20	20

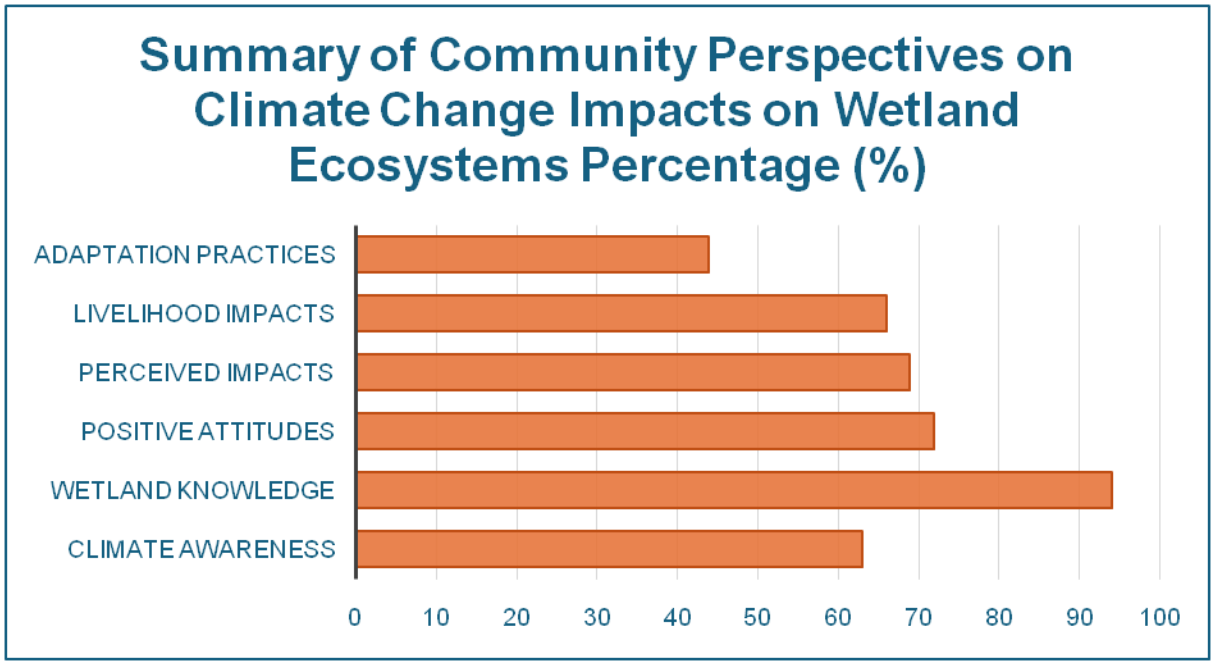


Figure 3: High Level Summary of Community Perspectives on Climate Change Impacts on Wetland Ecosystems

Statistical Variation Across Communities

Chi-square analysis revealed statistically significant differences in climate change awareness ($x^2 = 12.56, p < 0.05$) and adaptive strategies ($x^2 = 11.92, p < 0.05$) across the five communities. Baturiya and Musari had higher awareness and adaptation levels due to better access to NGO and government interventions. Chachamnau had the lowest awareness levels.

Table 10: Chi-Square Summary of Inter-Community Variation

Variable	(x^2Value)	df	p-value	Interpretation
Climate Change Awareness	12.56	4	0.014	Significant Difference
Adaptation Strategies	11.92	4	0.018	Significant Difference

Discussion

The findings of this study reinforce a growing body of literature emphasizing the crucial role of local communities in both sensing and adapting to the impacts of climate change, especially in ecologically fragile areas such as wetlands (Agbeko *et al.*, 2024). The socio-economic profile of the respondents confirms that they are predominantly agrarian and depend on the wetlands for their livelihoods, both in agriculture and fisheries. The low level of formal education among respondents, as reported in this study, exacerbates vulnerability by reducing access to knowledge, institutional support and adaptation resources (Adger *et al.*, 2012). The broad awareness of the importance of wetlands among respondents is consistent with similar findings in other parts of Africa where wetlands provide crucial ecosystem services (Olalekan, 2014; Ramsar, 2016). However, the study also revealed differences in perceptions depending on gender and educational level. These differences mirror the findings of (Paavola, 2008; Udo & Naidu, 2023) which reported that women and the less educated tend to prioritise immediate needs over long-term conservation because of their daily dependence on natural resources. Therefore, to be effective, policy interventions need to be both inclusive and sensitive to the concerns of the victims of terrorism. The mixed climate change attitudes of respondents also reflect trends in climate literacy in rural African communities. Although most people are aware of the environmental changes attributed to climate change, misconceptions about its causes and impacts persist. This confirms previous research showing that informal channels such as radio, traditional leaders and community forums remain the predominant sources of information on climate change (Boykoff & Roberts, 2008; Fleming *et al.*, 2021). Strengthening these channels through participatory education programmes can therefore bridge the knowledge gap. The observed environmental changesreduced water levels, declining fish stocks, and shifting migratory patterns of birdsconfirm the scientific evidence of vulnerability of wetland ecosystems to climate change (Fay *et al.*, 2016). These impacts are directly reflected in livelihood problems such as crop failures, food insecurity and forced migration. As noted in the sixth assessment report of the(Intergovernmental Panel on Climate Change (IPCC), 2023), these socio-economic impacts require urgent Adaptation planning.The adaptation strategies adopted by communities, while commendable, remain informal and reactive.These include changing agricultural calendars, adopting drought-resistant crops and engaging in seasonal migration. However, without institutional and technical support, these strategies are limited in their effectiveness and sustainability. This is similar to the findings (Stringer *et al.*, 2020), which stressed that capacity to adapt is often limited in resource-poor settings. Statistical differences in climate awareness and adaptation across the five study communities also indicate that proximity to development interventions, such as non-governmental and government programmes, increases the responsiveness of the population. Baturiya and Musari, who showed higher levels of adaptation, were supported by previous experience with such programmes. This confirms previous evidence that community-based programmes, if consistent and well supported, can build resilience (Adams *et al.*, 2004; Ahmed *et al.*, 2022; Ani *et al.*, 2022; Glover & Elsiddig, 2012; Karkarna & Danjuma, 2020; Rebelo *et al.*, 2018; Sadiq *et al.*, 2019; Safiah Yusmah *et al.*, 2020; Tenzing, 2020). Overall, the study supports the growing consensus that effective adaptation to climate change requires participatory, inclusive and locally based strategies. It stresses the need for multi-sectorial cooperation involving local governments, civil society, traditional institutions and the people themselves. These approaches are in line with the SDGs, in particular SDG 13 (climate action), SDG 15 (life on earth) and SDG 6 (clean water and sanitation) and the national adaptation strategy of Nigeria (Onyeneke *et al.*, 2020). The study shows that although rural communities have valuable local knowledge and evidence of climate change, their capacity to adapt is still insufficient. The institutionalisation of community

input into national climate policies and wetland management frameworks is essential to build resilience in vulnerable ecosystems such as the Baturiya wetlands.

CONCLUSION

This study provides strong evidence that the communities living around the Baturiya wetlands in the Hadejia National Park are both deeply dependent on the wetland resources and increasingly aware of the changing climate and its effects. The research highlights that although community members are aware of changes in rainfall patterns, water levels and biodiversity decline, their reactions are still limited by socio-economic, information and institutional constraints. The data show that the adaptation strategies adopted by these communities, such as changing planting schedules, migration and reliance on traditional coping mechanisms, are valuable but insufficient without outside help. This underlines the need to develop integrated adaptation policies that combine local knowledge with scientific approaches to increase resilience. The wide variation in awareness and adaptation capacity across communities highlights the importance of targeted interventions based on location-specific needs and capacity (Ani *et al.*, 2022; Eriksen *et al.*, 2021). The study also highlights the potential of wetlands as a buffer against climate change for both the environment and the economy. The protection and sustainable management of these ecosystems should be a priority not only for conservation purposes but also for the maintenance of the livelihoods of vulnerable populations. Policies should promote gender mainstreaming, strengthen education and awareness programmes, and empower local authorities to take decisions (Asante *et al.*, 2021).

Several recommendations are proposed to address effectively the challenges identified in this study. First, the creation of community-based climate adaptation committees is crucial to bridge the gap between local knowledge and national climate policies. These committees can play an important role in ensuring that local experiences inform wider adaptation strategies. Second, investing in climate literacy and education is vital. Use of available platforms such as radio broadcasting and engagement with recognised community leaders can help to raise awareness and understanding of climate issues. Thirdly, sustainable livelihood alternatives that reduce pressure on wetlands and at the same time increase economic resilience should be promoted. Initiatives such as eco-tourism, agroforestry and climate-smart farming should be supported in order to diversify income sources and build resilience. In addition, cooperation between NGOs, government agencies and traditional institutions should be stepped up to deliver integrated and community-based climate solutions. Another key recommendation is to integrate local perceptions and traditional ecological knowledge into wetland protection efforts and national climate change adaptation planning. Recognising the value of community input can lead to more inclusive, context-sensitive and effective environmental interventions. In short, the path to sustainable wetland management and climate resilience lies in empowering local communities to act as active stewards of their own environment. Recognising their concerns, removing barriers to participation and investing in their adaptive capacity will not only enhance environmental sustainability, but will also make a significant contribution to national progress towards achieving the SDGs.(Akinsemolu & Onyeaka, 2025; Bonnedahl *et al.*, 2022; Moallemi *et al.*, 2020).

Funding

No Funding

Declaration of competing interest

The authors affirm that they are not aware of any financial or interpersonal conflicts that may have influenced the results presented in this study.

Acknowledgments

The authors thank DunesGIS Tech Limited for its invaluable support in technical and geospatial resources which have facilitated this research. Their expertise in the analysis and mapping of environmental data has been instrumental in shaping the methodological framework and interpretation of the study data. We are also grateful to the Unik Impact Foundation for its community-engagement efforts, logistical support and commitment to sustainable development. Their links and outreach have allowed access to local knowledge and reinforced the participatory aspect of research. Contributions from these organisations have significantly increased the depth and relevance of this study.

Data availability

The full dataset created or examined during the study has been incorporated into the referenced articles and is duly credited in the reference section.

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