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# ANALYSIS OF FARMERS RESPONSE TO FOREST MANAGEMENT ON CLIMATE CHANGE MITIGATION AND ADAPTATION IN MAKODA LOCAL GOVERNMENT AREA, KANO STATE, NIGERIA

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## ABSTRACT

A land use practices like deforestation is among the practices affecting environment in satisfying human daily tree felling and carbon needs, these practices tremendously contributes to climate change. To help in addressing it this study delves into understanding farmers' response of climate change. A total 250 farmers were sampled through stratified random sampling techniques. Information was generated means of instruments and analysed using descriptive and inferential statistics. The results revealed that male respondents accounted for 92.2% while female farmers accounted for 7.8% of farmers. The mean age was 33years and 86.53% of them had education background, 75.46% perceived changes in temperature, wind action (8.18%), sunlight (86.3%),flood and change in the rainy days(90.9%) while (74.55) of farmers had changed their practices,42.8% farmers obtained information on climate change from extension agents (22.3%) while 17.8% acquired Knowledge from interactions of friends and families and NGOs(.4%).COVER cropping(80.90%)5th, planting economic trees(82.47%)4th,mixed farming (77.27%)7thearly maturing vanities(19.65)1st and other practices were adopted to mitigate changes. Problems inhibiting mitigation and adaptation practices were; cost of mitigation and adaption practices, lack of regular update on effects of climate change on their daily practices. The study recommends boosting farmers' climate change awareness, improvement in Agriculture and forestry, appropriate technology strategies, availability of high-yielding and cost effective technologies.

**Keywords:** Forest, Farmer responses, climate change, mitigation and adaptation.

## 1. INTRODUCTION

Land use practices, contribute to climate change thereby increasing to the global environmental challenges that have potentials to causing profound consequences, particularly on plants in the developing countries, including Nigeria. Climate is believed as the primary determinant of agricultural productivity(Apata, *etal.*, 2009).The rate and magnitude of changes in climate characteristics determine agronomic and economic impacts (Parake*et al*., 2001).Though climate change is a threat to agriculture and non-agricultural socio-economic development aspects,

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"agricultural production activities are generally more vulnerable to climate change than other sectors" (Ayanwuyi*et al*., 2010).Climate change is becoming a high profile issue both from the social, economic and related sectors including water resources, agriculture and food security, terrestrial ecosystems and biodiversity. Land degradation, especially soil erosion, soil nutrient depletion and soil moisture stress, are of the major problems globally.

It is not only the scientists and environmentalists who are concerned about climate change. These are apparent that there are shortcomings and very wide gap that need to be checked. These gaps are: integrating climate into policy, integrating climate into practice; climate services and climate information and statistics IPCC (2007).

## 2. OBJECTIVES OF THE STUDY

I. To find out types of mitigation Adaptation practices adopted by farmers in the study area.
II. To identify main challenges to climate change mitigation and adaptation by farmers in order to recommend strategies for improved policy option.

### 2.1 Literature Review and Conceptual Framework

The concepts of climate change terms have been variously defined. To Mendelsohn *et al;*( 2006) it as an environmental, social, economic hazards and challenges on a global scale. Intergovernmental Panel on Climate Change (IPCC, 2001) defined climate change as a statistically significant variation in climate conditions that persist for an extended period, typically for decades or longer of the atmosphere. Happenings as a result of anthropogenic emission of greenhouse gases (GHG), weather events such as drought and floods a well as greater unpredictability and variability. Changes are temperature unpredictability, sea level rises and low or higher rainfall regimes. These changes as believed; led to multiple social-economic impacts, such include floods droughts, storms, heat waves change, and change in the growing seasons in some areas, changes in water quality and quantity; sea level rise and glacier melt (Postnote, 2006, IRIN 2005).

The world has an estimated 850 million hectares of degraded forests, which could potentially restore lost biodiversity and ecosystem services and contribute to climate change mitigation and adaptation. FAO (2018) reported that around 13 million hectares of forest were converted to other uses or lost through natural causes each year between 2000 and 2010.

Forests and trees are important carbon sinks as they absorb carbon dioxide from the atmosphere and store it as carbon. Carbon sequestration by forests has attracted much interest as a mitigation approach, though relatively inexpensive means of addressing climate change.

### 2.2 Impacts of Climate Change in Nigeria

In Nigeria, the experiences of the adverse climate conditions with unfavourable impacts lives and biodiversity (Hulme, 2001). Persistent droughts, flooding, off season rains and dry spells have greatly affected growing seasons whereas the country is largely dependent on rain fed agriculture. Following the release of the 4th IPCC Assessment report, Climate Change has been confirmed with Africa expected to be worst hit by the effects with Nigeria inclusive (Christensen *et al*, 2007).The IPCC working groups II have suggested that mitigation and adaptation should be complementary.

### 2.3 Mitigation and Adaptation

Mitigation involve a systematic use of climate information system to reduce the uncertainty that impacts planning and decision making through Climate-informed technologies that reduce

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vulnerability to climate diversification, water harvesting, irrigation, improved water use efficiency, breeding for heat or drought and tolerance and adoption of Improved land use practices such as better management of grazing land, paddies through intermittent soil drying and reduced emissions of Methane ($CH_4$). In fact, changes in cultivation practices such as shifting from transplanting to direct seeding and use of water management practices can contribute to reduction in $CH_4$emissions. Adaptation refers to changes in processes, practices or structures to moderate or offset potential damages or to take advantage of opportunities associated with changes in climate (IPCC, 2001)..

## 3. METHODOLOGY

### 3.1 Description of the Study area

The study was carried out in Makoda Local Government Area (LGA) situated in the Northern part of Kano state. The area is one of the 44 districts heads in the emirate council of Kano state. Makoda Local Government has nineteen (19) wards.

### 3.1.2 Economic Activities

It has an area of about 441 km² and the density of 694.1/km$^2$. Makoda LGA lies geographically between the latitude 12º 14`49" N to 12º 36`7.4"N and longitude 8º29`5.7" E to 8º49`12" E.

### 3.1.3 Population

The population of the area was projected at 193,392,500 persons (NPC, 2018). Farming constitutes an important activity as the people of the area are predominately famers. They engaged themselves in both rainy and dry sessions farming and tree crops. Some of the crops cultivated and marketed are tomatoes, Pepper, Okro, Onions, cereals and pulses among others. The market in area is serving as center for economic activities for the Local Government revenue generation.

### 3.1.4 Geography

The area lies within the Sudan savannah zone and maximum temperature ranges from 33$^0$c and 15-85$^0$c and falls low as 10$^0$c during the hamates season between December and January. Annual rain fall ranges between 500mm in the North to 1,200mm in south. Natural vegetation species are often found in the area and these do not exceed 20 meters in height consisting of trees like *Accia Aibida*, *Tamarindus indica*, *Butyospermum parki*, *clappertonia*,neem tree species (*Azadrachta indica)* and others. Grasses are found in scanty patches; such include *Acaciatora*, *Vurhavea levis* and hardly ones reach 1 metre high at maturity and tend to dry up in the dry season; cultural vegetation has replaced the natural vegetation in the area where exotic species predominate (Aminu, 2016).The dry season crops mainly include wheat (*Panicum maximum*), Maize (Zea mays), *Rice (Oryza sativa)* and vegetables (spinach amaranth, cabbage, lettuce, onions, tomatoes and pepper *etc*, Abbas *et al*, (2018).Other crops include Millet (*Pennisetumtyphoidium*), Guinea corn (*Sorghum vulgar)* cultivated under rain fed. These crops enable the area to feed themselves and for the Gross Domestic Contribution to the Nation as GDP.

### 3.1.5 Drainage

The main drainage feature of the area constitutes numerous tributaries characterized by Thomas and other tributaries and drained to it (Aminu, 2016). The drainage system has been artificial with natural fadama depressions modified through Dams and constructions for irrigation, rain fed farming and flood control.

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### 3.2 Sources of Data

The sources of data for this study were structured questionnaire to elicit the information responses from traders and some documents from Kano Agricultural and Rural development authority (KNARDA) and National Population commission (NPC,2006).

#### 3.2.1 Primary Source

Primary data were sourced by using questionnaire prepared by the researcher based on the set objectives to gather the necessary information from the traders. In addition to the questionnaires, discussions were held with adult groups and community leaders to source some information on cooperative society and education in the study area and their challenges.

#### 3.2.2 Secondary Sources

The secondary data sources were especially the data obtained from some Books, Internet and Lecture notes and Library.

#### 3.2.3 Methods of Data Collection

The method employed in collection of information from the respondents was questionnaire as instrument. The sums of one hundred and twenty (120) questionnaires were prepared to gather relevant information from the marketers. Interview method was found feasible, so employed by the researcher himself with the assistance of five trained assisting enumerators.

#### 3.2.4 Sampling Framework

The study employed stratified random sampling techniques in the selection of the study areas. In the first place, the Makoda LGA was purposively selected as representative to zone II ADP due to its commodity market influence on the area. In the second place, four (4) wards were chosen as representatives. Variables such as farmers' population, farm size and proximities were considered.

#### 3.2.5 Selection of Sampling Sites

The selection of sites was done through systematic sampling by picking the second after arranging the wards numerically. The same principles as above were applied in selecting the wards under the LGA.

**Table: 1 Distribution of wards by Sample Size**

| s/n | Wards Selected | Frequency | percentage (%) n=120 |
|---|---|---|---|
| | 1.Makoda | 30 | 25 |
| | 2.Koguna | 30 | 25 |
| | 3.Maitsidau | 30 | 25 |
| | 4.Chidari | 30 | 25 |
| | **Total** | **120** | **100** |

Source: Updated from Field survey, (2018)

### 3.3 Method of Data Analysis

#### 3.3.1 Questionnaire Coding

Accordingly, questionnaires collected were coded using Microsoft Excel(MS) spreadsheet software and afterwards copied into the IBM Statistical Package for Social Scientist (SPSS) version 21(2012) software.

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### 3.3.2 Data Analysis

Information collected was analyzed using Statistical Package Software for Social Sciences (SPSS) version 21. Descriptive statistical tools such as percentages (%), frequency (f) and mean (μ) were used in the analysis.

### 3.4 Models Specification

I) **Percentage**

**Where:**

P = f / N X100 …….....1

Frequency (f)

Percentage%= (out of hundred)

II) **Mean**

Mean=$\sum X_i/n$……....2

Where:

$\sum$ =means total population of respondents.

N= population mean.

X=number of responses.

n= number of observations 1, 2,3...i-j,

### 2.6.4.1 Regression Analysis

The implicit form of the marketing function for poultry egg marketing enterprises in the study area is stated as follows:

$Y = f(X_1, X_2, X_3, X_4, X_5, \ldots + u)$……3

Where:

Y = Mitigation and Adaptation response

$X_1$ = Age

$X_2$ = Gender

$X_3$ = Educational background

$X_4$ = Occupation

$X_5$= Years of Experienced

u = error term

$X_1$,- $X_5$are the explanatory variables

## 4. RESULTS AND DISCUSSIONS

### 4.1 Result and discussion

Farmers' socio-demographic characteristics, climate response to mitigation practices and problems militating against the adoption of climate change mitigation practices presented.

### 4.2 Socio-Demographic characteristics

### 4.3 Farmers Age

Age can serve as a vehicle of understanding and controlling climate change and its' induced related effects. The result also shows that the age of farmer ranged from 40 to above, substantial

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number of farmers (57.3%) between 46 and 51 years. Fischer etal(2002) observed that there is no consensus in the literature as to the exact effect of age in the adoption of farming technologies.

**4.4 Farmers Gender**

Result in table 4 shows male respondents accounted for the majority (92.2%), while female farmers accounted for 7.8% of them across the study location. The findings agreed with other related studies for examples, Ishaya and Abaje (2008); Abraham, Bamidele, Adebola and Kobe (2012) that agricultural sector and the tedious activities related to climate change adaptation strategies are dominated by males.

**4.5 Farmers Education Background**

Table 4 reveals 46.81% farmers had experienced of secondary education, proportion of 32.7% had primary education and only 7.73% of the respondents had tertiary education.

**4.6 Farmers Experience on Climate Change**

The result in table 2.0 shows the temperature changes 194(88.3%) was most influencing, followed by sunlight (87.2%), Rainy days 190(82.6%), Drought 173(78.4%), Pest/disease are increasing 172(78.1%) and Change in all of the factors 192(87.5%) had the highest response from the crop farmers. This result is in line with the findings Idowu, *et al.*,(2011),Porter and Brown(1991) who reported that earth is likely to experience an average rise in temperatures ranging from 1.5 to 4.5$^{O}$C .

**Table 2.0: Distribution of Farmers Experience on Climate Changes**

| Climate variables changes | Frequency | | Agreed 1 | Rank |
|---|---|---|---|---|
| 1. Temperature | 194 | 88.3 | 1st | |
| 2. Rainfall | 168 | 76.4 | 6th | |
| 3. Wind | 122 | 55.5 | 7th | |
| 4. Sunlight | 190 | 86.2 | 2nd | |
| 5. Flood | 099 | 45.4 | 8th | |
| 6. Drought | 173 | 78.4 | 4th | |
| 7. Rainy days | 181 | 82.6 | 3rd | |
| 8. increasing pest/disease | 172 | 78.1 | 5th | |

*As multiple responses.* Source: Updated from Field Survey, 2018

**Farmers Mitigations and Adaptations Practices**

Result in table 3.0 shows that mitigation practices by farmer included planting drought resistant cultivars and planting early maturing varieties (89.1%), Erosion control by wind and water action (88.7%),cover cropping strategies and practicing irrigation recommended practices 181(82.3%), Planting drought resistant species 184(84.2%), planting drought resistant crops 184 (84.2%) and Planting exotic species (84.0%).Other identified mitigation and control practices were adoption of intercropping could drastically reduce and mitigate against the action of severity of climate change phenomenon.

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**Table 3.0: Mitigation and Adaptations Practices by Farmers**

| Farmers' practices | Frequency | Percentage (%) |
|---|---|---|
| a) Cover cropping/Mulching | 78 | 81.2 |
| b) Practicing irrigation | 181 | 82.3 |
| c) Planting of economic trees | 176 | 80.3 |
| d) Erosion (wind/water) control | 195 | 88.7 |
| e) Planting early maturing species | 196 | 89.1 |
| f) Planting exotic species/cultivars | 184 | 84.0 |
| g) Planting drought resistant species | 184 | 84.2 |
| h) Adoption of intercropping | 170 | 77.7 |

*Multiple responses* **Source:** Updated from Field Survey, 2018

### 4.7 Determinant of Mitigation and Adaptation Responses by Farmers

Table 4.0 shows Climate change mitigation practices as may be affected by several factors physical, social and economic aspect. Age (year $X_1$($P<0.001$*) and education background contribute significantly to understanding of the effect.

**Table 4.0: Regression Analysis for Factors Affecting Mitigation Responses by Farmers**

| **Variable** | Coefficient | Standard errors | *t-values* | Significant Levels (SL) |
|---|---|---|---|---|
| Constant $X_0$ | 0.036 | 7914.74 | 0.718 | 0.475 |
| Age (year) $X_1$ | 0.521 | 0.521 | 3.315 | 0.001* |
| Edu. Background.$X_3$ | -0.011 | 0.423 | -0.227 | 0.002 |
| Experience $X_4$ | 0.36 | 2774.83 | 0.711 | 0.479 |
| Occupation$X_5$ | 0.634 | 473.28 | 8.732 | 0.000* |
| $R^2$ | .826 | | | |
| $R^2$ Adjusted | 0.68 | | | |

Source: Updated from Field survey, (2018) Significant at 1%

### 4.8 Barriers to Effective Climate Change Mitigation and Adaptation on farmers

Table 5.0 shows that there are many barriers effecting mitigation to climate change these include maximum storage (21.66%), Carbon sequestration in soils or terrestrial biomass. This agrees with Smith et al. (2001) who reported that mitigation practice may saturate after 15 to 60 years, depending on management practice, management history and the system being modified. The most pressing barriers were the costs of mitigation (93.33%)1$^{st}$, uncertainty (80.83%)4$^{th}$, un clear leakages (81.66%)3$^{rd}$, reversibility (65.00%)5$^{th}$ and other barriers (28.30%) to climate change mitigation and adaptation.

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**Table 5.0: Barriers to Effective Mitigation and Adaptation Practices on Farmers**

| Barriers | Frequency | Percentage | Rank |
|---|---|---|---|
| Maximum storage | 26 | 21.66 | 9th |
| Reference | 57 | 47.50 | 7th |
| Unclear leakage | 98 | 81.66 | 3rd |
| Transaction costs | 78 | 65.00 | 5th |
| Measurement and monitoring costs | 77 | 64.10 | 6th |
| Property rights | 106 | 88.33 | 2nd |
| Cost of Mitigation and adaptation | 112 | 93.33 | 1st |
| Uncertainty | 97 | 80.83 | 4th |
| Reversibility | 78 | 65.00 | 5th |
| Other barriers | 34 | 28.30 | 8th |

*Treated as Multiple response*

## 5. CONCLUSION AND RECOMMENDATIONS

### 5.1 Conclusion

The study revealed how farmers climate change and how they practice mitigation and adapt. The choice of mitigation and adaptation practices depends on the age and Knowledge and information sources due to changing physical environmental conditions and factors within rainfall variability, temperature variability and wind action and so forth resulting from climate changes.

### 5.2 Recommendations

To respond to effect of climate change and mitigate using the adaptive practices, on the basis of findings the study put it that:

- There should be an active participation of communities in all aspects of forest management, taking into account people's needs, aspirations, skills and knowledge will contribute to the efficiency, sustainability and equity of forest-based sustainable measures.

- There should be regular payments and compensations for ecosystem services which may be useful in preserving, acknowledging and rewarding good community forest management practices through the establishment of transparent and fair benefit-sharing arrangements.

- There should be Government and the organized private sector presence at the center of climate change adaptation efforts and must focus on strengthening people's adaptive capacity and resilience.

- There should be crop diversification, water harvesting for irrigation, improved water use efficiency, breeding for heat or drought and tolerance.

- There should be an Adoption of Improved land use practices such as better management of grazing land, paddies through intermittent soil drying and reduced emissions of Methane ($CH_4$) emission by promoting agroforestry systems and urban forestry.

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