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ANALYSIS OF GENDER VULNERABILITIES TO CLIMATE CHANGE AMONG FARMERS IN KANO STATE, NIGERIA

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ABSTRACT
The study was designed to assess gender vulnerabilities to climate change among farmers in Kano State, Nigeria. The probability and non-probability sampling technique were used to select 250 farmers drawn from 50 co-operatives in the four (4) selected Local Government Areas (LGAs). Data were collected using a semi-structured questionnaire. Descriptive and inferential statistics were used to analyse the data. The results revealed the farmer's average age of 46 years; majority (95.2%) were married with an average household size of 14 persons; and 43.6% of the farmers had informal (Qur'anic) education. Vulnerability analysis showed that women and children were more vulnerable to scarcity of water (48.1%) and diseases (58.5%), respectively, and men (59.2%) were vulnerable to market distance. It was further disclosed that age influenced the farmers' adaptive strategies to climate change at $P \leq 0.01$ significant; and household size was significant at $P \leq 0.05$. However, farmer's annual and years of farming experienced had no significant influences on the use of adaptive strategies. In conclusion, women and children were most affected by the changes in climate and had low adaptive capacity compared to men. The study recommended that women and children who are more vulnerable should be given special attention by all the stakeholders in order to reduce the level of their vulnerability.

Keywords: Adaptation, Climate change, Farmers, Gender, Vulnerabilities.

INTRODUCTION
Climate change is emerging as a serious threat to progress in most countries. For instance, Nigerian Environmental Study/Action Team (NEST, 2003) and Intergovernmental Panel on Climate Change (IPCC, 2007) emphasized that climate change is expected to influence crop and livestock production, hydrologic balances, input supplies, and other components of agricultural systems as well as rural living standards. It is already affecting lives and livelihoods in many communities of the developing country like Nigeria, thus no part of Nigeria is safe from climate change. As indicated by Farauta *et al.* (2011), more than two-thirds of the country is prone to desertification; and that States in Nigeria, like Borno, Sokoto, Jigawa, Zamfara, Kebbi, Katsina, Yobe, Kaduna, Kano, Bauchi, Adamawa, and Niger are at risk (Farauta *et al.*, 2011). It is evidenced that climate change has a strong impact on Nigeria, particularly in the areas of agriculture, land use, energy, and biodiversity, health, and water resources.

Recent evidence from the research world indicates that vulnerabilities related to climate change and its impacts on communities are gendered (Goh, 2012; Moosa, and Tuana, 2014; and Morchain *et al.*, 2015). Climate change affects men, women, and children differently according to their respective vulnerabilities and adaptive capacities. Women are disproportionately more vulnerable than men due to their distinguished roles and

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responsibilities at the household and community levels (Goh, 2012). In developing countries, nearly all policies aimed at building the communities' resilience to climate variability fail to recognize the gendered nature of everyday realities and experiences, hence either completely overlook or incorrectly formulate gender issues in policy development (Arora-Jonsson, 2014). An understanding where climate vulnerabilities are located has immense practical significance. This study was therefore designed to analyse gender vulnerabilities to climate change among farmers in Kano State, Nigeria, and specifically to: describe the socio-economics characteristics of the respondents; describe the vulnerability of gender to climate change; and determine the socio-economics factors influencing the use of adaptive strategies by the farmers in coping with climate change.

MATERIALS AND METHODS

The Study Area

Kano State is situated in the Sudan savannah agro-ecological zone of Nigeria along latitude 9^0 30' and 10^0 33' to 12^0 37' North and longitudes 7^0 34' to 9^0 25' East. The State occupies a total land area of about 42,582.8 km square. It bordered to the west and northwest by Katsina State, to the east and northeast by Jigawa State, to the south by Bauchi State and the southwest by Kaduna State (Kano State Government Direct Diary [KNGD], 2019). Out of the total land area, agricultural land occupies 30,684.8 km square, while forest and grazing land has 11,898Km square (KNGS, 2019). Over 50 percent of the inhabitants of the State are farmers cultivating legumes, cereals, and vegetables (KNGS, 2019). Livestock rearing and trading are also common in the State (Suleiman *et al.*, 2017). The population of Kano State in 2019 was projected to be 13,076,892 persons (National Bureau of Statistics [NBS], 2019).

The major tribes are Hausa and Fulani ethnic group but other ethnic groups inhabiting the state include almost all major and minor tribes in Nigeria. The climate in the study area is a tropical dry climate with a monomodal rainfall distribution averaging 650 mm per annum with most rains occurring between June and September. The average temperature is 29^0C with a minimum temperature of 15^0C occurring from November to February and the highest temperature of 39^0C occurring in March and April, generally, the highest elevation in Kano State is found towards the south-western tip of the state (Figure 1). It is about 1,200m above sea level (Olofin and Tanko, 2002).

Sampling Procedure

A multi-stage sampling technique was used for the study. There are 44 LGAs in Kano State spread in two (2) agro-ecological zones (Sudan and Northern Guinea Savannah) with the majority falling into Sudan savannah. In stage one, three (3) LGAs were randomly selected from the 42 LGAs that are situated in the Sudan Savannah (Kunchi, Gwarzo, and Wudil) and one (1) LGA from Northern Guinea Savannah (Doguwa). At the second stage, 12 farmers' cooperatives were purposively selected from Kunchi, and Wudil while 13 from Gwarzo and Doguwa due to a high number of cooperative groups and the researcher's convenience. Finally, a proportionate random sampling technique was used to select 250 farmers out of 1,250 farmers' populations in the various group (Table 1).

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Table 1: Summary of Sample Size of the Farmers' Co-operative Groups

Agro-ecological zone	LGA	Number of farmers group	Farmer's population	Sampled farmers
Sudan Savannah				
	Kunchi	12	300	60
	Gwarzo	12	295	60
	Wudil	13	317	65
Northern Guinea Savannah				
	Doguwa	13	338	65
Total	4	50	1,250	250

Method of Data Collection

The primary data was collected by the use of a semi-structured questionnaire. Data collected were on socio-economic characteristics of the farmers, the vulnerability of gender to climate change, and adaptive strategies used by the farmers.

Analytical Techniques

The data collected were analysed using descriptive statistics and logit regression to achieve the objectives of the study. Descriptive statistics (such as mean, minimum, maximum, and bar chart) were used to achieve objectives i, and ii; and regressions were used to achieve objective iii of the study. The implicit form of logit regression is specified as:

$Y_i = \alpha + \beta xi \ldots Xn + u$ …(1)

Y = Use of Adaptive strategies …1

Do not use adaptive strategies-…0

β = Intercept

X = Independent variables

u = Error term

n= Number of observations

The explicit form of the model is:

$Y = \beta 0 + \beta_1 X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \varepsilon$ …(2)

where;

Y = Use of adaptive strategies

X_1 = Age (Age of farmers in years)

X_2 = Household size (Numbers)

X_3 = Gender (male = 0, female = 1)

X_4 = Annual income (Amount of income in ₦)

X_5 = Level of education (Number of years)

X_6 = Years of experience (Formal education = 0, Non formal education = 1)

ε = error term

$\beta_{1 \ldots} \beta_6$ = Regression coefficients of X variables from $X_1 - X_6$

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Farmers

The results of Table 2 shows average age of the farmers was 46 years with a minimum of 15 years and a maximum of 65 years. The farmers were within an active age and may likely relate to sources of weather information and can be able to cope with climatic hazards. The average household size of farmers was 14 persons with a minimum of 2 persons and a maximum of 25 persons. The result of the household size was further disaggregated based on the gender composition of the farm family, the average number of adult males and females

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were 4 persons, while the maximum adult males and females were 14 and 13 persons, respectively. However, the average and the maximum number of children in the household were slightly higher with corresponding values of 7 and 20 in the same order (Table 2). This was an indication of large household size with many respondents believed to be polygamous, with more children than adults. Thus, the households may likely be more productive and with a significant number of people with access to climate-related information. Hence, promoting both horizontal and vertical information exchange among the family members. This coincides with the findings of Anyoha *et al.* (2013) who reported that the majority (87.0%) of the farmers had 2-10 persons in their household with an average household size of 12 persons. Years of farming experience was relatively high in the study area with an average of 24 years (Table 2a). This implies that the farmers had enough experience to understand and cope with the changes in climatic conditions in the area over the years to increase crop productivity.

Table 2: Socio-economic Characteristics of the Respondents

Variables	**Minimum**	**Maximum**	**Mean**
Age (years)	15	65	46
Household size	2	25	14
Number of adult male in the house (≥ 15)	1	15	4
Number of adult female in the house (≥ 14)	1	13	4
Number of children in the house (≤ 15yrs)	1	20	7
Years of farming experience (years)	2	45	24

Source: Field survey, 2017

The results of Table 3 shows that majority (70.0%) of the respondents were males and 30.0% were female. This indicated that male-dominated the headship of the interviewed households. The predominance of the male household heads is in line with the cultural orientation of northern Nigeria where females are rarely allowed to interact with a non-family member. This agreed with the findings of Mustapha *et al.* (2012) who revealed that the majority (73.8%) of the farmers in the central agricultural zone of Borno State were males. The study also indicates that the majority (95.2%) were married, while 0.4% were divorced. This implies that farmers in the study area had high responsibilities and expectations in meeting up with family demands. Furthermore, 43.6% of the farmers had informal (Qur'anic) education whereas 56.4% had one form of formal education or the other, meaning that most of them can read and write and may be able to access information that can enhance their climate change adaptive capacity. This confirms the findings of James *et al.* (2014) who reported that formal education may positively influence access to information and adaptation to climate change.

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Table 3: Gender, Marital Status and Educational Level of the Respondents

Variable	Frequency	Percentage
Gender		
Male	175	70.00
Female	75	30.00
Marital status		
Single	4	1.60
Married	238	95.20
Divorced	1	0.40
Widowed	7	2.80
Level of education		
Informal Qur'anic education	109	43.60
Adult education	2	0.80
Primary education	40	16.00
Secondary education	46	18.40
Tertiary education	53	21.20

Source: Field survey, 2017

Gender Vulnerabilities to Climate Change

The results from Figure 3 shows the vulnerabilities of gender to climate change and it revealed that the scarcity of water affected more (48.1%) women than men (20.8%). This is because of the increase in the distance in search of water, which made them trek for quite a distance and also had to follow a long queue leading to a waste of time and adding to their workload. This coincides with the findings of Ana *et al.* (2011) who reported that women and girls in developing countries are often the primary collectors, users, and managers of water. Decrease in water availability will jeopardize their families' livelihoods and increase their workloads, putting their capacity to attend school at risk. Climate change makes children (58.5%) more vulnerable to diseases, then women (36.9%) while men were the least vulnerable to diseases. Diseases such as malaria, diarrhea, pneumonia, and other air and water-borne disease affect children easily and were more prevalent when the temperature is high and during harmattan. The distance from home to market was also affected as a result of climate change, due to the erosion and bridge breakage. Men were more (59.2%) vulnerable because they are responsible for taking family goods to the market, especially in a situation where they control all the family resources, Women (31.2%) are the second to be affected by the market's distance whereas children (9.6%) were not vulnerable.

The results from Figure 1 further revealed that women were mostly (76.2%) affected by the decrease in income-generating activities, because of additional household workload which arose due to changes in the climatic condition of the state. Children (56.1%) were more vulnerable to death as a result of climate change, for being more susceptible to changes in weather condition and climate-related hazards, while women (40.1%) were next vulnerable to death, they undergo several health issues, childbearing for example, before reaching district hospital they lost their lives due to bad road which is as a result of erosion or bridge breakage, this situation is serious during the raining season. State of the World (SOW, 2019) reported that in an analysis conducted in 141 countries in the period 1981 to 2002 found that natural disasters (and their subsequent impacts) on average killed more women than men in societies where women's economic and social rights were not protected. Children (39.6%) and women (38.5%) were mostly affected by the effect of climate change on cooking fuel sources (Figure 1). This is because access and proximity to sources of cooking fuel make an individual

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vulnerable to climate change, this could be an addition in workload, hazards involved in a search for cooking fuel, distance and sometimes makes the children unable to attend school.

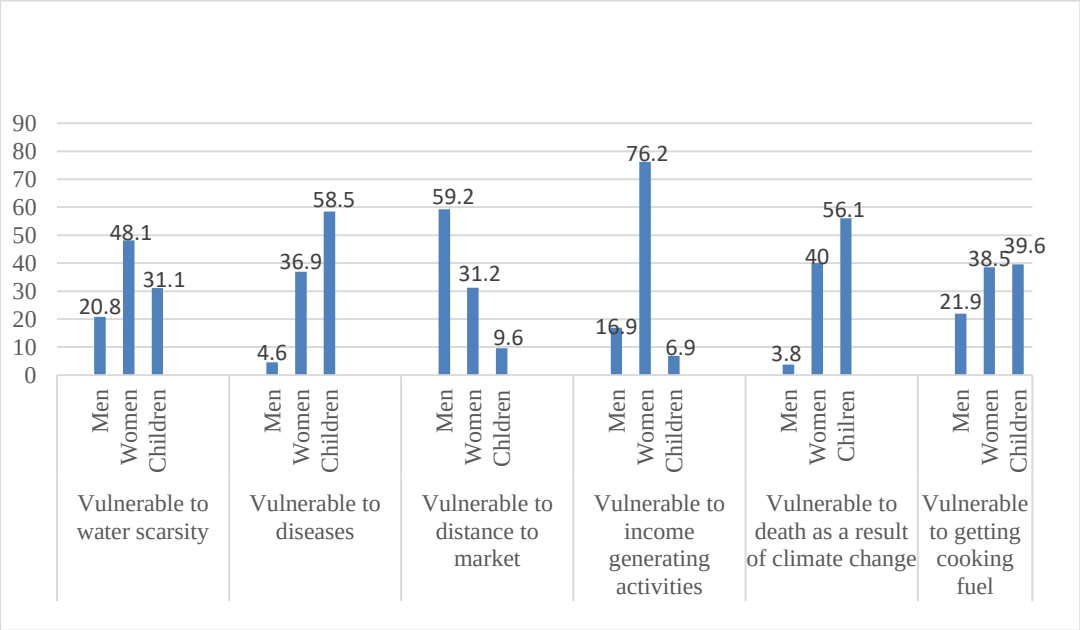

Figure 1: ***Distribution of farmers according to the gender vulnerability to climate change***

Source: Field survey, 2017

Climate Change Adaptive Strategies

The different adaptation strategies to climate change used by the farmers were identified and are presented in Table 4. Out of nine (9) adaptation strategies, the practice of crop diversification was ranked first and thus the most important way of used by the farmers' to mitigate the impact of climate change on household food security and income generation. Cultivation of short duration crop ranked second adaptive strategies used, this helped the farmers in increasing their yield especially with the changes of a pattern of rainfall that has a short duration and also it prevents them from losing the crops in the season (Table 4). The third strategy identified was increased use of organic and inorganic fertilizer. This benefits the plant to mature easily, early, and increase the yield, and also the organic fertilizer creates a healthy environment for the soil over a long period. The fourth most important adaptation strategy was the "integrated farming system" (being engaged in two or more enterprises which act symbiotically with one another). Increase use of irrigation was the fifth strategy adopted by the farmers in the study area. The sixth, seventh, and eighth adaptive strategies to climate change identified were practiced of crop rotation, move to non-farm activities/job, and soil conservation technique. The results further revealed that crop/livelihood insurance (9th) was ranked as the least important adaptation strategy (Table 4). This is most likely due to lack of farm-based insurance, poor deployment of technical assistance, and low-levels of farmer awareness about the use of agricultural insurance.

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Table 4: Farmer's Adaptive Strategies Used to Cope with Climate Change

Variables	*Frequency	Percentage	Ranking
Practice crop diversified	180	21.4	1st
Cultivating short duration crop	146	17.4	2nd
Increase use of organic/inorganic fertilizer	119	14.1	3rd
Integrated farming system	116	13.8	4th
Increase use of irrigation	113	13.4	5th
Practice crop rotation	63	7.5	6th
Move to non-farm activities/job	51	6.1	7th
Soil conservation technique	39	4.6	8th
Crop/livestock insurance	14	1.7	9th

*Multiple responses existed
Source: Field survey, 2017

Socio-economic Factors that Influenced the Use of Climate-adaptive Strategies

The socio-economic factors influencing farmer's use of climate change adaption strategies are presented in (Table 5). Age significantly ($P \leq 0.01$) influence farmers' adaptive strategies to climate change effects. This implies that the probability of adaptation significantly increases with the increase in farmer's age. It can be predicted that such farmers have suffered more due to climate variability, hence develop an interest or have more incentives to used climate change adaptation measures. Perhaps older farmers understand the necessity to adapt to climate change effects. Moreover, these older farmers may be more "set in their ways", interested in adopting modern farming techniques. This is contrary to the findings of Acquah (2011) who reported a negative relationship-related of age and climate change adaptive strategies. Household size was negative and significantly ($P \leq 0.05$) related to farmers' adaptation strategies to climate change effects. However, the negative sign on this relationship shows that the probability of farmers' adoption of an adaptive strategy decreases, the larger the household size the less available labor which can actively engage in work, lesser adaptive measures against climate change. This is similar to the findings of Mbwambo *et al.* (2012), and Quayum and Ali (2012) who reported that the household size was negative and significant (inverse relationship) related to the adaptation to the effect of climate change. Gender was also negative and significantly ($P \leq 0.1$) influence the adaptive measures, this shows an inverse relationship related to the adaptation to climate change effects. The level of education was significant at also $P \leq 0.1$. The probability of the adaptation to climate change increases the education a farmer can attain, such a farmer has more interest in taking climate change measures and adoption to any agricultural technology.

The result (Table 5) also shows no significant relationship between farmers' annual income and adaptive strategies to climate change. This disagrees with the finding of Mbwambo *et al.* (2012) in their article, reported that there was a significant relationship between farmers' income and the adaptive strategies used. Years of farming experience was negative and show no significant influence on the use of adaptive strategies by the farmers. The negative sign on this relationship shows the probability of adaptation to climate change decreases as the years of experience increase.

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Table 5: Factors that Influenced the Use of Climate-adaptive Strategies

Variables	B	SE	Wald	df	Sig.	Exp (B)
Constant	-3.160	1.523	4.304	1	0.038**	0.042
Age	0.078	0.027	8.297	1	0.004*	1.081
Household size	-0.072	0.036	3.909	1	0.048**	0.931
Gender	-1.497	0.814	3.386	1	0.066***	0.224
Annual income	0.000	0.000	0.818	1	0.366	1.000
Level of education	0.760	0.421	3.264	1	0.071***	2.139
Years of experience	-0.026	0.025	1.054	1	0.305	0.975
-2 Log likelihood	-180.323[a]					
Cox & Snell R Square	0.065					
Nagelkerke R Square	0.122					

Note: *1%, **5% and ***10% level of significant
Source: Field survey, 2017

CONCLUSION AND RECOMMENDATIONS

The study concluded that women and children are more vulnerable to disease and scarcity of water in the study area due to the negative consequences of climate change on peoples' livelihood. It was recommended that farmers should be encouraged to enhance their capacity to cope with climate change and more female extension agents should be employed and trained so that the rural women can have access to adequate climate and related agricultural information.

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