



## **Climate Change: Perception and Determinants of Rural Farmer's Adaptation in Abia State**

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### **Authors' contributions**

*This work was carried out in collaboration between both authors. Author IVE designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors IVE and OKA managed the analyses of the study. Both authors read and approved the final manuscript.*

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### **ABSTRACT**

This study was carried to examine the determinants of rural farmers' adaptation to climate change, and their perception with respect to farmers' socio-economic profile. The study conducted in Abia state utilized 120 farmers selected from 4 communities and 2 Local Government Area's through multi-stage random sampling. Primary data was sourced and collected through a structured questionnaire which elicited information relating farmers' socio-economic characteristics, climate change incidences and perception; and adaptation. Result from the descriptive statistics suggest that majority (84.2%) of the farmers are male. Also, 61.9% are 49 years and above suggesting that rural farming now is mostly dominated by more advanced farmers. More of the farmers (42.9%) spent at most 6 years in school. In addition, and comparing with NIMET data on climate variables, more farmers (74.5%) of age 50 and above perceived the changes in climate in relation to precipitation more correctly relative to other age groups. Also, 90.9% of farmers with more than 13 years of education perceived correctly as compared to 80% of farmers with 0-6 years. About 64.4% of female farmers perceived correctly the changes in climate as against 60% of male farmers who

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perceived correctly. The Logit regression result used to analyze the determinants of adaptation of rural farmers to climate change in the study area revealed that number of years in school, access to credit, and co-operative membership showed positive significant relationship with adaptation. Gender of farmer however showed a negative relationship with adaptation of farmer to climate change. This study reiterates the importance of micro-credit in agricultural development and poverty reduction especially in the rural areas as it enhances the likelihood of adoption of adaptation practices by farmers. This study therefore calls for a more holistic approach in solving the problem of credit especially in the rural areas so as to increase farmers' capacity to adapt to the vagaries of a changing climate.

*Keywords: Climate change; perception; socio-economic profile; adaptation; Nigeria.*

## 1. INTRODUCTION

Climate is considered to be the average of the observed pattern of weather in an area over a relatively long period of time [1]. This observed pattern has continued to change with impending global and regional consequences; and especially on the world's poorest. The United Nation Framework on Climate Change [2] defines climate change as a "change that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods. This alteration would not only have global effects but would also spell doom even for local farming communities in developing countries like Nigeria.

According to [3], rain-fed farming dominates agricultural production in sub-Saharan Africa covering around 97 per cent of total cropland and exposes agricultural production to high seasonal rainfall variability. Rural farmers are directly exposed to these elements which affect their lives in one way or the other [4]. The high dependence on weather would entail that local variability in climatic conditions would affect farming systems and by extension agricultural yield. Evidence has shown that climate change has already affected crop yields in many countries [5,6]. There is therefore a need to understand and make right perceptions of the conditions so as it occurs; as according to [7], the knowledge and perceptions of communities and the people about climate variability/change influence the way they respond to mitigation and adaptation initiatives and climate policies. Hence perception of the correct effects of climate change could help reduce the negative impacts of climate change in the form of adopting an appropriate adaptation measure. Nevertheless, while perception would depend on a number of socio-economic factors of rural households,

farming households who perceive the changes in climate as a severe concern may decide to take more serious steps in terms of adaptation as compared to farming households who perceive climate change on a lighter note or do not observe changes in climate at all. Thus, it is important that farmers perceive climate change correctly in order to make appropriate decisions with respect to adaptation.

According to [8], in most studies rural farmers' level of awareness seems to be on increase regarding their experiences in change and length of seasons, incidence of environmental hazards such as flood, droughts, and crop failures, long term shift in wind speed, change in rainfall intensity and uncertainty of rain etc. Increased level of awareness would increase the likelihood of an effective response in the form of adaptation which will help reduce vulnerability and crop losses. Adaptation to climate change is an effective measure at the farm level, which can reduce climate vulnerability by making rural households and communities better able to prepare themselves and their farming to changes and variability in climate, avoiding projected damages and supporting them in dealing with adverse events [9].

Hence, understanding how farmers perceive changes in climate and what factors shape their adaptive behavior is useful for adaptation research [10]. On the basis of this, this study seeks to examine the perception of climate change in relation to farmers' socio-economic factors and also analyze the determinants of adaptation in the study area.

### 1.1 Research Objectives

- Profile the socio-economic characteristics of the rural farmers in the area.
- identify climate change incidence and events in Nigeria

- examine farmers' perception to climate change in relation to their socio-economic characteristics
- analyze the factors affecting rural farmers adaptation to changes in climate
- Proffer policy recommendation(s) based on result obtained

## 2. METHODOLOGY

### 2.1 Study Area

The study was carried out in Abia state. The state is located in the southern part of Nigeria, and lies within approximately latitudes 4°40' and 6°14' north, and longitudes 7°10' and 8° east. It covers a land mass of 5,243.7 square kilometers, and have a population of 2,833,999 according to the 2006 population censuses. There are three Agricultural Development Zones namely Aba, Umuahia, and Bende. Over the years the State has witnessed increased manifestation of climate events which have affected agricultural production negatively. The worst affected areas have been: Umuahia, Ikwuano, Ohafia, Abariba, Nkporo, Igbera, Isiukwato, and parts of Arochukwu in Bende zone; others include Umuezeukwu and other surrounding villages like Umuodeche, Nbawsi, Umuogu, Ikputu, and Agburuikwe in IsialaNgwa L.G.A.

### 2.2 Data Source and Collection

Primary data was used for the study. Primary data was sourced from rural farming households in the study area. Collection of data was through a structured questionnaire designed to collect information on the socio-economics characteristics of the households, household perception of climate change, and adaptation measures adopted in coping with climate change. Data were also collected with interviews with key informants. The key informants are household heads of communities, and community chiefs. They were accosted in their homes and then interviewed.

### 2.3 Sampling Technique

Multistage random sampling method was used for the study. Abia state was purposively selected for the study. In the second stage, Bende and Umuahia was selected based on the severity of environmental related issues in the area. Thereafter, two L.G.A's (Bende and Ikwuano) was selected at random from where 4 villages (Amaogwu, Ameke, Itunta, Obioha,) was

selected. In the last stage, 30 households were selected randomly making a total of 120 respondents to be used for the study.

### 2.4 Analytical Technique

The objective will be analyzed using descriptive and inferential statistics. Descriptive statistics including tables and charts will be used to examine rural farmers' perception to climate change in relation to their socio-economic characteristics. Also, binary logit regression model will be used to analyze the determinants of rural farmers' adaptation to climate change in the study area.

### 2.5 Model Specification

To examine farmers' perception to climate change in relation to their socio-economic characteristics, historical/time series data of climatic variables obtained from NIMET; Nigeria's authoritative source of information on contemporary climate in the country. The data is based on empirical observations collected from NIMET's network of meteorological stations spread across Nigeria. The empirical data of the review of the climate over Nigeria as published in 2010 would be compared with results of respondents in relation to the climate variable under consideration (precipitation), and socio-economic characteristics of the respondent including age, number of years spent in school, and gender.

To analyze the determinants of adaptation of rural farming households to changes in climate Logit model was used. The Logit model is estimated with maximum likelihood estimation (MLE) technique.

The implicit model of the regression is specified as follows:

$$Y = \log(p/1-p) = f(X_1, X_2, X_4, X_5, X_6, e_i)$$

Where: The logit of a number  $p$  between 0 and 1 is given by the formula:

$p$  is the probability while  $(1 - p)$  is the corresponding odds, and the logit of the probability is the logarithm of the odds  
 $Y$  = Adaptation status of respondent (Adopt adaptation = 1, no adaptation = 0)  
 $X_1$  = Respondent's age (years);  
 $X_2$  = Respondent's gender (Dummy variable; male=1, female =0);

X3 = Respondent's educational level (years spent in school);  
 X4 = Respondent's access to credit facility (credit access =1, no access=0)  
 X5 = Respondent's access to extension agents (access = 1, no access =0)  
 X6 = Respondent's membership of co-operative society (co-operative member =1, non-member =0)  
 ei = Error term.

### 3. RESULTS AND DISCUSSION

#### 3.1 Socio-economic Characteristics of Rural Farming Households in the Study Area

The socio-economic profile of rural farmers is shown in Table 1. According to the result as shown, majority (84.16%) of the farmers are male headed compared to 15.83% that are females. Also, 61.9% and 28.57% are 49 years and above and between 40 and 49 years respectively. Only 9.52% of the rural farmers are

aged between 30 and 39 years. This suggests that rural farming now is mostly dominated by more advanced farmers. The number of years spent in school also shows that 42.86% of the farmer respondents spent at most 6 years in school as compared to 7.14% who spent more than 13 years in school. In addition, 28.57% and 21.43% respectively spent between 7-9 and 10-12 years in school. The income per annum of farmers shows that 71.43% earn at most #50,000, 16.67% earn between #51000-\$100000, while 4.76% earn above #150,000 respectively. Household size is an important ingredient amongst rural farming households in Nigeria as it constitutes labor for farm families. Accordingly, 57.14% of farmers have households of between 4 and 6, while 29% have households of between 1 and 3. 9.52% of the surveyed farmers have above 6 children. With respect to farm size, 66.67% of farmers have farm sizes of 0-6 hectares, 21.43% have between 7-12 hectares, 4.76% have between 13-18 hectares, 2.38% have between 19-24 hectares, while 4.76% have above 25 hectares of farm land.

**Table 1. Socio-economic characteristics of rural farmers in the study area**

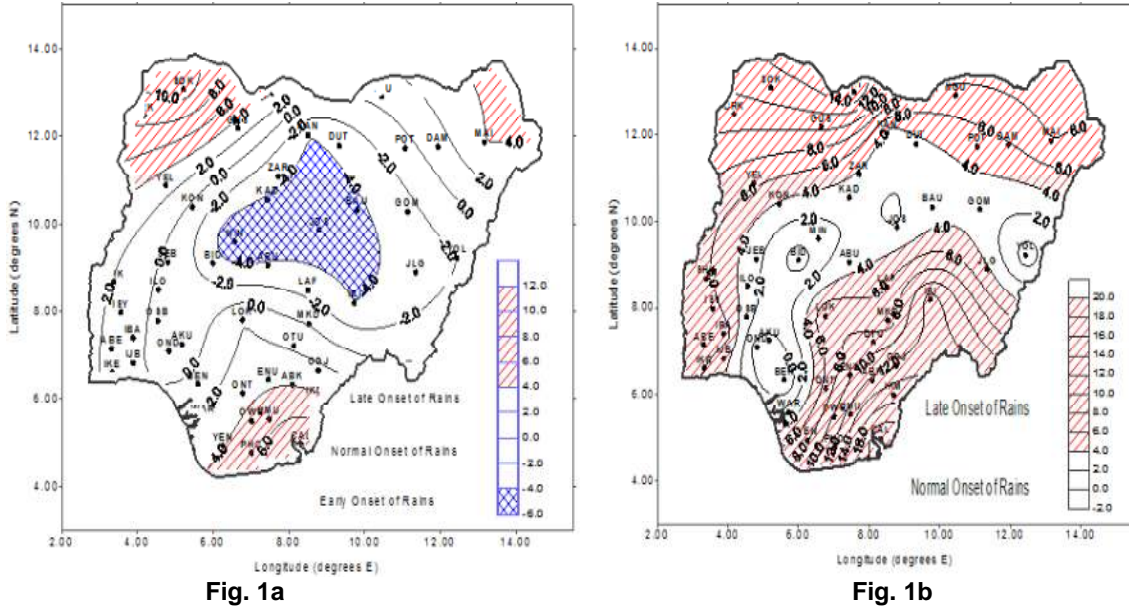
Variable	Frequency	%
<b>Sex (HH Head)</b>		
Male	101	84.16
Female	19	15.83
<b>Age (HH Head)</b>		
20 – 29	-	-
30 – 39	25	9.52
40 – 49	36	28.57
50 and above	59	61.90
<b>No. of years in school (HH Head)</b>		
0 – 6	41	42.86
7 – 9	31	28.57
10 – 12	37	21.43
12 and above	8	7.14
<b>Income</b>		
0 – 50000	76	71.43
51000 – 100000	20	16.67
101000 – 150000	9	7.14
150000 and above	16	4.76
<b>Household size</b>		
1 – 3	43	29
4 – 6	63	57.14
6 and above	15	9.52
<b>Farm size</b>		
0 – 6	86	66.67
7 – 12	20	21.43
13 – 18	3	4.76
19 – 24	2	2.38
25 and above	10	4.76

### 3.2 Climate Change Evidence and Incidences in Southern Nigeria

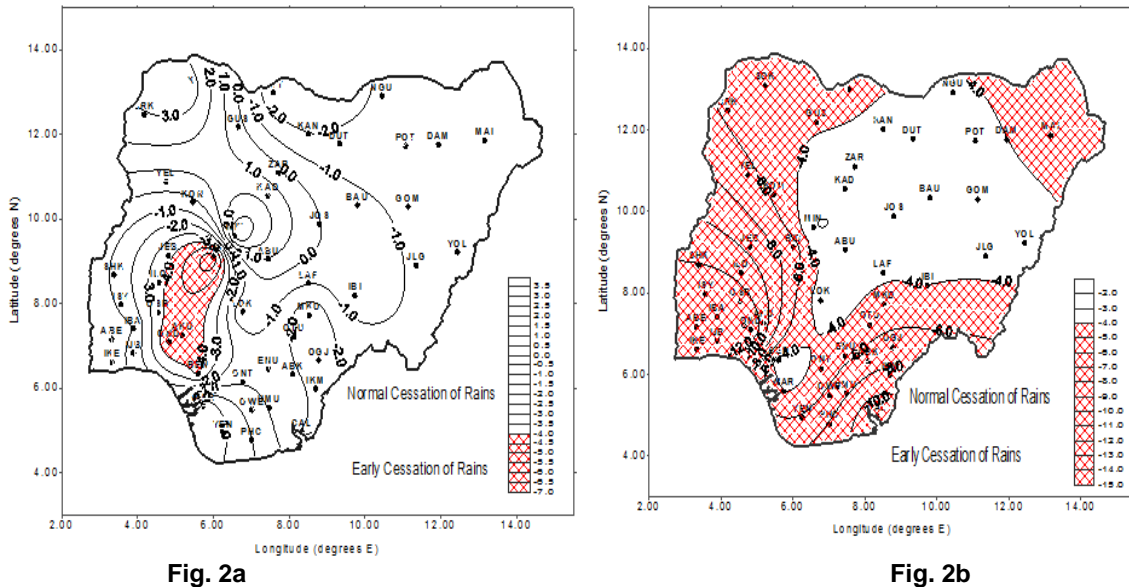
The climate of Nigeria has shown considerable signals of a changing climate through the careful study of meteorological data. Analysis of long term trends of meteorological parameters such as rainfall, in terms of onset and cessation of the rainy season [11]. Between the periods of 1941-

1970, only a few areas experienced late onset of rains. However between 1971-2000 a large portion of the country has consistently been experiencing late onset of rains.

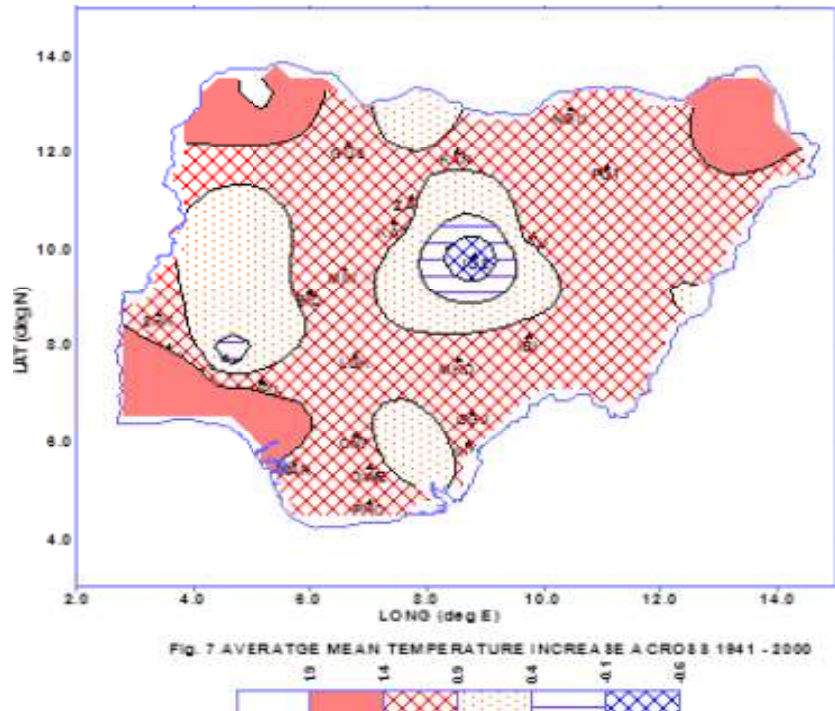
Similarly, the cessation of the rainy season in the country transformed from being generally "normal" between 1941 and 1970 to "early cessation" during the 1971 – 2000 period.



**Fig. 1. Rainfall data with respect to onset**  
Source: NIMET, 2008



**Fig. 2. Rainfall data with respect to cessation**  
Source: NIMET, 2008



**Fig. 3. Temperature data**  
Source: NIMET, 2008

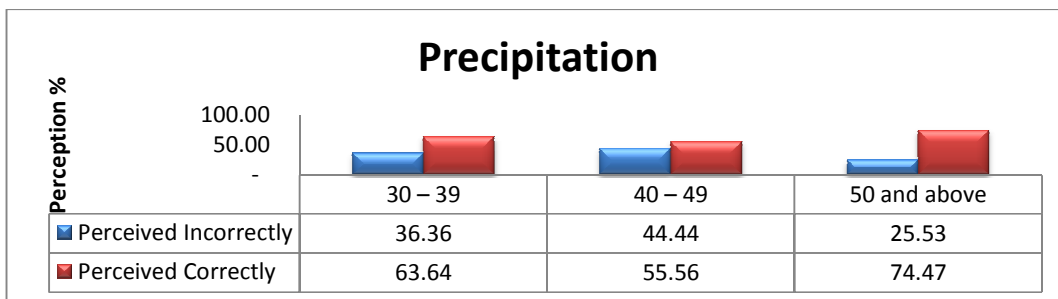
Also, and as indicated by NIMET, there has been a considerable variation in temperature in the country. From 1941 – 2000 evidence has pointed to an increase in temperature in most parts of the country.

### 3.3 Perception of Rural Farmers to Climate Change in Relation to Socio-economic Characteristics

#### 3.3.1 Perception with respect to age of respondents

Perception of climate change effects (precipitation) by age was examined to determine if age influences farmers' perception

to climate change in the study area. As shown in Fig 4. 63.64% of rural farmers aged 30-39 years perceived correctly the changes in climate in relation to onset and cessation while 36.36% perceived incorrectly. On the other hand, 55.56% aged 40-49 years of age perceived correctly while 44% perceived the changes incorrectly. Also, of the rural farmers aged 50 above years, 74% perceived correctly while 25.53% perceived incorrectly the changes in climate in relation precipitation. The result suggest that older and more experienced farmers perceived more correctly the changes in climate relative to younger less experienced farmers.



**Fig. 4. Perception with respect to age of respondents**

**3.3.2 Perception with respect to number of years in school of respondents**

Perception of climate change effects (precipitation) by the number of years in school was examined to determine if the years spent in school by rural farmers influences farmers' perception to climate change in the study area. Result from Fig. 5 indicate that 90.91% of respondents who spent above 13 years in school perceived correctly the changes in climate in relation to onset and cessation of rainfall compared to 9%, while 81.82% of respondents who spent above 10-12 years in school perceived correctly as compared to 18.18%. In addition, about 88.89% of respondents with 7-9 years of education perceived correctly the changes in climate with respect to onset and cessation as against 11.11%. Also, 80% of respondents with 0-6 years of education perceived correctly changes in climate with respect to precipitation. The result suggest that respondents with more years of education perceived more correctly changes in

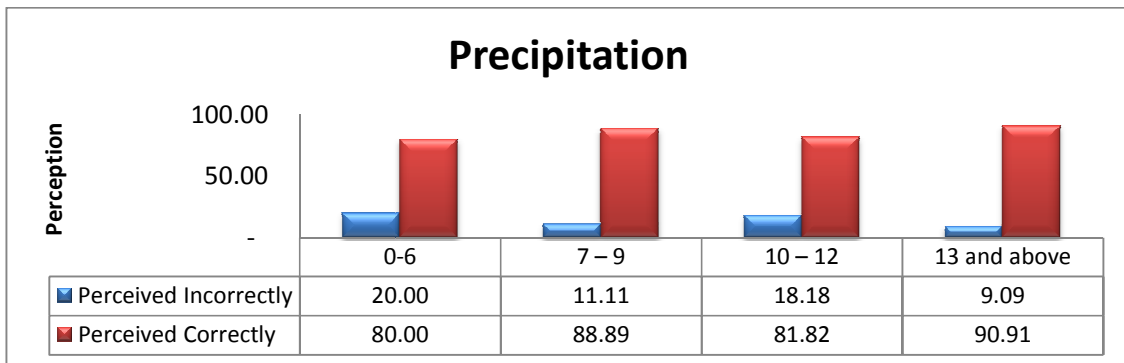
climate with respect to rainfall than respondents with fewer years of education.

**3.3.3 Perception with respect to gender of respondents**

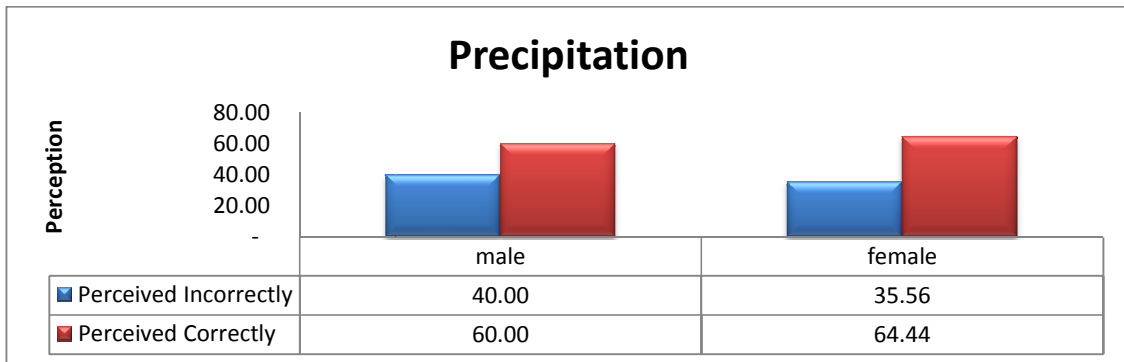
Perception of climate change effects (precipitation) by gender was examined to determine if gender influences farmers' perception to climate change. According to the result, 64.44% of female respondents perceived correctly the changes in climate with respect to precipitation against of 60%males who did not perceive the changes correctly.

**3.3.4 Perception of temperature with respect to age of respondents**

Fig. 7 shows respondents perception of temperature with respect to their age distribution. Majority of the respondents perceive correctly the change in climate with respect to temperature in conformity with the NIMET information on temperature as given in Fig. 2.



**Fig. 5. Perception with respect to number of years in school of respondents**



**Fig. 6. Perception with respect to sex of respondents**

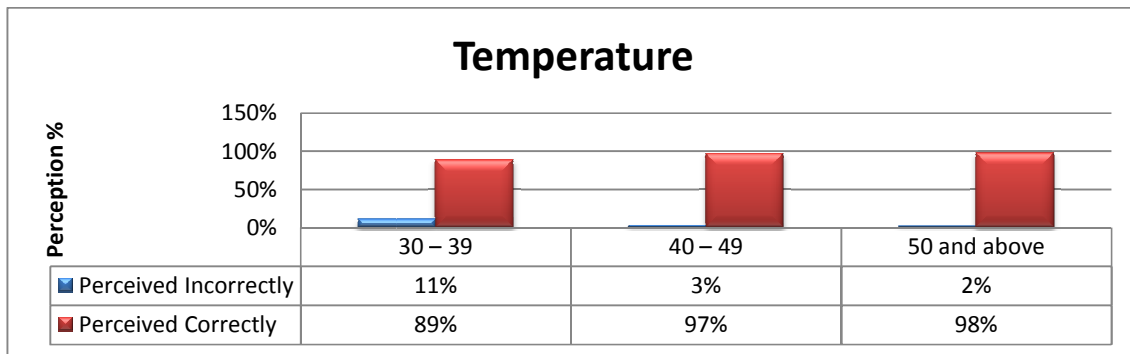


Fig. 7. Perception of temperature with respect to age of respondents

Table 2. Determinants of rural farmers Adaptation to climate change in Abia state

Number of obs = 120	Wald chi2(6) = 34.68		
Log pseudolikelihood = -43.147137	Prob> chi2 = 0.0000		
	Pseudo R2 = 0.3968		
Adaptation	Coef.	Std. Err.	P> z
Age	.004654*	.0266071	0.861
Sex	-1.274297	.6666267	0.056*
Years in sch.	.2090811	.0992588	0.035*
Credit access	3.045154	.7111021	0.000**
Extension	.5344064	.6229826	0.391
Cooperative mem.	1.581549	.6870244	0.021*
cons	-2.992095	1.249459	0.017

Note: \*\* Significant at 1%, \* Significant at 5%

#### 4. DETERMINANTS OF RURAL FARMERS ADAPTATION TO CLIMATE CHANGE IN THE STUDY AREA

The Logit regression result used to analyze the determinants of rural farmer adaptation to climate change in the study area is shown below. The model showed a good fit with a number of significant variables. The result indicated that gender, number of years in school, access to credit, and co-operative membership significantly influenced adaptation to climate change; while access to extension agents showed positive but however not significant. Accordingly, the number of years in school showed a positive relationship with adaptation implying that more educated farmers are more likely to adapt than less educated the rural farmers. Access to credit also showed a positive relationship with adaptation. These results reiterate that importance of micro-credit to rural farmers as it encourages the adoption of adaptation practices in the face of climate change. In addition, membership of co-operative society also showed a positive with adaptation. Co-operatives and

other similar societies play important roles in advancing the interest of the individual farmer. On the other hand, gender showed a negative relationship with adaptation implying that female farmers are more likely to adapt in the face of climate incidences.

#### 5. CONCLUSION

This study examined the determinants of adaptation to climate change amongst rural farmers in Abia state, Nigeria. Result from the study indicated that perception of climate change is related to farmers' socio-economic characteristics in this case age, education level, and gender. In addition, the logit regression result showed that number of years in school, access to credit facilities, and co-operative membership all positively influenced adaptation in the study area.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.



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