

Knowledge and Perception of Climate Change among Peasant Farmers in a Forest-Savannah Transition Zone of Osun State, Nigeria

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Abstract

This study assessed the level of awareness of climate change and its perceived impacts and adaptation methods among peasant farmers in a forest-savanna transition zone of Nigeria. Using a multi-stage sampling technique, 162 households were selected from five communities in Odo-Otin local government area of Osun State, Nigeria for questionnaire survey. Data obtained were summarized using frequency, percentages and mean. Respondents were mostly male (69.0%), with average age of 52 years, and mean monthly income of ₦9,500 with primary education (65.5%). Most of the farmers were smallholders with an average of 2.6 acres of farmland, acquired mostly through inheritance (49%), with considerable (average of 15.5 years) farming experience. Majority (76.0%) of the farmers claimed to be aware of climate change which manifested in the form of flooding (42.5%), soil erosion (22.3%) and drought (24.8%), while 51.8% of the respondents identified climate change as a possible cause of dwindling crop yield. Electronic (73.6%) and print (36.4%) media were identified as sources of climate change information, with no reference to extension agents. Farmers perceived rainfall (62.0%) and temperature (32.4%) as elements that have changed considerably in recent years, while irrigation (32.1%), planting of drought-resistant species (20.4%) and shifting cultivation (16.3%) were identified as common adaptation strategies. However, over 30% of the farmers adjudged their chosen adaptation measures ineffective. This has brought to the fore the gap between level of awareness of climate change and adaptive capacity of the

farmers. Future research should be targeted at addressing this missing link.

Key words: Climate change, adaptive capacity, crop yield

Introduction

Climate change, which implies a sustained deviation from the normal in the general circulation of the atmosphere on which climate ultimately depends (Ayoade, 2004; Shrotriya and Prakash, 2010), has remained a topical research and policy issue over the past decade (Lobell *et al.*, 2008). Climate change has had profound effects on crop and livestock production, hydrologic balances, input supplies and other components of agricultural systems (Apata *et al.*, 2009). These effects are manifested in the physical phenomenon such as acceleration of weathering process, shift in atmospheric condition, degradation and loss of nutrients in the soil; and change in socio-economic structure of settlements, occupational activities, population distribution, and industrial growth. It is also responsible for natural disasters such as flood, change in precipitation, change in water budget of earth surface, and increased greenhouse emission (Dinero, 2013; Teye *et al.*, 2015).

Agriculture is a primary occupation in most of the Third World countries and one of the surviving sectors that provides humanity with foods and resources for the production of material goods. Ologunorisa (2008) noted that agriculture is perhaps the most weather sensitive of all of man's activities, as climate determines whether or not rain-fed agriculture will be possible and the type of crops that can be successfully cultivated in a given area. However, the nature of these biophysical effects and the human responses to them are complex and uncertain (Apata *et al.*, 2009). Zoellick (2009) has observed that small scale farmers face prospects of tragic crop failures, reduced agricultural productivity, increased hunger, malnutrition and diseases as a result of climate change.

Although climate change is a global phenomenon, the impacts are likely to vary from one locality to another due to disparities in the biophysical and socio-cultural milieus, with the developing countries likely to be worse off. Nigeria, like other developing countries, is likely to be adversely affected by the impact of climate change (IPCC, 2007; NEST, 2004). This is based on the fact that the country has a coastline which is

about 800km long, with increased exposure to sea level rise and its associated ocean surge. Also, close to 75% of Nigeria's 923,000 km² landmasses in the marginal belt, exposed to drought and desertification. Given that more than half of the country's workforce still engage in primary activities of which agriculture remains the most important, Salau *et al.* (2012) have noted that Nigeria is likely to be adversely affected due to her geographical location, low incomes, and low institutional capacity, as well as their greater reliance on climate-sensitive renewable natural resources sectors like agriculture.

Change in climate is likely to compound negative impacts of unsustainable agricultural practices and undermine meeting projected increase in demand of agricultural products in many developing countries (Robert *et al.*, 2010). Impacts of changes in climatic regimes are felt more in ecological transition zones because of the sensitivity of these zones to slight modifications in atmospheric circulations. According to Wheeler and von Braun (2013), climate variability and change will exacerbate food insecurity in areas currently vulnerable to hunger and under-nutrition. In Nigeria, the transition zones between the southern tropical rainforest and northern savannah grassland have witnessed relentless expansion of the savannah vegetation into areas that were previously forest and hence are becoming increasingly sensitive to rainfall and temperature fluxes. However, there is paucity of research on climate variability in this ecological zone. Despite, the pervasiveness of information on climate change and its possible impact on agricultural activities, the level of awareness among the peasant farmers in most parts of Nigeria still remains abysmally low. This dearth of information on the reality and possible impact of climate change has been attributed to low literacy levels among peasant farmers and epileptic nature of extension services in the rural areas where these farmers reside (Salau *et al.*, 2012; Fosu-Mensah *et al.*, 2012). A growing body of literature has addressed different aspects of climate change, ranging from conceptualisation (IPCC, 2007), perception and awareness (SPORE, 2008; Apata *et al.*, 2009; Nzeadibe *et al.* 2011; Salau *et al.*, 2012), vulnerability (NEST, 2004; IPCC, 2007; Samuel *et al.*, 2013; Samuel *et al.*, 2017), impact on agriculture and food security (Lobell, *et al.*, 2008; Hassan and Nhemachem, 2008, Odjugo, 2010; Ezekiel, *et al.*, 2012; Wheeler and von Braun, 2013), to adaptation and mitigation strategies (Hassan and Nhemachem, 2008; Obayelu, *et al.*, 2014; Samuel *et al.*, 2017). The need to understand the perception of farmers in fragile ecological zones about climate change in

order to offer adaptation practices that meet their peculiar circumstances has become imperative.

The objective of this study is therefore to understand the level of awareness of climate change, perceived impacts and adaptation to climate change among peasant farmers in a transition ecological zone of the country. The research therefore seeks to ascertain the perception and adaptation strategies of indigenous farmers in Odo-Otin L.G.A of Osun State, and its impact on their farming activities. Specifically, the study assessed the perception of farmers about the reality of climate change in their locality; examined the extent to which perceived changes in climatic regimes have affected crop yields and identified strategies employed to mitigate the perceived effect of climate change.

Research Methodology

In this section, we present our methods, describing the main characteristics of the area of study and the applied techniques of data collection and data analysis.

The Study Area

Odo-Otin local government in Osun State was chosen as the study area due to its location at the transition zone between tropical rainforest and guinea savannah vegetation. This ecological zone is known to be sensitive to changes in climatic regimes. Odo-Otin local government with a population of 134,110 (National Population Census, 2006), projected to be 171,807 in 2015 (taking the growth rate to be 2.8%), covers an area of approximately 294km². It is predominantly a rural area, with sub humid climate and is consequently expressed as a contrast between a dry and a wet season. The climate is less humid, although with strong effects of harmattan felt during the dry season, the average annual rainfall ranges from 1,125 mm to 1,350mm with a mean temperature of 33.1°C, a fact that makes the area sensitive to changes in climatic regime. The area lies along the forest-savannah transition zone. The vegetation is characterised by the preponderance of less luxuriant rain forest with tall grasses found in areas of secondary vegetation. The favourable climatic and soil conditions created an added advantage for the people of the area to produce agricultural products in abundance. Cultivated crops vary from tree crops, root crops and vegetables to plantain, oil palm, cereals, fruits, seeds and nuts, grains

and legumes. However, a sizeable number of the people of Odo-Otin local government also engage in trading and cottage food processing industries.

Data Collection and Analysis

This study was conducted to assess knowledge and perception of climate change among peasant farmers in a forest-savanna transition zone of Odo-Otin Area of Osun State. To achieve this aim, the study utilized primary data generated through sample survey of farming households in the study area, using multi-stage sampling technique. In order to obtain a representative sample of the population, five communities were randomly selected, using the table of random numbers, out of the fourteen communities identified in the study area. The selected communities represent the two main types of farming systems in southwest Nigeria, namely those dominated by arable crop farming system (Asi, Opete) and those dominated by tree crop-based farming system (Okuku, Oyan and Inisa) (Figure 1). In each community, the households included in the survey were selected using systematic random sampling stratified by geographical location of residence. This sampling technique ensures that a broad spectrum, ranging from farming households in the traditional core of the community to newly established households in the periphery of the community, were included in the survey. All the selected households were interviewed. Across the five communities, 162 heads of household were purposively selected and interviewed using a structured questionnaire. Purposive sampling was used to select household heads for interview since the study focused more on farming households and the fact that the actual population of households in the communities was not known (Chacowry, 2014). The questionnaire was targeted at eliciting information from respondents (farmers) on their socio-economic characteristics (age, gender, income and level of education), farming characteristics (type of land tenure, size of farm holding, years of experience and main crops planted), awareness of climate change (if the farmer had heard about climate change), sources of climate change information, perceived effect of climate change on crop yields and adaptive measures employed by farmers to mitigate the effect of climate change on crop yield. The obtained data were analysed using descriptive statistics notably frequencies, percentages and mean. The descriptive statistics involved the presentation of the obtained data in tables, showing the various frequencies and calculated percentages.

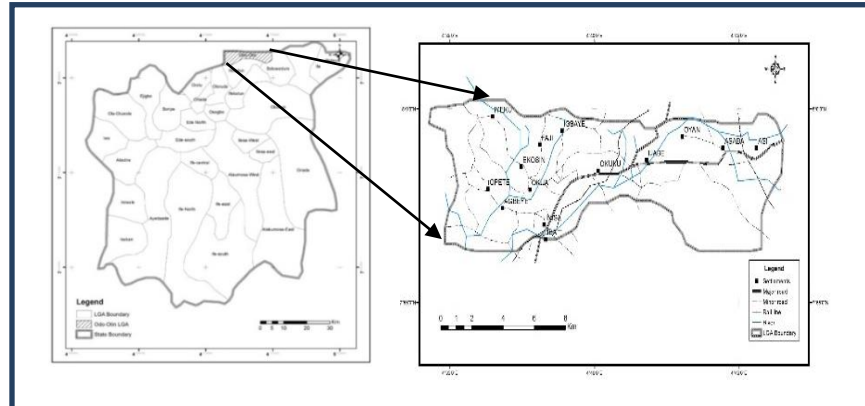


Figure 1: Odo-Otin Local Government Area

Results and Discussion

Socio-demographic Profiles of Respondents

The level of climate change awareness and farmers' ability to source and utilise adaptation information is a function of their socio-demographic profiles particularly age, gender, income, level of education (Salau *et al*, 2012; Fosu-Mensah *et al*. 2012). The socio-demographic profiles of the sampled farmers are presented in Table 1. The age distribution of the respondents indicates that the respondents were adults, with an average age of 48 years. A higher proportion of the respondents (33.3%) were within the age bracket of 41-50 years and while 22.2% were less than 30 years. The predominance of the middle-aged group among the respondents means that they are likely to be open to new ideas and innovation as far as climate change awareness and mitigation is concerned. Salau *et al*. (2012) found out that younger farmers have higher adaptive capacity than older ones. Also, the respondents were made up of males (69.0%) as against females who accounted for 31%. The distribution of respondents based on their level of education revealed that most of the farmers (63.0%) had primary education while 27.5% had no formal education. Those with secondary education and tertiary education accounted for 6.2 and 3.1 per cent respectively. Low level of education is capable of adversely affecting the level of awareness of the farmers and their perception of possible impact of climate change. It was revealed that most of the farmers earned low income, averaging ₦9,500. However, bulk of the farmers (63.0%) earned less than ₦20,000, while 13.0% and 12.3% were within ₦21,000-40,000 and ₦41,000 - 60,000 income

brackets respectively. A paltry (11.7%) earned more than 60,000 a month. Income level has been identified as an important factor that affects the adaptive capacity of farmers to climate change (Apata *et al.*, 2009; Nzeadibe *et al.* 2011). With the preponderance of low income earners among the farmers, their level adaptation to climate change impact is likely to be low.

Table 1: Socio-economic Characteristics of Respondents

Variables	Categories	Frequency	Percentage (%)	Mean
Age (Years)	<30	36	22.2	48
	31 - 40	32	19.8	
	41 - 50	54	33.3	
	51- 60	32	19.8	
	60 and above	8	4.9	
Gender	Male	112	69.0	
	Female	50	31.0	
Income Level (₦)	Less than 20,000	102	63.0	9,500
	21,000 - 40,000	21	13.0	
	41,000 - 60,000	20	12.3	
	61,000 and above	19	11.7	
Level of Education	No formal education	45	27.8	
	Primary education	102	63.0	
	Secondary education	10	6.2	
	Tertiary education	5	3.1	

Farming Characteristics of the Respondents

It has been established in literature that the farming characteristics of the farmers such as land tenure systems, size of farm holdings, years of experience, type of crop cultivated are germane to the perception of climate change and adaptation measures adopted by farmers (Salau *et al.* 2012). The farming characteristics of the respondents are shown in Table 2. Information from the table shows that 49% of the respondents acquired their land by inheritance and 16% purchased their land and 12% acquired their farmlands through leasehold and rents. The land tenure system in place oftentimes determines the size of farm holdings. Since the majority of the farmers acquired their farmlands through inheritance, it follows that the farm holdings are likely to be small. This is attested to in Table 2, as the majority of the farmers were small holders, with 49% having not more than 2 acres and another 31% having 3-5 acres. Jointly, these two groups account for 80% of the sampled farmers in the area. Only 12% and 8% of the farmers had 6-8 and more than 8 acres of land respectively. On average, a farmer

holds 2.6 acres of cultivated land, much lower than 3.5 ha reported by Salau *et al.* (2012) in their study of farmers in the southern agricultural zone of Nasarawa State. In terms of farming experience, most of the farmers (54 or 33%) had less than 11 years farming experience while 28% and 22% had 11–20 and 21–30 years of experience respectively. It was further revealed that (7%) and above 10% of the sampled farmers had 30–40 and more than 40 years of farming experience. However, the average years of experience of farmers was 15.2. Table 2 further showed that 32% of farmers cultivate tuber crops including cassava, sweet potatoes and cocoyam, followed by cocoa 21%, vegetables 15.7%, palm trees 14.5% and sorghums/maize 13.2%.

Table 2: Farming Characteristics

Variables	Categories	Frequency	Percentage (%)	Mean
Land Tenure System	Inheritance	79	49	
	Rent	19	12	
	Leasehold	21	13	
	Communal	16	10	
	Purchase	26	16	
Size of Farm holdings	0-2 Acres	79	49	2.6
	3-5 Acres	50	31	
	6-8 Acres	19	12	
	>8 Acres	13	8	
Years of Farming Experience (Years)	<11	54	33	15.2
	11 – 20	45	28	
	21 – 30	36	22	
	31 – 40	11	7	
	>40	16	10	
Main Crop Cultivated	Tuber	52	32	
	Vegetable	24	15	
	Cocoa	34	21	
	Oil palm	23	14	
	Maize	21	13	
	Kola nut	8	5	

Perception of Climate Change

Awareness and perception of climate change is capable of shaping action and inaction towards climate change adaptation and mitigation (Separanza, 2010). Table 3 shows that a greater proportion of the farmers (76%) claimed they were aware of the climate change phenomenon while 24% were not aware. This finding was consistent with the findings of Nzeadibe *et al.* (2011) in their study of climate change awareness and adaptation of Niger

Delta where they found that over 60% of the respondents were aware of climate change. This high level of awareness may have resulted from the level of literacy among the farmers as more than 70% of them had primary education or higher. Also, the long years of farming experience of the farmers may also explain why many of them were aware of changes in the climatic regimes. Electronic media (74%) and print media (24%) were the two sources from which farmers got information about climate change. Curiously, none of the farmers claimed to have had about climate change from professional services (extension service inclusive) despite the importance that has been attributed to it in the literature as a veritable source of climate change awareness (Madison, 2006; Gbetubouo, 2009). It is either the area is not covered by extension service or the service has not been effective in disseminating climate related information to farmers.

On what they perceived was responsible for decrease in yields which many of them reported, more than half of the respondents (51.8%) attributed this to climate change. Other reasons cited for decrease in yield included inadequate farm input (19%), land use practices (13%). This corroborates the findings of Nzeadibe *et al.* (2011) that most local farmers are aware of climate change and its effects. Majority of respondents (62%) identified rainfall as the climatic element that has changed over time while another 32.4% indicated that temperature had changed considerably. This is consistent with the report of NIMET's evidence of climate change in Nigeria (1941 to 2000) as reported in BNRCC report (2011) that rainfall and temperature have shown consistent variabilities in the past. Fosu-Mensah *et al.* (2012) in their study of perception and adaptation to climate change in Sekyedumase district in Ghana also identified temperature and rainfall as climatic elements perceived to have changed over time. It was further revealed that respondents perceived the effect of climate change to manifest in the form of flooding (42.5%), drought (24.8%), soil erosion (22.3%), rapid growth of weeds (7%), leaching (2%) and disease spread (1.4%). These facts are indications that the peasant farmers had been observing sustained variabilities in the rainfall and temperature patterns over the years, though may not have understood this in the context that climate change is currently conceptualised.

Table 3: Farmers' Perception of Climate Change

Variables	Categories	Frequency	Percentage
Awareness of Climate Change	Yes	123	76
	No	39	24
Sources of Awareness	Professional Services	0	0
	NIMET	0	0
	Internet	0	0
	Print Media	23	26.4
	Electronic Media	64	73.6
Reasons for poor crop yield	Climate change	84	51.8
	Land use practices	23	13.9
	Insufficient capital	12	7.3
	Inadequate farm input	31	19
	Others	13	8
Perceived elements that have changed	Temperature	52	32.4
	Rainfall	100	62.0
	Wind	5	3.0
	Pressure	0	0.0
	Others	4	2.6
Manifestations of effect of climate change on crop production	Flooding	69	42.5
	Soil Erosion	36	22.3
	Leaching	3	2
	Drought	40	24.8
	Disease spread	2	1.4
	Rapid growth of weeds	11	7

Climate change mitigation strategies adopted by farmers

Evidence gathered from farmers in the study area indicated that there had been practices that farmers employed to mitigate the effect of climate change. From Table 4, it is evident that a significant number of the farmers (32.1%) used irrigation to supplement water dwindling soil water, while planting of the drought resistant species (20.4%), bush fallowing (16.3%) and planting of early maturing seeds were some of the other mitigation measures adopted by the farmers. These practices have been established in literature on climate change adaptation (DFID 2009; Salau *et al*, 2012). It is instructive to note that a sizeable proportion of the farmers (12.5%) reported no mitigation measure. Equally, it is important to note that lack of improved seeds, lack of access to water for irrigation, lack of current knowledge of modern adaptation strategies, lack of capital, lack of awareness and knowledge of climate change represent critical constraints to adoption of adaptation measures (Ishaya and Abaje, 2008).

On the effectiveness of such mitigation measures, 21.2% perceived it as extremely effective, 14.3% as very effective, 22.5% as fairly effective while a whopping 30% perceived it as ineffective. However, whether a measure is perceived as effective or otherwise will depend on the particular measure adopted and the application, the management of such measure, farming experience and access to education (Apata *et al.* 2012). The preponderance of farmers who perceived their chosen adaptation measure(s) as ineffective brought to the fore the role of policy and institutional framework for climate change adaptation. Nzeadibe *et al.* (2011) have noted that discussion and action on climate change governance has been at the international level while there has been a tendency to overlook national level governance of climate change.

Table 4: Climate change mitigation strategies adopted by farmers

Variables	Categories	Frequency	Percentage
Mitigation Adopted by Farmers	Tree Planting	14	8.5
	Drought resistant species	33	20.4
	Irrigation	52	32.1
	Planting early maturing species	17	10.2
	Shifting Cultivation/Bush fallowing	26	16.3
	No mitigation measures	20	12.5
Effectiveness of Mitigation measures	Extremely effective	34	21.2
	Very effective	23	14.3
	Fairly effective	37	22.5
	Not effective	49	30.5
	Cannot say	19	11.5

Conclusion

The debates around climate change and its implication for sustainable agriculture have been clearly articulated at the international level without a commensurate effort to carry along farmers at the grass roots. Clear understanding of what constitutes climate change, its manifestation and possible scientific adaptation are germane to the success of peasant farmers generally and particularly those that are located in transition zones, known to be more sensitive to climate variabilities. Even though, majority of the peasant farmers reported awareness of the climate change phenomenon, their understanding of the effects and how to mitigate its impact still remain unclear. This is evident from the findings of the study which revealed that majority of the farmers adjudged the mitigation measure adopted as ineffective. It is also curious that none of the farmers claimed to

have got information about climate change from the extension service professionals. This raises the twin questions of availability and effectiveness of extension services in the study area as well as other areas.

Arising from the findings of this study, it is suggested that government puts in place sound policies and institutional frameworks that focus more on the adaptive capacity of the peasant farmers which remain the dominant group in the agricultural value chain in Nigeria. Presently, there is no clear policy direction for mitigating and adapting to the impact of climate change at the local level. Such policy will be better communicated through the extension service agents who will not only inform but also demonstrate the application of these adaptive measures.

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