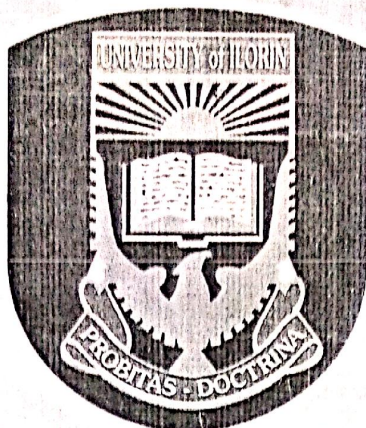


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A STUDY OF FARMERS' ADAPTATION TO CLIMATE CHANGE IN ESAN WEST LOCAL GOVERNMENT AREA OF EDO STATE, NIGERIA

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Abstract

The impact of climate change impact depends on a range of parameters, yet climate change is threatening not only the sustainable development of socio-economic activities of a nation but also the totality of human existence. Presently, Nigerians have started to feel the effect of climate change as frequency and intensity of extreme events like floods, rainfall and drought have increased. The study investigated farmers' adaptation to climate change in Esan West Local Government Area of Edo State. This study utilized primary source of data through the administration of questionnaires, direct interviews and direct field observations where 250 structured questionnaires were administered using simple random techniques. Tables and charts were used to present the data while regression and correlation and ANOVAs were inferential statistics used showing that there is a strong relationship between weather event and farming activities. This also shows that agricultural production depends highly on climate change. Therefore effort should be geared towards providing farmers proper awareness and training in order to enhance their intellectual ability on adaptation and mitigation in the face of climate change. This study also suggests the need for government's provision of proper and reliable information on adaption options for the farmers to harness in the face of climate variation.

Keywords: Climate change, Adaptation, Farming.

Introduction

There is a growing consensus in the scientific literature that in the coming decades, the world will witness higher temperature and changing precipitation level (People's Bank, 2008). The effect of this will lead to low or poor agricultural production. Evidence has shown that climate change is already affecting crop yield in many countries. This is particularly true in low income countries, where climate is the primary determinant of agricultural productivity and adaptive capacities are low. Many African countries, which have their economies largely based on weather-sensitive agricultural production systems like Nigeria, are particularly vulnerable to climate change.

One of the key challenges facing humanity today stems from changes within the climate system (Tilakasiri, 2008). Scientific evidence including the Fourth Assessment Report from working group 1 of the Intergovernmental Panel on Climate Change IPCC (2007) indicates that the energy balance within the earth's climate system has been altered and this resulted in significant changes in national, regional and world climate. Olanrewaju (2006) noted that in the field of agriculture, rainfall is the most

important climatic factor in Nigeria. This is because the onset of rain ushers in planting season, its duration and distribution ensures crop sustainability and favourable yield, while its cessation marks harvesting and storing season. Whenever there is late onset, hunger, temporal unemployment and poverty loom.

More so, according to Omotosho (2002), the most critical weather and climate dependent sectors of any West African and particularly Nigerian economy are agriculture and water resources. Rainfall determines crop yield. This is what Ojunigbo (2009) agreed upon that where rainfall is optimum, crop yield is high and if low, crop yield will be low and if too high, crop yield will be very poor. Plants need varying amounts of rainfall to survive. For example, certain cacti require small amounts of water (Mauseth, 2006) while tropical plants may need up to hundreds of inches of rain per year to survive. In areas with wet and dry seasons, soil nutrients diminish and erosion increases during the wet season. Animals have adaptation and survival strategies for the wet season. The previous dry season leads to food shortages into the wet season, as the crops have yet to mature (Frisancho, 1993).

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Climate change refers to the change in the mean values of climate measuring by element such as rainfall, temperature, etc., over long period of time usually 50 years. Climate change is the significant change in the state of the climate of a place that can be identified by change in the mean and/or in the variability of its properties that persist for an extended period typically decades or longer (IPCC, 2007). Climate change is a natural phenomenon that has been accepted globally as a fact of life. This means that as a matter of fact, it would always be subjected to natural dynamism or changes.

Nigeria like many other countries of sub-Sahara Africa is highly vulnerable to the impact of climate change. Though climate change is a threat to agricultural and non agricultural socio-economic development, agricultural production activities are generally more vulnerable to climate change than other sections. This is because agricultural production in most sub-Sahara African (Nigeria inclusive) is dependent on weather and climate. Nigeria is an agrarian economy with over 65% small holder farmers accounting for the nation's agricultural outputs. Agriculture takes place in the environment hence vulnerable to environment factors which includes weather, climate and soil properties. Agricultural practice in the country is grossly independent on natural conditions such as rain-fed farming, soil fertility, temperature, sunshine and humidity. All these affect agricultural production. Climate and agricultural resources are very closely related and as such any crisis situation in the agricultural sector notably a food crisis stands a great risk of becoming escalated by vagaries and extreme weather events like heat wave, drought and flood.

Adaptation is widely recognized as a vital component of any policy response to the climate change. According to Easterling (1998), without adaptation, climate change is generally detrimental to the agricultural sector, but with adaptation vulnerability can largely be reduced. This implies that the extent to which our agricultural system is affected by climate change depends on its adaptive capacity. IPCC (2001) opined that adaptive capacity is the ability of a system to adjust to climate change (including climate vulnerability and extremes) to moderate potential damages, to take advantages of opportunities or to cope with the consequences.

However, the nature of these biophysical effects and the human response to them are complex and uncertain. It is noted that Nigeria especially the developing rural populations such as Esan-West Local Government area of Edo State ought to be concerned by climate change because of the country high vulnerability due to high coast line that is prone to sea level rise and the risk of fierce storm. Climate change is evident in the late arrival of rain, drying up of streams and small rivers that usually flow all year round, and the gradual disappearance of flood recession cropping in the creek areas. Climate change is a delicate issue; therefore to approach the issue appropriately, one must take into account local communities' understanding of climate change since they perceive climate as having a strong spiritual, emotional and physical dimension. It is therefore assumed their communities have an inborn-adaptive knowledge from which to draw and survive in high-stress ecological and socio-economic conditions.

In view of the fact that stability and sustain ability of sufficient food production in the agricultural sector is the main sure way of eradicating poverty and bearing in mind the great threat posed by climate change issues to the realization of this goal, it becomes very important for agricultural system in the country to give climate change issues serious consideration if the objective of increased food production will ever be achieved.

Study Area

Esan West Local Government area of Edo State is located at approximately latitude $6^{\circ} 20'N$ and $6^{\circ} 50'$ of the equator and longitude $6^{\circ} 0'$ and $6^{\circ} 4'$ of the Greenwich meridian. It shared common boundary in the North with Owan East and Etsako west local government area, in the south with Igueben local government area and in the east by Esan Central Local Government area.

The wet season lasts seven months March to October, and the dry season is from November to February with scanty amount of rainfall. The Northern trade wind and the Southern west monsoon winds are the prevailing wind in the area (Aziegbe, 2005). Esan West is made up of sedimentary rock formation and its analysis of soil sample shows that the soils are dominantly clay- sands. The soils have been classified as fertile and having high proportion kainite and free iron oxide. It also comprises of loamy soil (Aziegbe, 2005).

Esan West is situated at Esan plateaus. The plateau acts as watershed at to small streams. The Oghidekperiver stream which takes it water sources in the Northern extreme and discharges its water in the Owan region. The tropical rainfall forest vegetation is noticeable in the area of study. The predominant vegetation is the moist deciduous forest, which is richer in timber resources its nature is attributed to the favorable humid climate. The canopy is more open than in the rainforest region which lies south in the equatorial rainforest as observed by (Adejuwon, 1979).

The major economic activities include manufacturing, crafts, building and construction, transportation, business and call centres, electrical engineering, automobile engineering, welding, milling/grinding and other petty businesses. It is worthy to note here that small scale industries dominate the study area. The study area, like other part of the state is essentially an agricultural area owing to a suitable climate edaphic factor in the area.

The total population stood at 127,718 with an average growth rate of 2.8%. The male population stood at 62,406 while the female stood at 65, 312 (NPC, 2006).

Materials and Methods

Data required for this study include data on the prevailing weather condition, data on the type of farming system adopted by farmers and response of farmers to climate change threat. Data were collected through questionnaire administration, oral interview and observations.

The methods adopted for analyzing the data were purely descriptive and inferential in nature. Such methods include regression and correlation. Descriptive methods include the use of tables and charts while multiple regression and analysis of variance explain the inferential aspect of statistical methods.

Regression and correlation analysis are used to analyze the strength of the relationship between weather events and farming activities with the formula as:

$$y = a + bx$$

y = dependent variable

b = independent variable

a = intercept on y axis the value of y at the point where x = 0

b = slope coefficient

Results and Discussions

As shown in Table 1, majority of the respondents are males (57.5%) which mean that a reasonable number of people living in the study area who engage in farming are males. The distribution indicates that farming has been left in the hands of the aging 40-50 which stood at about 40% of the population and age 50 and above which stood at 36.5% and majority of the population under study are married (60%) and just very few are widowed (4%). Just 2.5% of the farmers have reasonable level of education while 14% have secondary school leaving certificate and a large proportion of the population have no formal education at all. 25.5% are civil servants and have farming as their secondary occupation while 5.5% are into trading but have farming as their primary occupation but large proportions of the population do farming as their primary occupation. This data show that most of the respondents depend totally on agriculture for their livelihood. The implication of this is that most of the farmers are vulnerable to climate change induced poverty.

Sex	Frequency	Percentage
Males	115	57.5
Females	85	42.5
	200	100
Age		
20-30	15	7.5
31-40	32	16
41-50	80	40
50 and above	73	36.5
	200	100
Marital status		
Single	42	21
Married	120	60
Divorced	8	4
Widowed	30	15
	200	100
Educational level		
No formal education	95	47.5
Primary education	72	36
Secondary education	28	14
Tertiary education	5	2.5
	200	100
Occupation		
Farming	132	66
Civil servant	51	25.5
Trading	11	5.5
Others	6	3
Total	200	100

Source: Field survey, 2015

Agricultural System Adopted

As shown in Table 2, agricultural system is mainly dominated by subsistence farming that is majority of the farmers are subsistence farmers (84%) while few of the farmers are into commercial agriculture (16%).

Agricultural system	Frequency	Percentage
Subsistence	168	84
Commercial	32	16
Total	200	100

Source: Field survey, 2015

Farming Experience of the Respondents

Farming experience of the respondents as seen in Table 3 indicates that about 42.5% of the farmers have well over 30 years of farming experience, 35.5% have 21-30 years of experience in farming, 12% have 11-20 years of farming experience while just 10% have farming experience that means farming have always been a major means of livelihood over the years.

Table 3: Farming Experience of the Respondents

Farming experience	Frequency	Percentage
1-10	20	10
11-20	24	12
21-30	71	35.5
31 and above	85	42.5
Total	200	100

Source: Field survey, 2015

Farm Size of the Respondents

Indication from Table 4 shows that majority of the farmers have 4-7 hectares of farm land (51.5%), 37.5% have 1-3 hectares of land for farming while small fraction of the population have 7 and above hectares of land which means that they practice commercial system of agriculture but subsistence system of is dominant.

Table 4: Farm Size of the Respondent

Farm size	Frequency	Percentage
1-3 hectares	75	37.5
4-7 hectares	103	51.5
7 and above	22	11
Total	200	100

Source: Field Survey, 2015

Prevailing Extreme Weather Events

Figure 1 shows the prevailing weather condition in the study area. Majority of the respondent (55.5%) observed increased incidence of flooding, 30% indicated delay in onset of raining season while 27% of the respondent observed increase in temperature. In general, it can be concluded that the prevalent weather in the study area is increased incidence of flooding.

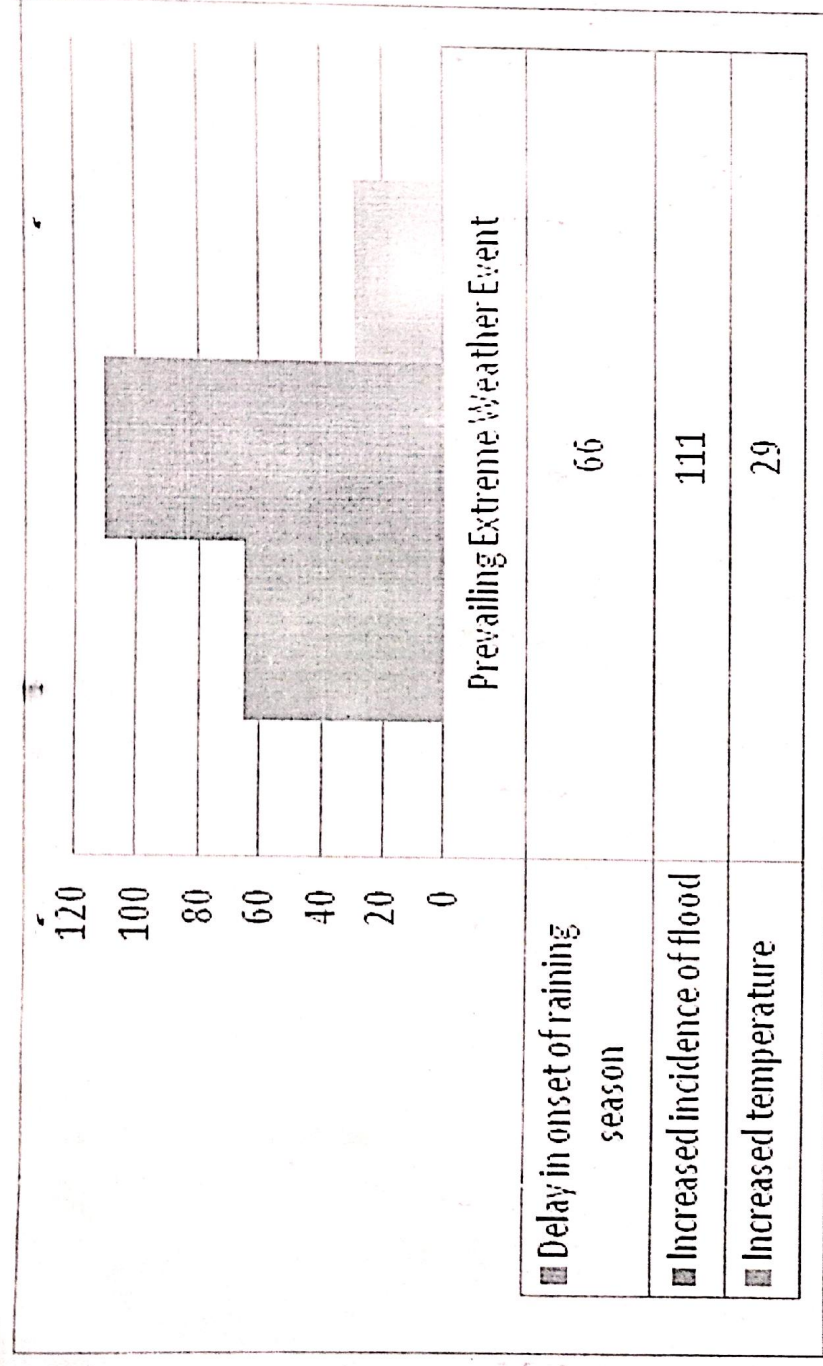


Fig.1: Prevailing Extreme Weather Event
Source: Field Survey, 2015

Farming System Adopted by Farmers

Table 5 shows the characteristics of farming system adopted by farmers to contain climate effect in the face of climate change. 61% of respondent plants cover crops to curtail the effect of climate change, 19% of respondents plant better heat and drought resistant crops as adaptation strategy in the face of climate change, 12.5% of respondent adopt improvement of pest management while few respondent (6.1%) indicated the adoption of early planting early maturing crops, changes in harvesting dates and use of weather forecast.

Table 5: Farming System Adopted by Farmers in the Face of Climate Change

Characteristics of farming system	Frequency	Percentage
Planting of cover crop.	122	61.0
Planting better heat and drought Resistant crop.	38	19.0
Improving pest management	25	2.0
Early Planting	12	6.0
Change in harvest day and		
Use of weather forecast	3	1.5
Total	200	100.0

Source: Field Survey, 2015

Perception of Respondents on Climate Change

As shown in Table 6, 50.0% of the respondents indicated increased daily temperature as their perceived change in climate, while 45.0% and 55.0% indicated increased in incidence of flooding and delay in onset of raining season respectively. This shows the complex nature of climate change, as it is manifests differs from place to place and from region to region.

Table 6: Perception of Respondents on Climate Change

Perception of Respondents	Frequency	Percentage
Increase in daily temperature	100	50.0
Increase in the incidence of flooding	48	45.0
Resistant crop		
Delay in onset of raining Season	52	55.0
Total	200	100.0

Source: Field Survey, 2015

Vulnerability of Farmers to Threats of Climate Change

Figure 2 shows the level of farmers' vulnerability to threat posed by climate change. 39% indicated they are most vulnerable to increased pest and diseases, 29.5% of respondent indicated their vulnerability to erosion problems, 26% indicated that they are most vulnerable to combine threat posed by climate change.

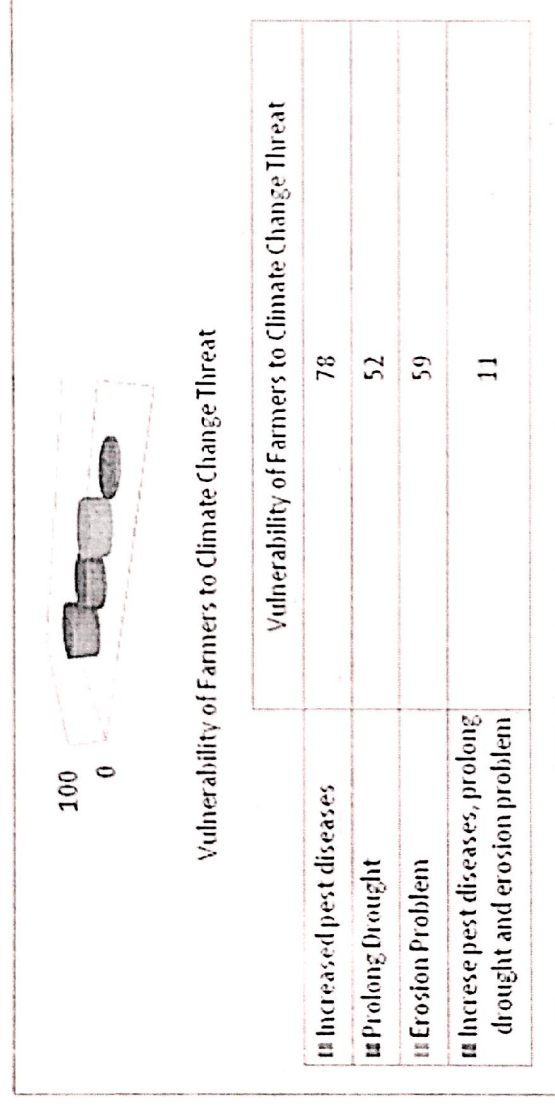


Fig 2: Vulnerability of farmers to threat posed by climate change

Source: Field survey 2015

Weather Events and Farming Activities

Table 7 shows that all selected weather events indicated as y which the dependent variables shows a positive and significant relationship. Thus Pearson correlation analysis in the table above shows that there is positive relationship between weather events and farming activities.

Table 7: Weather Events and Farming Activities

	Climate	Farming
Climate	Pearson Correlation 1	-.002-
	Sig. (2-tailed)	.981
	N	200
Farming	Pearson Correlation -.002-	1
	Sig. (2-tailed)	.981
	N	200

Source: Author's fieldwork, 2015

The value of correlation lies between -1, 1. The correlation value is 0.981 which is close to 1 and this shows that there is a strong correlation between weather events and farming activities in the study area.

Table 8: Impact of Climate on Agricultural Production

Model	Sum of Squares	Df	Mean Square	F	Sig.
1					
Regression	.000	1	.000	.001	.981 ^a
Residual	96.080	198	.485		
Total	96.080	199			

a. Predictors: (Constant): x

b. Dependent Variable: y

Source: Field Survey, 2015

Analysis of variance test (ANOVA) showed that there is a significant impact of climate change on agricultural production. With reference to the hypothesis setting which states;
 H_0 : Climate element has no significant impact on agricultural production.

Decision rule: Reject H_0 if $F_{cal} > F_{tab}$

Decision: Since F_{cal} (0.001) is $< F_{tab}$ (1.96) we therefore do not reject H_0 at $\alpha = 0.05$

Conclusion: there is significant impact of climate on agricultural production.

From the hypothesis stated above analysis of variance was carried out to test the hypothesis of climate change on agricultural production in Esan West Local Government area of Edo State. The table above shows the result of our ANOVAs when $F_{cal} = 0.001$

on adaptation and mitigation in the face of climate change.

Finally, the study recommends that funds should be made available to farmers by the government and other organizations in order for farmers to harvest various options available to them. Climatic data should be made available and be interpreted to local people to understand its impacts on agricultural practices. Proper and reliable information should be provided on adaption option by the government for the farmer to harness.

CONCLUSION AND RECOMMENDATIONS

The study assesses the farmer's adaptation to climate change in Esan West local government area. It is however observed that majority of the rural settlers are experiencing erosion problem and agricultural production in the area have been greatly reduced due to increased incidence of flooding. Majority of farmers are predominantly engage on subsistence agriculture with a few farmers practicing the commercial type of agriculture. The subsistence farmers use crude implements like hoes, cutlass for bush clearing instead of modern technology that can enhance productivity. It was observed that farmers are actually aware of climate change but sensed it, as been spiritual because of their educational background. This study also reveals that the study area practice major national bush fallowing as a farming system and bush burning is still a dominant method of land clearing. In order to enhance productivity in the study area, farmers should be giving proper training by extension workers or farmer's association so as to enhance their awareness

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