

Farmers' Awareness, Vulnerability and Adaptation to Climate Change in Adamawa State, Nigeria

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Abstract

This study assessed the awareness, vulnerability and adaptation of farmers to climate change in Adamawa state. Multi stage sampling technique was used to select 340 farmers from the state. Primary data collected from the farmers included the socio-economic characteristics of the farmers such as gender, age, marital status, and educational qualification, as well as their climate change awareness and adaptation. The data were analysed with descriptive statistics. Majority of the farmers in the state are aware of climate change and submitted that climate change has affected their farming activities in recent years. The effects identified included reduced crop yield, shortage of water and biomass for animals due to low rainfall and frequent dry spells. Similarly high temperature causes wilting of crops and diseases while excessive rainfall leads to destruction of farmlands and properties by flooding. The farmers are making efforts to adapt to climate change in various ways such as planting tolerant crop varieties, altering planting schedules, planting early maturing varieties and crop diversification. They however lack adequate information on how to adapt.

Key words: Farmers, climate change, adaptation and mitigation, awareness, Adamawa state.

1. Introduction

Climate change constitutes a very serious threat to sustainable agricultural production and food security in many parts of the world. Climate change impacts on agriculture include biological effect on crop yield, the resulting impact on prices, production, consumption and the impact on per capital calorie consumption and malnutrition. Research findings have shown that agriculture in developing countries is currently being affected by climate change (FAO, 2007; IFPRI, 2009). In Adamawa state, evidence of climate change includes delayed onset date of rains, increase in number of dry days during the raining season and increase in maximum temperature (Adebayo, 2010). In recent years, farmers in the state have been faced with the problems of crop failure, or low yield arising from climate variability particularly the delayed onset of rains and the increasing length and frequency of dry spells during the growing season. In addition the problem of flood, high temperature and incidences of pests and diseases have also aggravated the farmers' loss which consequently increase the incidence of poverty and malnutrition in the state.

Unless appropriate mitigation and adaptation measures are taken, climate change will frustrate farmers' efforts to achieve sustainable agricultural production and food security. However, developing such strategies will require information from the farmers since the ability to adapt and cope with climate change depends on their knowledge, skills, experiences and other socio economic factors (Maharjan *et al*, 2011). It is against this background that this study seeks to assess the awareness of the farmers on climate change, determine the extent and severity of vulnerability of the agriculture sector in the state to climate change and identify the farmers' response and adaptation to the problem.

Adamawa State is located at the North Eastern part of Nigeria. It lies between latitude 7 and 11⁰ N and between Longitude 11 and 14⁰ E. It shares boundary with Taraba State in the south and west, Gombe State in its North-west and Borno state to the North. The State has an international boundary with the Cameroon Republic along its eastern side (Fig. 1). It has a land area of about 38,741 km² (Adebayo, 1999). The state is divided into 21 local government areas.

Adamawa State has a tropical wet and dry climate. Dry season lasts for a minimum of five months (November-March) while the wet season spans April to October. Mean annual rainfall in the state ranges from 700mm in the North-west, to 1600mm in the extreme southern part of the state (Adebayo, 1997).

The state is naturally divided into two ecological zones; the guinea and Sudan savannah zones. In general, the distribution of vegetation reflects the combined control of rainfall, topography and to a lesser extent, that of soils. Agriculture is the mainstay of about 80% of the inhabitants of the State. The ecological condition of the state permits cultivation of root crops, cereals and rearing of livestock in large numbers.

2. Research Method

A multistage sampling technique was used in the selection of the farmers. The first stage involved the selection of agricultural /ecological zones. Adamawa State has been divided into four agricultural zones (ADP Zones) namely Zone I, II, III and IV (Table 2.3). The second stage involves the random selection of 40% of the local government areas from each zone (Table 1).

The selection of settlements constituted the third stage. Two farming settlements were chosen from each of the selected local government areas. This yielded a total of 18 settlements. The last stage is the selection of farmers from the chosen settlements. A minimum of fifteen farmers were selected from each settlement giving a total of 340 respondents for the state.

Table 1: Sampling frame for farmers' survey

ADP zone	LGAs involved	40% of LGAs	Names of selected LGAs	Number of settlements selected
Zone1	Mubi North, Mubi South, Maiha, Madagali and Micika	2	Mubi north, Micika	2 2
Zone 2	Gombi, Hong, Song, and Girei	2	Gombi Girei	2 2
Zone 3	Fufore, Yola North, Yola South, Mayo Belwa, Jada, Ganye and Toungo	3	Yola north Yola south Ganye	2 2 2
Zone 4	Guyuk, Shelleng, Lamurde, Numan and Demsa.	2	Guyuk, Numan	2 2
	Total	9		18

3. Results and Discussion

3.1 Socio economic background of the farmers

3.1.1. Age:

The age distribution of the respondents is presented in Table 2. The table reveals that both young and old people are involved in farming. The distribution shows that about 26% of the respondents were up to 30 years of age, while about 51% were between 31-50 years. Respondents that were over 50 years of age constituted about 23%. This implies that most of the respondents (about 55%) were relatively young and physically active. This has direct bearing on the availability of able-bodied manpower for agricultural production and also on the ease of adoption of climate change adaptation strategies. Also, age influences the ability to seek and obtain off-farm jobs and income, which could increase farmers' income and could help cope with adverse change in climate.

Table 2: Age of the farmers

Age Group	Number	Percentage
≤ 25	36	10.59
26-30	54	15.88
31-40	100	29.41
41-50	73	21.47
51-60	53	15.59
>60	240	7.06
Total	340	100.00

3.1.2. Educational Level:

This is an important factor that determines the ability of an individual to understand policies and programmes relating to climate change adaptation. The educational distribution of the respondents as measured by years of formal education is presented in Table 3. The table reveals that about 30% of the respondents had no formal education, about 24% attained primary education, while about 28% attained secondary education. Only about 18% attained tertiary education. Thus, about 70% of the respondents have some form of formal education. This study has revealed that literacy level is high among the respondents and this could have implication for agricultural production and also for adaptation to changes in the climate. Adoption of measures that could result in climate change adaptation is also easier and faster among the educated farmers than the uneducated farmers.

Table 3: Educational level of the farmers

Educational Level	Number	Percentage
No formal education	101	29.71
Primary school	81	23.82
Secondary school	96	28.24
Tertiary education	62	18.24
Total	340	100.00

3.1.3. Extension visit:

Extension visits afford the farmers the opportunity to learn improved technologies and how to acquire the needed inputs and services. The distribution of respondents by extension visits is presented in Table 4. The distribution reveals that majority of the respondents (about 77%) had no contact with extension agents, while only about 23% were visited by extension agents. This could affect climate change adaptation among farmers, since their understanding of climatic change depends only on their previous experience.

Table 4: Contacted or visited by extension agents

Extension visit	Number	Percentage
No	262	77.06
Yes	78	22.94
Total	340	100.00

3.2 Farmers' awareness and assessment of climate change

3.2.1 Awareness of climate change:

Awareness of climate change help farmers plan their production activities and reduces risks and uncertainties associated with farming. The distribution of the respondents according to climate change is presented in Table 5. The distribution shows that majority of the respondents (about 96%) are aware of climate change, while only about 4% seem not to be aware of climate change.

Table 5: Awareness of climate change

Aware of climate change	Number	Percentage
No	12	3.53
Yes	328	96.47
Total	340	100.00

3.2.2. Assessment of temperature trend:

The assessment of temperature trend in the State by the respondents is presented in Table 6. The temperature trend in the State has been increasing as claimed by majority of the respondents (about 87%). Only about 8% of the respondents stated that temperature trend in the state has been decreasing, while about 4% claimed to have noticed no change. The farmers' assessment agreed with the experts report on temperature trend in the state (Adebayo 2010; Adebayo 2011). The increase in temperature has the tendency to inflict more harm not only on agricultural production but also on the ecosystem.

Table 6: Assessment of temperature

Temperature trend	Number	Percentage
Increasing	295	86.76
Decreasing	26	7.65
No change	13	3.82
Don't know	6	1.76
Total	340	100.00

3.2.3. Assessment of annual rainfall trend:

Average annual rainfall in the state has been fluctuated due to effect of climate change. The distribution of the respondents according to their assessment of rainfall trend in the area is presented in Table 7. Majority of the respondents (about 55%) claimed that rainfall trend has been decreasing, while about 41% opined that rainfall trend has been on the increase. Only about 2% of the respondents claimed not to have noticed any change in rainfall trend in the area. Again, this opinion corroborated the previous research findings on general decline in annual rainfall in many part of Nigeria (Odjugo, 2009; Umar, 2011; Adebayo, 2011).

Table 7: Assessment of annual rainfall

Rainfall trend	Number	Percentage
Increasing	139	40.88
Decreasing	188	55.29
No change	6	1.76
Don't know	7	2.06
Total	340	100.00

3.2.4. Assessment of dry spells:

The frequency of dry spells in the area was assessed by the respondents and the distribution is presented in Table 8. About 39% of the respondents noticed an increase in the occurrence of dry spells, while about 36% observed a decrease in number of dry spells. However, about 16% of the respondents claimed not to have noticed any change, while about 9% claimed ignorant. Increase in the frequency of dry spells during the growing season is a serious problem facing farmers in the state and other parts of northern Nigeria. This farmer observation corroborated the findings of Sawa and Adebayo (2011) that dry spells of 10 and 15 days are on the increase in the Sudano sahelian zone of northern Nigeria.

Table 8: Assessment of frequency of dry spells

Dry spells	Number	Percentage
Increasing	132	38.82
Decreasing	122	35.88
No change	54	15.88
Don't know	32	9.41
Total	340	100.00

3.2.5 Assessment of onset dates of rains:

The trend in the onset dates of rains was assessed among respondents and the distribution is presented in Table 9. The distribution shows that majority of the respondents (about 73%) claimed to have noticed delay in the onset dates of rains in the area, while about 21% claimed to have noticed early trend in the onset dates of rains. However, about 4% of the respondents claimed not to have noticed any change, while about 2% claimed ignorant. This study has revealed that climate change has brought about delay in the onset dates of rains in the area. Again, this farmers' observation has been confirmed by experts' findings e.g. Adebayo (1998), Sawa and Adebayo (2011).

Table 9: Assessment of onset dates of rains

Trend of onset	Number	Percentage
Delay	247	72.65
Early	71	20.88
No change	15	4.42
Don't know	7	2.05
Total	340	100.00

3.2.6. Assessment of cessation dates of rains:

The trend in the cessation dates of rains was assessed among respondents and the distribution is presented in Table 10. The distribution shows that half of the respondents (50%) claimed to have noticed early cessation dates of rains in the area, while about 43% claimed to have noticed delayed cessation trend in the dates of rains. However, about 6% of the respondents claimed not to have noticed any change, while 1% claimed ignorant. This study has revealed that climate change has brought about early cessation dates of rains in the area.

Table 10: Assessment of cessation dates of rains

Cessation trend	Number	Percentage
Delayed	146	42.94
Early	170	50.00
No change	20	5.88
Don't know	4	1.18
Total	340	100.00

3.2.7. Effect of climate change:

On the effect of climate change on farming, the distribution in Table 11 shows that majority of the respondents (95%) claimed that climate change has affected their farming activities in the last ten years, while only 5% of the respondents claimed not to be affected by climate change in recent years. This study has revealed that climate change has affected farming activities in recent years in Adamawa State.

Table 11: Effects of climate change on farming activities in the last 10 years

Climate effect	Number	Percentage
No	17	5.0
Yes	323	95.0
Total	340	100.00

3.2.8. Effects of low rainfall on farming activities:

Rainfall amount in recent years has fluctuated in the State due to climate change. The distribution of respondents on how low rainfall affected their farm activities is presented in Table 12. The distribution shows that majority (about 87%) of the respondents had their crop yield reduced, about 9% had reduced water for animal, while about 4% had reduced grass or biomass. This therefore implies that low rainfall brought about by climate change has affected agricultural activities in the State.

Table 12: Ways low rainfall affected farm activities

Low rainfall effect	Number	Percentage
Reduced crop yield	297	87.35
Reduce water for animal	29	8.53
Reduce grass/biomass	14	4.12
Total	340	100.00

3.2.9. Effects of extreme/high temperature on farm activities:

High temperature resulting from climatic change has affected agricultural production in the State. The distribution of the respondents according to the effect of extreme/high temperature is presented in Table 13. The distribution shows that majority of the respondents (about 71%) stated that high temperature has brought about wilting of their crops, 25% had their farm produce spoilt, while about 4% had their livestock dead. It evident from this result that high temperature brought about by ozone layer depletion has affected agricultural production in the State.

Table 13: Effect of extreme/high temperature

Temperature effect	Number	Percentage
Wilting of crops	242	71.18
Spoilage of farm produce	85	25.0
Death of livestock	13	3.82
Total	340	100.00

3.3. Farmers' adaptation to climate change

3.3.1. Effort to adapt to climate change:

On whether there were efforts made by farmers to adapt to climate change, the information in Table 14 reveals that majority of the respondents (about 69%) stated that they have made efforts to adapt to climate change, while only about 34% claimed not to have made any effort to adapt to climate change. This reveals that most of the respondents in the study area have made efforts to adapt to climate change.

Table 14: Efforts to adapt to climate change

Effort	Number	Percentage
Yes	223	68.59
No	117	34.41
Total	340	100.00

3.3.2. Adequacy of adapting information:

The respondents were asked on whether they had adequate information on how to adapt to climate change and their responses is presented in Table 15. The distribution shows that more than half of the respondents (about 52%) claimed not to have enough information on how to adapt to climate change, while about 48% claimed to have enough information. This study reveals that many farmers in the area do not have enough information on how to adapt to climate change. This corroborates the findings of Ishaya and Abaje (2008) in Jemaa local government area of Kaduna state, Nigeria.

Table 15: Adequacy of information on how to adapt

Responses	Number	Percentage
Yes	163	47.94
No	177	52.06
Total	340	100.00

3.3.4. Factors limiting adaptation to climate change:

Adaptation to climate change in the State is constrained by factors. The distribution of the respondents on these factors is presented in Table 16. The table shows that about 43% of the respondents claimed that lack of information was the main factor hindering adaptation to climate change, while about 27% complained of appropriate technology. Also, about 27% of the respondents claimed the lack of necessary input as the factor hindering adaptation to climate change, while only about 2% complained of labour. This study reveals that lack of adequate information is the main factor hindering adaptation to climate change.

Table 16: Factors hindering adaptation

Limiting factors	Number	Percentage
Information	147	43.23
Appropriate technology	93	27.35
Necessary input	92	27.06
Labour	8	2.35
Total	340	100.00

3.3.5. Adaptation measures:

Adaptation measures embarked upon by the respondents to minimize the effect of climate change in the area is presented in Table 17. The distribution shows that about 30% of the respondents use seed tolerant variety, while about 26% alter their planting schedule. Also, about 21% of the respondents' plant early maturing seed, about 12% use different tillage system, and about 11% diversify their crops. This study has revealed that farmers adapt different adaptive measures to minimize the effect of climate change in the area. Information from focus group discussion revealed that some farmers have switched over from guinea corn to sweet potatoes due to crop failure arising from early cessation.

Table 17: Adaptation measures being used by farmers

Adaptation measures	Number	Percentage
Altering plant schedule	89	26.18
Using different tillage system	41	12.06
Tolerant seed variety	104	30.59
Planting early maturing seed	70	20.59
Crop diversification	36	10.59
Total	340	100.00

4. Conclusion and Recommendations

Majority of the farmers in the state are aware of climate change and they submitted that climate change has affected their farming activities in recent years. The effects mentioned include reduced crop yield, shortage of water and biomass for animals due to low rainfall and frequent dry spells. Similarly high temperature causes wilting of crops and diseases while excessive rainfall leads to destruction of farmlands and properties by flooding. The farmers are making efforts to adapt to climate change in various ways such as planting tolerant varieties, altering planting schedules, planting early maturing varieties and crop diversification. They however lack adequate information on how to adapt.

The following recommendations are proffered towards effective mitigation of and adaptation to climate change in the state.

- i. Farmers should adjust planting dates to avoid crop failure due to late onset and early cessation of rains.
- ii. Extension agents should be trained on climate change science to enable them pass adequate information to farmers on appropriate adaptation measures or strategies.
- iii. Farmers should be encouraged to go into dry season farming with support from relevant agencies.

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