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ECONOMIC ANALYSIS OF THE EFFECT OF FLOOD DISASTER ON FOOD SECURITY OF ARABLE FARMING HOUSEHOLDS IN SOUTHERN GUINEA SAVANNA ZONE, NIGERIA

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ABSTRACT

The study assessed the economic analysis of the effect of flood disaster on food security of arable farming households in southern guinea savanna zone, Nigeria. A multistage sampling technique was used to select 120 farmers who experienced and didn't experience flooding in Kwara and Niger States from whom data were collected with the aid of a structured questionnaire. The data were analyzed using descriptive statistics, food security index and logistics regression model. This revealed that majority of the farming household heads in the study area were predominantly young people, who were still in their active age and had at least secondary education. Also, the food security result shows that majority of the farming households who experienced flood were not food secure. The regression result shows that the coefficients which were significant were years of schooling, household size, off farm income, household expenditure and flooding. The adaptation practices adopted against flooding by households includes seasonal migration, diversification of livelihood, terracing and early harvesting. The study recommends that climatic information especially the seasonal rainfall prediction annual reports be made available early enough to farmers in the flood plain areas to reduce the effect of food insecurity.

Keywords: Flood, Food Security, Logistic Regression and Mitigate

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INTRODUCTION

Flood is the most common type of disaster causing serious economic losses in various part of the world (Ramakrishna et al. 2014). It has been described as a condition of complete or partial inundation of normally dry area due to overflow of tidal, inland water or rapid accumulation of runoff (Jeb and Aggarwal, 2008). The immediate effect of this natural disaster includes destruction of crops, loss of livestock, damage to properties, food insecurity, loss of lives among the affected communities (Alam et al. 2010; Islam & Wong 2017; Okeleye et al. 2016).

Nigeria experienced several devastating floods as a result of climate change which has affected millions of people and resulted in fiscal losses amounting to billions of US dollars (NEMA, 2013).Reports have shown that severe flood disaster had occurred in Ibadan (1985, 1987, 1990, and 2011), Osogbo (1992, 1996, 2002, and 2010, 2012), Yobe (2000), Akure (1996, 2000, 2002, 2004 and 2006) and the coastal cities of Lagos, Ogun, Port Harcourt, Calabar, Uyo, Warri among others.

In 2012, Nigeria hadone ofthe worst flooding experience in over forty years as a result of heavy rainfall that lasted several days causing flood to be experienced over 3 month period in that year. About 7.7 million people were affected with more than 2 million other people considered as internally displaced. More than 5000 individuals suffered physical injuries along with over 5900 houses damaged; food crops were wiped away resulting in major threats to food security in the nation (Nkwunonwo *et al.,* 2015; Nemine, 2015).

The incidence affected 32 states with 24 considered severely affected (NEMA, 2013). The National Emergency Management Agency (NEMA) estimated that a total of N2.29 trillion which represents 2.83 per cent of the Gross Domestic Product of N81 million for 2013 was lost as a result of the floods (Okoruwa, 2014). According to Anugwara and Emakpe (2013), flood disaster has damaged over 1.9 million hectares of lands and reduced food production along flood plains. This has been a recurrent event especially at flood plain areas where farmers rely on river as a source of irrigation during the dry season but are faced with flood experiences during raining season. According to Obalola & Tanko (2016), the huge reliance of agriculture on rainfall alone is becoming even more precarious in view of climate change. Nkwunonwo et al. (2015) debate that the impacts of flooding in Nigeria continue to trigger concerns for food security and as well vulnerability of the general public. 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 perpetually impacted negatively 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 food security of smallholder farmers occupies a large fraction of farming population and 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 natural disasters and climate change effect on agriculture, but empirical evidence on flood disaster, its implication on livelihood and coping strategies adopted by faming households in the study area is scarce. Therefore, the study seeks to examine the effect of flooding on the food security of arable farming households as well as the strategies used to mitigate flood disaster effects in the southern guinea savanna zone of Nigeria. The objectives are to

- describe the socio-economic characteristic of the farming household heads;

- examine the food security status of farming households in the study area;
- determine the effect of flood on the food security status of the farming households in the study area
- identify the mitigating strategies used in mitigate flood disaster in the study area

METHODOLOGY

Study Area

This study was carried out in Kwara and Niger States, Nigeria

Kwara and Niger States are located in the Southern Guinea Savanna Zone which is one of the four major zones into which Keay in 1953 divided the savanna regions of Nigeria (Adegbola & Onayinka, 1976). This area is commonly known as the middle belt. It is the most luxuriant of the savanna vegetation belts in Nigeria. The area is characterized by low rainfall and long dry periods of up to six months. Rainfall shows two peaks in July and September (Ogundare, Agele & Aiyelari, 2012). As the rainfall decreases, the dry season increases in severity from the south to the north and the vegetation density decreases. Rainfall varies between 1000mm in the northern end to 1800mm in the south east end (Tsado et al., 2012). The length of growing period of crops is 181 – 210 days (Salako, 2003). Coarse textured surface soils similar to the ultisols, alfisols and oxisols in the USDA classification of soils are found in this area. These soils are low in organic matter and chemical fertility. Phosphorus and nitrogen are the most deficient nutrients in these soils (Salako, 2003). Vegetation found in this area is a mixture of short trees and tall grasses. The area is also characterized by high population density and the demand for farm land is equally very high (Adeboye, Osunde, Ezenwa, Odofin & Bala, 2009).

Data used in this article are from a comprehensive survey of arable farming households in southern guinea savanna zone, Nigeria. Our sample consists of 120 farming households which were selected using a multi-stage sampling technique. The first stage involve the random selection of Kwara and Niger State. The second stage involve the purposive selection of agro ecological zone A in Kwara and zone C in Niger State, this is because the zones have always been a victim of flood experience over the years. The third stage involved the random selection of five villages from each zone and in the fourth stage, ten farming households were selected using the snow balling techniques. In all, a total of 120 respondents were used for this study comprising of 60 households who experience flooding and 60 who have not experienced flood. Personal interviews were carried out with the household heads, usually in the presence of other family members. A well-structured questionnaire was used that covered information on household expenditure, income from farming and non farming activities, food consumption and socioeconomic characteristics.

Food consumption data were elicited at the household level covering a wide range of food items. We used a 7-day recall in our survey and collected the quantities of food consumed include food from own production, market purchases, out-of-home meals including snacks. This was ultimately used to prepare a food table for the study.

Analytical Techniques

The data collected were analyzed with descriptive statistics, food security index and logistic regression model.

Descriptive Statistics

Descriptive statistics such as frequency, percentage and tabulation, use of central tendency and dispersion (mean, mode, median and standard deviation). This was used to describe the socio-economic and demographic characteristics of the respondent.

Food Security Index

The food security (Z) index as applied by Fakiyesi (2001) is given by the formula

$\mathbf{Z}=\frac{Yn}{R}$: where Yn is the nth household's daily per capita calorie intake and

R is the recommended per capita daily calorie intake.

Thus, Zn=1 for Yn>1 (i.e. food secure households) and

Zn= 0 for Yn< 1(i.e. food insecure households).

$\mathbf{H}=\frac{M}{N}$: where **H** is the headcount ratio, **M** is the number of insecure household and **N** is the total sample. The nutrients content of both produced and purchased food items were used to derive calorie availability. A daily recommended level of 2470kcal per capita and 65g protein per day defines the food security line, used in this study (Omotesho, Adewumi, & Fadimula, 2007).

Logistic Regression Model

Logistic Regression model was used to analyze the effect of flooding on food security status of farming households in the study area. It is specified asLi = $(P_i/1-P_i) = \alpha + \beta_1X_1 + \beta_2X_2\ldots+ \beta_{10}X_{10} + e_i$

Where: Li =Logit ; P_i = Food secure; $1-P_i$ = Food insecure; β_1 to β_{10}= Coefficients to be estimated; α = Constant term; e_i = Error term; X_1 = Gender of household head (binary variable: 1=male, 0=female); X_2 = Household size (adult equivalent); X_3 = Farm size (hectares); X_4 = Extension contact (binary variable: yes =1, no = 0); X_5 = Education (years of schooling); X_6 = Farming experience (years); X_7 = Farm income (Naira); X_8 = Off farm income (Naira); X_9 = Access to credit (binary variable: yes =1, no = 0); X_{10} = experience of flood (binary variable: yes=1, no=0)

RESULTS AND DISCUSSION

Socio-Economic Characteristics of Farming Household Heads

Table 1 revealed that 70.83% of the farming household heads were male which shows that farming is dominated by male in the study area. The mean age was 45.1 years. This revealed that majority of the farming household heads in the study area were predominantly young people, who were still in their active age. Majority (66.67%) of the farmers in the study area had at least secondary education which helps them to be better informed and have access to information on improved farming technologies. Also 70.83% of the farmers were married. The mean farm size is 3.2 hectares and most of the farmers (55%) had less 2hectares which they use for agricultural activities. This shows that majority of the farmers are small scale farmers.

Food Security Status of Farming Households

Table 2 presents the households food security status of farming households who experienced flood and those who didn't. About 45% and 62% of the farming households who experienced flood and farming households who did not, were food secure respectively. The mean daily energy and protein available to the food-secure households for those who experienced flooding and who didn't experience flood are (19124.75 Kcal and 450.17g) and (18050.51 Kcal and 411.86g) respectively while the daily per capita energy for food secure households who experienced flood and who didn't experience flood are 2951.35kcal and 3438.19kcal respectively.

Effect of Flooding on Food Security Status of Farming Households

The results in table 4 revealed that food security status of farming households is significantly affected by years of schooling, household size, off farm income, household expenditure and flooding activities. The coefficient of years of schooling was positive and significant at 10% which implies that the more educated a household head is the more the likelihood of being food secure. This is likely to be because such a farmer is exposed to better information and can easily adopt new technology which eventually improves their food security. Level of education influence farmer's adoption rate which agrees with Alene *et.al.*, (2000) who reported the relationship between farmer's rate of adoption of improved practices and food security in Ethiopia.

Household size was negative and significant at 1%, it implies that the smaller the household the likelihood of being food secured. This is inline with the study by Babatunde et al. (2007) who concluded that larger household sizes are more likely to be food insecure than smaller size households.

The coefficient of off farm income was positive and significant at 5%, implying that households with higher off farm income are likely to be more food secured. Household income is important as it determines how much can be spent on various needs of thehousehold. The quantity and quality of a household's expenditure patterns are highly correlated with the purchasing power of the household. Bashir et al. (2010) also found a positive impact of income on food security.

The coefficient of household food expenditure was also positive and significant at 1%, implying that an increase in household expenditure increased the likelihood of being food secured. Similarly, the coefficient of flood was also found to be negative and significant at

10%. This shows that the lesser the flooding activities farming households experienced the more the likelihood of being food secured.

The coefficients of determination with value 0.5241 shows that the explanatory variables explain about 52.4% of the variations in the factors influencing food security implying that more of the variation is explained by the model.

Adaptation Strategies Adopted by Farming Households

The result in Figure one shows the adaptation strategies employed by households living in flood prone areas in Kwara and Niger States. Seasonal migration is practiced by most households (about 58%) to reduce the effects of flooding on their welfare. The surveyed households who were arable farmers also adopted diversification of livelihood (about 25%) to be able to withstand the effects of flooding, this is in consonance with studies by (Yaro, 2013 and Epstein et al, 2018) that noted that livelihood diversification is commonly adopted to cope with economic and environmental shocks in various communities. About 10% practiced terracing to mitigate the effect of flooding while 7% of the households adopt early harvesting to reduce the effect of flooding

CONCLUSION AND RECOMMENDATION

In this article, we have analyzed the effects of flood on household food security and the various strategies used to mitigate flooding disaster in the study area. Descriptive analyses and econometric approaches used have shown that flood contributes to food insecurity at the household level in the study area.

However, the study recommends that if the problem of food insecurity among farmers cultivating along flood plain will be addressed. There is need for sensitization of farmers on how to effectively mitigate the effect of flooding by adopting adaptation strategies like early planting and planting of crops that can withstand flood.

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APPENDIX

Table 1: Socio-Economic Characteristics of the Farming Household heads

Characteristics	Frequency	Percentage
Sex		
Male	85	70.83
Female	35	29.17
Total	120	100
Age		
< 30	16	13.33
30-39	25	20.83
40-49	49	40.83
50-59	25	20.83
>60	05	5.00
Total	120	100
Educational Level		
No Formal	05	04.17
Primary	35	29.17
Secondary	65	54.16
Tertiary	15	12.50
Total	120	100
Marital Status		
Single	21	17.50
Married	85	70.83
Widowed	14	11.67
Total	120	100
Farm Size		
<2.0 hectare	66	55.00
2.0-4.0	39	32.50
>4.0	15	12.50
Total	120	100
Farming Experience		
<5	15	12.50
5-10	28	23.33
11-16	35	29.17
16-21	40	33.33
>22	2	01.67
Total	120	100

Source: Field survey, 2019

Table 2: Food Security Status of Farming Households

	Farming households Who Experienced Flooding		Farming households Who Didn't Experienced flooding	
	Food Secure	Food Insecure	Food secure	Food Insecure
Household Percentage	44.6	65.4	61.7	48.3
Mean Adjusted Household Size	6.48	6.85	5.25	6.15
Household daily energy availability (Kcal)				
Household daily per capita energy (Kcal)	19124.75	14762.09	18050.51	13813.39
Household daily protein availability (g)	2951.35	2155.05	3438.19	2246.08
Household daily per capita protein	450.17	337.09	411.86	348.83
availability (g)	69.47	49.21	78.45	56.72
Head Count Ratio	0.546	0.454	0.617	0.383

Source: Field survey, 2019

Table 4: Logit Regression Result of Effect of Conflict on Food Security

Variables	Coefficient	p>Z
Sex	0.464009	0.600
Age	0.011916	0.666
Years of Schooling	0.042934*	0.071
Farm Size	-0.360874	0.246
Household Size	-0.521138***	0.000
Off Farm income	0.000012**	0.042
Household Food Expenditure	0.000033***	0.000
Flood	-1.058139*	0.073
Constant	3.700533*	0.058

Source: Field survey, (2019)

* Significant at 1%, **significant at 5%, ***significant at 10%. Number of observation = 110. LR chi^2 (10) = 79.62. Prob> chi^2 = 0.0000. Log likelihood =-36.14451 Pseudo R^2 = 0.5241

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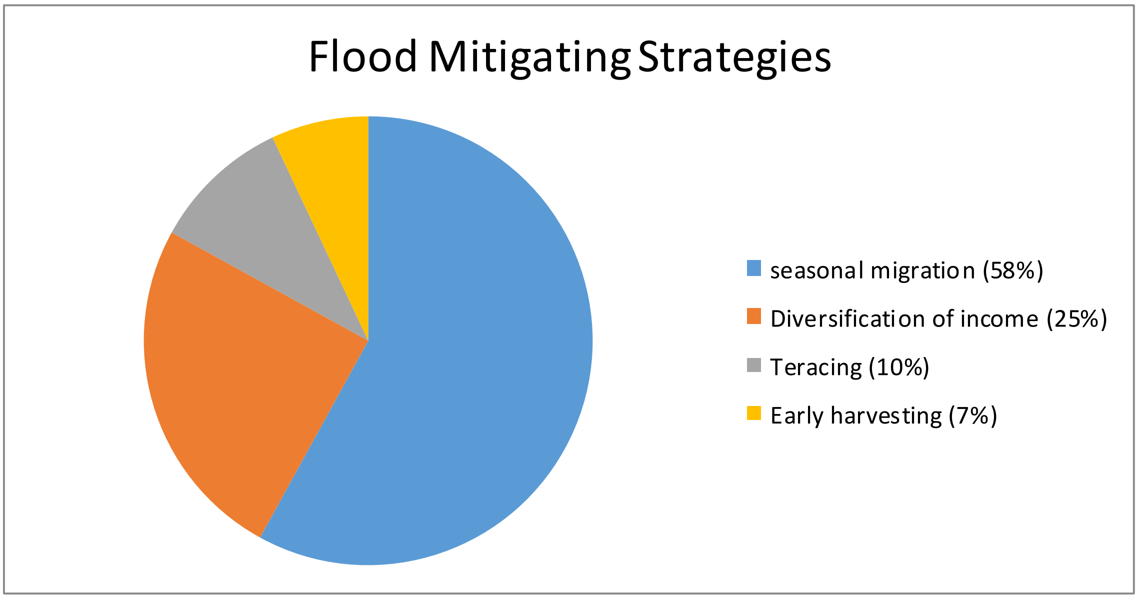

Figure 1: Percentage distribution of adaptation strategies to Flooding