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Effect of Livelihood Factors on Climate Change Adaptation of Rural Farmers in Ebonyi State, Nigeria

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ABSTRACT
The study examined the effect of livelihood factors on climate change adaption of rural famers in Ebonyi State, Nigeria. Multi-stage random sampling technique was used to select 120 farmers from the three agricultural zones of the study area. Structured questionnaire was used to collect data from the respondents. Statistical tools such as frequency, percentages, regression were used to analyze the data. Findings revealed the adaptation strategies adopted by farmers as majorly grouped include; land/soil, water, crop management and livelihood diversification. Specific livelihood factors that affected the level of climate change adaptation include: natural disaster, extension service, access to credit, income among others. It was recommended that basic amenities should be provided by government to improve the environment of the rural farmers, regular and effective extension service to educate them on suitable climate change adaptation measurers. Also, capital should be provided to the farmers through low interest loan and grants.
Keywords: Livelihood, climate change, mixed farming, land.

INTRODUCTION
Climate change is a very important concept in agricultural production, especially in the Sub-Saharan Africa (SSA) stemming from the high dependence of agriculture in climatic Parameters (Ozor, 2009). According to Intergovernmental Panel on climate change {IPCC} (2007} climate change refers to a change in the State of the climate that can be identified by changes in the mean and/or the variability of its properties and that persists for an extended period of time. It has been described as worst threat that manifests in different forms such as extreme conditions of flooding, temperature rise, rises in sea levels, drought and desertification, wind storms, and the drying up of streams and rivers (Ifeanyi – Obi & Asikaba, 2004; Ozor, Umunakwe, Ani & Nnadi, 2015).

Livelihood in sub-Saharan Africa is generally poor, rural and insecure (Food and Agriculture Organization (FAO), 2015; World Bank Group, 2015) with severe implications on their climate change adaptation and resource use efficiency. In the region farmers lack requisite skills and manpower, access to commercial markets for their produce, credit facilities, affordable improved inputs and sufficient labour services needed for optimum agricultural production (Nkondze, Masuku, & Manyatsi, 2013). This affects their ability to adapts to climate change and also improve their level of resource use efficiency through efficient and effective use of the factors of production (farmland, water and labour) and agricultural inputs (fertilizers, irrigation, seeds and capital equipment) (AGRA, 2014). It is in line with the report of NEST (2004) that the vulnerability of countries and societies to climate change depends not only on the magnitude and sensitivity of their economies to climate parameters, but also, on the capacity of the affected societies to adapt. Increasing farmer's adaptation to climate change would require a proper understanding of their livelihood. According to the Institute of Development Studies (IDS) (1996), livelihood comprises the

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capabilities, assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stress and shock, maintain or enhance its capabilities and assets, without undermining its natural resource base (United Nations Development Programme (UNDP), 1999). The sustainable livelihood (SL) provides a holistic framework for understanding the livelihood of the poor, and therefore most effective in helping them to improve their opportunities in life (Departmental Development (DFID), 1999; Sukendra, 2010). The sustainable livelihood framework (SLF) shows the dynamic interrelationships among the various capabilities, assets and activities required for a means of living (DFID 1998).

The SLF has five (5) key constituents which relate with each other: vulnerability context, livelihood assets, policies-institutions-processes, livelihood strategies, and livelihood outcomes. The vulnerability context describes the external environment of the farmers and are usually outside their control such as population, conflicts, seasonality of prices, etc (DFID, 1999). The livelihood assets are the building blocks of livelihoods and are made up of natural, physical, human, social and financial assets (Chambers & Conway, 1992). Polices, institutions and processes in the framework describe a large range of contextual factors such as culture, norms and value, rule and regulations, etc that exert immense influence on every aspect of people's livelihood (Sukendra, 2010). Livelihood strategies define the range and combination of activities and choices that people make/undertake in order to achieve livelihood goals and objectives (Su & Shang, 2012). The livelihood outcomes are the results, achievements or outputs of livelihood strategies, and are the product of different combinations of other components of the livelihood framework (DFID), 2010; such outcomes could be increased adaptation to climate change, increased resource use efficiency and productivity, as well as diversified livelihood portfolios. This study therefore investigated the effects of livelihood factors on climate change adaptation of rural farmers in Ebonyi State, Nigeria.

Objectives of the study

The broad objective of this study was to examine the effect of livelihood factors on climatic change adaptation of rural farmers in Ebonyi State, Nigeria.

The specific objectives were to:

i. describe climatic change adaption
ii. determine livelihood factors that affect climate change adaptation of rural farmers.

MATERIALS AND METHODS

Area of study

The study was carried out in Ebonyi State, Nigeria, comprising Ebonyi North, Ebonyi Central and Ebonyi South agricultural Zones. The state is located between latitude 7°30' and 8° 30'North of the equator and between longitudes 5°40' and 7°00' East of the Greenwhich Meridian with land area of 5935km² and a population of 2,176,947 (NPC, 2006: NBS, 2010). The State shares boundaries with Benue State in the North, Abia State in the South, Cross River in the East and Enugu State in the West. The vegetation of the area is

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mainly rainforest with porches of Savannah owing to climatic changes, Annual rainfall ranges from 1,400mm to 2,500mm with mean temperature range of 27°-33°c. The livelihood activity in the area is mainly agriculture. The agricultural products include yam, rice, cassava, maize, vegetable and cocoyam

Sampling Technique, Data Collection and Analysis

The study population was crop farmers in the study area. Multi stage random sampling technique was used in the selection of the sample for the study. Firstly, two Local Governments Areas were randomly selected each from the three agricultural zones. The Second stage involved the random selection of two (2) communities from each of the selected Local Government Areas. At the third stage, ten (10) farmers were randomly selected from each of the community, giving a sample size of 120 farmers. Data were collected with the aid of well structured questionnaire containing adequate information on the objectives. Descriptive statistical tools employed to analyze data collected were frequency and percentages. Multiple regression analysis was used to determine the livelihood factors that affect climate change adaptation of farmers. The regression model in its linear form is presented thus:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_{19} X_{19} + e_i$$

Where:

Y =farm output
β_0 = constant
X_1 = resource Conflicts (No of times)
X_2 = natural disaster (No of times)
X_3 = access to land/farm size (ha)
X_4 = access to drinking water (1 if access, 0, otherwise)
X_5 = access to forest resources (1 if access, 0, otherwise)
X_6 = farm distance (km)
X_7 = market distance (km)
X_8 = access to health care (1. if access, O otherwise)
X_9 = access to extension services (No. of visits)
X_{10}= membership of cooperative society (No. of societies)
X_{11} = marital status (1 if married, O otherwise)
X_{12} = farm income (₦)
X_{13} = non-farm income (₦)
X_{14} = local remittances (total remittances from relatives)
X_{15} = access to credit facilities (amount of loan in ₦)
X_{16} = age (years)
X_{17} = household size (No)
X_{18} = level of education (years)
X_{19} = farming experience (years)
e_i = error term

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RESULT AND DISCUSSIONS

Climate change Adaption Strategies of the Rural Farmers

The frequency distribution of farmers according to their use of 27 traditional farm practices as measure(s) of climate change is shown in table 1. These practices were grouped into four: land/soil management, water management, crop management and livelihood diversification.

Table 4. 3: Frequency distribution of the rural farm households according to their level of adoption of various farm practices as strategies for climate change adaptation

	Adaptation practices	Frequency	Percentage (%)
P1	**Land/Soil Management**		
P2	Land rotation/bush fallow	22	18.10
P3	Use of insecticides and weedicides	31	25.86
P4	Agro-forestry practices	32	27.87
P5	Fertilizer (inorganic) manure application	47	39.08
P6	Avoiding bush burning	61	50.86
P7	Organic manure application	74	62.07
P8	Prompt physical weeding and removal of insects	87	72.99
	Raising of mounds and ridges across slopes	96	79.89
P9	**Water Management**		
P10	Tree planting	5	4.02
P11	Physical irrigating	17	14.08
P12	Water harvesting and storage	26	22.13
P13	Construction and maintenance of drainage	36	29.89
P14	channels	43	35.92
P15	Prevention of forest losses along water bodies	62	52.01
	Mulching	94	77.87
P16	Cultivation of cover crops		
P17	**Crop management**	7	6.03
P18	Use of weather forecast	14	12.07
P19	Crop rotation	17	13.79
P20	Cultivation of drought-resistant crop varieties	24	20.11
P21	Cultivation of disease-resistant crop varieties	33	27.87
P22	Cultivation of early maturing crops	37	31.03
P23	Use of improved crop varieties	67	52.87
	Changing of planting dates	115	95.97
P24	Multiple/intercropping/mixed farming		
P25	**Livelihood Diversification**	34	27.87
P26	Artisans	47	39.08
P27	Trading	50	41.95
	On-farm employment (labourer)	79	66.09
	Off-farm employment (labourer}		

Source: Field survey, 2018

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Multiple Responses

The result shows that raising of mounds and ridges across slopes, P8 (80%), prompt physical weeding and insects removal, P7 (73%) and organic manure application, P6(62%) were the most frequently and widely used climate change adaptation measures of farmers under land/soil management practices category. The increase in raising of mounds across slopes helps to check devastating effect of erosion and flooding in farms. This is particularly important in South East Nigeria where large areas of agricultural land have been lost completely to erosion (Akinboade, 2013; Ezeigwe, 2015). On the basis of water management practices, cultivation of cover crops, P15 (78%) and mulching, P14 (52%) were the two predominant climate change adaptation practices of the farmers. It helps in the management of soil erosion, soil fertility, soil quality, soil water, weeds, pests and disease control (Sullivan, 2003; Anyaoha et al., 2013). Also, mulching helps to conserve water in the soil, regulate soil temperature and suppress the growth of weeds. This result is consistent with those of Owombo et al, (2014) in Ondo State, Nigeria which shows that 78% of farmers used mulching as an adaptation strategy.

Multiple/intercropping/mixed farming was the most widely adopted crop management adaptation strategy of majority (96%) of the farmers in this category. The intent of this practice is to insure and minimize the level of loss which the farmer could suffer in the event of adverse weather condition leading to crop failure (Enete et al, 2011). A mutual relationship exists in mixed farming. This finding is in agreement with the result of Anyoha et al, (2013) which reported that majority of the farmers (92%) in Abia State practiced mixed farming as a measure for climate change adaptation. Furthermore, 53% of the farmers adopt the strategy of changing of planting dates (P22). Other strategies in this category were adopted, although at lower properties (see table 1). On account of livelihood diversification, the result showed that majority of the farmers (66%) were engaged in off-farm employment, while a lower proportion (42%) were engaged equally as labourers in on-farm employment. Further results showed that 28% of the farmers were engaged as artisans, while another 39% were involved in trading agricultural goods. Diversification of livelihood has become a veritable opportunity for farmers to increase their income portfolio with the aim of reducing hunger and poverty. In support of this assertion, Ellis (1998), maintained that livelihood diversification raises the capacity of the rural poor to cope with the inherent vulnerabilities in agriculture.

Livelihood factors that affect the level of climate change Adaptation of Rural farmers.

The result of the regression analysis of the livelihood factors that affected the level of climate change adaptation of the rural farmer is shown in table 2.

Table 2: Parameter estimates of regression analysis of livelihood factors that affect the level of climate change adaptation.

Livelihood factors	Parameter	Coefficient	T-ratio
Constant	β_0	51.624 (20.096)	2.569***
Resources conflicts	X_1	-0.087 (0.213)	-0.408
Natural disasters	X_2	0.408(0.166)	2.458**
Access to land	X_3	0.881 (0.449)	1.962**

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Access to drinking water	X4	1.462 (1.630)	0.897
Access to forest resources	X5	0.159 (0.162)	0.982
Farm distance	X6	1.537 (1.252)	1.228
Market distance	X7	-0.727 (1.564)	-0.465
Access to health care centre	X8	0.385 (0.215)	1.791*
Access to extension services	X9	0.549 (0.171)	3.211***
Membership of cooperative societies	X10	0.509 (0.170)	2.994***
Marital status	X11	-0.190 (0.230)	-0.826
Farm income	X12	0.922 (0.187)	4.930***
Non-farm income	X13	0.288 (0.749)	0.385
Local remittances	X14	0.101 (0.112|)	0.902
Access to credit facilities	X15	0.087 (0.047)	1.851*
Age	X16	-0.235 (0.102)	-2.304**
Household size	X17	-0.153 (0.256)	-0.598
Level of education	X18	0.450 (0.378)	1.190
Farm experience	X19	-0.097 (0.043)	-2.256**
R-square (R^2)	06.32		
F-Value	4.205***		
Total number of observations, N	348		

Keys ***, **, * - 1%, 5% and 10% level of significance, respectively. Figures in parenthesis represent standard errors.

Source: Field survey, 2018

The result showed that about 63% of the variations in the level of climate change adaptation were explained by variation in the livelihood varieties. The specific livelihood factors that significantly affected the level of climate change adaptation of the farmers included occurrence of natural disaster, access to land (farm size), access to health care centre, access to extension service and membership of cooperative society. Others were farm income, access to credit facilities, age and farm experience. The effect of occurrence on natural disaster on climate change adaptation was positive and significant ($P<0.05$). It implies that as the level of occurrence of natural disasters increases, so also does the level of climate change adaptation of farmers increases. It's coefficient of 0.408 depicts that on the average, a unit increase in occurrence of natural disaster increases the level of adaptation of the rural farmer by about 40.8%. The emergence of climate change through changing temperature and rainfall, for instance, have brought about numerous changes in the environment, which have made it inevitable for farmers to adjust in order to fit into the changing ecosystem.

The effect of farm size was positive and significant ($P<0.05$). In order words, the level of climate change adaptation of farmer increases with increase in their access to farmlands. Its coefficient (0.881) implies that a unit increase in the size of farmland increases the level of climate change adaptation of rural farmers by 88.1%. The ability of rural farmers to access land gives them impetus to adjust their farming operations and activities. This agrees with the findings of Anyoha et al, (2013) which reported that farm size positively affected the adaptation strategies of farmers in Umuahia South Local Government Area of Abia State, Nigeria.

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Access to health care centre on level of climate change adaptation was positive and significant (P<0.05), depicting that farmers adaptation to climate change increase with increasing access to healthcare. A unit increase in farmer's access to health care centre will lead to about 38.5% rise in their level of adaptation. Access to extension services had a positive and significant (P<0.01) effect on climate change adaptation. This result is in harmony with Owombo et al., (2014) report that access to extension services positively affected the farmers' choice of varying planting time, tree planting strategies of farmers in Ondo State. The effect of membership of cooperative society on climate change adaptation was positive and significant (P< 0.01). This implies that there is a direct relationship between membership of cooperative society and climate change adaptation of farmers. Farmers coming together in cooperative gives them opportunity to pool resources together to solve common challenges facing them in their farms. Farm income was positive and significant (P<0.01). This suggests that increase in farm income leads to increase in the level of climate change adaptation of farmers. There would likely be more investment on climate change by farmers, with the optimism of getting more income for doing so. The result agrees with Temesgen et al, (2014) who reported that farm income had a positive effect on the probability of choosing various climate change adaptation techniques.

Access to credit facilities was positive and significant at 10%. Finance plays a central role in farming operations, especially in climate change adaptation. Age was negative and significant (P<0.05). This suggests that an inverse relationship exists between climate change adaptation and age of farmers. Climate change adaptation involves risks as it entails adjustment and adoption of innovations in place of routine farm activities and operations. Older people are risk averse than younger people. This result aligns with Balama et al., (2013) who established a negative effect of age on climate change adaptation among farmers in Kilombero District of Tanzania. Farm experience had a significant (P<0.5) and negative effect. In order words, the higher the experience of the farmers, the lower their adaptation to climate change. It implies that adapting to climate change does not necessarily depend on length of years the farmer have spent farming. The result is in accord with Ibrahim et al., (2011) who reported a negative effect of farm experience on the choice of multiple strategies over non adoption, among arable farmers in Ogun State.

CONCLUSION AND RECOMMENDATION

The livelihood condition of the farmers is poor, rural and insecure. Their primary livelihood activity is agriculture and natural resources which is under the threat of climate change. They are adopting several adaptation measures to ameliorate the adverse effect of climate change. In the light of the above, the following recommendations are made:

i. Efforts should be made by government, donor agencies, non-governmental agencies etc to improve the living condition and environment of the farmers through the provision of basic social amenities and infrastructure.
ii. Farmers should have regular and effective extension services to encourage them to adopt farm practices highly rated as suitable for climate change adaptation. Such practices include changing planting date, mulching etc.

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iii. Financial institutions to give a certain proportion of their credit to farmers with minimum collateral.

iv. Government should provide stabilized and guarantee prices for agricultural products to enhance the income of farmers.

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