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## Article

## Assessment of Knowledge and Perception of Climate Change, the Effects of Deforestation, and Mitigation Readiness among Residents of Damaturu Metropolis, Yobe State, Nigeria

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### Abstract

This cross-sectional study assessed knowledge and perceptions of climate change, the effects of deforestation, and mitigation readiness among residents of Damaturu Metropolis, Yobe State, with the objective of evaluating the level of knowledge and perception of climate change. A total of 128 questionnaires were administered through a random sampling technique. The data were collected using a structured Google Form questionnaire and analyzed using descriptive statistics. The mean age of respondents was  $35.38 \pm 11.83$  years, with the majority (39.1%) aged 18–30. Most respondents (78.1%) were aware of climate change; however, 53.9% incorrectly associated it with seasonal variation. Our study found that deforestation (36.7%) and burning fossil fuel (29.7%) were identified as the main causes of climate change. Of the respondents, majority (61.7%) had observed tangible effects, notably high temperatures. While 90.6% believed tree cutting harms the environment, common effects cited were loss of shade (39.8%) and soil erosion (28.9%). Our findings show majority (79.7%) cited firewood collection was the primary driver of cutting tree in the study area. Encouragingly, 78.9% believed tree planting could mitigate climate change, and 75.8% were willing to plant trees. However, only 8.6% had participated in climate-related campaigns. Key barriers included lack of awareness (51.6%), government inaction (21.1%), and resource constraints (17.2%). Suggested motivators for future action included community awareness programs (52.3%) and government support (32.0%). In conclusion, the findings indicates that most respondents were aware of climate change and its causes, particularly deforestation and fossil fuel use, though many confused it with seasonal changes. Strengthening public awareness and education is highly endorsed.

**Keywords:** Climate Change, Deforestation, Awareness, Mitigation

### 1. Introduction

Climate change refers to long term shift in temperature and weather patterns, primarily driven by human activities like burning fossil fuels, deforestation, and industrial operations, which release greenhouse gases that trap heat in the Earth's atmosphere [1,2]. In Nigeria, the effects of climate change are increasingly visible, with extreme weather events such as floods and droughts becoming more frequent and intense [3]. Numerous studies have explored the knowledge, awareness, and perceptions of climate change among different groups in Nigeria, such as farmers [4,5,6] and healthcare professionals [7,8,9]. However, there is a lack of research focused on the knowledge, awareness, and

perceptions of climate change among resident in Nigeria. Evidence indicates that climate change in the 21st century is caused by increased concentrations of greenhouse gases in the Earth's atmosphere due to human activities [10]. The main greenhouse gases are carbon dioxide, methane, nitrogen oxide, hydrofluorocarbons, and sulfur oxides. Considering the effects of greenhouse gases (to a greater extent CO<sub>2</sub>) and aerosols, with exponential population growth, together with a large amount of unregulated anthropogenic environmental destructive forces, the average temperature of the Earth is expected to increase and its consequences to become a global threat [11].

The impact of climate change on human health can be direct or indirect. According to the National Climate Response Centre (BNRCC), the direct impacts of climate change in Nigeria include cerebral spinal cord meningitis, cardiovascular disease and respiratory diseases, skin cancer, high blood pressure, malaria, and cholera [12]. The adverse health effects of climate change include changes in the geographical range and transmission of vector and reptile diseases, malnutrition, food insecurity, air pollution, reduced drinking water and sanitation, inadequate housing and psychosocial effects such as anxiety and depression following extreme weather events or natural disasters [13].

Recent studies have also taken into account the impacts of climate change on agriculture and natural resource management in Africa, Asia and Latin America [14,15]. Studies show that many people have limited knowledge, misconceptions and misunderstandings about the causes and effects of climate change [16]. According to a climate risk index, Nigeria has been placed in the 95th percentile to ascertain its future vulnerability and readiness to adapt to global trends [17]. In 2012, Nigeria faced a deforestation rate of 3.5% per annum, arguing with clean-up measures such as re-afforestation [18]. Much of this deforestation has been caused by erratic, unseasonal weather, which has affected the agriculture sector, producing output failures [19]. Nigeria is experiencing significant climate changes, including higher temperatures, extreme weather events, altered rainfall patterns, and rising sea levels, a pattern also seen across West Africa [20]. Research identifies human activities, particularly since the mid-20th century, as the primary cause of these changes [21]. Damaturu, the capital of Yobe State, faces recurrent drought, erratic rainfall, and severe desertification due to its semi-arid climate. These conditions increase community vulnerability, yet little is known about resident's perceptions of climate change and their coping strategies. Therefore, this current study evaluates the level of knowledge and perception of climate change among residents of the Damaturu metropolis, Yobe State.

## 2. Materials and Methods

### 2.1 Study area

Damaturu is the capital of Yobe State, located between latitude 11°39'30"–11°47'00" N and longitude 11°54'00"–12°02'00" E. The city covers a land area of 2,366 square kilometers and had a population of 88,014 as of the 2006 National Population Census [22]. Damaturu shares boundaries with Tarmuwa Local Government Area to the north, Kaga Local Government Area of Borno State to the east, Gujba Local Government Area to the south, and Fune Local Government Area to the west. The town is characterized by semi-arid savannah vegetation and experiences a prolonged hot season, with average maximum temperatures ranging from 38°C to 42°C. The region faces significant desertification, resulting in sandy terrain during the dry season and muddy conditions during the rainy season. These environmental conditions often make the terrain difficult to navigate, and many communities are classified as hard to reach. Damaturu was purposively chosen as the study area because it is highly vulnerable to climate change impacts such as excessive heat, unpredictable rainfall, recurrent drought and desertification. In addition, limited research on residents making it a suitable location to generate context-specific evidence.

### 2.2 Study design

The target population comprised residents of Damaturu Metropolis aged 18 years and above, regardless of gender, occupation, or educational background. Participants were selected from various neighborhoods within the metropolis.

### **2.2.1 Inclusion criteria**

1. Adults aged 18 years and above.
2. Residents of Damaturu Metropolis who have lived in the area for at least six months.
3. Individuals willing to provide informed consent.

### **2.2.2 Exclusion criteria**

1. Individuals below 18 years of age.
2. Non-residents of Damaturu Metropolis.
3. Individuals unwilling to participate in the study.

### **2.3 Determination of sample size**

The sample size was calculated using a commonly accepted formula informed by a prior study [23]. With a 95% confidence level, a precision level of 0.05, and an added 14% margin to account for potential non-response, a total of 128 participants was selected for the study.

### **2.4 Sampling techniques**

This study adopted a random sampling technique to select participants from Damaturu Metropolis, Yobe State. Individuals were randomly selected from different parts of the study area to ensure a broad and inclusive representation of the population.

### **2.5 Data collection**

A structural google form questionnaire was used to obtain information from respondents in different residential areas of Damaturu Local Government Area, Yobe State. The questionnaire comprised both closed-ended and open-ended questions. It was divided into two sections, section one for the bio-data of the respondents and the other section for the main questions of the research. The responses obtained formed the basis for the analysis. The primary sources of data were the self-administered and interview-administered questionnaires, which were designed and adopted as the instruments for data gathering.

### **2.6 Data analysis**

The collected data were entered into a Microsoft Excel database, cleaned, and analyzed using SPSS (Version 2022). Descriptive statistics, such as frequencies, percentage, means and standard deviations were used to summarize the study variables.

## **3. Results**

A total of 128 questionnaires were distributed, out of which 128 were retrieved giving a response rate of 100%. The mean age of respondents ( $\pm$ SD) was 35.38 $\pm$ 11.83 years, with the majority ranged within the age group of 18- 30 years. The Majority of the respondents 81.3% were male followed by 18.8% females. Of the respondents, the majority were married 50.0%, employed 46.1%, and 68.0% had a tertiary level of education and 66.4% have 10 years above duration of living in the present resident. The Sociodemographic characteristics of the participant was presented in table 1.

**Table 1.** Sociodemographic characteristics of respondents

Variables	Frequency ( <i>n</i> =128)	Percentage (%)
<b>Age group</b>		
18-30	50	39.1%
31-40	46	35.9%
41-50	14	10.9%
51 above	18	14.1%
<b>Mean</b>	35.38±11.83	
<b>Gender</b>		
Male	104	81.3%
Female	24	18.8%
<b>Marital status</b>		
Married	64	50.0%
Single	57	44.5%
Divorce	5	3.9%
Widowed	1	1.6%
<b>Types of occupation</b>		
Employed	59	46.1%
Unemployed	37	28.9%
Retired	6	4.7%
Student	26	20.3%
<b>Level of education</b>		
Primary	3	2.3%
Secondary	25	19.5%
Tertiary	87	68.0%
No Formal Education	13	10.2%
<b>Duration of living in present residence</b>		
1-5years	19	14.8%
5-10years	24	18.8%
10years above	85	66.4%

**Table 2.** Knowledge of climate change

Variables	Frequency (n = 128)	Percentage (%)
<b>Have you ever heard of climate change before?</b>		
Yes	100	78.1%
No	28	21.9%
<b>What do you understand by climate change?</b>		
Long term shift in temperature and weather pattern	59	46.1%
Seasonal changes	69	53.9%
<b>Which of the following are causes of climate change?</b>		
Burning of fossil fuel	38	29.7%
Deforestation	47	36.7%
Pollution	16	12.5%
I don't know	27	21.1%
<b>What effect of climate change have you noticed in Damaturu?</b>		
High temperature	79	61.7%
Flooding	10	7.8%
Reduced rainfall	15	11.7%
Drought/desertification	6	4.7%
Increase in dust and air pollution	13	10.2%
None	5	3.9%

The majority of the respondents, 78.1% have heard of climate change before with few 21.9% who have never heard of it before. Of the respondents, 53.9% misunderstood climate change as seasonal change whereas 46.1% correctly identified as long-term shift in temperature and weather pattern. A slightly larger proposition of the respondents, 36.7% indicate deforestation as the causes of climate change, followed by 29.7% burning of fossil, 12.5% pollution and 21.1% admitted they did not know the causes. Of the respondents, majority 61.7% indicate high temperature as effect of climate change noticed, followed by 11.7% reduced rainfall, 10.2% increase in dust and air pollution, 7.8% flooding, and 4.7% drought or desertification. A small proportion 3.9% indicated that they had noticed no effects as presented in above table 2.

**Table 3.** Perception of the effect of deforestation

Variable	Frequency (n=128)	Percentage (%)
<b>Do you think cutting down trees affect the environment?</b>		
Yes	116	90.6%
No	9	7.0%
Not sure	3	2.3%
<b>What do you think are the effects of deforestation?</b>		
Soil erosion	37	28.9%
Desertification	34	26.6%
Loss of shade and coolness	51	39.8%
Extinction of animals	6	4.7%
<b>In your opinion, what is the major reason trees are cut down in Damaturu?</b>		
Firewood	102	79.7%
Construction	6	4.7%
Farming	3	2.3%
Charcoal business	17	13.3%
<b>Do you think tree planting can reduce climate change?</b>		
Yes	101	78.9%
No	17	13.3%
Not sure	10	7.8%

The majority of respondents, 90.6% believe that cutting down trees affects the environment. Only a slight proportion disagreed 7.0% or were unsure 2.3%. Of the respondents identified several key effects of deforestation, with the most common being **loss of shade and coolness** 39.8%, followed by **soil erosion** 28.9%, and **desertification** 26.6%. Only 4.7% mentioned **extinction of animals**. The majority of participants 79.7% indicated that **firewood collection** is the primary driver of cutting down trees in the study area, followed by other reasons such as **charcoal business** 13.3%, **construction** 4.7%, and **farming** 2.3%. of the respondents, 78.9% of respondents believe that **tree planting can help reduce climate change**, whereas 13.3% did not believe in this approach, while 7.8% were unsure.

**Table 4.** Mitigation readiness

Variables	Frequency (n=128)	Percentage (%)
<b>Are you willing to plant tree in your community or compound?</b>		
Yes	97	75.8%
No	31	24.2%
<b>Are you aware of any government or NGO initiative promoting tree planting?</b>		
Yes	56	43.8%
No	72	56.3%
<b>Have you ever participated in a climate change or environmental campaign?</b>		
Yes	11	8.6%
No	117	91.4%
<b>What challenges may prevent you from engaging in climate change mitigation efforts?</b>		
Lack of awareness	66	51.6%
Lack of support or resources	22	17.2%
Cultural/religious belief	2	1.6%
Government inaction	27	21.1%
Not interested	11	8.6%
<b>What would encourage you to participate in climate change mitigation?</b>		
Community awareness program	67	52.3%
Incentive	6	4.7%
Support from government	42	32.0%
Community leader involvement	13	10.9%

A total of 75.8% of respondents are willing to plant trees in their community while 24.2% are not. Majority of respondents are not aware of government or non-governmental organization (NGO) climate change campaign, only 43.8% of respondents are aware. Of the respondents, majority 51.6% indicate lack of awareness is the main challenges preventing engagement in climate change mitigation efforts followed by 21.1% government inaction, and 17.2% lack of support or resources while 8.6% not interested and 1.6% cultural religious belief were less common challenges. Of the respondents, majority 52.3% indicate **community awareness programs** as what would encourage participate in climate change mitigation, followed by **government support** 32.0%, **involvement of community leaders** 10.9%, and **incentives** 4.7%.

#### 4. Discussion

The respondents in this study exhibited a sociodemographic profile that was varied in certain aspects yet predominantly uniform in others, with the majority being male, married, employed, and having attained tertiary education, with many residing in the area for over 10 years and falling within the 18–30 age range. The predominance of male respondents may have influenced the findings and limits their generalizability to females. These findings are consistent with previous studies conducted in Nigeria [4], Jordan [24], and South Africa [25]. The current study revealed that a high proportion of respondents (78.1%) had heard of climate change, while a smaller percentage (21.9%) demonstrated lower levels of knowledge. This finding aligns with reports from Nigeria, South Africa, Jordan, and Rome, where high levels of climate change awareness were also observed [26,27,25,24,28]. Moreover, the awareness level in this study is higher than that reported in similar studies conducted in Ethiopia [29] and Nigeria [23]. These results suggest that climate change is a recognized issue within the community, possibly influenced by factors such as media exposure, educational attainment, or direct experience with environmental changes.

Our study found that 53.9% of respondents mistakenly equated climate change with seasonal variations, while only 46.1% correctly identified it as a long-term shift in temperature and weather patterns. This finding highlights a significant misconception that may hinder effective communication about the urgency and scope of climate change. The higher proportion of respondents who confused climate change with seasonal variation could be attributed to a lack of awareness, reliance on daily weather observations, and limited access to accurate information. This study shows that the majority of respondents demonstrated a good understanding of the causes of climate change, with 36.7% identifying deforestation and 29.7% citing the burning of fossil fuels as the most common causes. This was followed by 12.5% who mentioned pollution, while a notable 21.1% admitted they did not know the causes of climate change. The prominence of deforestation and fossil fuel combustion as perceived causes aligns with findings from previous studies conducted in Nigeria, South Africa, and Jordan [30,31,26,32,25,24]. This relatively high level of awareness may be influenced by respondents' educational background and personal experiences with environmental issues.

Regarding the effects of climate change, this study found that respondents have observed tangible impacts in their locality, with 61.7% citing high temperatures as the most noticeable effect. This finding aligns with previous studies, all of whom reported similar observations of rising temperatures [33,34,35,32]. These results are consistent with broader climate trends in the Sahel and northern Nigerian regions, which are experiencing rising temperatures and increased aridity. Other observed effects include reduced rainfall (11.7%), increased dust and air pollution (10.2%), and, to a lesser extent, flooding (7.8%) and desertification (4.7%). These observations reflect a localized experience of climate change, which aligns with regional climate models and reports. Only a small fraction (3.9%) reported no noticeable changes, underscoring the growing presence of climate impacts in daily life. These findings are consistent with studies conducted in Nigeria [27,36], Jordan [24], and Rome [28].

A large proportion of respondents (90.6%) believe that cutting down trees negatively affects the environment, with only 7.0% disagreeing and 2.3% were uncertain. The most commonly identified effects of deforestation were loss of shade and coolness (39.8%), followed by soil erosion (28.9%), desertification (26.6%), and the extinction of animals (4.7%). Our findings regarding soil erosion and desertification are higher than those reported by [37], who found rates of 11% and 2%, respectively. The higher proportion of respondents identifying loss of shade and coolness suggests that people are particularly aware of changes in the microclimate and personal comfort. In the current study, the dominant reason for tree cutting down was the **collection of firewood (79.7%)**, highlighting the population's dependence on wood as a primary energy source followed by significantly lower values for **charcoal business (13.3%)**, **construction (4.7%)**, and **farming (2.3%)**. Our finding on higher cutting down of trees contradict with the findings of a similar study in Nigeria whose reported that fuel wood extraction and logging activities is the major sources of cutting trees respectively [37,38]. This higher findings on dependence on firewood maybe due to limited access to alternative energy sources (electricity, gas), poverty, and rural livelihoods. This trend further accelerates deforestation,

exacerbating soil erosion, biodiversity in the region. In addition, reliance on biomass fuels exposes households to indoor air pollution, a major risk factor for respiratory diseases, particularly affecting women and children. These findings highlight the need for targeted policies to promote affordable clean energy transitions and provide rural communities with sustainable alternatives to firewood.

Our study revealed that most respondents (78.9%) believe that tree planting can help reduce climate change, which is encouraging and shows that many people are open to solutions. However, 13.3% disagreed, and 7.8% were unsure. The high proportion of agreement of tree planting may reflect increasing awareness of environmental issues and visible effects of deforestation and desertification in the study area, underscoring the importance of tree planting as a recognized strategy for climate change mitigation.

The majority of respondents (75.8%) indicated a willingness to plant trees in their community or compound. This high proportion reflects a generally positive attitude toward environmental action, which could be leveraged in future tree planting initiatives. However, 24.2% who said no may be constrained by factors such as land ownership, lack of interest, or competing priorities. This study found that only 43.8% of respondents were aware of any government or non-governmental organization-led tree planting initiatives, while a higher proportion (56.3%) reported no awareness. This finding may be attributed to the low awareness rate or outreach of such programs, poor communication channels, or ineffective mobilization strategies.

The current study found that a very low percentage (8.6%) of respondents had participated in a climate change or environmental campaign, while the vast majority (91.4%) had not. The low level of participation in climate change campaigns observed in this study may be attributed to factors such as limited access to such initiatives, inadequate awareness, and a lack of coordinated sensitization efforts by both governmental and non-governmental bodies. The majority of respondents identified challenges that prevent them from participating in climate change mitigation efforts, with the most common barriers being lack of awareness (51.6%), followed by government inaction (21.1%) and lack of resources (17.2%). Only a small percentage cited cultural or religious beliefs (1.6%) or lack of interest (8.6%). These findings likely reflect the absence of consistent, community-focused climate education and the failure of existing awareness efforts to reach or resonate with the local population. Of the respondents, when asked what would encourage them to participate in climate change mitigation, community awareness programs (52.3%) appeared as the highest motivator, followed by government support (32.0%) and community leader involvement (10.9%) as also notable motivators, while monetary incentives (4.7%) ranked very low. This finding of higher preference for community awareness program reflects the need for sensitization on climate change, while government support indicates expectations of resources and policy backing.

## 5. Conclusion

The study shows that most respondents were aware of climate change and its causes, particularly deforestation and fossil fuel use, though many confused it with seasonal changes. High temperatures were the most commonly observed impact. While most recognized the negative effects of deforestation and were willing to plant trees, participation in environmental initiatives was low due to limited awareness, government inaction, and lack of resources. The findings highlight the need for targeted awareness campaigns and stronger community and government engagement to support climate change mitigation efforts.

### 5.1 Recommendation

The study recommends that government and non-governmental organizations enhance tree-planting initiatives and promote alternative energy sources to reduce dependence on firewood, while also strengthening climate change awareness and education. Local leaders and influencers should be actively involved in promoting tree planting within communities. Policymakers should introduce and enforce regulations requiring each household to plant and maintain at least one tree to support local

restoration and climate resilience, and they should also enforce regulations that prohibit unnecessary tree cutting by requiring individuals to obtain official approval before cutting down or trimming trees.

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The author(s) hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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