

Research



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Community perception and adaptation to climate change in Benue State, Nigeria, 2021

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Abstract

Introduction: climate change is a global public health problem that has affected the health, livelihoods, food productivity, water availability, and overall security of Nigerian people. We conducted this study to assess community perception and adaptation strategies to climate change in Benue State to contribute to the burden of knowledge, policy change, and awareness programs. **Methods:** we used a descriptive cross-sectional study with a multistage sampling technique to assess community perception and adaptation strategies to climate change among dwellers in Benue State. We collected responses from six hundred and eighty-six (686) respondents using a semi-structured interviewer-administered questionnaire using an Android-enabled device on

*Open Data Kit (ODK). We entered data into Microsoft Excel, performed descriptive and inferential statistics using IBM SPSS Statistics version 23 and determined an association between sociodemographic variables, community perception and adaptation strategies to climate change using the chi-square test. We explored the predictors of community perception and adaptation strategies to climate change using logistic regression models at a 95% confidence interval. **Results:** most of the respondents were females, 362 (52.8%) with a median age of 31.4 years (IQR = 20-39 years). The majority were younger age group, 15 to 24 years, and more than half, 350(51%) were married while one-third of respondents were students. About 13.4% of those employed earned between 60,000 to 120,000 naira (\$146.3 - \$292.7) per year. Majority the majority, 98.5% of respondents, have heard of climate change, and the main source of information includes school (52.0%), television (43.1%) and radio (30.8%). Most of the respondents, 674 (98.3%), believe climate change affects men, women, and children's health. Risky behaviours contributing to climate change adaptation by respondents include smoking (32.9%), bush burning (32.9%) and tree felling (21.1%). Predictors of community perception and adaptation of climate change include the level of education ($p < 0.001$), marital status ($p = 0.002$), age ($P < 0.001$) and sex ($p = 0.002$). **Conclusion:** community perception of climate change was high. However, adaptation strategies towards climate change were poor. Knowledge and education were the predictors of poor adaptation strategies. Therefore, policymakers should develop effective communication strategies to increase awareness of the dangers of climate change, reduce the risks of climate change and promote better climate change adaptation.*

Introduction

Based on the most recent projections, most countries globally are threatened by climate changes direct and indirect impact, most of which

will more than likely accelerate in the coming decade [1]. Climate change occurs when changes in the earth climate system result in new weather patterns that last for at least a few decades and maybe for millions of years. Among some of the possible effects are increased coastal flooding, storm surge, erosion of hillsides and other coastal hazards - leading to extensive damage to coastal infrastructure and communities, tourism infrastructure and coastal ecosystems; drought from reductions in water resources and increased invasion of non-native species, which may include pest infestations. The planet's climate changes over geological time. Today's global average temperature is about 1.5°C, though geological evidence suggests it has been much higher and lower in the past [2]. Evidence shows that the temperature change has affected the health, livelihoods, food productivity, water availability, and overall security of the African people [3]. Africans are at most risk from climate change, and the Sahel and Southern Africa and increased parts of Central Africa have continued to observe decreased in rainfall [3]. Climate change has been source of worries to Africa since the 1970s, according to the report of the Intergovernmental Panel on Climate Change [4], which described the African continent as the one that will be most affected in the coming future if the impending danger of climate change goes un-averted in the coming years. Africa will experience significant temperature increases by 2010, particularly in the Sahel and part of southern Africa. In addition, a dramatic decrease in precipitation by more than 20% observed when compared to the level at 20 years ago. Although, more frequent and intense tropical storms in some parts of the continent will see a 20% increase in cyclone activity [5]. Water source has been adversely affected in Africa and would range from flooding, drought, change in the distribution of rainfall, the drying-up of rivers, melting of glaciers and the receding of bodies of water [3]. The entire economies suffer when the water levels of S Africa's huge rivers drop. Ghana, for example, has become reliant on the

hydroelectric output of the Akosombo dam on the river Volta [6].

In Nigeria, most of its population uses unclean water for drinking and domestic use due to deplorable access to clean water [4] and this has resulted to poor agricultural production and output, food insecurity and infectious disease outbreaks. Climate change is the biggest threat to Nigeria's economic and social development [7]. The climate in Nigeria has been irregular for years. It has always alternated between periods of extreme dry or rainy seasons with increases in temperature; variable rainfall; rise in sea level and flooding; drought and desertification; land degradation and more frequent extreme weather events [8,9]. Economic sectors such as agriculture, fishery and forestry are more predisposed to the adverse effects of climate change with affectation of freshwater resources and loss of biodiversity [9]. The frequent change in climate has led to seasons of drought and excess flood, which has affected agricultural activities and displaced many people from their homes in the country. In 2019 alone, the National Emergency Management Agency (NEMA) revealed floods had displaced approximately 1.9 million Nigerians. Climate change has affected environment, agriculture, livestock and health of individuals in the northern part of Nigeria [10].

The current global estimate of sea-level rise is 0.2 m, with a projection to increase to 1 m by 2100 [11]. The implication is that sea incursion due to sea-level rise means salt-water intrusion into the freshwater. In addition, invasion and destruction of mangrove ecosystems, coastal wetlands, and coastal beaches will be felt [12]. The worst impact is population displacement, resulting in communal crisis in some part of Nigeria [13,14]. Northern part of Nigeria have experienced increasing temperature and decrease rainfall that led to frequent drought and desertification, [15]. Studies have mostly revealed significant gaps in Africa's knowledge, attitude, perception, and behavioral adaptation to climate change. Despite the implementation of several climate

change awareness projects in selected communities/parishes in recent years, consultations held earlier in 2012 with a broad cross-section of stakeholders confirmed the need for more public awareness and education on the current and likely impact of climate change and appropriate adaptation strategies [16,17]. Few studies were conducted on climate change among the general population [18]. The study addressed community perception and adaptation strategies to climate change in Benue State, Nigeria. This study will generate findings on the knowledge, perception, and adaptation of climate change, which will help policymakers develop policies that aim to tackle the challenges posed by climate change and add to existing knowledge on climate change-related issues.

Methods

Study area: Benue State is located in Northcentral Nigeria with 7° 47' and 10° 0' East longitude. Latitude 6° 25' and 8° 8' North shared boundaries with five other states, namely Nasarawa State to the North, Taraba to the East, Cross River State to the South, Enugu State to the South-west and Kogi to the West. A-State also shares a border with the Republic of Cameroon in the southeast. Benue occupies 34,059 square kilometres and has Makurdi as the Capital City and 23 local government areas. Benue State has a population of 4,253,641 according to the 2006 census, making it the ninth most populous State in Nigeria. Benue State is the primary source of food production in Nigeria, and it engages more than 70 percent of the workforce while the rest were 10% traders, 6% civil servants and 9% private employees.

Study design: we used a descriptive cross-sectional study with a quantitative method approach.

Survey population: women and men were aged 15-64 years living in residential households and visitors who slept in the home the night before the survey.

Operational definitions: our study used the operational definition below throughout the survey to establish participant eligibility.

Household: we defined a household as "a group of persons who normally live and eat together. These people may or may not relate by blood, however have a common source of food provision or other essentials for living, and they have only one person they all regarded as the head of the household". Households will be eligible for participation in this survey if they are within the pre-defined enumeration area (EA) and selected for inclusion in the survey.

Household resident: we defined a household resident as an individual listed by the head of the household as a household resident or overnight guest of the family the night before completing the household interview.

Head of household: we defined the head of the family as the person who is recognized within the home as being the head and is 18 years and older or is considered an emancipated minor (a child aged 15-17 years who are free from parental control and the parents are free of all obligation toward the child).

Inclusion/exclusion criteria: criteria for inclusion of subjects aged 15-64 years: resides in the selected household or spent the night before the survey, per the above definitions, and self-reported aged 18-64 years, and between aged 18-64 years, able and willing to provide written informed consent in English; matured minors aged 15-17 years, able and willing to provide written assent and parent/guardian able and willing to provide written informed consent/permission in English. Note that persons unable to give consent due to cognitive impairment or intellectual disability were not eligible to participate. Individuals with disabilities who could not provide written permission, mark, or thumbprint were offered survey participation.

Sample size calculation: sample-size estimation was determined using Epi-info Statical. The population of the age group 15-64 yrs. According to the 2006 census figure was 451,079. We used an assumption of 50% as the estimated proportion for perception of climate change for the study, the confidence interval of 95%, 4% error margin and 1% design effect. The sample size calculated was 599 after adjusting for 20% non-response at the LGA population level; the calculated total sample size was 872.

Sampling design: the study adapted a multistage sampling technique to select respondents for the study.

Sampling technique

Sampling technique and procedures: multi-stage was used by the stratifying the LGAs into urban and rural enumeration, followed by selecting two LGAs using a simple random sampling with the selection of three enumeration areas using a systematic sampling technique. Finally, selecting the households using a systematic sampling and in each household, two participants were enrolled and interviewed without replacement using simple random sampling with a table of random numbers for family size with more than two adults.

Sample allocation: we used allocation proportionate to the size of the population of the age group 15-64 yrs. Table 1 showed the sample size allocated to the selected LGAs in Benue State.

Study instrument: the questionnaire designed on kobo toolbox and administered using open data kit. It comprised four sections; section A composed of general information about the research, which included information about the researcher, purpose of the study, and brief information about the research and consent/absence to participant in the study. Section B had information on the demographic characteristics such as age, gender, marital status, educational status, occupational status, and income status. Finally, section C contained information on climate change's

household characteristics. The information included: what kind of house does the dweller live, ownership of the house, do you have electricity, what is your alternative source of electricity, do you have a generator, generator close to the dwelling, how do you deposit your domestic waste, what kind of electric bulb do you use?

Pre-test: the pre-test of the survey procedures, including data collection and management, was conducted in the enumeration areas in Makurdi that were not part of the sampling frame. In total, the survey team visited approximately 10-15 households. After field training, we pre-tested our study tools and applied the consent procedure used in the primary survey. We used the pilot data to modify the survey collection instruments and the field procedures.

Survey procedure

Recruitment: field teams visited each selected household, identified the head of the family, and introduced the purpose of the survey. First, the survey staff determined if the head of household had the cognitive ability to consent to the household interview and the administration of the questionnaire to their family members. A home is ineligible for the survey if the head of the household could not agree and there was no alternate adult head of household. Next, the survey team administered the household questionnaire to the household head in each selected home and their family members. This form helped identify the household size and persons eligible for survey participation based on the inclusion/exclusion criteria.

Enrollment and identification: eligible participants who provided informed consent for the interview (individuals ages 18-64). We administered both consent and assent to participants aged 15-17 yrs and their parents and assigned a 4-digit unique participant ID (PTID). We used this identifier throughout the survey procedures, including data collection, analysis, and management.

Consent and absent: we used two levels of consents in the study: household consent and individual consent/absent. We took consent from the family head or any member of the family not less than 15 yrs of age designated by the head of the household.

Individual consent: we administered consent and assent form to all survey participants above 18 yrs and the mature minors aged 15 yrs to 17 yrs.

Refusals/withdrawals: participants were at liberty to answer the survey questions without any perjury. The consented participants who had started answering the survey questions could decline further participation any time during the interview.

Data collection: we collected study data within two weeks, and a maximum of five households visited daily, including weekends, and used an android phone enabled device ODK to administer the household and individual questionnaires. Field Staff administered hard copy consent forms to the eligible participants. We interviewed our study eligible participants privately to maintain and enhance confidentiality, and the field team followed survey processes and procedures.

Data management: we used android enabled device ODK to collect and export the data into Microsoft Excel, then Epi-info for analysis using Microsoft Excel and Epi-info.

Data analysis: the data collected using ODK was transferred into Microsoft Excel and then entered into a computer. EPI -Info version 7.2.2 and SPSS version 23 analyzed data. We summarized and presented the sociodemographic variables and “participants” responses into frequency tables. We measured perception about the causes and effects of CC using a 5-point Likert scale. Furthermore, we aggregated different components on the matrix into a composite perception score, regrouped them into a good or poor perception by scores above or below the mean composite score. In addition, we scored an indifferent response as

zero, while the correct answers were scored +1. We did this for all questions related to perception about climate change's cause or effect. The questionnaire contained 35 questions for knowledge. A correctly answered knowledge score is a +1 mark, while an incorrectly answered or do not know response scores zero (0). We considered above the mean as good Knowledge, while those below as poor knowledge. The questionnaire contained 26 questions on adaptation to climate change. A correctly answered question on adaptation to climate change earned a +1 mark, while a wrong answer on adaptation scored 0. We calculated the mean score, and we considered scores above the mean as good adaptation, while scores below the mean as poor adaptation to climate change. The mean of knowledge scores was calculated and scores above the mean were considered good knowledge, while those below the mean were classified as poor knowledge. We determined an association between sociodemographic variables, responses and knowledge, perception, and adaptation by cross-tabulation and χ^2 statistic at a 95% confidence interval. We adjusted for confounders and determined independent predictors using the logistic regression model.

Ethical consideration: we obtained ethical approval from the Benue State Ministry of Health ethnic review board to conduct the study. We also got permission to conduct the study from the head of the selected communities and written consent from the selected research. However, we allowed the participants not to read or write to give written consent through thumbprints and verbal consent.

Results

Table 2 showed 686 respondents from both rural and urban areas of Benue State. Female preponderance of 362 (52.8%) with a median age of 31.4 years (IQR = 20-39 years) was observed. The majority were in the younger age group, 15 to 24 years, and more than half, 350 (51%) were

married and one-third 254 (37.0%) current students, followed by traders, 160 (23.3%) while 51 (7.4%) are farmers. Two-thirds of respondents have secondary school education, and more than one-third, 254(37%), are students. One hundred and five (105 (15.3%) are professionals, and 13.4% of those who are gainfully employed earning between five thousand to ten thousand naira (\$12.2 - \$24.4)) per month, which is about 60,000 to 120,000 naira (\$146.3 - \$292.7). The majority, 676 (98.5%), of respondents, have heard of climate change. The main source of information was school (52.0%), television (43.1%), radio (30.8%), social media (29.9%) and family and friends (24.9%). When respondents were asked about causes of climate change, almost one-third (29.3%) believed that climate change is due to an increase in population (29.3%), change in weather (22.4%), God's work (21.1%), natural occurrence (20.6%), men's activities (18.5%), civilization/modernization (3.9%), men's sins (1.7%) while 9 (1.3%) of respondents do not know the cause of climate change. Most of the respondents, 674 (98.3%), also believe climate change has an effect on men, women, and children's health.

Table 3 showed a little above one-third of respondents, 249 (36.3%), reported that they are very concerned about climate change while 70 (10.2%) of respondents are somewhat concerned about climate change, 42 (6.1%) are not concerned, and almost half, 325 (47.4%) of respondents are indifferent to climate change. About half of respondents, 345 (50.3%), reported they are very interested in finding out more about climate change in Benue State, while 168 (24.5%) reported they are not interested, 148 (21.6%) are somewhat interested, and 25 (3.6%) are indifferent. Risky behaviors contributing to climate change were smoking, 226 (32.9%), bush burning, 226 (32.9%) and tree felling, 145 (21.1%). The majority of the respondents have never planted a tree before, 581 (84.7%). Only 105 (15.3%) of respondents reported taking any action(s) to prevent or lessen the impact of climate change.

Major actions respondents reported to have taken include raising awareness, proper waste disposal, reforestation, not cutting down trees/forests, observing building code, having a disaster management plan and others.

About 319 (46.5%) of respondents have good knowledge of climate change, the majority have a good perception about climate change, 586 (85.4%) while less than 10% of respondents have good adaptation to climate change (Table 4). Table 5, showed an associated factor to the adaptation of the climate, some factors were age group ($p < 0.001$), tertiary level of education ($p < 0.001$), having an occupation ($p < 0.001$) and earning more than 5000 naira monthly ($p = 0.002$) were found to be statistically associated with the perception of climate change. Table 5 also showed an associated factor to the adaptation of the climate, some factors were age group ($p < 0.001$), being female ($p = 0.002$), tertiary level of education ($p < 0.001$), having an occupation ($p < 0.001$) and earning more than 5000 naira monthly ($p < 0.001$) were found to be associated with the adaptation to climate change and were statistically significant. Predictors of perception and adaptation of climate change include the level of education ($p < 0.001$), marital status ($p = 0.002$), younger age group, 25 to 34 years, ($p < 0.001$) and sex ($p = 0.002$) (Table 6).

Discussion

This study assessed knowledge, perception, and adaptation to climate change in Benue State, north-central Nigeria. The majority of respondents are female students with a median age of 31.4 [18]. Our findings differ from most studies where most respondents were males and farmers [19,20]. Awareness of climate change was high, with most respondents having heard about climate change from school, television, radio, social media, and newspapers. Our results may be because most respondents are students, and schools were a significant source of information about climate change in this study. The results are comparable to a study conducted in Bangladesh,

which reported that people with higher educational levels or who live near a school were more knowledgeable about climate change and its impact on health [21]. The results from Bangladesh agrees with other studies, which reported about half of the respondents as having good knowledge of climate change [22-24].

On the contrary, a study conducted among farmers in north-central Nigeria reported poor knowledge of climate change among respondents, with radio and television being the dominant source of information about climate change [22]. Despite the poor general knowledge reported in this study, a significant proportion of people believed that climate change has deleterious health effects on men, women, and children. In addition, participants in other studies in Nigeria and Tanzania reported less knowledge about the impact of climate change at the country level [25]. However, the findings should be interpreted with caution in this context as some of these studies were conducted mainly among farmers since climate change can have deleterious effects on farmland, crop yield, and soil fertility, as reported in these studies. The outcome could have stimulated their interest in increasing awareness on how to mitigate the effect of climate change on agriculture. This study showed an excellent perception among the study participants. Similar findings showed good perceptions of the communities toward climate changes [22,26,27].

Respondents also reported that changes in weather are due to climate change, and this is similar to other study [27]. Climate change adaptation was deplorable in this study, despite good perception. This observed finding could be because of poor knowledge about the causes of climate change, since respondents do not know much about how their activities may be contributing to climate change. Hence, they may not know much about measures to improve the climate. Risky behaviors contributing to climate change in our study were smoking, bush burning, and tree felling. This empirical finding is similar to the study in rural southwestern Nigeria [24].

We examined the association between sociodemographic variables and the participants' knowledge of CC. Sex, education, occupation, and monthly income were significantly associated with respondents' knowledge; this is similar to a study conducted in Bangladesh [22]. Age, education, occupation, and monthly income were significantly associated with respondents' perception, while age, sex, education, participant's monthly income, and occupation were significantly associated with the adaptation to climate change.

In our study, participants with higher educational level were more likely to be aware of climate change than those with lower education levels. Other studies also reported that climate change awareness depended on the respondent's level of education. Hence, suggests that schools play an essential role in increasing knowledge, perception and adaptation to climate change and is similar to findings by [22]. Other significant factors found to be associated with knowledge, perception and adaptation to climate change include marital status ($p=0.002$), age ($p<0.001$) and sex ($p=0.002$). Married female respondents in the younger age group have better knowledge, perception and adaptation of climate change when compared to others. Our finding could be because of an increase in enrolment of the girl child in school in recent times; we suggest that future studies could further explore the association between these factors and climate change. Our study could be generable since it included both rural and urban populations with a wide geographical spread and was representative of the State. More females also participated in the study, which is different from other climate change studies that emphasize the male respondents. However, the limitation to this study includes potential recall bias since it relied on previous experiences and personal judgments of individuals. We also could not observe perception and adaptation to climate change in real-time in this study; hence, these could have been over-reported since good perception and adaptation were desired outcomes.

Conclusion

Our study showed that the knowledge level of the study participants on CC was less than that in previous studies, while perception of changing climatic factors and their impacts on health was higher with poor CC adaptation strategies. In addition, level of education, age, sex, monthly income, and occupation were influential factors to understanding climate change and its impact on health. Based on these critical findings, policymakers can develop effective communication strategies to address community members on the dangers of climate change and put in place activities that will protect the climate and health of Benue State and Nigeria in general.

What is known about this topic

- *Climate change has affected the health, livelihoods, food productivity, water availability, and overall security of the African people;*
- *There are significant gaps in Africa's knowledge, attitude, perception, and behavioural change to climate change adaptation.*

What this study adds

- *Our showed that communities in Benue State, Nigeria, have a good perception of climate change (CC) however, there were poor CC adaptation strategies among the dwellers in the communities;*
- *Our study also identified poor knowledge of climate change and level of education as determinants of poor CC adaptation strategies. Those with poor knowledge and less educated are less likely to adapt to climate change strategies.*

- *The implication of this is that CC awareness should be tailored to the people with poor knowledge of CC and those that are less educated. Messages on CC and practices that promote CC should reach these people to improve safe practices among community dwellers.*

Competing interests

The authors have no competing Interest.

Authors' contributions

All the authors contributed to this study, and their contributions are as follows; UAO conceptualized, studied design, reviewed literature, collected data, data review and analysis and drafting of the manuscript. RU participated in the data review, drafting and review of the manuscript, UIK critically reviewed and edited the manuscripts reviewed, conducted manuscript review, and SS performed data analysis and review manuscript. All authors have given unanimous approval to the final version of this manuscript and equally contributed to its content.

Tables

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Table 3: univariate analysis of perception and adaptation to climate change variables in Benue State North Central Nigeria

Table 4: grading of knowledge, perception and adaptation of climate change among respondents in Benue State, North Central Nigeria

Table 5: bivariate analysis of variables associated with perception and adaptation of climate change among respondents in Benue State, North Central Nigeria

Table 6: multivariate analysis of variables associated with perception and adaptation of climate change among respondents in Benue State, North Central Nigeria

References

1. Nations U. World Population to 2300 UN. 2004.
2. Adama Muhammad. Global warming: a review of the debates on the causes, consequences and politics of global response. International Digital Organization for Scientific Research ISSN: 2550-794X IDOSR Journal of Scientific Research. 2021;6(1): 65-76. **Google Scholar**
3. Connolly-Boutin L, Smit B. Climate change, food security, and livelihoods in sub-Saharan Africa. *Reg Environ Change*. 2016;16: 385-399. **Google Scholar**
4. Adger N, Aggarwal P, Agrawala S, Alcamo J, Allali A, Cruz RV *et al*. Intergovernmental panel on climate change 2007?: impacts, adaptation and vulnerability working group II contribution to the intergovernmental panel on climate change fourth assessment report summary for Policymakers 2300. 2007. **Google Scholar**
5. Aberman NL, Tirado C. Impacts of climate change on food utilization. In *Global Environmental Change*. 2014;717-724.
6. United Nations Educational, Scientific and Cultural Organization. Climate change mitigation and adaptation. Simple guide to schools in Africa. 2009. Accessed January 10, 2022.
7. Change, C. 12/2013 Stakeholder Participation in Adaptation of Climate Change. 2013.

8. Future Learn Local. What are the impacts of climate change in Nigeria?. Accessed January 10, 2022.
9. IODS. Climate change in Nigeria: impacts and responses. 2019.
10. Okon EM, Falana BM, Solaja SO, Yakubu SO, Alabi OO, Okikiola BT *et al.* Systematic review of climate change impact research in Nigeria: implication for sustainable development. *Heliyon*. 2021 Sep 6;7(9): e07941. **PubMed** | **Google Scholar**
11. Samson AO, Oluwatoyin OR. Challenges of waste management and climate change in Nigeria?: Lagos State Metropolis Experience. *Africa Journal of Scientific Research*. 2012;7(1). **Google Scholar**
12. Hengeveld GM, Didion M, Clerckx S, Elkin C, Nabuurs G, Schelhaas M. The landscape-level effect of individual-owner adaptation to climate change in Dutch forests the landscape-level effect of individual-owner adaptation to climate change in Dutch forests. *Regional Environmental Change*. 2015. **Google Scholar**
13. Akpodiogaga AP, Odjugo O. General overview of climate change impacts in Nigeria. In *J Hum Ecol*. 2010;29: 1. **Google Scholar**
14. Fasona M, Omojola A. Climate change, human security and communal clashes in Nigeria human security and climate change. *Researchgate*. June 2014. **Google Scholar**
15. Ayoola SO, Idowu AA, Opele AI, Ikenweiwe NB. Impact of climate change in Nigeria. *Iranica Journal of Energy & Environment*. 2011;2(2): 145-152. **Google Scholar**
16. Asekun-Olarinmoye E, Bamidele JO, Odu OO, Olugbenga-Bello AI, Abodunrin O, Adebimpe W *et al.* Public perception of climate change and its impact on health and environment in rural southwestern Nigeria. *Res Rep Trop Med*. 2014 Feb 10;5: 1-10. **PubMed**
17. Akponikpè PBI, Johnston P, Agbossou EK. 'Farmers' perception of climate change and adaptation strategies in sub-Saharan West-Africa. 2nd International Conference?: Climate, Sustainability and Development in Semi-Arid Regions. 2010;2015: 15. **Google Scholar**
18. Mengistu DK. "Farmers" perception and knowledge on climate change and their coping strategies to the related hazards: case study from Adiha, central Tigray, Ethiopia. *Agricultural Sciences*. 2011;02(02): 138-145. **Google Scholar**
19. Ishaya S, Abaje I. Indigenous people's perception on climate change and adaptation strategies in Jema'a local government area of Kaduna State, Nigeria. *Journal of Geography and Regional Planning*. 2008;1(8): 138-143. **Google Scholar**
20. Kabir MI, Rahman MB, Smith W, Lusha MAF, Azim S, Milton AH. Knowledge and perception about climate change and human health: findings from a baseline survey among vulnerable communities in Bangladesh. *BMC Public Health*. 2016 Mar 15;16: 266. **PubMed** | **Google Scholar**
21. Burka Daniel, Steele Lindsay, Siegler Anne, Abraham F, Bamidele FS, Adebola AJ *et al.* Knowledge, perception and adaptation strategies to climate change among farmers of Central State Nigeria. *Sustainable Agriculture Research*. 1390;2(3): 99-117. **Google Scholar**
22. Ojomo E, Elliott M, Amjad U, Bartram J. Climate change preparedness: a knowledge and attitudes study in southern Nigeria. *Environments - MDPI*. 2015;2(4): 435-448. **Google Scholar**
23. Mayala BK, Fahey CA, Wei D, Zinga MM, Bwana VM, Mlacha T *et al.* Knowledge, perception and practices about malaria, climate change, livelihoods and food security among rural communities of central Tanzania. *Infect Dis Poverty*. 2015;4: 21. **PubMed** | **Google Scholar**

24. Banstola A, Stebbing M, Banstola A. Willingness to act for adaptation. 2014.
25. Ndamani F, Watanabe T. Farmers perceptions about adaptation practices to climate change and barriers to adaptation: a micro-level study in Ghana. *Water (Switzerland)*. 2015;7(9): 4593-4604. **Google Scholar**
26. Tarfa PY, Ayuba HK, Onyeneke RU, Idris N, Nwajiuba CA, Igberi CO. Climate change perception and adaptation in Nigeria's guinea savanna: empirical evidence from farmers in nasarawa state, Nigeria. *Applied Ecology and Environmental Research*. 2019;17(3): 7085-7111. **Google Scholar**
27. Kabir MI, Rahman MB, Smith W, Lusha MAF, Milton AH. Child centred approach to climate change and health adaptation through schools in Bangladesh: a cluster randomised intervention trial. *PLoS ONE*. 2015;10(8);1-17. **PubMed | Google Scholar**

Table 1: sample allocation proportionate to size across the selected population

Selected LGAS	Population (2006 census)	Population, age group 15-64 yrs	Allocated sample size	Calculating the individual LGA response rate (20%)	Household size	No of day for completion of survey
Makurdi	300,372	152,288	243	300	75	11
Otukpo	266,411	135,070	215	258	65	10
Ushongo	130,988	97,311	155	186	47	7
Ogbadibo	191,935	66,410	106	128	32	5
Total	889,706	451,079	719	872	219	33

Table 2: sociodemographic characteristics of respondents on community perception and adaptation of climate change in Benue State, Nigeria

Variable (N=686)	Frequency	Percent
Age		
15 - 24	272	39.7
25 - 34	179	26.1
35 - 44	108	15.7
45 - 54	68	9.9
55 - 64	58	8.5
Sex		
Male	324	47.2
Female	362	52.8
Marital status		
Married	350	51.0
Unmarried	336	49.0
Educational status		
None	16	2.3
Primary	123	17.9
Secondary	412	60.1
Tertiary	135	19.7
Occupation		
None	42	6.1
Farmer	51	7.4
Professional	105	15.3
Public/civil servant	71	10.3
Student	254	37.0
Trader	160	23.3
Monthly income level (Naira)		
<5000	59	8.6
5000-10000	92	13.4
11000-20,000	50	7.3
21-50,000	27	3.9
51000-70000	10	1.5
>70000	2	.3
Ever heard of climate change		
Yes	676	98.5
No	10	1.5
Source of information		
Television (yes)	296	43.1
Radio(yes)	211	30.8
Newspaper (yes)	108	15.7
Social media (yes)	205	29.9
Family/friends (yes)	171	24.9
School (yes)	357	52.0
Others (yes)	18	2.6
Believed the cause(s) of climate change were		
Change in weather	154	22.4
Civilization/modernization	27	3.9
Increased population	201	29.3
Men's activities	127	18.5
It is a natural occurrence	141	20.6
God's work	145	21.1
Men's sins	12	1.7
Don't know	9	1.3
Climate change affects men, women and children's health		
Yes	674	98.3
No	5	0.73
Don't know	9	1.31

Table 3: univariate analysis of perception and adaptation to climate change variables in Benue State North Central Nigeria

Variable (N=686)	Frequency	Percent
Age		
15 - 24	272	39.7
25 - 34	179	26.1
35 - 44	108	15.7
45 - 54	68	9.9
55 - 64	58	8.5
Sex		
Male	324	47.2
Female	362	52.8
Marital status		
Married	350	51.0
Unmarried	336	49.0
Educational status		
None	16	2.3
Primary	123	17.9
Secondary	412	60.1
Tertiary	135	19.7
Occupation		
None	42	6.1
Farmer	51	7.4
Professional	105	15.3
Public/civil servant	71	10.3
Student	254	37.0
Trader	160	23.3
Monthly income level (Naira)		
<5000	59	8.6
5000-10000	92	13.4
11000-20,000	50	7.3
21-50,000	27	3.9
51000-70000	10	1.5
>70000	2	.3
Ever heard of climate change		
Yes	676	98.5
No	10	1.5
Source of information		
Television (yes)	296	43.1
Radio(yes)	211	30.8
Newspaper (yes)	108	15.7
Social media (yes)	205	29.9
Family/friends (yes)	171	24.9
School (yes)	357	52.0
Others (yes)	18	2.6
Believed the cause(s) of climate change were		
Change in weather	154	22.4
Civilization/modernization	27	3.9
Increased population	201	29.3
Men's activities	127	18.5
It is a natural occurrence	141	20.6
God's work	145	21.1
Men's sins	12	1.7
Don't know	9	1.3
Climate change affects men, women and children's health		
Yes	674	98.3
No	5	0.73
Don't know	9	1.31

Table 4: grading of knowledge, perception and adaptation of climate change among urban and rural dwellers in Benue State, Nigeria

Variable	Frequency	Percent
Knowledge		
Good	319	46.5
Poor	367	53.5
Perception		
Good	586	85.4
Poor	100	14.6
Adaptation		
Good	65	9.5
Poor	621	90.5

Table 5: bivariate analysis of variables associated with perception and adaptation of climate change among urban and rural dwellers in Benue State, Nigeria

Variables	Frequency (%)	X ²	P-value	Frequency (%)	X ²	P-value
Age						
15 - 24	272(39.7)	16.07	<.001	272(39.7)	25.17	<.001
25 - 34	179(26.1)			179(26.1)		
35 - 44	108(15.7)			108(15.7)		
45 - 54	68(9.9)			68(9.9)		
55 - 64	58(8.5)			58(8.5)		
Sex						
Male	350(47.2)	0.36	0.548	350(47.2)	11.00	<.001
Female	336(52.8)			336(52.8)		
Marital status						
Married	350(51.0)	2.31	0.129	350(51.0)	9.53	0.002
Unmarried	336(49.0)			336(49.0)		
Educational status						
None	16(2.3)	67.79	<.001	16(2.3)	62.77	<.001
Primary	123(17.9)			123(17.9)		
Secondary	412(60.1)			412(60.1)		
Tertiary	135(19.7)			135(19.7)		
Occupation						
None	42(6.1)	26.01	<.001	42(6.1)	28.68	<.001
Farmer	51(7.4)			51(7.4)		
Professional	105(15.3)			105(15.3)		
Public/civil servant	71(10.3)			71(10.3)		
Student	254(37.0)			254(37.0)		
Trader	160(23.3)			160(23.3)		
Income (Naira)						
<5,000	59(8.6)	20.29	0.002	59(8.6)	14.91	<.001
5,000-10,000	92(13.4)			92(13.4)		
11,000-20,000	50(7.3)			50(7.3)		
21,000-50,000	27(3.9)			27(3.9)		
51,000-70,000	10(1.5)			10(1.5)		
>70,000	2(.3)			2(.3)		

Table 6: multivariate analysis of variables associated with perception and adaptation of climate change among urban and rural dwellers in Benue State, Nigeria

Variable	aOR (95%CI)	P-value
Knowledge		
Tertiary level of education	0.29 (0.17 - 0.50)	<.001
Perception		
Married	0.35 (0.16 - 0.80)	0.002
Tertiary level of education	0.05 (0.01 - 0.39)	<.001
Adaptation		
25 - 34 yrs	4.98 (1.14 - 21.80)	<.001
Female	2.65 (1.37 - 5.15)	0.002
Tertiary level of education	0.31 (.01 - 0.65)	<.001