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COMMUNITY AWARENESS AND PERCEPTIONS ON THE CHALLENGES ON WATER RESOURCE DUE TO OVERUSE AND MISUSE IN A FORESTED WETLAND HABITAT OF NORTHERN NIGERIA

Environmental Science

Mohammed L Nuruddeen* Department Of Civil Engineering, School Of Engineering And Technology, Noida International University-NIU, Gautam Budh Nagar, 201308. *Corresponding Author

Paritosh Srivastava Centre Of Excellence: Occupational Health, Safety, Fire & Environment. G. D. Goenka University, Gurugram

ABSTRACT

Forested wetlands are vital ecosystems that provide numerous ecological, economic, and social benefits, including biodiversity maintenance, water cycle regulation, and climate change mitigation. The health of these wetlands is closely linked to the water table, which influences vegetation composition, soil properties, and wildlife habitats. This study aim to assess the community awareness and perceptions on the challenges on water resource due to overuse and misuse in a forested wetland habitat of the Hadejia-Nguru Wetlands in Yobe State northern Nigeria, a critical ecological zone facing threats from climate variability, agricultural expansion, and urbanization. A cross-sectional survey was conducted among 400 participants in the Hadejia-Nguru Wetlands area. Data were collected using a structured questionnaire focusing on demographic factors, challenges related to resource overuse, awareness of climate change, and perceptions of water table dynamics. The study area is significant for its biodiversity and supports various agricultural and economic activities, but it is increasingly threatened by environmental degradation. Results indicated that most participants perceive a significant decrease in water resources, negatively impacting agricultural productivity, biodiversity, and personal water use. While awareness of climate change is relatively high, with many participants recognizing its impact on local ecosystems, there is a notable lack of educational initiatives to inform the community about these challenges. This study highlights the urgent need for effective conservation and management strategies to preserve the ecological integrity of the Hadejia-Nguru Wetlands. Enhancing community awareness and implementing sustainable resource management practices are critical to mitigating the adverse effects of water table fluctuations and climate change on these vital ecosystems.

KEYWORDS

awareness, challenge, Hadejia-Nguru Wetlands, perception, wetland

INTRODUCTION

A wetland is an area of land that is either covered by water or saturated with water. Wetlands are among the most important areas in the ecosystems, providing a wide range of ecological, economic, and social benefits (Nayak and Bhushan, 2022). Forested wetlands play a vital role in maintaining biodiversity, regulating water cycles, and mitigating climate change. The hydrology of these ecosystems, especially the water table, plays a crucial role in determining their structure and function. The health of forested wetlands is intrinsically linked to the water table (Furlan et al., 2023). Fluctuations in the water table can lead to significant changes in vegetation composition, soil properties, and wildlife habitats (Wang et al., 2021). Understanding these effects is crucial for maintaining the ecological integrity of these wetlands.

The forested wetland is significant for the region's ecological health and the livelihoods of local communities (Adhya and Banerjee, 2022). However, these habitats are increasingly under threat from both natural and anthropogenic factors, including climate variability, agricultural expansion, and urbanization, which can alter the water table dynamics. Understanding the effects of the surrounding water table on these wetland habitats is essential for developing effective conservation and management strategies.

Wetlands are often lost or degraded because their ecological, economic, and social values are not adequately recognized or prioritized by human institutions and policies (Amenu and Mamo, 2018). This unsustainable exploitation of wetland resources stems from a combination of information gaps, market and policy failures, ineffective interventions, and various socioeconomic factors (García-Ayllónm 2019). Moreover, communities living in and around wetlands often lack awareness of their broader ecological and economic importance, primarily valuing them for limited consumptive purposes (Alikhani et al., 2021).

A significant challenge in community-based wetland conservation is the ineffective enforcement of existing wetland management policies (de Oliveira et al., 2024). Although, if the regulations are in place, weak institutional structures hinder their effective implementation. Additionally, policy failures are exacerbated by the lack of easily understandable and accessible information for all wetland stakeholders, including policymakers, managers, planners, and resource users.

MATERIAL AND METHODS

Study Area

The Hadejia-Nguru Wetlands, located in Yobe State, northeast Nigeria, are a crucial ecological and economic zone within the Yobe-Komadugu sub-basin of the Chad Basin. These wetlands, formed by the convergence of the Hadejia and Jama'are rivers, are vital for biodiversity, especially waterbirds, and are recognized as a Ramsar Site of international importance. The area, once covering up to 3,000 km², has seen a significant reduction in flooded land due to changing climatic conditions, with less than 300 km² flooded in the drought year of 1984.

The wetlands are home to approximately 1.5 million people, supporting diverse agricultural activities such as wet-season rice farming, flood-recession agriculture, and dry-season farming, as well as fishing and grazing by Fulani cattle. However, the region faces significant environmental challenges, including reduced flooding, deforestation, and increasing human-wildlife conflict. Conservation efforts include the designation of Forest Reserves, a Wildlife Sanctuary, and protection under the Ramsar Convention, but the wetlands continue to be threatened by environmental degradation and resource competition.

Research Design

The cross-sectional survey study design was employed for this study. A free-tested open-ended structural questionnaire was used, comprising four sections:

- **Section A**: Focused on demographic factors such as age, gender, educational level, occupation, socioeconomic status, and geographic location of the participants.
- **Section B**: Gathered information on major challenges observed due to the overuse of resources in dry arid regions, which contribute to the decrease in water resources needed for establishing and constructing irrigation systems for agricultural and other economic purposes.
- **Section C**: Addressed awareness of climate change challenges in the wetland resources of the study area, emphasizing how changes in hydrology and the biogeochemistry of the aquatic ecosystem significantly impact these wetlands.
- **Section D**: Elicited information on how the water table in wetlands is influenced by the surrounding area's strata characteristics and the effects on recharge/discharge ditches or mini tube wells.

Validation Of The Instrument

A pilot testing was conducted on the questionnaires and survey instrument on a small subset of the target population to identify and

correct any issues with question clarity, survey length, and or any technical problems.

Sample Size Determination

The sample size of the study was calculated using formula for sample side determination put forward by Cochran, (1977).

Using

1. Sample size formula for infinite population

$$n^o = \frac{Z^2P(1-P)}{d^2}$$

2. Adjust the sample size to required population

$$n = \frac{n^o}{1 + \frac{n^o - 1}{pop}}$$

Where: n = number of size for finite population
n^o = number of samples for infinite population
Z = statistic for level of confidence at 95% = 1.96
P = Population proportion assumed 50% (0.5).
d = allowable error of 5%, (0.05)
pop = study population (Yobe State 3,649,600 and Jigawa State 5,828,163) (NBS, 2018).

$$n^o = \frac{1.96^2(0.5)(1-0.5)}{0.05^2}$$

$$n^o = 384.16$$

$$n = \frac{n^o}{1 + \frac{n^o - 1}{pop}}$$

$$n = \frac{384.16}{1 + \frac{384.16 - 1}{9477763}}$$

n = 384
The sample roundup to 400

Data Collection

A total of 400 questionnaires were distributed to participants using convenience sampling techniques. Out of these, 391 questionnaires were successfully recovered and included for analysis.

Data Analysis

The data generated in this study was expressed in frequency and percentages.

RESULT

A total of 487 questionnaires were distributed, 421 were retrieved, and 400 questionnaires were included in the analysis. Participants aged 30 – 39 years had the highest number of participants 120 (30.0%), followed by 104 (26.0%) and 96 (24.0%) among those >60 years and 50 – 59 years, respectively. The majority of the participants 297 (74.2%) are male, 145 (36.2%) of the participants had a primary level of education, followed by 103 (25.8%) and 82 (20.5%), who have Islamic school and secondary level of education. The majority of the participants 170(42.5%) are farmers, 88 (22.0%) herder, and 64 (16.0%) civil servant. One hundred and thirty-six (34.0%) lived in the area for >10 years, while 22 (5.5%) lived for < 1 and 9 – 10 years each (Table 1).

Table 2 presents participants' perceptions of water resource usage and the challenges faced due to the overuse of these resources. The majority of participants perceive a significant decrease in water resources, which has impacted agricultural productivity, biodiversity, and personal water use. The primary use of water is for farming, and the overuse has led to economic and ecological challenges.

The majority of participants (187) are familiar with the concept of climate change, but a substantial number (59) are not, and 62 are uncertain. Most participants (179) have received information about climate change, suggesting that information dissemination efforts are somewhat effective. However, 105 participants have not received such information, and 24 are unsure. A significant number (187) perceive that climate change affects their local environment, though 27 do not and 94 are unsure. There is strong awareness (319) about changes in water levels in local wetlands, which suggests that participants are sensitive to changes in their immediate environment. However, 73 are unsure about these changes, and 3 did not respond. The impact on biodiversity is similarly recognized by 270 participants, indicating awareness of ecological changes but with some degree of uncertainty. Most participants (277) believe that local fishing practices are affected by changes in the aquatic ecosystem. Traditional practices or knowledge are seen as helpful in managing wetland resources by 274 participants. Awareness of the challenges posed by climate change to wetlands is relatively low (25), with 258 participants not aware and 97 unsure. The absence of educational initiatives (315 responses) indicates a lack of structured efforts to inform the community about climate change challenges, which may contribute to low awareness levels. There is recognition of the role of local organizations and government agencies (217) in addressing climate change impacts, although 12 participants disagree and 142 are unsure (Table 3).

Table 1 Distribution of the Demographic Variable among the Study Participants

Demographic Variables	Frequency	Percentages
Age (Years)		
<20	22	5.5
20 – 29	24	6.0
30 – 39	120	30.0
40 – 49	34	8.5
50 – 59	96	24.0
>60	104	26.0
Total	400	100.0
Sex		
Male	297	74.2
Female	103	25.8
Total	400	100.0
Education		
Islamic	103	25.8
Primary	145	36.2
Secondary	82	20.5
Tertiary	70	17.5
Total	400	100.0
Occupation		
Civil Servant	64	16.0
Farmer	170	42.5
Fisherman	38	9.5
Herders	88	22.0
Hunter	18	4.5
Trade	22	5.5
Total	400	100.0
How long do lived in this region (Years)		
<1	22	5.5
1 – 2	34	8.5
3 – 4	78	19.5
5 – 6	38	9.5
7 – 8	70	17.5
9 – 10	22	5.5
>10	136	34.0
Total	400	100.0

Table 2 Participants Perception on Water Resource Usage and Challenges Due to Overuse of Resources

S/N		Decreased	Increased	No Change	No
1	How would you describe the current state of water resources in your region	217	39	132	12
2	How has water sources changed over the past years	217	39	132	12
3	What are the primary uses of water in your community	Farming (201)	Fishing (71)	Other Purpose (128)	
4	How has water usage for agriculture changed over the years	105	272	23	0
5	What are the main challenges you face due to the overuse of water resources	217	0	182	1
6	How has the overuse of water affected agricultural productivity in your region	209	0	180	11
7	What impact has the overuse of water had on local ecosystems and biodiversity	211	0	180	9
8	How has the availability of water for personal and domestic use been affected by overuse	194	1	203	2
9	What are the economic implications of reduced water availability for irrigation	283	0	27	90

10	How has the decrease in water resources affected the establishment and construction of irrigation systems	170	0	111	119
11	What challenges do you face in maintaining existing irrigation systems				
12	How have changes in water availability impacted the types of crops you can grow	197	0	166	37
13	What strategies have you or your community implemented to cope with reduced water availability for irrigation	No			
14	How effective have these strategies been in addressing the challenges				

Table 3 Participants Perception on Awareness of Climate Change

S/N		Yes	No	Don't Know	No Response
1	Are you familiar with the concept of climate change	187	59	62	92
2	Did you get information about climate change	179	105	24	92
3	Did you perceive any impact of climate change on your local environment	187	27	94	92
4	Did you know how the water levels in local wetlands can changed over the past years	319	0	73	3
5	Did you know the main factors contributing to changes in water levels in your area	79	198	85	38
6	Is there hydrological changes affect the availability of water for local communities	79	112	201	8
7	Is there any impact cause due to changes in hydrology on agricultural activities in the region	79	112	201	8
8	Is local water management practices adaption cause any changing to water levels	79	112	201	8
9	Did you observed the quality of water in wetlands changing over time	188	191	21	0
10	Is there any visible signs of biogeochemical changes in the wetlands	17	293	87	3
11	Did these changes affect plant and animal life in the wetlands	17	-	-	-
12	Is there any implications of these changes for human health and livelihoods	17	-	-	-
13	Is the changes in soil and water chemistry affected agricultural productivity	270	19	99	12
14	Is the changes in hydrology and biogeochemistry impacted the biodiversity of the wetlands	270	19	99	12
15	Is there any specific species or habitats that affected by these changes	19	14	302	65
16	Is the local fishing practices been affected by changes in the aquatic ecosystem	277	58	8	57
17	Did the traditional practices or knowledge help in managing wetland resources sustainably	274	35	37	54
18	Is the local community aware about the challenges posed by climate change to wetlands	25	258	97	20
19	Is there any initiatives or programs put in place to educate the community about these challenges	0	315	71	14
20	Is there any role do local organizations or government agencies play in addressing climate change impacts on wetlands	217	12	142	29

Discussion, Conclusion And Recommendations

DISCUSSION

The water quality of the wetlands is critical for maintaining the health of its ecosystem and supporting various uses such as agriculture, fishing, and domestic (Nayak and Bhushan, 2022). The report of the presence study provides insight into the community's views on water availability, usage, and the impacts on agriculture, ecosystems, and local economies. The participants' perceptions of the challenges faced on the resources due to overuse and or misuse of the wetlands underscore the critical challenges that cause a decrease in the water resources. As reported by Bukar et al. (2021) respondents in their study reported that major changes include inadequate and fluctuating rainfall resulting in the overall reduction in water availability and recurrent droughts, Typha grass invasion, population pressure, and unregulated human activities (Bukar et al., 2021). Therefore, addressing these challenges requires a multifaceted approach involving efficient water management, agricultural adaptation, and community engagement to ensure sustainable use and conservation of water resources in the region.

Regarding the participants' awareness and perceptions of the climate change, and its impacts on local environments, and the adaptive practices of local communities. This study highlights the critical need for increased awareness and education on climate change, its impacts on local environments, and effective adaptation strategies. The respondent's participants reported a considerable gap in knowledge regarding the factors contributing to changes in water levels and the biogeochemical changes in wetlands. Addressing these needs through targeted initiatives and leveraging traditional practices can help communities better manage water resources and adapt to changing environmental conditions. This study is supported by the report of other studies done by Galtima and Tafida (2016), Bukar et al. (2021), Nguru et al. (2022) and that of Gujja et al. (2023).

CONCLUSION

The community awareness and perceptions on water resource usage and challenges due to overuse of resources highlight the need for increase community awareness and education on climate change impacts and adaptive practices through targeted outreach programs and Engage local communities in conservation and resource management initiatives, that leveraging traditional knowledge and practices.

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