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An Assessment of the level of Farmers Awareness and Adaptation to Climate Change in Northern Taraba State, Nigeria

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Abstract: This paper investigated the extent of awareness of climate change by local farmers in northern part of Taraba State, Nigeria. The study explores the choice of adaptation measures employed by the local farmers and the constraints to such measures. Descriptive statistics was used to analyze data obtained from a survey of 248 farmers from 31 villages in six local government areas of northern Taraba State. The finding of the study reveals that about 88% of the farmers are aware of climate change in the study area, however, only 48% of the respondents claimed they know the causes of climate change. 90% of the farmers claimed that they have been affected by recent changes in climate in the study area through low rainfall, excess rainfall, flooding and extreme high temperature. The study findings show that most of the farmers' opinion, observations and adaptation measures to climate change agrees with experts report. The study findings show that the common adaptation measures applied by the local farmer's in the study area include altering of planting season, use of different tillage system, use of tolerant seed variety, planting early maturing variety and crop diversification/mixing. Despite the peoples' awareness and adaptation to climate change in the study area, lack of finance hinders farmers from getting the necessary resources and technologies that facilitate adapting to climate change. The study recommends the need to increase farmers' accessibility to information on adaptive research findings on early maturing, insect/pest tolerant, and high yielding varieties through increase extension service and soft loans to the farmers.

Keywords: Adaptation; Assessment; Awareness; Climate change; Farmers.

1. Introduction

Climate change is a threat to agricultural development since its production activities are generally more vulnerable to climate change than other sectors (Ajetomobi and Abiodun, 2010). Decline in crop yield and food crop production due to reduction in rainfall and relative humidity, and increase in temperature has been observed in recent times in Nigeria (Agbola and Ojeleye, 2007). Like other developing countries, the challenge of climate change and global warming is enormous in Nigeria leading to widespread poverty (Sofoluwe *et al.*, 2011). Adaptation strategy is identified as one of the policy options to reduce the negative impact of climate change (Adger *et al.*, 2003; Kurukulasuriya and Mendelsohn, 2006; Sofoluwe *et al.*, 2011). Adaptation to climate change refers to adjustment in natural or human system in response to actual or expected climatic stimuli or their effects which moderates harm or exploits beneficial opportunities (IPCC Intergovernmental Panel on Climate Change, 2001). The knowledge of adaptation methods and factors influencing the choice of adaptation methods could enhance policy towards tackling the challenges climate change is imposing on Nigerian farmers. This is because agricultural sector in the Nigerian economy accounts for about 60-70% of employment of the labour force and 30 - 40% of the nation's gross domestic product (GDP) (Adejuwon, 2004). The level of awareness of climate change is rather low in Nigeria and its likely to continue if no intervention measures are taken (Anslem and Taofeeq, 2010). Lack of scientific data can constrain any effort to create awareness about climate change. Several attempts have been made to study the effect of climate change on agricultural productivity and farmers' adaptation in Nigeria's agriculture (Fakorede *et al.*, 2001; Sofoluwe *et al.*, 2011), but information on the farmers' level of awareness and factors influencing choice of adaptation methods by farmers in Nigeria has been limited.

Taraba state is an agrarian state with over 75 percent of its inhabitant dependent on agriculture as their main source of livelihood. This makes them most prone to the effects of climate change and variability. Although climate change has begun to create havoc in the study area, there is paucity of research work that examines the pattern of climatic change and local awareness and knowledge of this problem. This knowledge gaps may greatly reduce the failures in measures to develop effective monitoring, adaptation and mitigation measures to climate change in the study area. It is against this background that this study intends to examine the level of farmers' awareness and their

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adaptation to climate change and its implication to the attainment of food security in Taraba State Nigeria. The study covers the 6 LGAs that make up northern Taraba state.

2. Method and Materials

2.1. Description of the Study Area

Taraba state is the second largest state in terms of landmass in Nigeria. It is located in the southern part of north eastern Nigeria along the eastern borderland between Nigeria and Cameroon. The state lies roughly between latitude 6°25'N and 9°30'N and between longitude 9°30'E and 11°45'E. It is bordered on the west by Nassarawa and Plateau States, to the north by Bauchi and Gombe States and by Adamawa State to the northeast. It also shares its south western boundary with Benue State. Taraba State is bounded on the south and south east by the Republic of Cameroon (an international boundary). The state covers a land area of about 60,291km² with a population of about 2,300,736 people according to the 2006 census.

Taraba state is made up of 16 Local Government Areas (LGAs) and 3 Senatorial districts (northern Taraba, southern Taraba and Taraba central). Northern Taraba (the study area) consists of six LGAs, Ardo Kola, KarimaLamido, Lau, Jalingo, Yorro and Zing. The area has a tropical continental type of climate with wet summer and dry winter. Rainfall usually starts around May/June and ends at about September/October. The area receives an average rainfall of about 900mm per annum. The mean maximum temperature of the area is about 30°C. The highest air temperature is normally experienced in March and April. Maximum temperature ranges between 26°C to 39°C, while minimum temperature ranges between 15°C to 18°C the vegetation of the study area is the Sudan savanna woodland.

The major occupation of the people of northern Taraba State is agriculture. The crops cultivated include maize, guinea corn, millet, rice, cowpea, groundnut, melon, yam and cassava. Animal rearing is also very important and includes cattle, sheep and goats.

2.2. Data Collection

The data used for this study were obtained from a survey of farmers in six LGAs of northern Taraba state, Nigeria. The data were obtained during the 2012 cropping season. Data were collected using a pre-tested, well-structured questionnaire on socio-economic characteristics of the respondents, level of awareness of climatic variables, methods of adaptation, problems of adaptation and factors influencing choice of adaptation techniques. A total of 248 local farmers were selected from 31 villages of the six LGAs of northern Taraba State. The local crop farmers were chosen because the effect of climate change is likely to be more instantaneous on them. The data generated was analyzed using descriptive statistics which summarized the socio-economic characteristics of the local farmers, level of awareness of climate change, methods and problems of adaptation.

3. Result and Discussion of the Findings

The demographic data shows that 71.8% of the respondents are male and 28.2% are female as shown in Table 1 below. The demographic data also shows that 18.9% are within the ages of 20-30 years, 35.1% are between 31-40 years, 29.7% between 41-50 years and 16.3% are between the ages above 51 years. The result also shows that 49.6% of the respondents are married, 32.3% are single, 8.8% are divorcee and 9.3% widow.

Table-1. Demographic characteristics of respondents

GENDER		
Gender	Frequency	Percentage (%)
Male	178	71.8
Female	70	28.2
Total	248	100
AGE		
20 - 30yrs	47	21.3
31 – 40yrs	87	42.6
41 – 50yrs	74	26.9
51yrs and above	40	4.6
Total	248	100
MARITAL STATUS		
Married	123	49.6
Single	80	32.3
Divorcee	22	8.8
Widow	23	9.3
Total	248	100
Education		
No formal education	85	34.3

Continue

Primary education	52	21
Secondary education	60	24.2
Tertiary education	51	20.5
Total	248	100
Years of Farming		
0 – 10years	58	23.4
11 – 20years	102	41.1
21 – 30years	56	22.6
31 years and above	32	12.9
Total	248	100

Source: Fieldwork, 2012.

The study findings show that the most common crops cultivated in the study area include cereals, legumes and tubers such as Maize (26.6%), rice (21.9%), groundnut (13.3%) and yam (11.5%) as shown in Table 2. These crops which form the staple food in the study area are susceptible to the impacts of climate change.

Table-2.Common crops cultivated in the study area

Common crops in the study area	Frequency	Percentage
Maize	162	26.6
Rice	133	21.9
Guinea corn	47	7.7
Yam	70	11.5
Vegetable	11	1.8
Ground nut	81	13.3
Cassava	31	5.1
Cotton	1	0.2
Beans	55	9.0
Soya bean	2	0.3
Melon	1	0.2
Sugar cane	2	0.3
Millet	7	1.2
Bambara nut	5	0.8
Total		100

Source: Fieldwork 2012

Further analysis shows that 87.9% of the respondents were aware of changes in climate conditions in recent years, while 12.1% are not aware of any changes in climate. This corroborated the findings of Ishaya and Abaje (2008) which shows a high level of climate change awareness among local farmers in Kaduna area of northern Nigeria. When the respondents (local farmers) were asked if they know the causes of the change in climate conditions in recent years, 48 percent of them responded in affirmative, while 52 percent claimed that they don't know the causes of climate change. Also, when the farmers were asked if the changes in climate condition in recent years has affected their farming activities, 90.3 percent responded in affirmative while 9.7 percent of the respondents claimed that they don't know. The respondents stated that some of the changes in climate conditions that they have observed in recent years include low rainfall, excess rainfall, late onset of rainfall, early cessation of rainfall, flooding and extreme high temperature.

When the farmers were asked how low rainfall has affected them, their response ranges from reduced crop yield (91.1%) to reduce water for livestock (6.5%) as shown in Table 3.

Table-3.How low rainfall affects farmers in the study area

S/No	How low rainfall affect you	Frequency	Percentage
1	Reduced crop yield	226	91.1
2	Reduced water for livestock	16	6.5
3	Reduced grass or biomass for livestock	6	2.4
4	Total	248	100

Sources: Fieldwork 2012

On the other hand, when the farmers were asked how too much or excess rainfall affects them, their response ranges from destruction of farmlands by flood (81%) to submergence of houses by flood (11.7%) as shown in Table 4. This corroborated the findings of Oruonye (2012a); (Oruonye, 2012b) which shows an increasing cases of flood disaster in the study area with worse flood in 2005 and 2012 in which over 5000 farmlands were destroyed.

Table-4.How too much rainfall affects farmers in the study area

S/No	How too much rainfall affect farmers	Frequency	Percentage
1	Destruction of farmland by flood	201	81.0
2	Submergence of houses by flood	29	11.7
3	Death of livestock	18	7.3
4	Total	248	100

Sources: Fieldwork 2012

When the farmers were further asked how extreme high temperature affect them, their response ranges from wilting of crops (46.4%) to spoilage of farm produce (47.2%) as shown in Table 5. Yam which is a common crop in this zone is susceptible to spoilage with high temperature. Research findings also suggest that increase in temperature can lead to increase in pest development and fecundity and frequency of outbreaks of insect pest and diseases that affects crops and livestock (Spore, 2008). Thus, the increasing temperature in the study area has a tendency of affecting yam production in the study area, with implication on food security.

Table-5.How extreme high temperature affects farmers in the study area

S/No	How extreme high temperature affect farmers	Frequency	Percentage
1	Wilting of crops	115	46.4
2	Spoilage of farm produce	117	47.2
3	Death of livestock	16	7.3
4	Total	248	100

Sources: Fieldwork 2012

4. Adaptation to Climate Change

When the farmers were asked if they have been making any effort to adopt or adjust to climate change regarding their farm operation, 69.8 percent of the respondents respond in affirmative while 30.2 percent insist that they have not been making any effort. In terms of accessibility to adequate information on how to adapt to climate change, 41.9 percent of the respondents believed that they do have access to adequate information while 58.1 percent claimed that they do not have access to adequate information on how to adapt to the problem of climate change. When the respondents were asked what major challenges can hinder or limit their adaptation efforts in the present circumstance, the respondent response ranges from information accessibility (54.4%), appropriate technology (20.2%), necessary inputs (11.3%) and required labour for adaptation measures (14.1%) as shown in Table 6. Ishaya and Abaje (2008) reported similar findings in their study in Kaduna state and Onyeneke and Madukwe (2010) in south east rainforest zone of Nigeria.

Table-6.Constraint to farmers' adaptation effort in the study area

S/No	Constraints to farmers adaptation effort	Frequency	Percentage
1	Information	135	54.4
2	Appropriate technology	50	20.2
3	Necessary inputs	28	11.3
4	Required labour for adaptation measures	35	14.1
5	Total	248	100

Sources: Fieldwork 2012

On the most suitable adaptation measures applicable or relevant to the farmer's immediate environment, the respondent's response ranges from altering of planting season (27%), use of different tillage system (23.4%), use of tolerant seed variety (14.1%), planting early maturing variety (29%) and crop diversification/mixing (6.5%) as shown in Table 7.

Table-7.Adaptation measures suitable or relevant in the study area?

S/No	Adaptation measures suitable in your area	Frequency	Percentage
1	Altering the planting schedule (date of planting) of crops	67	27.0
2	Using different tillage system	58	23.4
3	Using tolerant seed variety	35	14.1
4	Planting early maturing varieties	72	29.0
5	Crop diversification/mixing	16	6.5
6	Total	248	100

Sources: Fieldwork 2012

5. Discussion

The findings of the study show that the farmers were very much aware of the recent increase in rainfall in the study area which resulted in flood disaster. The losses that the farmers incurred in the last flood disaster which ranges from loss of farmlands, crops, livestock and homesteads among others (Oruonye, 2012a;2012b) were still fresh in their memories. Although one may think that the local farmers in the study area may not understand the concept of global warming or climate change, but they observe and feel the effects of decreasing rainfall, increasing air temperature, increasing sunshine intensity and seasonal changes in rainfall patterns. An increase in temperature is conducive for a proliferation of pests and diseases, which are detrimental to crop production (Ozor and Nnaji, 2011). Increased temperatures and accompanying decrease in water availability reduce the length of growing seasons and yield potential and hence the areas suitable for agriculture, further adversely affecting food security over the continent (Thornton *et al.*, 2006). The observations of the farmers are corroborated by a study that recorded a reduction in mean annual rainfall of 22.2 percent and a gradual rise in average maximum temperatures of 1.3°C or 4.3 percent from the 1961 to 2006 in West Africa (Gyampoh *et al.*, 2007). Increasing temperature and intense sunshine, coupled with prolonged rainfall shortages, cause crops to wilt. Some cocoa growers described their trees withering as a result of exposure to intense and prolonged sunshine.

Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC, 2001). Adaptation methods are those strategies that enable the individual or the community to cope with or adjust to the impacts of the climate in the local areas. Adaptation to climate change includes all adjustments in behaviour or economic structure that reduce the vulnerability of society to changes in the climate system (Smith *et al.*, 1996). Such strategies will include the adoption of efficient environmental resources management practices such as the planting of early maturing crops, adoption of hardy varieties of crops and selective keeping of livestock in areas where rainfall declined. They also include the use of technological products that enable the individual to function in the “new” condition. Obviously, adaptation strategies are expected to be many, and their combinations in various ways will be required in any given location. Whether people can adapt, and for how long, depends on the resources available (Onyeneke and Madukwe, 2010).

The study findings show that the common adaptation measures applied by the local farmer’s in the study area include altering of planting season, use of different tillage system, use of tolerant seed variety, planting early maturing variety and crop diversification/mixing. The use of tolerant seed and animal varieties/species provides useful adaptations and resilience to the effects of climate change. Such crops or animals are known to survive and complete their life cycles normally even when the environment will not allow others to thrive. The increased adoption of tolerant varieties/species may not be unconnected with the fact that farmers encounter serious pest and disease infestations and weed growth, which have been recognized as the most significant effects of climate change (Ozor and Nnaji, 2011). It has already been reported that one of the many adaptations to climate change involves the use of resistant varieties such as early maturing varieties or drought resistant ones (Maddison, 2006). Mixed farming practice is adopted by farmers for many reasons such as to ensure food security, increased income, reduced incidence of pests and diseases, among others (Ozor and Nnaji, 2011). These common adaptation methods adopted by the local farmers agrees with modern climate change adaptation measures advocated by scholars (Bradshaw *et al.*, 2004);(Kurukulasuriya and Mendelsohn, 2006; Nhemachena and Hassan, 2007; Onyeneke, 2010).

Despite the peoples’ awareness and adaptation to climate change in the study area, lack of finance hinders farmers from getting the necessary resources and technologies that facilitate adapting to climate change. Adaptation to climate change is costly (Deressa *et al.*, 2008), and the need for intensive labour use may contribute to this cost. Thus, if farmers do not have sufficient family labour or the financial means to hire labour, they cannot adapt (Onyeneke and Madukwe, 2010). Africa is the region most vulnerable to the negative impacts of climate change and at the same time has low adaptive capacity. But the people, particularly at the local level, are making efforts to adjust to the changes they observe.

None of the farmers indicated use of irrigation as an adaptation measure to climate changes in the study area. This corroborates with earlier findings of Oruonye (2011) that farmers are not exploiting fully the huge irrigation potentials of the area. The limited use of irrigation in the area could be attributed to its capital intensive requirements, lack of agricultural inputs and the total dependence on rainfed agriculture. The main barriers to adaptation to climate change are lack of information on appropriate adaptation option, lack of finance, and shortage of farm labour.

6. Conclusion

The study has investigated the extent of awareness of climate change by local farmers in northern parts of Taraba State, Nigeria. The study explores the choice of adaptation measures employed by the local farmers and the constraints to such measures. The findings of the study show that most of the farmers were aware of climate change in the study area, however, only a few of the respondents claimed they knew the causes of climate change. Most of the farmers claimed that they have been affected by recent changes in climate in the study area through low rainfall, excess rainfall, flooding and extreme high temperature. The study findings show that most of the farmers’ opinion, observations and adaptation measures to climate change agree with experts report. The study findings show that the common adaptation measures applied by the local farmer’s in the study area include altering of planting season, use

of different tillage system, use of tolerant seed variety, planting early maturing variety and crop diversification/mixing. Despite the peoples' awareness and adaptation to climate change in the study area, lack of finance hinders farmers from getting the necessary resources and technologies that facilitate adapting to climate change.

7. Recommendations

Based on the findings of the study, the following recommendations were made;

- i. There is need to intensify effort at environmental enlightenment campaign through jingles in mass media and local farm exhibitions on the effects of climate change.
- ii. There is need to increase farmers accessibility to information on adaptive research findings on early maturing, insect/pest tolerant, and high yielding varieties among others through increase extension services in the study area.
- iii. Extension services should be improved upon.

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