CAN CLIMATE CHANGE AFFECT INCOME-GENERATING ACTIVITIES?: EVIDENCE FROM FARMERS IN ENUGU STATE NIGERIA

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ABSTRACT

The need to analyze the changes that the effect of climate change brings on the income-generating activities of farmers in Enugu state necessitated this study. The study examined farmers' socio-economic characteristics, described the perceived climate change effects, analyzed changes in income-generating activities, and evaluated the link between socio-economic factors and income-generating activities. Primary data were collected from 120 respondents using well-structured questionnaires. The data were analyzed using descriptive statistics and Pearson product-moment correlation. The results showed that the majority (73.3%) of the respondents were male farmers. Results of the study also showed that reduction in productivity (89.2%), change in farming pattern (77.5%), and soil degradation (65.0%) were the most perceived effects of climatic change among the respondents. The result also revealed strong negative change in income-generating activities in the areas of goat/sheep rearing (-33.4), fishing (-32.5), rabbit rearing (-15.0), and basket weaving (15.0), while petty trading (+23.4), hair barbing (+18.3) and food vending (+15.8) had strong positive change in the study area. The study revealed that socio-economic characteristics such as marital status, household size, and years of farming experience are correlated with positive income-generating activities. The study recommends that farmers should prioritize positive income-generating activities that correlate with their socio-economic characteristics. The study also recommends the implementation of crop rotation and organic manure as one of the ecological practices for climate change mitigation.

INTRODUCTION

Climate change is characterized by a consistent and prolonged pattern of fluctuations in various weather elements over thirty years or more. These elements encompass temperature, pressure, wind systems, direction, humidity, cloud cover, and precipitation, as outlined by the IPCC in 2007.

Climate change has led to desertification, flooding, and drought, impacting various aspects of life, with a primary focus on agricultural systems (Twumasi et al., 2022). The progress achieved in agricultural activities in Enugu State is threatened by climate change, as highlighted by (Ozor & Nnaji, 2011). Farmers in this region are facing challenges such as soil erosion, degradation, loss of fertility, reduced productivity, scarcity of potable water, loss of vegetation, intense weed growth, health issues, increased pests and diseases, and disruption of wildlife ecosystems. The agricultural sector, individuals with poor health, and those with lower levels of education are particularly vulnerable to the risks posed by climate change (Ishaya & Abaje, 2018).

The significant impacts of climate change in the research area encompass diminished agricultural yields and income, the depletion of streams or rivers, deterioration in crop storage quality, the loss of pastureland or vegetation, and disruption of wildlife ecosystems (Enete et al., 2011). This could be that Enugu state is an arid area and also being closer to the Northern parts of Nigeria where there is insufficient rain for optimal crop production (Nzeh & Eboh, 2011). Hence, some research in developing countries like Nigeria have opined that farmers rely on both farm and non-farm activities for income generation for their livelihood (Oladeji, 2007; Alalade et al., 2021; Kebede et al., 2024). In Sub-Sahara Africa for example, farmers depend on livestock rearing for their livelihoods because they generate most of their incomes from livestock farming (Twumasi et al., 2021; Jamro et al., 2021; Jabessa et al., 2023). Climate change has profound implications for the income-generating activities of farmers, disrupting traditional agricultural practices and challenging livelihoods in Nigeria (Alalade et al., 2021). This multifaceted issue encompasses a spectrum of impacts on farming, from altered precipitation patterns and temperature fluctuations to extreme weather events, leading to environmental degradation and economic instability. In addition, Shifts in precipitation and temperature can disrupt traditional growing seasons, leading to reduced crop yields and increased vulnerability to pests and diseases (Patrick et al., 2023). These changes threaten the stability of farm income, particularly farmers who rely only on agriculture for their livelihood. In regions where agriculture is rain-fed, irregular rainfall patterns can result in prolonged droughts or sudden floods, which have detrimental effects on crop production (Alalade et al., 2021). Farmers may face increased financial strain as they grapple with the uncertainties associated with these climatic variations.

The study area is currently facing drought, fluctuation in rain and drying up of numerous rivers because of climate change. These challenges are expected to contribute negatively on income-generating activities of farm household as well as impacting negatively on human living standards, particularly in sub-Sahara Africa like Nigeria (Akinbile, 2010; Adefalu, et al., 2013; Alalade et al., 2021). Unlike other existing literature, this study explores the intricate relationship between climate change and the income-generating activities of farmers, examining both challenges and potential adaptations. The study also emphasized more on positive income-generating activities that correlate with the socio-economic characteristics of the farmers in the study area.

The broad objective of this study is to analyze climate change and its effect on farmers' income-generating activities in Enugu state. The specific objectives of the study include: describing farmers' socio-economic characteristics, determining the perceived effect of climate change among farmers in the study area; examining the change in income-generating activities of farmers in the study area; and examining the relationship between socio-economic characteristics and income-generating activities.

LITERATURE REVIEW

Internationally, climate change is acknowledged as a significant menace to sustainable development, posing adverse effects on the environment, human health, food security, and physical infrastructure, as highlighted by the Africa-Wide Civil Society Climate Change Initiative for Policy Dialogues (ACCID) in 2010. The comprehensive impact of climate change encompasses unpredictable rainfall, altering seasonal patterns, and elevating the probability and intensity of extreme events like floods. It is crucial to highlight that the gradual reduction of trees in forests, without replenishment, has impacted the presence of diverse plant and animal species. Despite rising demand, deforestation has substantial consequences on exposed soil, resulting in thinner vegetation cover and compromising soil fertility (Shove, 2016). In this regard, the income-generating activities of farmers have been diversified, forcing farmers to adopt different income-generating activities other than farming activities due to perceived effect of climate change in the study area.

MATERIALS AND METHODS

Study Area

The study was carried out in Enugu State, Nigeria. Enugu state is one of the 36 states in Nigeria, located in the Southeast geopolitical zone. The state lies between latitudes 5056'N and 7005'N of the Equator and longitudes 6053'E and 7055'E of the Greenwich meridian (ENADEP, 2012). The state comprises 17 Local Government Areas (LGAs) and is divided into six agricultural zones (ENADEP, 2012). These zones are Nsukka zone: Igbo-etiti, Nsukka, and Uzo-uwani LGAs; Enugu Ezike zone: Udenu, Igbo-Eze South and Igbo-Eze North LGAs; Enugu zone: Enugu North, Enugu East, and Isi-Uzo LGAs; Agbani zone: Nkanu East, Nkanu West, and Enugu South LGAs; Awgu zone: Awgu, Oji River and Aninri LGAs; and Udi zone: Udi and Ezeagu LGAs.

Sampling Procedure

A multi-stage sampling technique was used for the study. In first stage, two agricultural zones (Nsukka and Enugu Ezike) were selected from the six agricultural zones. These zones were selected because they generate income from non-farm and farm activities. In stage two, Uzo-uwani LGA and Igbo-Eze North LGA were purposively selected from Nsukka and Enugu Ezike agricultural zones respectively, giving two LGAs. These LGAs were selected because they depend on agricultural activities for income generation. Stage three involved a purposive selection of two communities from each of the two LGAs, making four communities. These communities were selected because they depend on farming activities to generate income. In the fourth stage, two villages were randomly selected from each of the four communities to get eight villages. In the finally stage, fifteen respondents were selected randomly from each of the eight villages to generate sample size of 120.

Data Collection
Primary data were collected with well-structured questionnaires for the study. The questionnaires were administered to household farmers. It contains information on the socio-economic characteristics of the farmers, some effect of climate change, and income-generating activities of the farmers in the study area.

Data Analysis
The data was analyzed using relevant statistical and econometric tools. First, second and third objectives were realized using descriptive statistics such as frequency and percentages while fourth objective was analyzed using Correlation analysis.

RESULTS

Table 1. Distribution of farmers according to their socio-economic characteristics

Socio-economic characteristics	Frequency	Percentages %
Age		
Less than 20	4	3.3
21 – 30	11	9.2
31 – 40	31	25.8
41 – 50	33	27.5
51 – 60	34	28.3
61 and above	7	5.8
Sex		
Male	88	73.3
Female	32	26.7
Marital status		
Single	35	29.2
Married	73	60.8
others	12	10
Educational level		
Primary school	24	20
Secondary school	58	48.3
Tertiary education	38	31.7
Primary Occupation		
Agriculture	44	36.7
Trading	44	36.7
Artisanship	19	15.8
Civil/public service	13	10.8
Years of farming experience		
1-5	13	10.8
6-10	17	14.2
11-15	40	33.3
16 and above	50	41.7
Household size		
1 – 3	20	16.7
4 – 6	50	41.7
7 – 9	36	30.0
10 and above	14	11.7
Monthly Income (₦)		
Less than 2000	32	26.7
>2000	88	73.3
Total	**120**	**100**

Table 2. Perceived effect of climatic change among farmers in Enugu State

Perceived impact of Climatic Change*	Frequency	Percentages (%)
Soil degradation	78	65.0
Economic instability	23	19.2
Fluctuation in the rainy seasons	61	50.8
Change in farming pattern	93	77.5
Deforestation	14	11.7
Destruction of wildlife ecosystem	37	30.8
Loss of pasture land and vegetation	42	35.0
Reduction in productivity	107	89.2
Air pollution	15	12.5

Multiple responses recorded

Table 3. Change in Income-generating activities of farmers

Income-generating activities of farmers*	Engaged in ten years ago		Engage presently		% Change in income generating activities
	Frequency	Percentages	Frequency	Percentages	%Diff
Goat/sheep rearing	68	56.7	28	23.3	33.4-
Fishing	53	44.2	14	11.7	32.5-
Livestock production	13	10.8	10	8.3	2.5-

Hunting	28	23.3	20	16.7	6.7-
Piggery production	37	30.8	34	28.3	2.5-
Palm oil processing	38	31.7	27	22.5	9.2-
Crop planting	26	21.7	28	23.3	1.7+
Selling of firewood	27	22.5	29	24.2	1.7+
Keeping of local fowls	32	26.7	26	21.7	5.0-
Rabbit rearing	37	30.8	19	15.8	15.0-
Snail collection	37	30.8	21	17.5	13.3-
Basket weaving	43	35.8	25	20.8	15.0-
Food vending	50	41.7	31	57.5	15.8+
Petty trading	42	35.0	14	58.3	23.3+
Hair plating	40	33.3	25	45.8	12.5+
Hired labour	37	30.8	31	25.8	5.0-
Tailoring	31	25.8	14	40.0	14.2+
Palm-tapping	13	10.8	13	10.8	0.0*
Blacksmithing	15	12.5	19	15.8	3.3+
Cloth weaving	24	20.0	25	20.8	0.8+
Carpentry	30	25.0	39	32.5	7.5+
Welding	13	10.8	12	10.0	0.8-
Barbing	45	37.5	23	55.8	18.3+
Transporter	28	23.3	36	30.0	6.7+
Traditional medicine	37	30.8	25	20.8	10.0-
Mean		33.76		23.55	

*+ signify more involvement in income generating activities, - signify less involvement in income generating activities; * signify no change in income generating activities*

Table 4. Pearson product-moment results showing the correlation between some selected socio-economic characteristics of the farmers and positive income-generating activities

Variable s	Chi-square value	Df	p-value
Age	0.58	4	0.170
sex	0.11	2	0.321
Marital status	7.67	1	0.006*
Level of education	2.08	1	0.148
Primary occupation	1.12	1	0.472
Household size	4.08	2	0.005*
Farming experience	21.10	4	-0.001*

* means significant correlation

DISCUSSIONS

Table 1 discusses the socio-economic characteristics of the farmers, such as age, sex, marital status, level of education, primary occupation, years of farming experience, household size, and monthly income. The result revealed that the majority (28.3%) of the respondents are within the age of 51-60 years, (27.5%) and (25.8%) are within 41-50 years and 31-40 years respectively. The results also show that the majority (73.3%) of respondents were male farmers whereas (26.7%) are female farmers. The result of the marital status indicates that the majority (48.3%) of respondents is married and (29.2%) are single, (10.0%) are others. This suggests that farmers who were married are keen into diversifying their income generation to support their household needs. The result also revealed that the majority of the respondents (48.3%) were secondary school graduates, while (31.7%) were graduates from tertiary institutions and (20%) were from primary school.

The result of the primary occupation revealed that the majority (36.7%) of the respondents were agriculturist and traders whereas (15.8%) were artisans. The finding shows high level of diversification in income-generating activities by the respondents in the study area. The finding is in line with Oladeji (2007) who opined that most developing countries like Nigeria generates income from difference sources other than farm activities for their livelihood. The result of the farming experience shows that the majority (41.7%) of the respondents has more than 16 years of farming experience, whereas (33.3%) have between 11 and 15 years, and (14.2%) have between 6-10 years of farming experience. This means that significant numbers of respondents in the study area are experience farmers. This means that significant numbers of respondents in the study area are experience farmers. On that note, they can easily navigate the adverse effect of climate change by diversifying their income-generating activities.

The result also shows that the majority (41.7%) of the households has between 4-6 persons in a house, (30.0%) have between 7-9 persons in the house and (16.7%) have 1-3 persons in the house.

The result also shows that the majority (73%) of the respondents earn more than ₦2000 while (26%) earn less than ₦2000 per month from both farming and non-farming activities. This finding is not in conformity with Adefalu et al. (2013) who reported that farm earnings have decreased in recent years as a result of the impact of climate change on agricultural productivity.

Table 2 revealed that about 89.2% of the respondents perceived reduction in productivity to be the greatest adverse effect caused by climate change in the study area. The results also show that 77.5% and 65.0% of the respondents perceived change in farming patterns and soil degradation as the second and third ranking adverse effects caused by climate change in the study area respectively. Fluctuation in the rainy season was reported by 50.8% of the respondents, and 35.0% of the respondents reported that the loss of pasture land and vegetation was also among the adverse effects caused by climate

change in the study area. It also revealed that 30.8% of the respondents reported destruction of wildlife, and 19.2% of the respondents reported economic instability as the adverse effect caused by climate change. In addition, 12.5% and 11.7% of the respondents mentioned air pollution and deforestation respectively as the least adverse effect caused by climate change in the study area. The findings revealed that respondents perceive climate change as being detrimental to agriculture, particularly in decreasing agricultural productivity, shifting farming practices and causing degradation of soil quality. Consequently, respondents are likely to engage in additional off-farm income-generating endeavors to support their livelihoods. The findings align with that of Alalade et al. (2021), who argue that climate change adversely affects agricultural activities. Thus, it is crucial to investigate the repercussions of climate change and devise strategies to mitigate its adverse effects for sustainable agribusiness within urban and rural areas in Nigeria. Additionally, soil degradation resulting from exposure to adverse weather variability reduces productivity, hence, affecting income-generating activities in the study area. Furthermore, deforestation emerges as a significant contributing factor, because it exposes soil to harsh climatic conditions, thereby disrupting crop growth and diminishing farmers' agricultural productivity.

Table 3 indicates the various farming and non-farming activities that farmers engaged in between 10 years ago and the present. The finding revealed that some of the activities reduced and/or increased in the recent time. For instance, income-generating activities such as Goat/sheep rearing (33.3%), fishing (32.55%), rabbit rearing (15.0%), basket weaving (15.0%), snail collection (13.3%), traditional medicine (10.0%), and palm-oil processing (9.2%), reduced in the recent time compared to ten years ago. Petty trading (23.3%), hair barbing (18.3%), food vending (15.8%), tailoring (14.2%), and carpentry (7.5%), increased recently. The finding implies that large numbers of farmers are now shifting from agricultural related activities to other ventures such as trading, hair barbing etc. This is because climate change is adversely affecting the cultivation of staple crops and overall farming practices, prompting farmers to seek alternative sources of income through off-farm activities. In addition, this also shows that there is diversification in farmers' income-generating activities, aimed at mitigating high risks associated with climate change. The finding is in line with Alalade et al. (2021), who opined that non-agricultural activities assist farmers in spreading production risks by diversifying their income generation. Consequently, agricultural income-generating activities of the farmers have been negatively influenced by climate change. The implication is that there will be potential decline in food production in the region on the long run. Hence, the finding is in line with Onumadu et al. (2000) who stated that climate change are risk to food security and the sustainability of agricultural production. Therefore, adapting to the challenges posed by climate change requires innovative and sustainable practices. Precision agriculture, which utilizes technology to optimize inputs like water and fertilizers, can enhance efficiency and mitigate resource use. Diversification of crops and income sources can also make farmers more resilient to climatic uncertainties. Additionally, the promotion of agroforestry and conservation agriculture practices helps improve soil health, water retention, and overall resilience in the face of changing climate conditions. According to Shove (2016), concentrating on positive income-generating activity such as crop planting with the help of organic practices could also play vital role in climate change mitigation.

Table 4 showed that out of the seven selected socio-economic characteristics (age, sex, marital status, level of education, primary occupation, household size, and farming experience) of the respondents, only marital status (0.006), household size (0.005) and farming experience (-0.001) were significantly correlated with the positive income generating activities as perceived by the respondents. This implies that experience farmers who are married with up to four children have more tendency of adopting climate change mitigation and diversify their income generation through non-farm activities. However, the study is in contrast with Akinbile (2010); Alalade et al. (2021) who reported that there is positive relationship between socio-economic characteristics (age and level of education) with income-generating activities of farmers.

CONCLUSIONS

The study aimed at analyzing climate change and its effect on farmers' income-generating activities in Enugu state, Nigeria. The study revealed that most farmers in the study area are male and married with a household size of about 4-6 persons. The most perceived effects of climate change in the study area are reduction in productivity, change in farming patterns, and soil degradation. The study revealed that income generation on Goat/sheep rearing, fishing, rabbit rearing, basket weaving, snail collection, traditional medicine and palm oil processing were low. However, it revealed that there are increase in income generation among farmers who combines petty trading, hair plaiting, hair barbing, food vending, tailoring and carpentry with farming activities. It was also revealed that marital status (0.006), household size (0.005), and farming experience (-0.001) were correlated with the positive income-generating activities as perceived by the respondents. The study recommends that farmers should prioritize positive income-generating activities that correlate with their socio-economic characteristics. The study also recommends the implementation of crop rotation and organic manure as one of the ecological practices for climate change mitigation. Furthermore, extension agents need to put in more efforts in educating farmers on the possible ways of addressing the severity of climate change.

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