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Assessment of Climate Change on Living Standard: Evidence from Flood-Prone Smallholder Rice Farmers in South-East Nigeria

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A B S T R A C T

This study seeks to assess the effect of flood on farm household living standard among smallholder rice farmers in southeast, Nigeria. Specifically, the study described the perceived climate hazard occurrence in the study area, analyzed the effect of flood on farm households' living standards in the study area and described the flood control measures used among smallholder farmers in the study area. Multi-stage random sampling technique was used to select a total sample size of 480 smallholders. Primary data were collected using a well structured questionnaire. Descriptive statistics and OLS regression model were used to analyze the data. The result also showed that majority (90%) of the respondents experienced flooding as the major climate change hazard in the study area. The result of the regression showed that flood reduced rice yield/quantity, flood caused lost of revenue and farm proximity to river negatively significantly influenced the consumption expenditure among smallholder rice farmers at 5 % probability level in the study area. The result also showed that fitting of water inflated sandbags as flood barriers (M= 3.44), creation of drainage (M= 3.28), removal of sediment (M= 3.26), building of water gates (M= 3.22) and construction of flood barrier socks (M= 3.19) were the control measures they used during the incident of flood in the study area

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INTRODUCTION

Climate change has become a big threat in the world most especially developing countries such as Africa in which they lack mitigation strategies when compare with the developed countries. Climate change is a serious problem facing humanity and development. Its impact is not uniform across sectors, communities, regions and countries (Tarfa et al., 2019). Climate change makes agricultural production systems more vulnerable, most especially those manifested in the form of uncertain and rapid changes in rainfall, temperature patterns and other extreme weather events in the subcontinent (Owusu et al., 2020; Kangogo et al., 2021). In the sub-Saharan Africa region for example, agricultural production system is mostly rain-fed and subsistence and this could probably lead to decline in food production, especially in the aspect of staple foods (Asare-Nuamah & Botchway, 2022). To the people of Nigeria, the impact of climate change on agriculture, especially for rice production in southeast Nigeria, is very important. This is because the majority of the inhabitants depend on rice production for their livelihood. Rice is highly susceptible to climate vagaries because of its sensitivity to changing climatic conditions. Climate change can destroy crops through excessive rainfall, overflow of rivers, when snow melts and when dams break. All these result to what is called flooding, with southeast especially rice producing areas being one of worst- hit states that experiences flooding every year in Nigeria.

Flooding is one of the natural hazards that is destructive in the world because of its frequent occurrence that affect large population at a time Akukwe et al., (2020) and its negative effect on lives and properties in Nigeria (Olorunfemi et al., 2020) . It has also lead to displacement of livelihoods and induced poverty in the affected areas which frustrates human existence (Okafor, 2020). For instance, 2012 and 2022 flood incident in Nigeria has displaced many villages and communities to internally displaced persons (IDPs) camps. Those affected areas were faced with a lot of challenges such as lack of food stuffs, drinking water, clinic, drugs and competition for space, which made their situation worst in the camp (NEMA 2022).

Flooding and the means of addressing its challenges are issues of utmost concerns (Obeta, 2014). Serious damages from flood incidences and the vulnerability of rural small holder farmers due to low capital has negatively impacted on their welfare and their ability to employ diverse adaptation techniques hence, mitigating subsequent shock events is usually left to the government (Ajibade et al., 2015). A clear understanding of the extent to which flood disaster affect farm households' living standards of smallholder rice farmers occupies a large fraction of farming population in the southeast Nigeria. The strategies they adopt to mitigate the effect of this disaster is critical to policymakers and other stakeholders to further improve and implement holistic strategies and actions in order to minimize the effect of the disaster. Though, different literatures have studied the effect of climate change and flood on agriculture. There is little empirical evidence on flood disaster and its implication on livelihood and coping strategies adopted among smallholder rice farmers in

southeast. Therefore, the study seeks to assess the effect of flood on farm household living standard among smallholder rice farmers in southeast, Nigeria.

The increased frequency and intensity of flooding in Nigeria has negative implications for food security and agricultural production (AkukweOluoko-Odingo & Krhoda, 2020; Ajaero 2017). This extreme weather condition is practically vulnerable to smallholder and subsistence farmers living closed to riverine regions (Ahmed et al 2021). As a result of this, changing sowing time, soil and water conservation practices, use of improved crop variety, fertilizer application and pesticide use have been some of the adaptation measures employed by smallholder farmers (Ajibade et al., 2019; Onyeneke et al., 2019; Danso-Abbeam et al., 2021). However, with all these effort, smallholder farmers may not be effective in ameliorating the negative effects of climate change on their living standards (van der Gest & Schindler, 2017). None of the reviewed studies were able to explain the implication of climate change (flooding) on household living standard in term of consumption expenditure, by calculating the value of all food and nonfood goods and services consumed by the effected households.

LITERATURE REVIEW

Problem Statement

Nigeria faces food insecurity, ranking among the top 10 nations most susceptible to this issue due to climate change, economic challenges, and conflict (World Food Programme 2020). Annual floods in several states significantly impact its food security, as acknowledged in studies such as (AkukweOluoko-Odingo & Krhoda, 2020; Ajaero 2017). In July 2021, the Nigeria president attributed the escalating food insecurity to flooding (Ogundele, 2021). However studying the assessment of climate change on living standard especially on flood-prone smallholder rice farmers in Enugu State Nigeria would help us to understand how flood could affect living standard and some of its management strategies.

Purpose of the Study

The broad objective of this study is to assess the effect of flood on farm household living standard among smallholder rice farmers in southeast, Nigeria. The specific objective of this study include is to:

1. Socioeconomic characteristics of the smallholder rice farmers.
2. Describe the perceived climate hazard occurrence.
3. Analyze the effect of flood on farm households living standards and
4. Describe the flood control measures used among smallholder farmers in the study area.

Research Questions

The following research questions were formulated to guide the study

1. What are the socioeconomic characteristics of the smallholder rice farmers?
2. How does rice farmers perceiveclimate hazard occurrence?
3. What is the effect of flood on farm households' living standards?

4. What are the flood control measures useamong smallholder rice farmers in the study area?

METHODOLOGY

Study Area

The study will be carried out in the South-east geopolitical zone of Nigeria. The zone is made up of five states: Abia, Anambra, Ebonyi, Enugu, and Imo, covering latitude 40 50'N to 70 10'N and longitudes 60 40'E to 80 30'E. It spreads over a total area of 78,618 km^2, representing 8.5% of the nation's total land area. The area is projected to have a total population of 16,381,729 (National Population Commission, 2019).

Sampling Procedure

A multi-stage sampling procedure was used for this study. In the first stage, two states, Enugu and Ebonyi, from South-east Nigeria were selected purposively for this study. This is because they are the major producer of rice in southeast Nigeria and rice is the major staple food that is grown in the district. Then, one local government area (Uzo-Uwani) was purposively selected from Enugu state because they are the only producer of rice in the state and three local government areas (Ikwo, Izzi and Ezza) from Ebonyi state. In Enugu state, all the 5 communities that produce rice were selected from the Local Government area and twenty four smallholder rice farmers were randomly selected from each of these communities, which gave a total of 120 smallholder rice farmers. In Ebonyi state, 5 communities were randomly selected from the three Local Government areas. Finally, twenty four smallholder rice farmers were randomly selected from each of these communities which gave a total of 360 smallholder rice farmers. Therefore, the overall sample size were 120 plus 360, which gave a total of 480 respondents.

Methods of Data Collection

Primary data source was used, and this was collected using a set of well-structured and pre-tested questionnaire in the survey area. The questionnaire was administered to household farmers eliciting the socio-economic characteristics of smallholder farmers, a well-structured questionnaire which involved face to face interviews with the smallholder rice farmer were used for the study. The questionnaire included sections on general household characteristics, asset ownership, production and marketing of rice and other agricultural activities, and non-agricultural economic activities, as well as infrastructure and institutional details. To capture household living standards, details of food and non-food consumption expenditures (including consumption of own-produced goods) were asked. The interviews were conducted with the household head. For the part on food consumption, the person in the household responsible for food purchases and food preparation were asked to join the interview.

Data Analysis

Descriptive statistics were used to analyze the socioeconomic characteristics of the smallholder rice farmers, perceived climate hazard occurrence and the flood control measure among smallholder rice farmers.

Whereas, OLS regression model was used to analyze the effect of flood on farm households' living standards of the respondents.

Measurement for the Key Variable

Household living standard was measured in the form of consumption expenditure express in naira per day. Having seen that consumption expenditure is an indicator for measuring household welfare and living standard (Sellare *et al* 2020); consumption expenditure was calculated as the value of all food and non-food goods and services consumed by the household for a period of one week and one month respectively.

Model Specification

The following econometric analysis model was used to estimate the primary data: Linear regression model was used to estimate the effect of flood on rice farmers' consumption expenditure in the study area.

Linear Function

$Y= b_0+b_1x_1+ b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8 + b_9x_9+\varepsilon_i$ …… (1)

Where Y= consumption expenditure, X_1= gender, X_2= household size, X_3= education status, X_4= age (years), X_5= farming experience (years), X_6= average annual income (in naira), X_7= Flood reduced rice yield/quantity(1 = yes, 0 = no), X_8= Flood caused lost of revenue (1 = yes, 0 = no), X_9= Farm proximity to river (1 = yes, 0 = no), ε_i = standard error.

RESULTS

Table 1. Socio-Economic Characteristics of Small Holder Farmers in Enugu State (n=480)

	Frequency	**Percentages (%)**
Gender		
Male	73	57.4
Female	47	42.6
Household Size		
1-4 Persons	35	27.8
5-9 persons	76	64.3
10-14 persons	5	04.3
15-19 persons	2	01.7
20 persons and above	2	01.7
Educational Status		
No formal Education	9	07.8
Primary Education	38	33.0
Secondary Education	56	44.3
Tertiary Education	17	14.8
Age		
Under 20	14	12.2
20-29	46	35.7

30-39	27	23.5
40-49	17	14.8
50-59	13	11.3
60 and above	3	02.6
Farming Experience		
1-10 years	32	27.8
11-20 years	79	64.3
21-30 years	5	04.3
31 years and above	4	01.6
Average annual Income		
100,000-200,000	14	10.9
201,000-300,000	13	11.3
301,000- 400,000	72	60.9
401,000-500,000	11	9.5
151,000 and above	10	7.4
Flood reduced rice yield/quantity		
Yes	80	92
No	20	8
Flood caused lost of revenue		
Yes	87	93.3
No	13	6.7
Total	**480**	**100**

Source: Field Survey, 2023

Table 2. Farmers Perception of Climate Hazard Occurrence in the Study Area

Variables	**Frequency**	**Percentages (%)**
Sea level rise	24	41
Flooding	68	**90**
Drought	18	31
Windstorm	27	48

Source: Field Survey, 2023

Table 3. Parameter Estimate for Effects of Flood on Rice Farmers' Consumption Expenditure in the Study Area

	Coef	**Std. Error**	**z**	**P>|z|**
Dependent variables		(Consumption Expenditure)		
Gender	324.645	228.1194	1.42	0.155
Household size	-31.5270	42.4660	-0.74	0.458
Education status	13.607	26.88384	0.51	0.613
Age	11.517	14.3024	0.81	0.421
Farming experience	5.679	30.29963	0.19	0.851

Flood reduced rice yield/quantity	-0.0022	.0001178	-18.92	0.012**
Flood caused lost of revenue	-0.0008	.0002856	-2.54	0.011**
Farm proximity to river	-0.130	.0400126	-3.26	0.021**
_cons	-1345.007	952.719	-1.41	0.158
Log likelihood	-893.296			
Number of obs	120			
chi2(15)	1172.98			
Prob> chi2	0.0000			
Pseudo R^2	0.6851			

Field survey 2023, ***, **, * Implies Significant at 1, 5, 10% Probability Levels, Respectively

Table 4. Flood Control Measures Used Among Rice Farmers in the Study Area

Rank	Practices	SA	A	D	SD	Mean	Remark
1	Fitting of water inflated sandbags as flood barriers	51 (44.3)	55 (47.8)	9 (07.8)	--	**3.44**	Agree
2	Creation of drainage	42 (36.5)	52 (45.2)	21 (18.3)	-	**3.28**	Agree
3	Removal of sediment	41 (35.7)	51 (44.3)	23 (20)	-	**3.26**	Agree
4	Building of Watergates	40 (34.8)	49 (42.6)	23 (20.0)	3 (02.6)	**3.22**	Agree
5	Construction of flood barrier socks	37 (32.2)	51 (44.3)	23 (20.0)	4(03.5)	**3.19**	Agree
6	Construction of shop vacuuming	8 (7.0)	30 (26.1)	35 (30.4)	42(36.5)	**2.03**	Disagree

Field Survey 2023, ≥3: Agree; < 3: Disagree

DISCUSSION

Table 1 shows the socio-economic characteristics of the sampled small holder farmers discussed in this section include, gender of household head, household size, education statue, age, farming experience and average annual income. The result showed that (57%) of the respondents were male while (23%) were male. Majority of the respondents are within the age range of 20-29 years. This showed that male rice farmers experienced more flood when compared with the female counterpart. This could be that male farmers are more into rice production considering labour involvement in the production and they are also willing to take risk of the frequent flood occurrence. Majority of respondents (64%) have 11- 20 years farming experience and (44%) of the respondents also attended secondary school. Majority (64%) of the respondents have household size that falls within 5-9 number of individual. Majority (61%) of the respondents has an average annual income of 301,000- 400,000 naira.

The results of table 2 indicate that majority (90%) of the respondents experienced flooding as the major climate change hazard in the study area. During the survey, the respondents indicated that over the years, there has been increased incidence and frequency of flooding. However, they emphasized that the major floods experienced in the various communities occurred in 2012 and 2022. In line with this, AkukweOluoko-Odingo & Krhoda (2020) noted that the 2012 flood was one of the most devastating flood incidences that have been experienced in Nigeria.

The estimated OLS regression model as presented in table 3 showed that flood reduced rice yield/quantity, flood caused lost of revenue and farm proximity to river negatively significantly influenced the consumption expenditure among smallholder rice farmers at 5 % probability level in the study area. The value of R2 is 0.69%; this shows that 69% of the consumption expenditure was explained by the explanatory variables as indicated in the model. Therefore, the result of the regression indicates that flood has significant effect on the farm household living standard hence; the null hypothesis was rejected. Flood negatively influenced rice yield and revenue as indicated from the analysis. This means that frequent occurrence of flood decreased rice yield (Onyeneke, 2020) as well as farmers' revenue. This study is in conformity with the finding of Amaechina et al (2022) whose study revealed that farmers loosed their crops and revenue to the incidence of flooding which had a severe effect on their livelihood. In addition, flood could also lead to rise in food prices (Sujakhu et al. 2016; Regonial et al. 2017), thereby making household living standard more difficult. The result also revealed that farm proximity to river significantly influenced the consumption expenditure. The reason could be because farms closers to the rivers tend to be more prone to flooding which account for the decrease in consumption expenditure (Ajibade, et al 2015).

Findings in table 4 revealed that the participants agreed that adding a sand bag as flood barrier is an effective flood control practices, with mean of 3.44, followed by the creation of drainage with mean 3.28. Results further show that removal of sediments from river bank is also another flood control measure with mean of 3.26 while participants also agree that building Watergates control flood with mean of 3.22. They also agreed that flood barrier socks is a control measure among farmers, creating flood barrier socks is another measure among them with mean of 3.19. However, the participants disagreed on the construction of vacuum pump as a control measure among the farmers.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

The study evaluated the effect of flood on farm household living standard among smallholder rice farmers in southeast, Nigeria. Specifically, describe the perceived climate hazard occurrence in the study area, analyze the effect of flood on farm households' living standards in the study area, described the flood control measures used among smallholder farmers in the study area. The study was guided by null hypothesis that there are no significant effects of flood on farm household living standard. Multi-stage random sampling technique was

used to select a total sample size of 480 smallholders. Primary data were collected using a well structured questionnaire. Descriptive statistics and OLS regression model were used to analyze the data. The results of the socio-economic characteristics of the respondents indicated that (57%) of the respondents were male while (23%) were male. Majority of the respondents are within the age range of 20-29 years. This showed that male rice farmers experienced more flood when compared with the female counterpart. Majority of respondents (64%) have 11-20 years farming experience and (44%) of the respondents also attended secondary school. Majority (64%) of the respondents have household size that falls within 5-9 number of individual. Majority (61%) of the respondents has an average annual income of 301,000- 400,000 naira. The result also showed that majority (90%) of the respondents experienced flooding as the major climate change hazard in the study area. The result also showed that flood reduced rice yield/quantity, flood caused lost of revenue and farm proximity to river significantly influenced the consumption expenditure among smallholder rice farmers in the study area. The result also showed that fitting of water inflated sandbags as flood barriers (M= 3.44), creation of drainage (M= 3.28), removal of sediment (M= 3.26), building of water gates (M= 3.22) and construction of flood barrier socks (M= 3.19) were the control measures they used during the incident of flood in the study area.

Recommendations

The study recommends that policy makers need better information about the challenges and potential solutions to loss and damage caused by flooding most especially for farmers living closer to river. There should also be a policy that will regulate food prices any year there is incident of flood in the country. Government should also provide palliative to flood-prone communities as this will improve farm household living standard..

FURTHER STUDY

There is need to evaluate the impact of flood on the nutritional outcome of rice considering the fact that it could be possible that flood may not only reduce rice yield but may as well affect its nutritional outcome.

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