



## Understanding Demographic Impacts of Climate Change on Water Resources among Communities in North-eastern Nigeria

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### ABSTRACT

Climate change impacts negatively on available water resources in rural communities have achieved greater publicity especially during the middle of this century in Nigeria. This paper investigates the negative impacts of climate change on the available water resources in selected rural areas in North-eastern Nigeria. Some of the selected households are from Kaga and Damagum Local Government Area Councils in Borno and Yobe States respectively. The study collected household survey data from various communities in Kaga and Damagum Local Councils of Borno and Yobe States respectively. The study employed a semi-structured questionnaire for investigating the awareness levels of climate change related problems such as general knowledge about climate change conditions and their effects on communities, concerns about climate change and their sources of water supply, and life time experiences on climate variability in their communities.. Results show that 74% of the households respondents are totally unaware of climate change effects on available water resources, 26% have experienced the effects of climate change. Also, only about 15% of the households surveyed are concerned with the potential effects of climate change in their areas of domain. In addition, majority (67.6%) of the community leaders interviewed have witnessed unusual climate variability conditions in their life time. Lastly, statistical tests show that no significant relationship between household's level of education and their awareness about climate change problems ( $p = 0.07 > 0.05$ ). Overall, various household's perceptions towards climate change conditions is negative and their level of awareness is very low. This provides a baseline data for climate change mitigation and adaptation decision making by planners, policy makers, and bilateral organisations as well as other external stakeholders in providing sustainable environmental management policies.

**Keywords:** Climate change, Water resources, Demographic characteristics, North-eastern-Nigeria

### INTRODUCTION

Climate change is an altered state of the climate that can be identified by change in the mean and/or variability of its properties and that persists for an extended period, typically decades or longer. It is largely due to anthropogenic changes in the composition of the atmosphere or in land use. Over the past 150 years global mean temperatures have increased with the rate of warming, accelerating in the past 25 to 50 years (IPCC, 2016). Climate also varies in response to natural phenomena on seasonal, inter-annual, and inter-decadal scales such as the El Nino Southern Oscillation. The presence of, and degree of influence from these natural phenomena vary between countries and regions.

In Nigeria, climate change is already having significant impacts on the available water resources and these impacts are expected to increase into the future (IPCC, 2007). According to recent estimates by the Nigeria climate change policy report, in the absence of adaptation, climate change could result in monetary loss of about USD 43 billion, this account for about 11% of Nigeria's GDP by 2020, and this will rise to between 6% and 30% by the year 2050. According to the World Bank (2014) this loss is equivalent to between N15 trillion (US\$100 billion) and N69 trillion (US\$460 billion). This large projected cost is

the result of a wide range of climate change impacts affecting all sectors in Nigeria (World Bank, 2015).

In Nigeria the lack of data on estimates of climate change impacts is hampering the implementation of sustainable adaptation policies. Also, the lack of awareness and low levels of capacities in different communities across the country is hindering the adoption and implementation of sustainable policies that will mitigate the effect of climate change at the grass root level. Therefore, the active involvement of government and non-governmental organisations is highly required in ensuring successful design and implementation of sustainable climate change adaptation and mitigation frameworks. Over the years, the need for awareness and management of our environment seems overwhelming. This study assesses the climate change awareness levels of selected communities in North-eastern Nigeria so as to provide baseline data for planning appropriate climate change awareness campaign strategy for the region. The outcome of the study can be used by decision makers and planners in the policy domain.

### MATERIALS AND METHODS

#### Description of the Study Area

Benisheikh is the capital of Kaga local government area in Borno State while Damagum is the capital of Fune local

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government area in Yobe State (Figure 1). Both study areas are located in the semi-arid zone of north-eastern Nigeria. They enjoy warm tropical climatic condition of Western Africa. Most parts of the two stay areas fall within the

Sudan savanna vegetation zone, whereas the far northern area fall within the Sahel vegetation zone. Because of their proximity, they enjoy similar climatic conditions.



**Figure 1:** Map of Nigeria showing the study areas location  
**Source:** Modified from Geology.com

Climatologically, there are three distinct seasons affecting the study area: a long hot dry season from March to May. Day time temperatures are in the range of 36°C to 40°C and night time temperatures fall to 11°C to 18°C. This is followed by a rainy season from June to September with a daily minimum temperature of 24°C and a maximum of 34°C with relative humidity of 40% to 65% and annual rainfall from 560 mm to 600 mm. Finally, the cold (Harmattan) season runs from October to February when temperatures fall to about 20°C and a dry dusty wind blows from the Sahara desert.

#### Data Collection

A total of 500 questionnaires were distributed to low income households in the two study areas. These households were selected through stratified random sampling method. Equal amount of questionnaires were administered for these selected households between June and October 2016 in parts of North-eastern Nigeria; a total 78 % response rate was achieved. Prior to this, research assistants with good education were recruited from within the local communities to help administer and interpret the questions to households with little or no formal education. The research assistants were trained to ask the questions (interpret from local language to English) properly and to help in filling out the questionnaires for the households with least education. Methods used in identifying the survey participants were also clarified to them. In addition,

gender sensitive steps were taken to ensure representation of both males and females in the survey.

#### Data Analysis

IBM SPSS statistical software (version 22) package was used in data analysis; which includes descriptive and non-parametric statistical tests. The descriptive statistics used are mean, median, cross-tabulation, and frequencies. These are employed to analyse the demographic characteristics of the respondents as well as to explain the overall perception of respondents in relation to each variables were tested.

#### RESULTS

##### Socio-demographic Characteristics

##### Sex of respondents

A response rate of 390 respondents was achieved across the study areas. About 59.2% were male while the remaining 40.7% were females (Table 1).

##### Marital status of the respondents

Basically, there are four characteristics among the respondents in terms of their marital status. These are; singles, the married, the divorced and the widowed respondents. About 22.9% of the respondents were single while 43.1% were married, 16.3% were divorced or separated, and the remaining 17.7% were widowed. More frequently, the quantity of water used is related to the household size, hence the married households are likely to be high consumers of water in the study area.

**Table 1:** Summary of respondent's distribution in the study areas

<b>Respondents description</b>	<b>Benisheikh</b>	<b>Damagum</b>
Total no. of respondents	190	200
Male respondents	101	130
Female respondents	70	89

**Age of respondents**

The highest frequencies of those interviewed were above 40 years of age. The result consistently shows that the highest proportion of the total number of respondents falls between the ages of 41 and above. The age bracket 18-25 constitutes 10.4% of the sample, 26-33 make up 22.2%, and those in the range of 34-41 constitutes 26.4%.

**Education of respondents**

The highest education attainments of 47.2% are those that attended primary school. More than 23% of the respondents are secondary school leavers. The post-secondary's category includes graduates from University, Polytechnics, and Colleges of Education and they constitutes 12.8%. Others which include those that have attained Qur'anic/Arabic education made up the remaining 16.7%.

**Income of respondents**

Income of most individuals inhabiting less affluent settlements in most Sub-Saharan African countries and other developing nations is often generally low. In the study areas, the situation is not quite different. The result of this analysis shows that close to two-third of the total number of respondents earn less than N100, 000 annually (USD 267/year). In the same area, 29.9% of respondents earn between N100, 000-N500, 000 (USD 267-1,333/year). Another category that exists is those earning between N500, 000-N1Million (USD 1,333-2,666/year). This skewed income distribution can be attributed to the difference in economic activities of the households.

**Employment status of respondents**

The uneven distribution of respondents among the various employment statuses in the communities studied show that there are more self-employed (42.4%) individuals as traders (market men and women), farmers, local crafts men and women, mechanics and artisans than any other group. Those going to University, Polytechnics and colleges as students constitute 11.5%, individuals employed by the government as civil servants most of whom were junior to mid ranking officers constitute 37.5%, and those without jobs constitute the remaining 8.7%.

**Household size**

In Sub-Saharan Africa most households are large because of the extended family structure. However, this century long tradition is losing popularity due to economic burden associated with it, and modernity. In the study area, households with 0-5 inhabitants constitute 36%, those in the range of 6-11 constitute 25.7%, and the remaining

percentage is dominated by those with more than 11 inhabitants.

**Household type**

The household types in the study area ranged from owned, rented, compound and bungalow. Majority (41.7%) of the household type is owned by the individuals; these are mostly 1, 2 or 3 bedroom detached flats built from mud or bricks. Up to 36.5% of the inhabitants of the study area dwell in rented building, 20.8% live in compound houses where 2 to 3 families co-exists as extended family. Only a few exceptions (less than 2%) with strong economic status live in duplexes.

**Household survey results**

The overall results obtained from the survey suggest that most of the respondents are not knowledgeable about climate change conditions; with more than 74% (n=289) of the households unfamiliar, only a minority (26%) of the respondents are informed about this issue. Descriptive statistical analysis was carried to investigate the level of awareness of the various households surveyed on the general issues pertaining climate change conditions by sex and educational status of the respondents. In this respect, a handful of male respondents (n=61) were aware of climate change in comparison to their female counterparts (n=13). A majority of the males (n=197/231) and females (n=86/159) are entirely unaware of climate change in their domains.

**Distribution of climate change concerns by age**

The descriptive statistical analysis show that about 50% of the respondents of the age group 18-25 were concerned with the effect of climate change in the study area. Also, about 30 out of 64 respondents that are within the age group of 26-33 are concerned with the likely effect of climate change. Furthermore, 12 out of 76 respondents of the age group 34-41 are also concerned with the probable impact of climate change in the study area. Lastly, only 5 out of 118 respondents of those within the age group of 41-above were seriously unconcerned about the likely impact of climate change in the study area.

**Distribution of climate change concerns by educational level**

Consequently, taking the educational attainment of respondents into consideration, the analysis shows that none of the 106 respondents with primary school level education are concerned with effects of climate change.

About 29 out of the 87 respondents with secondary school level qualification are concerned with impacts of climate change. Furthermore, 11 out of 37 respondents with post-secondary school education were concerned with the effect of climate change in their areas. Lastly, about 6 out of 50 respondents with other qualifications are concerned with the likely effect of climate change in the study area.

#### DISCUSSIONS

Climate change and variability has received increased global attention in the last three decades. This is largely due to the risk it poses to the environment and hence the global community. According to the IPCC (2014b), climate change is attributed directly or indirectly to human activity that modifies the composition of the global atmosphere over comparable periods (Bords *et al.*, 2000). Climate variability, on the other hand, refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes etc.) of the climate on spatial and temporal scales. Climate variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability).

#### Knowledge about climate change

Huge information and knowledge gap on climate change and variability, as well as the potential impacts still exist in most part of the study area. Most parts of the study area are widely recognised to be vulnerable to climate change and variability. Despite this, general knowledge about climate change is limited in the study area; this trend is common to males and females as well as the older generation respondents. Some of the younger respondents were knowledgeable about climate change conditions.

Generally, respondents were more knowledgeable about the effects of climate change than about its general knowledge. This difference in knowledge may occur as a result of the uncertainties inherent in projections of climate hazards in the region (Ojomo *et al.*, 2015). Evidence from IPCC (2014a) shows that across the study area precipitation/rainfall events are projected to become more frequent. Also, there is the tendency for high variability in precipitation in the Sahel region. Furthermore, both Savannah and Sahel regions are projected to witness decreasing and highly variable precipitation coupled with increasing temperature/warming.

This region is also projected to be affected by more droughts with increasing desertification. Therefore, the lack of knowledge by the populace across this region will impede the adoption of appropriate mitigation strategies. Thus, there is the need to sensitise the people of this region by the relevant government agencies, NGOs and other multi-lateral organisations in adaptation and resilience.

#### Concerns about climate change and their effects on available water supply

The older generation survey respondents are not particularly concerned with the likely impact of climate change conditions in their domains. However, aside from the lack of concerns to climate change effects in their

communities by the older generation of the stakeholders, most of the younger generation stakeholders were particularly worried about this trend; in their response, they affirmed that most of the ponds and smaller rivers where they sourced drinking water for their cattle's and other animals have dried-up in recent years. Also, the younger generation of cattle owners attest that if this trend should continue into the future, they will lose their animals and livelihood in their communities. However, a minority of the younger generation of cattle owners are not particularly concerned with the negative effects of climate change in their communities.

This can be attributed to their lack of awareness, cultural and religious beliefs towards climate change phenomenon. Despite the lack of concerns on the effect of climate change in the study area, evidence from OFDA (2000) shows that both droughts and floods have increased in frequency and severity over the past 30 years. In particular, the Sahelian zone has experienced a continued decline in rainfall as compared to pre-1960s averages, and the Lake Chad has shrunk to 5 per cent of its size 35 years ago (National Aeronautics and Space Administration Agency, 2001). Furthermore, severe droughts were experienced across the study area between 1973 and 1984, when almost all African countries suffered reduced rainfall, and several million people in the Eastern and Western parts of Africa were affected.

Contrastingly, the younger generation respondents are very much concerned with the effect of climate change in their environments. This trend can be attributed to their awareness on recent global events; especially with the prevalence of social media news. According to Bords *et al.* (2000), the concerns by the citizenry on climate change, and the lack of it, is the greatest predictor of both stated intents to take voluntary actions by communities. However, this conclusion is specific to individual action and intentions rather than societal actions that bring change. Despite their lack of concern on climate change, the older generation respondents; especially the farmers have experienced climate variability. Accordingly, they noticed unusual pattern of rainfall and onset of the dry season based on their personal experience. According to Lorenzoni, *et al.* (2006) individuals characterise climate change in relation to their everyday experiences. Lowe *et al.* (2006) also note that perceptions of climate change are linked to people's own direct experiences. This relation to personal experiences may be inferred here because the delay from the onset of rainy season or the early set of dry season is experienced by the different individuals across different communities. This variability is common in the northern parts of Nigeria and it is particularly prone to the study area.

#### CONCLUSION

This study has explored household respondent's knowledge and concerns with respect to climate change conditions in Damagum and Benisheikh towns in Yobe and Borno States respectively. It concludes that the limited knowledge about climate change issues and low level of concerns about the likely effect of climate change in the study area calls for

massive awareness campaigns across the study area and Nigeria as a whole. There is need for formal and informal awareness creation targeted at the citizenry so as to boost their capacities for adopting climate change mitigation and adaptation strategies. Therefore, appropriate climate change mitigation strategy that is capable of overcoming the cultural norms, institutional barriers, and one that inspires the adoption of integrative approach is required to boost the capacities of the people in North-eastern Nigeria. This must be pursued with humility, commitment, and vision.

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