

Full Length Research Paper

Indigenous people's perception on climate change and adaptation strategies in Jema'a local government area of Kaduna State, Nigeria

Ishaya, S.¹ and Abaje, I. B.^{2*}

¹Department of Geography, University of Abuja, Gwagwalada, Abuja, Nigeria.

²Department of Geography, Kaduna State College of Education, Gidan-Waya, Nigeria.

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This study examines the way indigenous people in Jema'a Local Government Area of Kaduna State perceive climate change and their adaptation strategies to climate change. The paper also asks indigenous people of the impacts of climate change on their various activities and any perceive hindrance to its adaptation. A total of 225 questionnaires were administered in five settlements within the study area, although only 200 of these questionnaires were used for the purpose of analysis. Findings revealed that indigenous people in the study area perceived that the environment, climate in particular, has been changing over the years due to diverse human activities. Findings also revealed that the threat of climate change is more on health, food supply, biodiversity lost and fuelwood availability than on businesses and instigating of disaster; and it is the poor, who depend heavily on the natural resources that are mostly affected by incidence of climate change. In adapting to climate change indigenous people cultivate different/varieties of crops which are tolerant to climate change and shortening of growing season as adaptation strategies. Result further revealed that lack of improve seeds, lack of assess to water for irrigation, lack of current knowledge of modern adaptation strategies, lack of capital, lack of awareness and knowledge of climate change scenarios are the hindering factors to the adoption of modern techniques of combating climate changes in the area.

Keywords: Indigenous people's, perception, climate change, adaptation strategies, Jema'a.

INTRODUCTION

Climate change is an environmental, social and economic challenge on a global scale (Scholze et al., 2006; Mendelsohn et al., 2006). Climate change can be exacerbated by human induced actions such as: the widespread use of land, the broad scale deforestation, the major technological and socioeconomic shifts with reduced reliance on organic fuel, and the accelerated uptake of fossil fuels (Millennium Ecosystem Assessment, 2005).

The most devastating adverse impacts of climate change in Nigeria and other subtropical countries includes frequent drought, increased environmental damage, increased infestation of crop by pests and

diseases, depletion of household assets, increased rural urban migration, increased biodiversity loss, depletion of wildlife and other natural resource base, changes in the vegetation type, decline in forest resources, decline in soil conditions (soil moisture and nutrients), increased health risks and the spread of infectious diseases, changing livelihood systems, etc (Reilly, 1999; Abaje and Giwa, 2007).

Indigenous Peoples who are vital and active parts of many ecosystems may help to enhance the resilience of these ecosystems. Their livelihoods depend on natural resources that are directly affected by climate change, and they often inhabit economically and politically marginal areas in diverse, but fragile ecosystems. In addition, they interpret and react to climate change impacts in creative ways, drawing on traditional knowledge as well as new technologies to find solutions,

*Corresponding author. abajebest@yahoo.com

which may help society at large to cope with the impending changes (Jan and Anja, 2007).

In Nigeria, just as in many developing countries in the Subtropical region the agricultural sector is more vulnerable to climate change landless farmers, livestock keepers, people in poor health, those who are undernourished, people with low economic power, women and children including women headed households, those with low level of education, and those with low technological know-how are more exposed to the risk of climate change (Barber, 2003).

Doss and Morris (2001) opine that the perspectives of the indigenous people, the way they think and behave in relation to climate change, as well as their values and aspirations have a significant role to play in addressing climate change. Despite this, Indigenous and other Traditional Peoples are only rarely considered in academic, policy and public discourses on climate change, despite the fact that they are greatly impacted by impending changes of climate (Berkes and Jolly, 2001).

Climate models paint the bigger picture of climate change and provide estimates for the likely consequences of different future scenarios of human development; they are not very good at providing information about changes at the local level. In recent years, there has been an increasing realization that indigenous groups are a valuable source of this information. Indigenous Peoples are not only keen observers of climate changes but are also actively trying to adapt to the changing conditions. In some instances, people can draw on already existing mechanisms for coping with short-term adverse climatic conditions. Some of these responses may be traditionally included in their normal subsistence activities, while others may be acute responses, used only in case of critical weather conditions (Stott and Kettleborough, 2002).

Most research on people perception of climate changes were carried out in the developed countries of the world which dominate the uppermost northern region of the earth where the relationship between Scientists and Indigenous Peoples is high (Jan and Anja, 2007). Though the hope in this devastating scenario of climate change lies with the indigenous peoples themselves, who are very successful at preventing deforestation and managing natural environment, those in the developing countries are rarely considered (Jan and Anja, 2007).

Despite the fact that efforts have been made towards fighting climate change from scientific views, research and policies directed towards indigenous knowledge and perception are highly needed. It is, therefore, important to understand indigenous perceptions of climate change and their preferences of strategies towards adaptation. The specific drive of this study is to assess the perceptions of Indigenous People's in selected villages/wards in Jama'a Local Government Area of Kaduna State on climate change issues, and adaptation/coping measures, identify indigenous response options for information and knowledge that will help in policy making that may have

positive impact on the life of the local and marginalized poor people who are directly affected by climate change.

Study area

The study area (Jema'a Local Government Area) is located between latitude $9^{\circ} 11'$ and $9^{\circ} 30' N$ and longitude $8^{\circ} 00'$ and $8^{\circ} 30' E$. The Local Government is bounded in the East by Kagoro in Kaura Local Government, in the North by Zonkwa and Ungwa Rimi District of Zangon Kataf Local Government, to the West by Jaba Local Government and in the South by Nassarawa State and in the South-East by Sanga Local Government Area respectively. The study area has witness a tremendous growth in population in the last 30 years. It has a population of 278,735. Presently it has twelve wards, namely: Jagindi, Godogodo, Atuku, Gidan-Waya, Maigizo, Kaninkon, Kagoma, Asso, Kafanchan 'A', Kafanchan 'B', Bedde and Takau (Figure 1).

The study area, just as all the areas in the middle belt of Nigeria, has the Aw type of climate as classified by Koppen and found within the Guinea Savanna region of the country. It is characterized by wet and dry seasons. Rainfall occurs between the months of April to October with a peak in August. The mean annual rainfall is about 1800 mm, the mean monthly temperature at $25^{\circ}C$, while the relative humidity is about 62% (Abaje and Giwa, 2007). The orographic effects of the Jos-Plateau and the Kagoro Hills have positive influence on the climate of the study area influencing rainfall, temperature and relative humidity.

Ferruginous tropical soil which is related to the climate, vegetation, lithology and the topography dominate the study area (Hill, 1975). Clayey and sandy clay soils are also found along the banks of some of the rivers. The relief of the area is relatively flat and undulating with lowest relief in the South and South-West of the study area with a height of 180m rising steadily north and north-eastward to about 450 m along the northern edge of the study area and reaching 600m in the extreme North-East (Chori, 2003). The relief also influences the drainage pattern; most of the study area lies within the Mada, Okawa and Gurara River basin. The Okawa and Mada systems flow into the River Benue, while the Gurara flows into the River Niger.

METHODOLOGY

The required data and information were collected from a direct field study based on the results of 225 questionnaires that were administered in five selected villages (Jagindi, Godogodo, Gidan-Waya, Maigizo, and Takau) in Jama'a Local Government Area in the southern part of Kaduna State. Information used in this article is generally qualitative in nature based on field observation, household survey and informal discussion with key informants conducted in January 2008. Only villages that were easily assessable were randomly selected.

For the purpose of administering the questionnaires, household heads above the age thirty five years were purposively adminis-

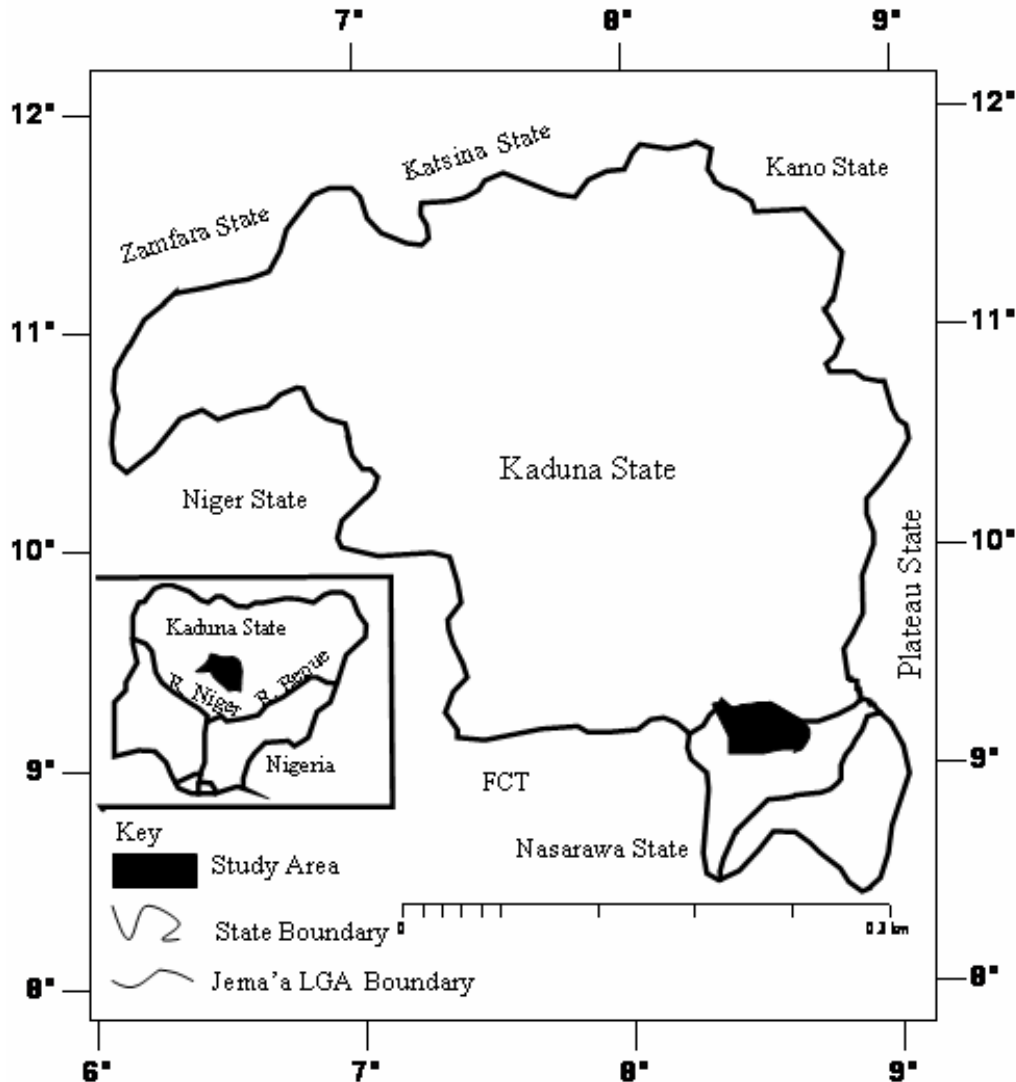


Figure 1. Map of Nigeria showing the study area.

tered questionnaires to. A total sum of 45 questionnaires was administered to each of the settlement and only to Households' Heads that were willing to be administered questionnaires to. The crucial reason for this decision is to pay attention to those who were more interested and concerned by the incidence of climate change. Approximately 10 min were spent to complete one questionnaire. The study was conducted at the face-to-face level and obtained a response rate of approximately 97%. Out of the 45 questionnaires administered to each of the settlements, 40 were analyzed because not all were completely returned or answered.

The analysis was based on mainly descriptive analysis and presentation. However, Analysis of Variance (ANOVA) and Chi-square were used to test if significant differences exist in adaptation strategies associated to climate change. ANOVA and Chi-square were also used to see if significant difference exists in the hindrances of the adaptation strategies towards reducing the impact of climate change.

RESULTS AND DISCUSSION

In this study about 98% percent of the inhabitants of the

villages studied were farmers even those who claimed not to be farmers engage themselves in little farming activities. Out of those studied 66% were males while 34% were females and 11.5% of the respondents fall between 31 to 40 years while the remaining 81% falls between the 41 to 65 years of age. More experienced and matured farmers were administered questionnaires to because they are better at distinguishing climate change from merely inter-annual variation of weather scenarios.

Considering the issues of environmental change, majority (86%) of the respondents opine that the environment has been changing over the years due human activities such as farming, deforestation either by cutting down of trees for fuel, roofing, farmlands extension, furniture; overgrazing, bush burning, urbanization and industrialization. In analyzing the issues of climate change 85.5% of the respondents agreed that the environment and the climate in particular are changing due to diverse human

activities. 84% of the respondents opined that climate change is a critical environmental issue that needs immediate attention. In the same vein 73% of the respondents believe that temperature has been rising over the past few decades, 83.5% of them expressed that rainfall is decreasing every year with varied rainfall anomalies and due to these the environment is becoming dry every year affecting human comfort within the study area as expressed by 75% of the respondents. The rainfall is declining and not supporting crop production as stated by 78% of the respondents. Experienced farmers and more elderly inhabitants were more inclined that temperature has increased and rainfall quantity is falling.

Because of indigenous increase in experience over the years they claimed that there is less rainfall, more likely to notice changes in the timing of the rains and more likely to notice a change in the frequency of droughts and floods as well as crop infestation and output drop. According to 85.5% of the Indigenous Peoples studied from the various villages, it shows that climate change has led to various forms of crops infestations there by reducing the quality and quantity of crops produced, which are very significant factors that increase cost of food crops generally as concluded by 81% of the respondents. There have also been problems of flood and drought which are also serious contributing problems associated with climate change that threatened the livelihood of the inhabitants of the study area as expressed by 81% of the respondents.

Apart from the impact of climate change on crop production in the study area, 72.5% of the indigenous people studied stress that the environment is suffering from excessive de-vegetation that is presently instigating fuel scarcity and loss in forest resources in the study area as indicated by 73% of the respondents. In the study area majority of the Indigenous Peoples depend so much on environmental resources which are already under threat and this is already affecting the livelihood of the Indigenous Peoples as opined by 52% of the respondents.

According to 97.5% of the respondents the poor are usually always mostly affected by the incidence of climate change while the remaining 2.5% of the respondents don't know who are being affected the more. 32% of the respondents said that the impact of climate change is more on food production, 28.5% of the respondents said the impact is more on health, 20.5% of the respondents subscribed that the impact is more on biodiversity loss, 11.5% stress that the impact is more towards instigating disaster and 7.5% of the respondents were of the opinion that businesses are more jeopardized by climate change. In responding to issues on sustainability of the environment, 79% of the respondents incline that climate change can be a hindrance towards the struggle towards achieving sustainable environmental development in Nigeria.

In terms of awareness 13% of the respondents agreed that there is a high level of awareness on climate change in the study area, 33% of the respondents said they don't

know and finally majority 54% of the respondents declined saying that the awareness on climate change is very weak in the study area and Nigeria as whole.

In general, if Indigenous Peoples are to adopt land conservation techniques they must first be aware that the technology exists and perceive that it is profitable (Doss and Morris, 2001). Climate change adaptation studies should do the same. In response to adaptation strategies to climate change 60.1% of the respondents said that they cultivate different/varieties of crops as adaptation strategies. It was perceived that adapting to climate change by planting different varieties of crops is high. Some Indigenous Peoples restrict themselves to different planting dates by shortening the growing season. These changes occur when there is a reduction in rainfall and a change in the timing of the rains or a change in the frequency of drought cause by temperature increase and insufficient rains.

In other vein 30.04% of the respondents adopt water maximization by practicing fadama farming while the remaining 15.02% said they adopt shortening season strategies in combating climate change. Recent rainfall extremes according to some Indigenous Peoples lead to a change from farming to non-farming activities. This is contemplated when rainfall becomes less. 12.45% responded that they adapt fertilizer as climate change adaptation strategy, 3.65% opine that they increase the extent of land put into agriculture.

Increase in temperature and decrease in rainfall also leads to soil moisture loss. This instigates increase in the use of soil water conservation techniques (Huber and Pedersen, 1997). Mulching and land sheltering techniques are also extremely important ways of dealing with changes in temperature and soil moisture loss. 2.36% said that they mulch the land to reduce the loss of soil moisture for crops like yams and ginger.

The findings using ANOVA, shows that there are significant differences in the extent of adaptation strategies of combating climate change in the study area. The calculated value was 38.09, while the ANOVA table value at 5 and 1% are 2.87 and 4.43 respectively which is a clear indication (Table 1). Using Chi-square also, it shows that there is significant difference in the adaptation strategies towards talking climate change in the study area. The calculated value given as 247.12 clearly shows that significant difference exists when compared with the 9.49 and 13.28 obtained at 5% and 1% Chi-square alpha levels.

There are many factors hindering adaptation techniques of combating climate change. Gender influences adoption level indirectly through access to complementary inputs. Non-availability of the desired variety seed and higher price of quality seeds were the most significant hindering factors in the adaptation strategies.

In response, 24.37% of the respondents stress that lack of improve seeds is the major hindrance of adoption of modern techniques, 21% of the responded saying that

Table 1. ANOVA Table.

Source	df	Sum of Squares	Mean Square	F
Regression	2	739.38692850568	369.69346425284	38.087
Residual	2	19.413071494324	9.7065357471618	
Total	4	758.8		

Table 2. ANOVA Table.

Source	df	Sum of Squares	Mean Square	F
Regression	2	142.27785683171	71.138928415856	31.462
Residual	2	4.522143168288	2.261071584144	
Total	4	146.8		

The findings using ANOVA, shows that there are significant differences in the hindrances of adaptation strategies of combating climate change in the study area. The calculated value 31.46, while the ANOVA table value at 5 and 1% are 2.87 and 4.43 respectively which is a clear indication (Table 2).

In the same vain using Chi-square also shows that there are significant differences in hindrances of adaptation strategies targeted towards reducing the impact of climate change in the study area by the indigenous people. The calculated value given as 247.12 clearly shows that significant differences exist when compared with the 9.49 and 13.28 obtained at 5 and 1% Chi-square alpha levels.

Conclusion

The change in climate patterns (rainfall, temperature, precipitation, etc.), and the destruction of the natural resource base leads to the unpredictable and erratic rainfall pattern, warmer temperature, increased evapotranspiration, increased deforestation and ecosystem fragmentation, diminishing pasture and water availability, frequency of drought, changes in the livelihood patterns of communities, increased social conflicts between communities, loosening of social cohesions, increased incidence of diseases and epidemics, increased rural urban migration and increased community displacement from fragile environment.

The findings of this study shows that the threat of climate change is more on health, food supply, biodiversity quality and fuelwood availability than on businesses, instigating of disaster. Indigenous adapting to climate change strategies in the study area include, planting different varieties of crops, cultivating different crops, shortening growing season, changing the extend of land put into crop production, changing to irrigation/fadama farming, the use of chemical fertilizer, improve in water maximization and mulching. More of the adaptation strategies are more on planting different varieties of crops, cultivating different crops and shortening of growing sea-

son. Factors hindering the use of quality seed are found to be the non-availability of the desired variety seeds and higher price of quality seeds.

The analysis has revealed to a great extent that the indigenous people in the study areas take the issues of climate change seriously. The perceived hindrances to adoption of modern technique as adaptation strategies of climate change include lack of improved seeds, lack of assess to water for irrigation farming, lack of current knowledge on adaptation methods, lack of information on weather incidence and lack of money to acquired modern techniques all influences the drive towards adapting to climate change.

Indigenous Peoples in the study area have very weak approach towards tackling climate change problems. Poverty and ignorance of various adaptation strategies are the major contributing factors to the impact felt by indigenous people. The knowledge and information gap concerning the effect of climate change, information dissemination, awareness programmes and training programmes calls for immediate action in order to relegate the impact of climate change in the study areas. The role of public administration in the study area must also change from implementing to specific climate conservation and adaptation programmes serving as facilitators, promoters, encouragers, guardians and makers of more possible larger participation of indigenous people in developing and applying more sustainable forms land uses in the study areas.

The overall needs are to setup serious environmental conservation ethic among indigenous people. This can only be possible by first and famous educating the indigenous people on the implication of climate change, educate the indigenous people on the significance of conservation of the natural environment, support the most environmental friendly people and groups towards achieving set goals and objectives in the study areas.

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10. The yearly rains are not supporting crop production as before
11. Climate change has lead to crop infestation and diseases
12. The cost of food crops are increasing because of climate change.
13. The Environment suffers from excessive de-vegetation due climate change.
14. There is now fuelwood scarcity.
15. Climate change has lead to rural-urban migration
16. Climate change has lead to the decline of forest resources
17. Climate change has lead to the change of livelihood system
18. There have been increase incidences of floods during the raining season
19. There have been increase incidences of droughts during the raining season
20. Who are the people seriously affected by climate change
 A. The poor B. The rich
21. The threat of climate change more on
 a. Health
 b. Food supply
 c. Fuelwood availability
 d. Businesses
 e. Instigating disaster
 f. Biodiversity quality and sustainability
22. The incidence of climate change will affect the sustainability of our environment.
23. There is serious awareness on climate Change
24. What are the strategies to adapting to climate change?
 a. Planting Different Varieties of crops ()
 b. Cultivating Different crops ()
 c. Shortening growing season ()
 d. Changing the extend of land put into crop production ()
 e. Changing to irrigation/fadama farming ()
 f. The use of chemical fertilizer ()
 g. Improve in water maximization ()
 h. Mulching ()
 i. No adaptation method used ()
25. What are the perceived hindrances to adaptation of modern techniques of combating climate change?
 a. Lack of improved seeds
 b. Lack of assess to water for irrigation farming
 c. Lack of current knowledge on adaptation methods
 d. Lack of information on weather incidence
 e. Lack of money to acquired modern techniques
 f. There is no hindrance to adaptation
26. What do you recommend to be done that will enhance the fight towards climate change? Comment freely.

APPENDIX

Questionnaire on the Study of Indigenous People Perception on Climate Change and Adaptation Strategies in Jama'a Local Government Area of Kaduna State, Nigeria

Please answer the following questions sincerely.

1. Are you originally from this Village town **A.** Yes **B.** No
2. Were you raised in this village? **A.** Yes **B.** N
3. Please circle your gender: **A.** Male **B.** Female
4. Please circle your age bracket: **A.** 35-40 **B.** 41-50 **C.** 51-60 **D.** 60+

Kindly use the options below to answer the following questions according to your level of agreement or disagreement:

A–Strongly Agree, **B**–Somewhat Agree, **C**–I Don't Know **D**–Somewhat Disagree, **E**–Strongly Disagree

5. The Environment in this village is changing due to human activities.
6. The Climate is changing
7. Temperature is rising.
8. Rainfall is decreasing every year
9. The weather is becoming dry every year.