Awareness and Adaptation to Climate Change among Small-Scale Farmers in Emohua Local Government Area of Rivers State, Nigeria

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Abstract: This study examined the awareness and adaptation to climate change among small-scale farmers in Emohua L.G.A in Rivers State. Data for the study were collected from 60 respondents selected through the Multi-stage sampling technique. A socio-economic analysis of the respondents indicated that the average age of respondents' was 49 years and majority (90%) had attended at least primary school. The study also revealed that a majority (92. 3%) of the respondents were small-scale farm holders. Analyses of the source of climate change awareness revealed that majority (83.3%) of the respondents were aware of the phenomenon of climate change. Of that number, extension service and friends/neighbours were ranked high as sources of awareness about climate change, accounting for 33.3% and 25% respectively. Analysis of adaptation practices used by the respondents showed that planting ahead of rains, use of improved varieties and planting of cover crops were used mostly. Analysis of the relationships between some selected socio-economic variables and the use of climate change adaptation measures revealed that educational qualification and the number of extension contacts were the most important factors influencing the use of adaptation measures among the respondents. The main constraints on climate change adaptation measures by farmers in the study area were poor financial resources and unavailability of weather information. The study concluded that the majority of farmers were aware of climate change and its consequences. The study also concluded that although the majority of farmers were engaged in husbandry practices aimed at climate change adaptation, they were constrained by some factors; therefore we recommended that extension education should be strengthened to boost farmers' awareness of climate change and prepare them for adaptation measures and that appropriate/indigenous technologies be promoted for adaptation by farmers.
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1. Introduction

Agriculture is the main means of livelihood of the people of Emohua Local Government Area. The people depend on rain-fed agriculture. This implies that their agricultural productivity depends on climate variability. The growing problems of climate change have become a threat to food security and sustainable agricultural development of the rural communities in Emohua LGA. Evidence has shown that changing climate is already affecting crop yields in many countries, including Nigeria where majority of population are farmers (IPCC, 2007; Deressa *et. al.*, 2008; BNRCC, 2008; Nwaiwu *et al*, 2014; Orebiyi *et al*, 2014). This is particularly true in low-income countries like Nigeria where climate is the primary determinant of agricultural productivity and adaptive capacities are low (SPORE, 2008; Apata *et. al.,* 2009). Many African countries including Nigeria, which have their economies largely dependent on weather-sensitive agricultural production systems, are particularly vulnerable to climate change (Dinar *et. al.*, 2006). According to Apata *et. al.,* (2010), this vulnerability has been demonstrated by the devastating effects of recent flooding in different parts of the country and the various prolonged droughts that are currently being witnessed in some parts of Northern region. Although the understanding and perceptions of farmers in Sub-Saharan Africa about what climate change is and the extent to which it has changed are still vague.

Evidence from literature and several studies revealed that the recent global warming, fluctuation in rainfall patterns and flooding have influenced agricultural productivity leading to declining food production (Kurukulasuriya and Mendelsohn, 2006; IISD, 2007; Lobell *et. al*., 2008). The IPCC 4th African Assessment Report estimates that by 2020 between 75 and 250 million people are likely to be exposed to increased water stress and that rain-fed agricultural yields could be reduced by up to 50% in Africa if production practices remain unchanged. In order to support humanity's growing population, fertile soils, fossil groundwater, biodiversity and numerous other non-renewable resources are seriously being depleted (Abrahamsonn, 1989). This resource depletion has been linked with anthropogenic factors

on the environment. The most serious of these factors is the injection of greenhouse gases [(Carbon (IV) Oxide CO_2, Methane (CH_4), Nitrogen Oxide (NO_2),etc)] into the atmosphere. The reality of the impact of climate change on agricultural development has started showing signs (Adams *et. al*., 1998; Fischer *et.al*., 2002; SPORE, 2008).

Climate change has been identified as one of the greatest challenges to the persistent low agricultural productivity amidst myriads of efforts by government and other stakeholders to control it (Buckland, 1997; Matarira, *et. al*., 1995; Adama, *et.al*., 1998; Apata, *et.al*., 2009, and Nwaiwu *et. al.,* 2013). Many studies have shown the ravaging effects of climate change on agricultural productivity, (Slater *et. al*., 2007; IPCC, 2007; Deressa *et. al*., 2008, BNRCC, 2008; Nwajiuba, 2008; Nwajiuba, *et. al*; 2008, Nhemechena, *et al*; 2009; Nwajiuba and Onyeneke, 2010, Nwaiwu et. al., 2014 and Orebiyi et. al. 2014).

Over the years, smallholder farmers have adjusted agricultural systems and cultural practices to meet changing climatic/environmental conditions by adopting new technologies, changing crop mixtures and institutional arrangements. Such flexibility suggests a human potential to adapt to climate change (CAST, 1992; Rosenberg, 1992). Changes in temperatures and rainfall patterns as well as an increase in carbon dioxide (CO2) levels are expected to affect agriculture, especially in rural communities. Such changes may manifest in the reduction in land quality and low agricultural yields.

Climate change refers to any long-term change in the average weather conditions of a place (Umeghalu and Okonkwo, 2012). Average weather elements include temperature, rainfall, wind pattern, humidity, cloudiness, etc. It has to do with the variability or average state of the atmosphere over periods ranging from decades to millions of years. Conscious attempts at developing the rural areas and improve the livelihood of its inhabitants will have to be agriculture-oriented. It is known that climate change is affecting agriculture in many ways. A lot of studies have been carried out by agriculturalists, scientists and economists on the adverse effects of climate change. These studies show that agricultural production and productivity remain below thresholds in Nigeria, leading to food and fibre insufficiency and nutrition related negativities as a result of negative impact of climate change (Pearce, Cline, Achonta, Fankhauser et al, 1996; Parry, Rosenzweig, Iglesias, fisher and Livermore, 1999; NEST, 2004; Apata, Samuel and Adeola, 2009; Onyeneke, 2010; and Nwachukwu and Nnadozie, 2011). Mitigation measures and adaptation options must be put in place to reduce or cushion the negative impact of climate change. Mitigation strategies are actions and policies that reduce exposure to climate change, for example, through regulation and institutional changes, technological shift, alterations in behavior or changes in location. On the other hand, adaptations are actions and adjustments undertaken to maintain the capacity to deal with stresses induced as a result of current and future external change (IPCC, 2001). Mitigation and adaptation are processes of improving society's or farmers' ability to cope with change in climate condition across time scale, from short term (e.g. seasonal to annual) to the long-term (e.g. decades to centuries) Okezie and Simonyan (2011). This study tried to know the extent of awareness to climate change and adaptation strategies employed by small – scale farmers to cushion the effects of climate change in Emohua L.G.A. of Rivers state.

2. Objectives of the Study

The broad objective of this paper is to analyze the awareness and adaptation to climate change among small-scale farmers in Emohua L.G.A, Rivers State.

The specific objectives are:

1. identify the socio-economic characteristics of the respondents;
2. examine the level of awareness and sources of information about climate change among respondents in the study area;
3. analyze the adaptation mechanisms to climate change being used by the respondents in the study area;
4. determine the factors that influence adaptation to climate change by the respondents; and
5. identify the constraints to adaptation to climate change by small-scale farmers in the study area.

3. Material and Methods

(a) The Study Area

The study was conducted in Emohua Local Government Area of Rivers State. Emohua Local Government Area is located at North, East part of Rivers State. Emohua consists of fourteen political wards and the predominant occupation is farming. It has an area of 831 km^2 (321 sq mi) and a population of 201,901 at the 2006 census. It has common boundaries with Ogba/Egbema/Ndoni, Ahoada East, Ahoada West, Abua/Odual, Akuku Toru, Asari Toru, Obio-Akpor and Ikwerre.

The people of Emohua L.G.A are predominantly farmers, depending on rain-fed agriculture while some depend on other activities in the area, like trading, tailoring, hair dressing, etc. The villages in Emohua L.G.A are Emohua, Obelle, Ibaa, Elele Alimini, Ndele, Rumuji, Oduoha, Rumuekpe, Omudioga, Ovogo and Egbeda.

(b) Sampling Technique

A multistage sampling technique was used. All the communities in Emohua L.G.A were covered in this study. In stage one, all the ADP contact farmers where identified. The list of these farmers forms the sampling frame.

For stage two six communities were randomly, selected from the communities that make up the L.G.A. In the third stage, 10 farmers each from each of the six communities were randomly selected. This gave rise to 60 farmers used in this study.

(c) Data Collection

Data for this study were collected from both primary and secondary sources. Primary data were obtained by the use of structured questionnaires administered to the farmers. Secondary data were collected from published and unpublished literature. All the farmers' respondents were asked questions relating to their socio-economic characteristics, knowledge of climate change, adaptation practices undertaken as well as the constraints faced in adapting to climate change.

(d) Data Analysis

Data collected were analyzed using descriptive statistics (Tables, percentages frequencies and arithmetic mean) and econometric techniques.

4. Results and Discussions

(a) Socio-Economic Characteristics of Farmers – Beneficiaries

Age of Respondents

Age is relevant to the quality of the physical labour employed in any rural occupational activities especially in agriculture, which is the major occupation of the rural people of Emohua L.G.A. It is generally known that as individual ages the force exerted as well as his ability to withstand stress declines especially when it is realized that aging population are no longer able to source and synthesize information.

Table 1: Age Distribution of Respondents

Age of Respondents	No of respondents	Percentage
20 – 30	2	3.3
31-40	8	13.3
41-50	30	50.0
51-60	15	25.0
61 – above	5	8.3
Total	**60**	**100**

Source: Survey Data, 2015

Data on the percentage distribution of the respondents by age is presented in table 1. The table shows that most respondents (50%) were between 41-50 years of age. The average age of the respondents was 49 years. On the cumulative basis, 80.3% of the farmers were 41 years and above, indicating that a large proportion of the farmers are advancing in age and likely to have declining productivity. Aging farming population are less able to engage in modern agricultural practices and also less able to source and synthesize information (Idrisa *et al*, 2012.).

(b) Sex Distribution of Respondents

The respondents were also identified based on the gender distribution. This is shown in table 2.

Table 2: Sex Distribution of Respondents

Sex	No of respondents	Percentage
Male	25	41.7
Female	35	58.3
Total	**60**	**100**

Source: Survey Data, 2015

Table 2 shows that 58.3% of the respondents were women while 41.7 were men. This indicates that women play a significant role in agriculture and rural economy. This finding is supported by a previous study by Tasie, 2013.

(c) Marital Status of Respondents

Table 3: Distribution of respondents based on marital status

Marital Status	No. of Respondent	Percentage
Single	16	26.7
Married	35	58.3
Divorced	5	8.3
Widowed	4	6.7
Total	**60**	**100**

Source: Survey Data, 2015

Table 3 shows that 58.3% of the respondents are married. 26.7% are single, 8.3% are divorced and 6.7% are widowed.

(d) Educational Qualification of Respondents

Table 4: Distribution of respondents based on educational qualification.

Qualification	No. of Respondents	Percentage
No formal Education	6	10
Primary (FSLC)	17	28.3
Secondary (SSCE)	27	45
Tertiary	10	16.7
Total	**60**	**100**

Source: Survey Data, 2015

Table 4 shows the educational qualification of the respondents. If shows that 45% of the respondents finished secondary school. 16.7% of the respondents

finished tertiary institutions. 28.3% have first school leaving certificate while 10% never attended any formal school. On cumulative basis 95% of the respondents are literate and enlightened enough to be aware of climate change and have the capacity to develop indigenous agricultural practices for adaptation. Education is an important determinant in creating awareness in farming communities about climate change, since the farmers can source for their own information considering their educational background.

(e) Farm Size

Arable land is a very important resource in farming in Nigeria. Unfortunately, one of the problems to agricultural transformation in Nigeria is the atomistic and scattered nature of farm holdings in the study area due to increasing population and need for residential and industrial developments.

Table 5: Distribution Of Respondents Based On Size Of Farm.

Farm Size (Hectare)	No. of Respondent	Percentage
≤ 0.5	4	6.6
0.6-1.0	8	13.3
1.1-1.5	12	20.0
1.6-2.0	15	25.0
2.1-2.5	11	18.3
2.6-3.0	6	10.0
3.1-above	4	6.7
Total	**60**	**100**

Source: Survey Data, 2015.

Table 5 above shows that 25% of the respondents have between 1.6-20 hectares of farm land. Also 20% have 1.1-1.5 hectares of land, while 18.3% have 2.1-2.5 hectares of farm land. The table 4.5 further revealed that majority of the farmers are small-holder farmers and operate obviously at the subsistence level, making them susceptible to climate change. This is supported by Idrisa et al (2012) and Oyekele (2009).

(f) Household size

Table 6 shows the percentage of respondents by household size. Most respondents (50%) had between 4-6 people in their households, while 28.3% had between 1-3 persons in their households. Also, 15% of the respondents had 7-9 people in their households, while 6.7% had to people and above in their households. The average household size was found to be 5 persons per household.

Table 6: Distribution of Respondents Based On Household Size

Household Size	No. of Respondent	Percentage
1-3	17	28.3
4-6	30	50
7-9	9	15
10 and above	4	6.7
Total	**60**	**100**

Source: Survey data, 2015

(g) Awareness and sources of information about climate change among the famers-respondent.

(i) Awareness of Climate Change

Table 7: Distribution of respondents according to awareness of climate change.

Awareness of CC	No. of Respondent	Percentage
Yes	50	83.3
No	10	16.7
Total	**60**	**100**

Source: Survey data, 2015

Table 7 shows that 83.3% of the farmers – respondents are aware that there is climate change, while 16.7% of the farmers- respondents are not aware of climate change. This implies that majority of the farmers in the study area are aware of climate change. This result is supported by Orebiyi et al (2014) and Idrisa et al (2012).

(ii) Sources of Information about Climate Change

Table 8: Sources of information about climate change

Information Sources	Frequency	Percentage
Friends / Neighbours / Relatives	15	25.0
Media (Print / Electronic)	8	13.3
Extension Agents	20	33.3
Co-Operatives Societies	11	18.3
Nigerian Meteorological /Agency	1	1.7
Ngo's	5	8.4
Total	**60**	**100**

Source: Field Survey, 2015

Table 8 shows that farmers get information on climate change from various sources. About 33.3% gets their information from extension agents, 25% from friends / neighbours /relatives. Also, 18.3% get

their information from co-operative societies and is closely followed by 13.3% which get information from the media, with the least source of information about climate in the study area being **NIMET**. More needs to be done in the area of enlightenment and the farmers' climate smart. Empowering the extension agents with needed capacity would translate to more extension of needed information to farmers about climate change and mitigation and adaptation strategies to cushion the effect of climate change.

(h) Causes of Climate Change

Table 9: Causes of Climate Change

Causes	Frequency	Percentage
Industrial activities (Gas Flaring)	15	25
Domestic activities (burning fire wood)	8	13.3
Deforestation /bush burning	26	43.4
Over grazing of livestock	2	3.3
Emission of greenhouses gases($C0_2$)	6	10.0
Nature Phenomenon	3	5.0
Total	**60**	**100**

Source: Survey Data, 2015

Table 9 shows the perceived causes of climate change. 95% of the respondents believe that climate change is caused by human and animal activities. Only 5% believe that climate change is a natural phenomenon destined to happen.

(i)Adaptation Strategies to Climate Change

Table 10: Adaptation strategies to climate change

Adaptation Strategies	Frequency	Percentage
Use of cover crops / mulching	13	21.7
Use of improved/ tolerant varieties	15	25.0
Irrigation / water harvesting	10	16.7
Changing date of planting	11	18.3
Agro-forestry and planting trees	6	10.1
Mixed cropping / farming	5	8.3
Total	**60**	**100**

The respondents' adaptation strategies to influence of climate change are shown in table 4.10 above. It shows that 25% of farms use improved and tolerant varieties, 21% use cover crops and mulching as strategy. Also, 18.3% of the respondent's use changing of planting date, while 16.7% practice irrigation and water harvesting.10.1% use agro-forestry and planting of trees while 8.3% practice mixed cropping and mixed farming as a strategy. This is attributed to the understanding that people now sought and have easy accessibility to information firm different sources.

(j) Factors Determining the Adaptation to Climate Change

Factors that influenced the use of adaptation measures among the respondents were determined as shown on table 4.11. Adaptation was measured in terms of the number of strategies used by a respondent (table 10); the higher the number of such strategies used by respondents, the higher the rank in adaptation status. The result revealed that level of education of the respondents and extension visits were highly significant in influencing the use of adaptation measures among the respondents. Both variables were positive and significant at 0.01. This implies that as the level of education of the respondents' increase, the capacity to use the adaptation strategies correspondingly increases; the same applies to extension visits. These two variables (educational level and the frequency of extension visits) also affect awareness. This therefore implies that level of awareness among the respondents also influence the level of adaptation to climate change by the respondents.

Table 11: Estimates of Factors Influencing Adaptation to Climate Change

Adaptation to Climate Change	Coefficients	Std Error	Z-Statistics	Prob.
Age	-8.8144	4.45910	-1.97667	0.0081**
Level of Education	80.6456	20.583	3.73641	0.0000*
Household Size	54.4058	7.41850	-7.3334	0.0005**
Extension Visit	131.56	111.8750	7.99103	0.0000*
Constant	965.3053	446.4361	2.162247	0.0306

Source: Survey data, 2015

***Significant of 1%; **Significant at 5%**

(k) Constraints to Adaptation

Table 12 shows the constraints to adaptation to climate change among the farmers-respondents in Emohua L.G.A The table 4.12 shows that inadequate financial resources was the major constraint facing farmers in the study area which accounted for 80%, while poor access to weather information necessary for adoption and adaptation to climate change ranked second with 76.%. Extension serves was not a serious constraint to adaptation to climate change it accounted for 20%.

Table 12: Constraints to Adaptation to Climate Change

Constraints	Frequency	Percentage
Inadequate extension service	12	20.0
Poor access to the innovation	10	16.7
Inadequate financial resources	48	80.0
Non availability of weather information	45	75.0

Source: Survey Data, 2015
Multiple Responses Recorded.

As stated by Oyekele (2009), the small-scale farmers, having low resource base, are more vulnerable and less able to cope with the consequences of climate change. Such farmers also have lees likelihood of accessing weather information or capacity to develop technologies on their own.

5. Conclusion

In this study, awareness and adaptation to climate change among small-scale farmers' in Emohua L.G.A. Results of the study indicated that a large proportion of the respondents were 41 years and above, with the majority (90%) having formal education. Access to extension service was low in the study area, even though extension service played the leading role in providing information about climate change to the respondents. The study showed that use of improved and tolerant varieties (25%) was the leading adaptation measure by the respondents, followed by application of mulch/planting of cover crops. Important factors that influenced the use of adaptation practices among the respondents included level of education (P> |z| 0.01) and extension visits (P> |z| 0.01). Major constraints that militated against the use of adaptation measures include inadequate financial resource and unavailability of weather information.

6. Recommendation

Based on the findings of this study, we suggest the following recommendations: (1) extension service should be strengthened through organizing adult education programmes for farmers to expose them to climate change coping strategies, and (2) programmes should be put in place to attract young people into farming, especially young school leavers and young graduates. These recommendations can be accomplished through strengthening programmes such as the National Directorate of Employment (NDE) and the Agricultural Development Programme (ADP). (3) In addition, affordable climate change adaptation technologies should be appropriated and developed for resource-poor farmers to adopt.

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