

Assessment of Barriers to Climate Change Adaptation in Northern Senatorial Zone of Kaduna State-Nigeria

*Suleiman Umar Bambale¹, Abdulhamid Adamu Ibrahim²

¹ Department of Geography,
Federal College of Education, Zaria

² Department of Geography,
Ahmadu Bello University, Zaria
Email: talk2usbambale@gmail.com

Abstract

This study assessed barriers to climate change adaptation in northern senatorial zone of Kaduna state-Nigeria. The objectives of this research are to: examine the perceived barriers/ challenges to climate change adaptation; test for the significant difference in barriers to climate change adaptation; determine the strongest barriers to climate change adaptation in the area. A total of 400 copies of questionnaire were administered to households' heads that were purposively sampled using Taro Yamane (1969) from the sixteen (16) selected communities. The questionnaire was administered proportional to the population of each community and the response rate of 97.5% was recorded. Focus group discussion (FGDs) was also employed for data collection. Data was analyzed using descriptive statistics such as frequency table, percentages along with pair wise comparison matrix. Findings indicate that the major barriers/challenges to climate change adaptation in the area include: lack of current knowledge; water scarcity; lack of information on weather events; high level of poverty etc. the Chi-square result shows calculated (χ^2) statistic = 22.083, $df = 7$, $R\text{-value} = 0.002$ that there is significant difference in barrier to climate change adaptation strategies in the various LGAs of the study area. Findings further revealed lack of current knowledge of adaptation methods ranked highest with highest score (14) is the strongest barrier to climate change adaptation in the area. The paper concludes that the fight against the scourge of climate change is strongly impeded by the barriers to climate change adaptation. The paper recommends that there is the need for integrating community's' knowledge of local adaptation methods with modern adaptation techniques to overcome major barriers to climate change adaptation in the area.

Keywords: Barriers, Climate change, Adaptation, Senatorial Zone, Northern Kaduna

INTRODUCTION

Livelihood systems have the capacity to cope with adverse effects of climate change, but with continuing climate change, adaptation is impeded (Noble *et al.*, 2014). The tendency of systems to adapt to impacts of climate change is influenced by certain system characteristics called determinants of adaptation (Abaje, Sawa, Iguisi, and Abdulhamid, (2015). These terms, include: sensitivity (degree to which a system is affected by, or responsive to, climate stimuli); vulnerability (degree to which a system is susceptible to injury, damage or harm); *resilience* (degree to which a system rebounds, recoups or recovers from a stimulus); and, *adaptive capacity* (the potential or capability of a system to adapt or alter to better suit climatic stimuli).

Most studies of specific adaptation plans and actions argue that there are likely to be both

**Author for Correspondence*

limits and barriers to adaptation as a response to climate change (Audu 2016). Barriers refers to the conditions or factors that render adaptation ineffective as a response to climate change and are largely insurmountable (IPCC, 2007). The barriers are necessarily subjective and dependent upon the values of diverse groups. These barriers include: physical /environmental barrier; technological barrier, financial barriers. Asuquo (2009) also recognized additional barriers to include: limited understanding of climate change risks and vulnerabilities; lack of supportive policies, standard regulations and design guidance encouraging status quo or presenting impediments to progress; existing legal or regulatory restrictions; Social/cultural/financial rigidity and conflicts; short-term nature of planning horizon-necessity of realizing returns on investments; uncertainty and confidence for the long-term mismatch between business planning horizons and time frame of projections of climate change; not seen as a big problem yet, so temptation to wait for impact to react; Belief that the uncertainty is too great to take action now; lack of useful precedents or evidence of adaptation actions; lack of acceptance/understanding of risks associated with implementing.

There are few researches on barriers to climate change adaptation. Even the few studies carried out at different temporal scales and in different parts of the country such as (Abaje, 2010; Fenan, and Adekola, 2014; Ikpe,2014; Suleiman,2014; Audu,2016; Mamman, Hazo, and Sawa, 2019), amongst others where not in-depth. Thus, assessment of barriers to climate adaptation climatic in norther part of Kaduna State is imperative to facilitating appropriate understanding and updating institutional and legal framework. There is therefore the need for comprehensive assessment of these adaptive barriers and determining their strengths using scientific analytical tool.

The Study Area

Northern senatorial zone of Kaduna state is located between Latitude 9° 58' N - 11° 30' N of the equator and Longitude 7° 29'E- 8° 35'E of GMT. It is approximately 650km from the Atlantic Ocean. The study area is bounded by Katsina to the north, Kaduna central senatorial zone to the West, southern senatorial zone to the South and Kano State to the East (see Figure 1). The study area experiences a typical tropical continental climate classified by Koppen as A_w. It has two distinct wet and dry seasons. The wet seasons begins in May and extend to October with peak in August. The dry season extends from mid- October one calendar to April next year (Abaje, 2010). The spatial distribution of the rain varies, decreasing from an average of about 1733mm in Kafanchan-Kagoro areas in the Southeast to about 1032mm in Ikara, Makarfi districts in the northeast. The highest average air temperature occurs in April (28.9°C) and the lowest in December (22.9°C) through January (23.1°C). The mean atmospheric relative humidity ranges between 70-90% and 25-30% for the rainy and dry seasons respectively. The highest amount of evaporation occurs during the dry season (Abaje, Sawa, Iguisi, and Ibrahim, 2016). The relief of area is dominated by high plains, popularly known as the high plains of Hausa land which is between 500 – 600 metres above sea level (Udo, 1970). The drainage of the area is dominated by three important rivers. River Saye and Kubanniare major tributaries to river Galma which is a major tributary to river Kaduna (Adamu, 2004). The study area is covered by the tropical grassland vegetation with the density of trees and other plants decreasing as one move northwards (Abaje, 2007). The whole area is covered by the tropical grassland vegetation with the density of trees and other plants decreasing as one move northwards (Abaje, 2007). The dominant species are trees are *Acacia nilotica* (Bagaruwa), *Acacia albida* (Gawo), *Tamarindaindica* (Tsamiya), *Adansoniadigitata*/Baobab (Kuka), *Azadirachtaindica*/Neem (Tsamiya) and *Eucalyptus Spp.* (Turare), *Isobertina spp.* (Doka) and *Parkiabiglobosa* (Dorawa). The study area is covered by the red-brown to red-yellow

ferruginous tropical soils which are heavily weathered and markedly laterized. soils within the "fadama" areas are richer in kaolinitic clay and organic matter, very heavy and poorly drained, characteristics of hydromorphic/ vertisols soil (Adamu, 2008).

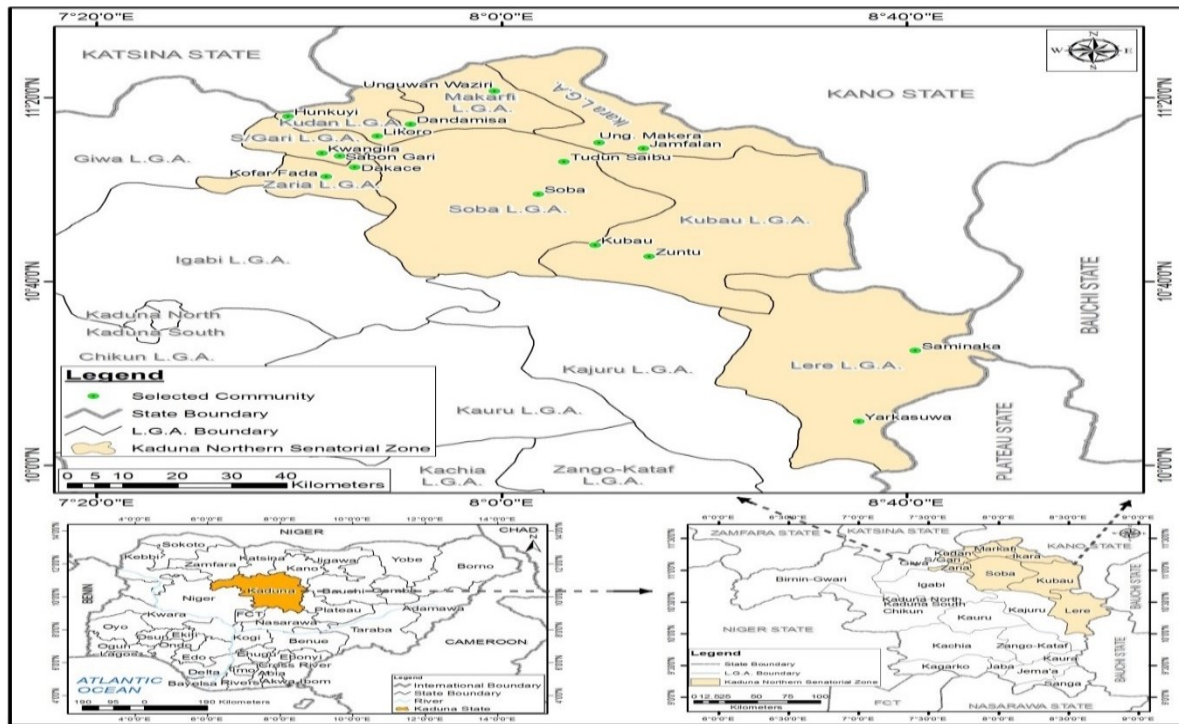


Figure 1: Kaduna Northern Senatorial Zone (Study Area) showing selected community
Source: Extracted from Google Map, 2018

MATERIALS AND METHODS

Data were collected on the perceived barriers/ challenges to climate change adaptation in the area through the field survey using closed and open-ended questions. A total of 400 copies of questionnaire were administered to household heads that were purposively sampled using Taro Yamane (1969) from the sixteen (16) selected communities. The questionnaire were administered proportional to the population of each community and the response rate of 97.5% was recorded. FGDs and KIS were also employed for data collection.

For the purpose of administering the questionnaire, household heads from forty (40) years and above whom must have lived at least, thirty (30) years within the study area were identified and issued a questionnaire. The reason for this decision is that those within the age bracket will have the information needed about barriers to climate change adaptation in the area.

Descriptive statistics such as frequency tables, percentage, were used in analyzing and presenting the results. Pairwise comparison matrix was used in ranking barriers to climate change adaptation.

Pairwise ranking matrix was used to identify the strongest barriers to climate change adaptation strategies in the area. Pairwise ranking matrix is a scientific tool for comparing entities in pairs to judge which of the entity is preferred or has a greater amount of some quantitative property. This study therefore used a modified pairwise ranking matrix employed in Miputu, and Ndola district, Zambia by Russell, (1997) and Audu, (2016).

RESULTS AND DISCUSSIONS

Table 1. Socio-demographic Characteristic of Respondents

Households characteristics		Frequency	Percentages (%)
Sex status	Male	345	88
	Female	45	12
			100
Age (Years)	<40years	150	39
	41-44	73	19
	45-49	92	24
	≥50	74	18.9
			100
Marital status	Single	20	5.1
	Married	360	92.3
	Divorced	3	1
	Widowed	7	2
			100
Level of Education	Primary	70	18
	Secondary	95	24
	Tertiary	177	45
	Non formal	48	12
			100
Occupation	Farming	140	36
	Livestock production	44	11.3
	Trading	34	9
	Civil service	115	29
	Fishing	3	9.5
	Craft & others	20	5.1
			100
Duration of residency	30-34	139	36
	35-39	83	21
	40-44	69	18
	≥45	99	25
			100
Household size	1-5	103	26
	6-10	116	30
	11-15	64	16
	16-20	45	12
	≥20	62	16
			100
Estimated income per annum	≤₦150,000	151	39
	₦150,001-300,000	71	18
	₦300,001-450,000	61	16
	₦450,001-600,000	35	9
	≥₦600,000	72	18
			100
Total		390	100

Source: Authors analysis, 2018

Table 2. Perceived Barriers to Climate Change Adaptation among the Households

LGAs	Barriers	Ikara	Kubau	Kudan	Lere	Makarfi	Sabon - Gari	Soba	Zaria	Total	Percentage (%)
	Lack of improved seeds	10	5	4	3	3	6	8	3	42	10.8
	Water scarcity	2	4	2	7	2	5	4	17	43	11.0
	Lack of current knowledge on adaptation methods	7	9	5	9	10	7	3	11	61	15.6
	Inadequate information on weather events	13	6	1	6	9	4	9	9	57	14.6
	No credit	1	2	8	3	0	2	1	2	19	4.9
	High level of poverty	1	3	3	4	3	9	5	5	33	8.5
	Soil erosion	2	3	1	4	1	3	3	3	20	5.1
	Soil infertility	3	2	1	2	0	1	2	4	15	3.8
	Flooding	0	2	1	3	1	3	2	5	17	4.4
	Outbreak of pest/ diseases	2	2	0	3	1	5	1	2	16	4.1
	Large family size	2	3	0	2	2	1	1	3	14	3.6
	Old age	0	1	2	1	2	1	1	1	9	2.3
	poor markets	0	1	2	2	2	1	2	2	12	3.1
	Absence of policy on climate change	2	0	3	1	13	5	2	2	24	6.2
	No hindrance	1	0	1	1	0	0	0	1	4	1.5
Total		46	43	34	51	49	53	44	70	390	100
Chi square (χ^2) = 22.083					df = 7		R-value = 0.002		Remark Significant		

Source: Authors Analysis, 2018

Table 2 shows that majority of the household heads have attested that lack of current knowledge of adaptation methods is the greatest challenge to implementation of climate change adaptation in the area. This is closely followed by 14.6 % who attributed adaptation challenges to lack of information on weather events; 11.0 % attested that water scarcity is the next barrier to adaptation in the area; 10.8 % indicated lack of seed. The high level of poverty is attested by 8.5% of the households; 6.2 % attested that absence of policy on climate change is a hindrance to adaptation; 4.9% attested that soil erosion and inadequate credit/ funds; 4.4% indicated flooding. 4.1% attested that outbreak of pest/ diseases is a barrier to adaptation; 3.8 % attested soil infertility; 3.6% indicated large family size; 3.1% attested poor markets; 2.3% attested old age; 1.5% indicated no hindrance. This is in agreement with the findings of Fanen

and Adekola, (2014) that many communities in northern Nigeria perceived barriers to climate change adaptation and attribute them to age, lack of credit facilities, high level of illiteracy, soil erosion, large family sizes, lack of farm inputs and poor access to markets for their produce.

Table 3 Chi-square Table

Adaptation Barriers Test	
LGA	
Chi-Square	22.083
df	7
Asymp. Sig.	.002

Source: Authors' Analysis, 2018

Results of tested hypothesis also revealed that the calculated (χ^2) statistic =22.083, df = 7, R-value = 0.002). This indicates that the significant value (0.002) is less than the usual threshold value of 0.05. This suggests that there is significant difference in the barriers to climate change in the various LGAs of Kaduna Northern Senatorial.

Table 4. Pair Wise Matrix Ranking of Barriers to Climate change Adaptation in Northern Senatorial Zone of Kaduna State

LGAs Barriers	Barriers Numbers															Score	Rank
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
1 Lack of improved seeds			0	0	0	1	1	1	1	1	1	1	1	1	1	11	4
2 Water scarcity	1		0	0	1	1	1	1	1	1	1	1	1	1	1	12	3
3 Lack of current knowledge on adaptation methods	1	1		1	1	1	1	1	1	1	1	1	1	1	1	14	1
4 Inadequate information on weather events	1	1	0		1	1	1	1	1	1	1	1	1	1	1	13	2
5 No credit	0	0	0	0		0	0	1	1	1	1	1	1	0	1	7	7
6 High level of poverty	0	0	0	0	1		1	1	1	1	1	1	1	1	1	10	5
7 Soil erosion	0	0	0	0	1	0		1	1	1	1	1	1	0	0	7	7
8 Soil infertility	0	0	0	0	0	0	0		0	0	1	1	1	0	1	4	11
9 Flooding	0	0	0	0	0	0	0	1		1	1	1	1	0	0	5	9
10 Out Break of pest/ diseases	0	0	0	0	0	0	0	1	0		1	1	1	0	1	5	9
11 Large family size	0	0	0	0	0	0	0	0	0	0		1	1	0	1	3	12
12 Old age	0	0	0	0	0	0	0	0	0	0	0		0	0	1	1	14
13 Poor markets	0	0	0	0	0	0	0	0	0	0	0	1		0	1	2	13
14 Absence of policy on climate change	0	0	0	0	0	0	1	1	1	1	1	1	1		1	8	6
15 No hindrance	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	15

Source: Author's Analysis, 2018

An entry "1" indicates that the barriers in that "row" is stronger than that of the "column" in which it is entered, while an entry "0" indicates that the barrier in that "row" is weaker than that of the "column" in which it is entered. However, it can be deduced from the matrix that lack of current knowledge of adaptation methods ranked highest with highest score (14) is the strongest barrier to climate change adaptation. This could be attributed to households'

attitude/ culture of rejecting modern adaptation methods. Lack of information on weather events such as drought, floods, windstorms among others) with a score (13) is the second strongest barrier. Water scarcity with a score (12) is the third strongest barrier. Lack of improved seeds with a score (11) is the fourth strongest barrier. Then, no hindrance with a score (0) means there no barrier to climate change adaptation. Consequently, it is inferred the weakest adaptation barrier in the study area. This implies that lack of current knowledge of adaptation methods is the strongest barrier to climate change adaptation employed by the households in the study area. This result is in agreement with the findings of Ishaya and Abaje (2008) that indigenous people in Kafanchan 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 access to water for irrigation farming, lack of current knowledge on adaptation methods, lack of information on weather events. This assertion agrees with the view of a participant during the FGD who said:

“Here in this community, we carried out our farming activities in the way that we were taught by our ancestors (using traditional farming methods and techniques)... once in a time people do bring some new methods but we do not usually accept anything outside the ones we are used to... due to the prevailing beliefs that at the end of the day they will not yield any good results” (Wazirin, Saminaka, Lere LGA)

Conclusion and Recommendations

This study has identified major barriers encountered in adapting to climate change in the area. These hindrances greatly undermined the efforts of the households to quickly adapt to climate change. This also increased their degree of susceptibility to the effects of climate change in the area. It is also deduced that there is significant difference in the barriers to climate change in the various LGAs of Kaduna Northern Senatorial. The research concludes that lack of current knowledge of adaptation methods is the strongest barrier to climate change adaptation in the area.

Based on the aforementioned findings the following recommendations are made:

Since most households could not effectively implement adaptation strategies to climate change due to lack of current knowledge of adaptation methods. There is therefore the need for integrating community's knowledge of local adaptation methods with current / modern adaptation techniques to overcome major barriers to climate change adaptation in the area. There is also the need for improving information delivery to increase the level of awareness of weather events such as floods, droughts and windstorms.

REFERENCES

- Abaje, I. B., Sawa, B. A., Iguisi, E. O. and Ibrahim, A. A. (2016). Impacts of Climate Change and Adaptation Strategies in Rural Communities of Kaduna State. *Ethiopian Journal of Environmental Studies and Management* 9 (1): 97 – 108
- Abaje, B. I., Sawa, B. A., Iguisi, E. O. and Abdulhamid, A. I. (2015). Assessment of Rural Communities' Adaptive Capacity to Climate Change in Kaduna State, Nigeria. *Journal of Environment and Earth Science* www.iiste.org 5, (20): 17-20
- Abaje, I.B., Ishaya, S. and Usman, S.U. (2010). Analysis of Rainfall Trends in Kafanchan, Kaduna State. *Research Journal of Environmental and Earth Sciences*. 2 (2): 89-96.
- Abaje, I.B. (2007). *Introduction to Soils and Vegetation*. Kafanchan: Personal Touch Productions.

- Adamu, U. (2004). *Assessment of the Effects of the Public Policies on Agricultural Commodity Prices and Rural Income in Zaria Region*. (Unpublished M.Sc. Thesis), Department of Geography, Ahmadu Bello University, Zaria- Nigeria.
- Adamu, K. U. (2008). An Assessment of Irrigation Activities in Zaria: A Case Study of Kubani Irrigation Farms. *The Zaria Geographers* (2008) 17 (1): 99-107.
- Asuquo, E. O. (2009). Climate Change Adaptations an Area Paper. An Unpublished Ph.D Thesis Presented in the Department of Geography, University of Ibadan, Oyo State.
- Audu, A. (2016). Assessment of Farmers' Adaptation Strategies to Climate Change in Parts of Yobe State, Nigeria. (Unpublished M.Sc. Thesis), Department of Geography, Ahmadu Bello University, Zaria- Nigeria.
- Fenan, T. and Adekola, O. (2014). Perceptions, Knowledge, Adaptation and Socio- Economic Cost of Climate Change in Northern Nigeria. Published by Canadian Center of Science and education. *Journal of Agricultural Science*; 6 (8): 66-67.
- Ikpe, E. (2014). Adaptation to Climate change Among Grain Farmers in Goronyo Local Government Area, Sokoto State, Nigeria. (Unpublished M.Sc. Thesis), Department of Geography, Ahmadu Bello University, Zaria- Nigeria.
- (Intergovernmental Panel on Climate [IPCC] 2007). Climate change 2007. The 4th Assessment Report (AR4). Synthesis Report for Policymakers http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf. (Access 10th August, 2009).
- Ishaya, S. and Abaje, I. B. (2008). Indigenous People Perception on Climate Change and Adaptation Strategies in Jama'a Local Government Area of Kaduna state, Nigeria. *Journal of Geography and Regional Planning*, 1 (8): 138-143.
- Mamman, M., Hazo, A. I., and Sawa, B. A. (2019). Assessment of Adaptation Strategies to Climate change Impacts Among rural People in Funtua Local Government Area, Katsina State, Nigeria. *Assessment of Adaptation Strategies to Climate change Impacts Among Rural People in Funtua Local Government Area, Katsina State, Nigeria.*, 20(1):10-10.
- Noble, I., Huq, S., Anokhin, Y., Carmin, J., Goudou, D., Lansigan, F..... Wright, H. (2014). Adaptation Needs and Options. In Patt, A. and Takeuchi, K. (Eds), *Climate Change 2014: Impacts, Adaptation and Vulnerability*, (51pp). Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. United Kingdom and New York, NY, USA: Cambridge University Press.
- Russel, T. (1997). *Pairwise Made Easy*. Lakeland View, Galegreen Westhouse, Via Carnforth, Lancs. La6 3NJ, England, UK. PLA Notes (1997), Issue 28, Pp25-26, IIED London.
- Suleiman, U. B. (2014). *Farmers Adaptation Strategies to Drought in Katsina and its Environs*. (Unpublished M.Sc. Thesis), Department of Geography, ABU, Zaria- Nigeria.
- Udo, R. K. (1970). *Geographical Regions of Nigeria*. Heinemann, London.
- Yamane, T. (1976). Sampling Method for Determining the Population Size. *International Journal for Statistical Analysis*. Vol.3