SOCIOECONOMIC RESPONSE PATTERNS OF FARMERS TO CLIMATE CHANGE IN AFRICA: LESSONS FROM SOUTHEAST NIGERIA

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ABSTRACT
The potential of African agriculture to support livelihoods for millions of people and employment for up to 60% labour has been heavily impeded by the growing threat of climate change. This challenge has left farmers to face the pressure to adjust the agricultural systems under widespread poverty, high population and low productivity resulting in low coping capabilities. Consequently, this study sought to examine to socioeconomic response patterns of farmers to climate change in Southeast Nigeria. Specifically, it assessed the level of awareness of climate change adaptation options among farmers; determined the rate of adoption of climate change adaptation measures and estimated socio-economic factors influencing their choice of the adaptation categories. With multistage sampling technique, 360 farmers were selected from three out of five states that make up the Southeast of Nigeria from whom data and information were elicited using pretested and structured questionnaire. Analysis of data was done using descriptive statistics, adoption formula and probit model. Results show that level of awareness of climate change adaptation measures and their adoption rate was low. The likelihood of adapting reactive options was influenced by predominantly by education, farm size and membership of cooperatives while the probability of choosing the anticipatory or proactive adaptation options was affected by extension contact. The need to sensitize and incentivize has become imperative if climate compatible development which involves food security paradigms is to be achieved.

Keywords: Climate change, Adaptation, Socioeconomics and Southeastern Nigeria

INTRODUCTION
Climate change is considered one of the most pressing environmental problems facing the globe today. This is because it is affecting patterns of life and general living conditions of people around the world: the availability of water, food production, weather conditions, health, cultures, economic well-being, and recreation among others. This scenario presents a major challenge especially to agriculture in Africa, severely compromising food security and livelihoods for millions of people (Nyasimi *et al*. 2014). Africa is a region considered a climate change hotspot due to its high population with widespread poverty and large areas under low agricultural productivity. As such, the region is prone to high climatic stresses which further compound the problem (Aggarwal *et al*., 2013).

Research at the community - and household-levels has provided insight into particular adaptation strategies and impacts (Below *et al*., 2012; Vermeulen *et al*., 2011), but it remains unclear to what extent these strategies and impacts are generalizable. Furthermore, there is a gap in literature on the particular adaptation behaviour of households across multiple regions in response to changes in climate (Wood *et al.*, 2014).

According to Pachauri and Reisinger (2007) and Gifford *et al* (2011), climate change is primarily driven by greenhouse gas (GHG) emitting human behaviors, such as the burning of fossil fuels, and therefore may be largely mitigated by changes to those behaviors. However, human behavior is the least-understood aspect of the climate change system; unfortunately, the main cause of the problem is the very aspect of it that is least understood. Worldwide GHG emissions resulting largely from human causes continue to rise despite official efforts to promote mitigation and reports from many citizens that they are taking steps to overcome the problem. We have a considerable opportunity and an enormous responsibility to effect change through increased understanding of the factors that underlie the anthropogenic causes of climate change and the ways in which GHG-mitigating behaviors may be effectively encouraged. Although a dire need for more research remains, a body of knowledge already exists in behavioral science which elucidates some of the key mechanisms that underlie climate change-relevant behavior and points to some promising avenues for human responses to the climate crisis through behavioral interventions.

Farmers respond to climate change by mitigation or adaptation with adaptation interested in reducing the impacts. Although both measures are complementary, emphasis seems to be on adaptation because some degree of global warming is inevitable. This is the result of a fact that adaptation is interested in reducing the impacts of climate change and perceives as a local response to a local need (Garcia *et al*. 2014).

While behavioural change is recognized as being central to effective response to climate-change, there has been relatively little consideration to how this might be achieved. This is not surprising given the complexity of both climate and behaviour changes. Stern (2006) emphasized the removal of barriers to behavioural change as a required policy element for climate change adaptation but this has taken some time to be tackled directly. Often, the first area of focus in relation to behaviour studies are people's attitudes and that is why targeting the households (unit of society's decision making mechanism) is necessary as a growing unit for analysis in relation to climate change (Davis, 2009; Moore, 2012).

Farmers, who constitute bulk of the poor in Africa, face prospects of tragic crop failures, reduced agricultural productivity, increased hunger, malnutrition and diseases. It has been projected that crop yields are to decline by as much as 50% in 5 years time (2020) and revenues to fall by up to 90% by 2100 in Africa (Nyasimi *et al*, 2014). This is particularly because African agriculture is predominantly rain-fed and hence fundamentally dependent on the vagaries of weather. As people of Africa strive to overcome poverty and advance economic growth, this phenomenon threatens to deepen vulnerabilities, erode hard-won gains and seriously undermine prospects for development (Zoellick, 2009). These have plausibly also prompted the problem of weak response of poor farmers to damages caused by weather elements. More so, the situation is exacerbated by the absence of functional policies that prompt quick government response to climate based disasters on smallholder farmers in Nigeria. The need to fill the identified research gaps has prompted this study which sought to examine the socioeconomic response patterns to climate change in Southeast Nigeria. Specifically, it assessed the level of awareness of climate change adaptation measures among food crops producing households in the study area and analyzed socio-economic factors influencing the choice of adaptation categories by the households.

METHODOLOGY

The study was conducted in the Southeast zone of Nigeria. The zone consists of five states namely: Abia, Anambra, Ebonyi, Enugu, and Imo States and located on latitudes 5°06'N to 6°34'N of the Equator and longitudes 6°38'L and 8°08'L of the Greenwich (Prime) Meridian (Onyeneke and Madukwe, 2010).

The Southeast Nigeria is a rainforest belt of tall trees with dense undergrowth of shorter species dominated by climbing plants. The prolonged rainy season, resulting in high annual rainfall above 1,800mm, humidity of above 80% during the rainy season, and temperature of 27°C annually in this area; ensures adequate supply of water and promotes perennial tree growth. The inhabitants of this zone are predominantly farmers producing mainly food crops like cassava, yam, and maize (Nwajiuba and Onyeneke, 2010).

According to NPC (2007), the population of the Southeast zone stood at 16, 381, 729 persons, disaggregated into 8, 306,306 males and 8, 075, 423 females. The study employed pragmatic approach (mixed methods) which entails using the method that appears best suited for the research problem given its socio-economic focus. It grants the researcher(s) the freedom to use any of the methods, techniques and procedures typically associated with quantitative or qualitative research. However, multistage sampling technique was employed in the selection of households from the agricultural zones of 5 states (Enugu, Imo, Abia, Anambra and Ebonyi) that make up the Southeast of Nigeria (Fig 1). In stage one, 3 states were randomly selected from the 5 states that make up the Southeast of Nigeria. In stage two, 4 local government areas each were selected randomly from each state selected across the zones (ie 12 LGAs). The third stage involved random selection of 3 communities each from the 12 local government areas set aside for the study (36 communities). The last stage was random selection of 10 food crops producing households from the communities, giving a sample size of 360 households.

The information and cross- sectional data required for the study were elicited from the households selected with a pretested and structured questionnaire. Data collected include the socio-economic characteristics of the households, farming practice, output and input values and prices, adaptation options etc.

The study used well trained enumerators and supervisors for data collection. As part of ethical consideration, the households were told that the data and information gathered would be treated strictly confidential and only for research purposes. GPS device was employed in taking the coordinates of the location for the purposes of developing a map.

In assessing the level of awareness of climate change adaptation options among the households (objective i), descriptive statistics were applied. To determine the level of adoption of the adaptation measures, adoption formula was employed (objective ii). In addressing socioeconomic factors influencing the choice of adaptation categories, a probit model was estimated.

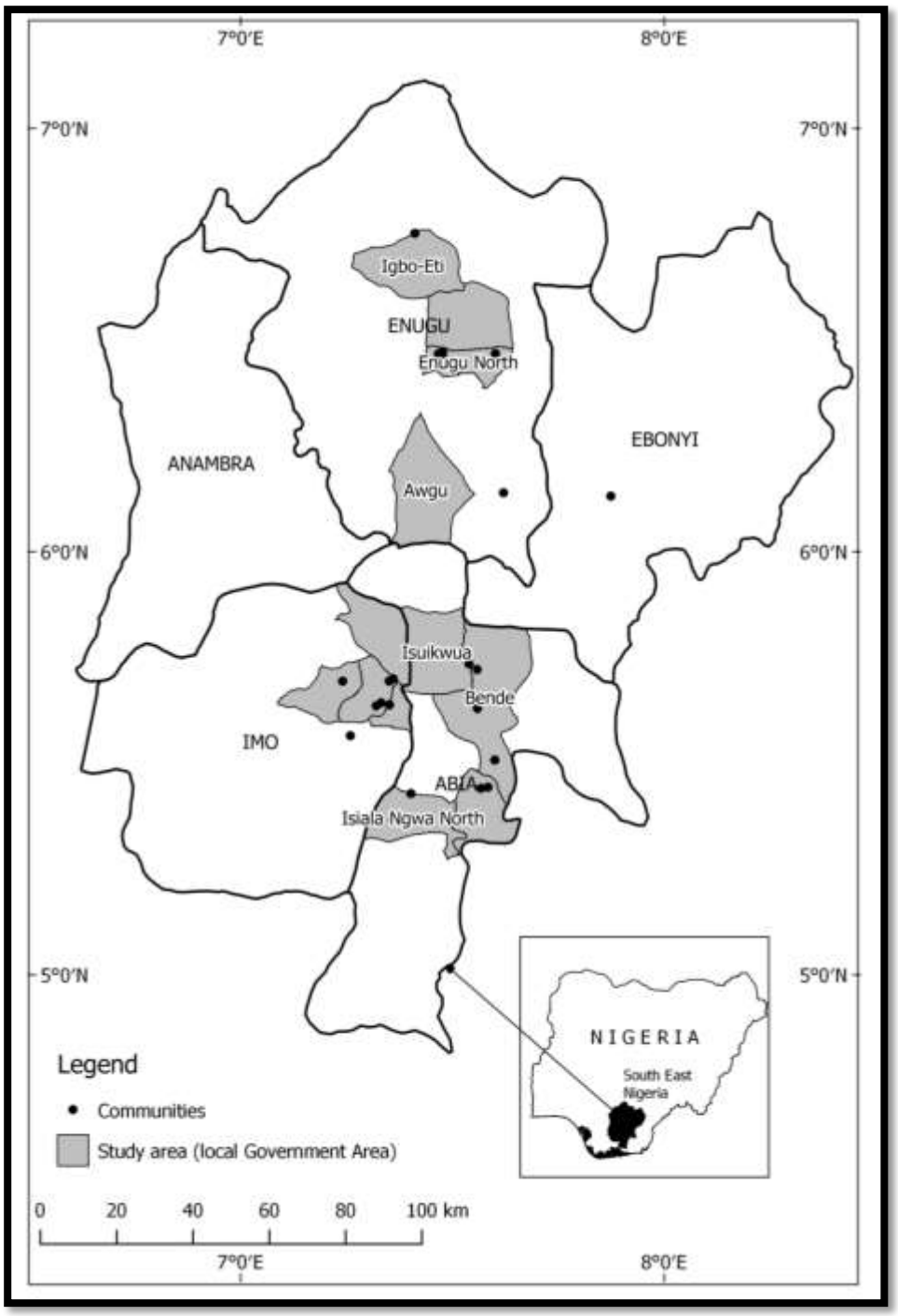

Figure 1: Map of South East Nigeria Showing the Study Sites

Model Specification

The percentage adoption formula applied in the analysis of objective two is specified:

Number of adaptation measures adopted X 100% ……...(1)
Total number of adaptation measures available in the area

The probit model is stated as follows:

$P(Y=1/X) = F(XB) = 1/\sqrt{2\Pi}\int_{-\infty}^{XB} e^{\frac{-(XB)2}{2}}dx$ ……(2)

Where: $X = (1, x_{1i}, x_{2i}, \ldots\ldots\ldots x_{ki})$

$\beta' = (\beta_0, \beta_1, \ldots\ldots\ldots\ldots..\beta_k)$

Y = vector of dependent variable (1 for reactive; 0 for anticipatory);

X = vector of explanatory variables (predictors);

β = Probit coefficients;

e_i random error term.

The explanatory variables included in the model are:

X_1 = level of education of Household head (years);

X_2 = Gender of Household head (male =1, female = 0);

X_3 = Age of Household head (years);

X_4 = Access to credit (yes =1, no = 0);

X_5 = Seasonal farm household Income (₦);

X_6 = Number of extension visit (no);

X_7 = Farming experience (years);

X_8 = Household farm size for food crops (hectares).

X_9 = Membership of cooperative society (yes =1, No = 0);

X_{10} = Land ownership (permanent = 1, otherwise = 0).

RESULTS AND DISCUSSION

Using descriptive statistics, the study analyzed awareness of climate change adaptation measures in the study area (Table 1).

Table 1: Awareness and Rate of Adoption of Climate Change Adaptation Measures

Climate Change Adaptation Options	Awareness Rating*	Adoption Rating*
No adaptation	55	35
	(6.72)	(5.29)
Soil conservation	67	14
	(8.19)	(2.11)
Water conservation	28	21
	(3.42)	(3.17)
Use of climate information	140	14
	(17.12)	(2.11)
Use of improved varieties	174	301
	(21.27)	(45.47)
Agro-forestry	14	9
	(1.72)	(1.36)
Change of cropping systems	167	123
	(20.42)	(18.58)
Livelihood diversification	76	82
	(9.29)	(12.39)
Change in amount of productive resources	60	61
	(7.33)	(9.22)
Migration	37	2
	(4.52)	(0.30)

Source: Authors' calculation from study data

NB: Percentages in parentheses; *multiple responses

The results show that awareness of the adaptation measure is low because the proportion of farmers who are aware of the climate change adaption options was not up to 50% in each. In terms of proportion, awareness for use of improved varieties was highest as a climate change adaptation measure with 21.27%. This was followed by change of cropping system with awareness proportion of 20.42% and use of climate information which posted 17.12%. The rest recorded single – digit proportions indicating that awareness of the climate change adaptation options in the area is generally low.

In terms of rate of adoption of adaptation options, use of improved varieties is the most adopted in the study area with a proportion of 45.47%, followed by change of cropping system and livelihood diversification which posted 18.58% and 12.39% respectively. This low adoption outlook may be connected to the dwindling population of farmers in the Southeast which is not compensated for given the rising incidence of rural emigration by young people (Nwajiuba, 2012). This result can be compared to Nzeadibe *et al* (2011) who conducted a related study in the Niger Delta region of Nigeria and observed reasonably higher rates of adoption of the adaptation options. It should be noted that the predominance of multiple responses is an indication that the farmers are aware and adopted a number of adaptation options simultaneously.

Applying the probit model as shown in Table 2, the determinants of climate change adaptation categories adopted were analyzed where reactive adaptation is 1 and anticipatory is 0. From the result, education, extension visit, farm size, and membership of cooperatives were statistically significant with varied probability levels and sign identities.

Table 2: Probit estimates for determinants of adaptation categories adopted

Variables	Coefficients	Standard error	Z - Value
Education	0.294**	0.100	2.93
Gender	-0.137	0.214	-0.56
Age	-0.037	0.012	-3.17
Access to credit	-0.010	0.254	-0.04
Income	-1.78e-07	1.83e-06	-0.10
Extension visit	-0.454*	0.232	-1.96
Experience	-0.04	0.015	-0.28
Farm size	0.434***	0.105	4.14
Membership of cooperatives	0.642***	0.201	3.20
Land ownership	0.012	0.203	0.06
Constant	-0.178	0.729	-0.24
Log likelihood	-101.219		
LR $chi^2(10)$	17.77		
Rseudo R^2	0.5807		

Source: Authors' calculation from study data

The coefficients of education, farm size and membership of cooperatives recorded positive signs, implying that increasing rate of the factors enhances the chances of selecting reactive adaptation options. However, the negative significant coefficient of extension visit depicts that frequency of extension contact reduces the likelihood of choosing anticipatory adaptation by the households. The model was statistically significant as shown by the likelihood function, indicating that the model has a good fit.

CONCLUSION

Having examined the socioeconomic response patterns to climate change in Southeast Nigeria, the need to sensitize and incentivize the farmers who bear the brunt of food production to adapt climate change adaptation options has become imperative. This is necessary if the national programme on agricultural transformation will bear fruits and food demand – supply disequilibrium addressed. As shown by the results, awareness and adoption of the climate change adaptation measures are relatively low. The likelihood of adapting reactive options was influenced by predominantly by education, farm size and membership of cooperatives while the probability of choosing the anticipatory or proactive adaptation options was affected by extension contact.

It is equally important that the implementation of the national climate change policy be configured to drive coordinated and harmonized response to climate change menace in Nigeria. With the instrumentality of this policy, an effective framework for combating climate change can be put in place to ensure climate compatible development in the polity and ecosystem resilience. This is one way of ensuring that the Sustainable Development goals are achieved.

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