EFFECT OF CLIMATE CHANGE-INDUCED MIGRATION ON FOOD SECURITY OF FARMING HOUSEHOLDS IN SELECTED LOCAL GOVERNMENT AREAS OF ABIA STATE, NIGERIA

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ABSTRACT

The study examined the effect of climate change-induced migration on food security status of farming households using 120 households selected from four communities in Abia State, Nigeria. Data were analyzed using descriptive statistics, FGT and probit model. The result showed that climate change-induced migrants more likely come from households with older heads that are less educated as compared with non-migrant household heads. There was high perception of climate change incidences (flooding and erosion 93.33%, irregular and unpredictable rainfall patterns 85%, increased incidence of pest and disease 81.67%) by the farming households in the area. In spite of this, a high percentage of the households (43%) do nothing in the form of adaptation. The food security of households based on their migration status showed that 47% and 31% of migrant and non-migrant households were food secure respectively. The mean monthly food expenditure of migrant households was ₦49535.13 while non-migrant households was ₦40493.12 with p-value of 2.24 which showed that migration significantly influenced food security in the study area. The probit regression result showed that climate change-induced migration significantly improved food security status of farming households. Also, education, access to credit, farm size and remittance significantly influenced the food security of the farming households in the study area. The study therefore, recommends the need for the government to provide the necessary incentives for people living in climate ravaged communities to encourage them relocate from high risk areas to low risk areas.

Keywords: Adaptation, Climate Change, Farming Households, Food Security, Migration

INTRODUCTION

The world's demand for food is expected to double within the next 50 years, while the natural resources that sustain agriculture will become increasingly scarce, degraded, and vulnerable to the effects of climate change (FAO, 2016). In many poor countries, agriculture accounts for at least 40 percent of GDP and 80 percent of employment. At the same time, about 70 percent of the world's poor live in rural areas and most depend on agriculture for their livelihoods (World Bank, 2008). Also, in sub-Saharan Africa, two-thirds of the working population still make their living from agriculture (ILO, 2007).

Climate change affects food availability through its increasingly adverse impacts on crop yields, fish stocks and animal health and productivity, especially in sub-Saharan Africa where most of today's food insecure live (Porter *et al.*, 2014). Along with a more volatile climate, there is tendency to be an

increase in the intensity and frequency of climate-related natural disasters. Poor people, including many smallholder farmers and agricultural workers, are more vulnerable to the impacts of such disasters. Severe droughts or floods can sharply reduce incomes and cause asset losses that erode future income earning capacity. Both urban and rural poor would be most affected by increase in food prices, as they spend much higher shares of their income on food (Zezza *et al.,* 2008; World Bank, 2010; Porter *et al.,* 2014).

Climate change poses a major and growing threat to global food security. As climate change impacts on agriculture intensify, it will become increasingly difficult to grow crops, raise animals, manage forests and catch fish in the same ways and in the same places as we have done in the past. However, the evidence and impact of climate change are reflected in extreme temperature, droughts, heavy rainfall, floods and severe weather storms. These shocks are becoming the norm in several African countries leading to loss of farm lands, livestock resources, homes and livelihoods. These translate to reduced food production, income and asset base.

The impact of climate shocks easily takes a severe effect on rural communities because production systems which include tree felling, bush burning, and other ecosystems unfriendly approaches are often practiced (Aworemi *et al.*, 2011). Climate and weather extremes can lead to social disruption, population displacement and spread of communicable diseases (Xiaoxu *et al.*, 2016). In the event of severe shocks, households in rural communities tend to seek off-farm/off-household opportunities to tie them over difficult seasons. Traditionally, they diversify risks by planting several crops, developing a side-trade, taking on jobs with regular payment and migrating. It is however becoming more common to have more households opt for migration as a result of climate shock impact on the farm and other means of livelihoods (Marchiori *et al.,* 2012). Migration may be defined as the movement of people from one location to the other for economic, social or political reasons (Sinha, 2005, Jolly and Reeves, 2005). Migration could be the end result of a process and it can be induced by an event such as extreme climate shocks. According to Marchiori *et al.* (2012), the analysis of the impact of weather anomalies on migration in sub-Saharan Africa had revealed that climatic forces and fluctuations are capable of inducing human migration. In 1990, the Intergovernmental Panel on Climate Change (IPCC) noted that the greatest single impact of climate change could be on human migration—with millions of people displaced by shoreline erosion, coastal flooding and agricultural disruption. Myers (2005) pointed out that more than 200 million people will be climate migrants by the year 2050.

A primary dimension, along which studies of the effects of climate change on migration vary, is the degree to which they are able to identify the causal channel through which climate affects migration decisions (IOM, 2009). In the extreme bad weather events as well as seasonal flooding and drought can clearly lead to migration by sweeping off rural settlements thereby forcing communities to move to another location. In this case, climate change acts as a push factor

in determining migration just as favorable climate could also pull people from adversely affected areas – or it may have direct effects on migration due to increased amenity differentials between source and host countries (Olajide, 2017).

Migration is a vital component in understanding the link between population, livelihood and climate change (Stephenson *et al.,* 2010). While some scholars described migration as an adaptation strategy to climate change (Davis *et al.,* 2018; Mayer, 2011), migration is also described as a failure to mitigation or adaptation (Mayer, 2011). The effect of climate change on migration has gained attention among researchers as well as those in charge of policy design and implementation. It is becoming a concern for analyzing the movement of people from one location to another. It is implicitly imbedded in other drivers of migration such as the lack of employment and the primary objective of migration which is to move from a place that is considered as bad to another place considered as good. For instance, migrants move to areas (destinations) that can give higher income (Cai *et al.,* 2016).

As an adaptation strategy to climate change and climate shocks, smallholder farmers are faced with the decision to migrate or not to migrate. Whichever way the decision is taken, there are implications on the farming households and the rural economy. On one hand, migrants are able to send remittances to their households in the affected areas in order to cushion their expenditure and standards of living. Where production conditions return favourable, households are able to invest remittances in agriculture through inputs purchase as well as investment in improved technologies. On the other hand, migration leads to a reduction in agricultural labour. Considering that smallholder farmers are resource poor; the low availability of human labour can have an obstructing effect on agricultural activities.

There is substantial evidence of the impact of migration on agriculture labour supply and output in Nigeria. For instance, Mgbakor *et al.* (2014) found that rural-urban migration leads to a reduction of agricultural labour supply and as well as output in Aniocha South Local Government Area of Delta State while Lawal and Okeowo (2014) in their study of the effects of rural-urban migration on labour supply in Cocoa production in Ondo East Local Government Area of Ondo State found that an increase in rural-urban migration will reduce total number of labour available for agricultural production, and this will consequently reduce farm output as well as farmers' income. There is an increasing rural labour gap as a result of the continuous migration of the youths to the urban areas. Ofuoku and Chukwuji (2012) concluded that rural-urban migration is a major challenge to agriculture in the Niger-Delta States, as it has significantly led to labour loss, incomplete harvest and revenue forgone. But there is no study that substantially revealed if migration as a result of climate change affect the food security of the households left behind. It is in this light that the study seeks to examine the effect of climate change-induced migration on food security of households in selected local government areas of Abia State, Nigeria.

MATERIALS AND METHODS

The study was carried out in Abia State, Nigeria. The State lies between latitude

5° 25′ 0″ North and longitude 7° 30′ 0″ East. It is situated in the Southeast geopolitical zone of Nigeria and is bounded by Imo State on the West, Ebonyi and Enugu States on the North, Cross Rivers and Akwa Ibom States on the East, and Rivers State on the South. The State has a total land area of 6320 square kilometres and a population size of 4,222, 476 persons (National Population Commission, 2017). The State is divided into three agricultural zones, namely Umuahia, Ohafia, and Aba Zones. Major agricultural produce includes maize, yam, plantain, rice, vegetable, melon, beans. Livestock reared in the area include goat, sheep, pigs, poultry and fish. Most prominent of economic activities in Abia state includes: farming, trading, manufacturing, and fabrication.

Analysis of rainfall pattern showed a very unstable pattern with the region experiencing early cessation and late onset since 1941 which has shortened the length of the rainy season; with the mean annual rainfall also decreasing by 2-4mm in few places across the region, (Akpodiogaga-a and Odjugo, 2010; NIMET, 2016). This observation indicates high volatility in the movements of rain day, and rainfall volume. In addition, significant increase in temperature has also been observed in the south-east region since 1941. Temperature increased from $0.4^{o}C - 0.9^{o}C$ in the region; and it is still projected to rise further (NIMET, 2016). Empirical evidence also showed that Abia State and other southern states are vulnerable and susceptible to flooding and erosion due to its unconsolidated, friable, sandy or silty condition (Obasi, 2013; Ajiere *et al.*, 2019; Ibeabuchi *et al.*, 2018).

A multistage random sampling approach was used for the study. The first stage involved purposive selection of 2 LGAs (Ikwuano and Bende) where farming is predominant and also climate change incidences such as flooding and erosion are profound. The second stage involved the random selection of two villages from each of the LGAs, namely: Okporoenyi and Ameke in Bende; and Itunta and Obohia in Ikwuano. The final stage involved the systematic selection of 30 households from each of the four villages (Okporoenyi, Ameke, Itunta and Obohia) with a sampling interval of 4,2,5 and 3 respectively to get a total sample of 120 respondents. Out of these 120 respondents, 42 were non-migrant households while 78 were migrant households.

Primary data were used for the study. The data were collected from households through the use of a structured questionnaire. For the purpose of this study, a household would have a climate change induced migrant if any household member has moved to another location temporarily or permanently; and by the collective decision of the household; basically due to climatic stress or fluctuation with potential impact on the household. We therefore adopt the New Economics of Migration approach (Stark and Bloom, 1985; Katz and Stark, 1986) where migration is a household collective activity and not an individual decision. The unit of observation is therefore the household.

Descriptive and inferential statistics were used for the study. Household's expenditure on food which has found wider application in several empirical studies (Foster *et. al.*, 1984; FAO, 2003; Omonona *et al.*, 2007; Abimbola and Kayode 2013) was used to

estimate the food security line for households in the study.

The food security index formula is given by:

$$Fi = \frac{per\ Capita\ food\ expenditure\ for\ the\ ith\ household}{^2/_3\ mean\ per\ capita\ food\ expenditure\ of\ all\ households} \quad (1)$$

Where Fi = Food security index

When Fi > 1= Food secure i^{th} household

Fi < 1= Food insecure i^{th} household.

The construction of the food security line follows from Omonona *et al.* (2007). Therefore, the food security line was estimated as the mean-per capita monthly expenditure of all households. Households thereafter were classified into their food security status as - food secure and food insecure households based on the food security line computed. A food insecure household is that whose per-capita monthly food expenditure falls below two-thirds of the mean monthly per-capita food expenditure, while a food secure household is that whose per-capita monthly food expenditure is greater than or equal to two-third of the mean per-capita expenditure on food.

Based on the food security index (Fi), probit regression was estimated to examine the effects of explanatory variables including climate change-induced migration on food security among the respondents.

Binary Probit Regression Model

The binary probit regression model is appropriate for modelling dichotomous endogenous variables. For this paper, the Households Food Expenditure proxies the household food security status, where households were classified into food secure (assigned a numeric value 1) and food insecure (assigned a numeric value 0). The binary probit regression model then provides a framework for detecting the probability of being food secure or otherwise (food insecure) by a household as a result of climate change-induced migration. The choice of the determinants of household food security status was guided by various studies, such as the (Usman and Olagunji, 2019; Cameron and Trivedi 2010; Cheema and Abass, 2016; Oluyole and Taiwo, 2016)

$$P_r(y = 1) = P_r\left(Z^i\beta + \mu > 0\right) \text{..... (2)}$$

$$= P_r\left(-\mu < Z^i\beta\right) \quad (3)$$

$$= F\left(Z^i\beta\right) \quad (4)$$

where F is the cumulative density function specified for a standard normally distributed error term.

Z^i represents explanatory variables which include climate change-induced migration. β is a vector of parameters

The threshold index equation for the binary model is stated as;

$$\begin{cases} 1, if\ food\ secured\ household \\ 0, otherwise \end{cases} \text{..... (5)}$$

The empirical model used to estimate the Probit model is given thus:

$$P_r* = \beta 0 + \beta 1X_1 + \beta 2X_2 + \beta 3X_3 + \beta 4X_4 + \beta 5X_5 + \beta 6X_6 + \beta 7X_7 + \beta 8X_8 + \mu_{1i} \text{ ... ...(6)}$$

Where, P_r* is the food security status of the household in the study area which takes the value of 1 for food secure and 0 otherwise.

The variables included in the model are as follows:

P_r* = Household food security status (1=food secure, 0=otherwise)

X_1 = age of household head in years

X_2 = sex of household head (male =1, otherwise=0)

X_3 = education measured as number of years in school

X_4 = credit access (credit=1, 0 otherwise)

X_5 = farm size in hectares

X_6 = household size in number

X_7 = annual non-farm income in Naira

X_8 = Climate Change-Induced migration (household with climate change induced migrant =1, otherwise=0)

X_9 = Remittance (measured as total remittance income received by the household over the last one year expressed in naira per adult equivalent)

μi= error term

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Migrant and Non-Migrant Households in the Study Area

The results of the socioeconomic characteristics of migrant and non-migrant households are presented in Table 1.

TABLE 1: SOCIOECONOMIC CHARACTERISTICS OF MIGRANT AND NON-MIGRANT HOUSEHOLDS IN THE STUDY AREA

Variable	Non-Migrant Household		Migrant Household	
	Frequency	%	Frequency.	%
Sex				
Male	31	73.81	70	89.74
Female	11	26.19	8	10.26
Age (Years)				
29-38	-	-	1	1.27
39-48	4	9.52	20	25.64
49-58	26	61.90	33	42.30
59-68	12	28.57	24	30.77
Mean	**48.2**			**53.1**
Level of Education (Years)				
Primary	18	42.86	30	38.46
Secondary	21	50.00	43	55.13
Tertiary	3	7.14	5	6.41
Mean Number of years spent in school	**12.8**			**11.2**
Farm Income (~~N~~)				
1000 – 50000	30	71.43	45	57.71
50001 – 100000	7	16.67	13	16.67
100001 – 150000	3	7.14	6	7.68
150001 and above	2	4.76	14	17.94
Mean		**44035.15**		**56108.67**
Household Size				
1 – 3	14	29	28	35.90
4 – 6	24	57.14	39	50.00
7 –9	4	9.52	11	14.10
Mean		5.1		4.8
Farm Size (Hectare)				
0.1 – 1	28	66.67	57	73.08
1.1 – 2	9	21.43	11	14.10
2.1 – 3	2	4.76	1	1.28
3.1 – 4	3	7.14	9	11.54
Mean	1.33			1.01

Source: Field Survey, 2018

The sex distribution of the respondents showed that 89.7% and 73.8% of the migrant and non-grant household heads respectively, were male. This is as expected in the traditional African society where male is always the household head. The age distribution of the respondents showed that 42.3% and 62% of migrant and non-migrant household heads were within the age of 49-58 years with mean age of 53.1 years and 45.2 years, respectively. This suggests that households with older heads could respond more to climatic stress by having one or more member(s) of households who migrate than to younger household heads.

The distribution of the respondents based on their level of education showed that majority (50% and 60.3%) of migrant and non-migrant household heads had secondary education with years spent in school of 11.2years and 12.8years, respectively. This implies that non-migrant household heads were more educated than the migrant heads in the study area as a result, education could act to expose the non-migrant heads to adaptation strategies in the face of extreme whether events.

The distribution of the respondents based on their monthly income showed that majority (57.7% and71.4%) of the migrant and non-migrant household heads earn between ₦1000-50000 per month with mean household income of ₦56108.7 and ₦44035.2 respectively. This implies that migrant household heads earn more income than the non-migrant heads. This suggests that climate change-induced migrant households earn more than non-migrant households; this could be as a result of remittances they receive from their wards that have migrated.

The distribution of the respondents based on their household size showed that 50% and 57.1% of migrant and non-migrant households had between 4-6 persons in their households with mean household size of 5 persons. This implies that the household size of the respondents was moderate and relatively the same in the study area.

The distribution of the respondents based on farm size showed that majority (73.1% and 66.7%) of migrant and non-migrant household heads cultivated between 0.1-1 hectare with mean farm sizes of 1.01 hectares and 1.3 hectares, respectively. Migration of active labour force could be attributed to the fact that while the farm size of migrant households are less than that of non-migrant households; with less active labour, high cost of hired labour and extreme weather events, households with migrants may resort to other livelihood activities while maintaining a subsistence level of farming that could only take care of the available members.

Household Perception of Climate Change Incidence in the Study Area

The perception of climate change and the antecedent incidences in the study area is given in Figure 1. Accordingly, 93.33% of the respondents observed an increased incidence of flooding and erosion as against 6.67% who perceive otherwise. In addition, 85% of respondents observe irregular and unpredictable rainfall patterns as against 15% who feel otherwise. Also, on the other hand, 81.67% of respondents perceive an increased incidence of pest and disease attacking their crops and livestock. This implies that households in the study area were aware of

the incidence of climate change event in their environment.

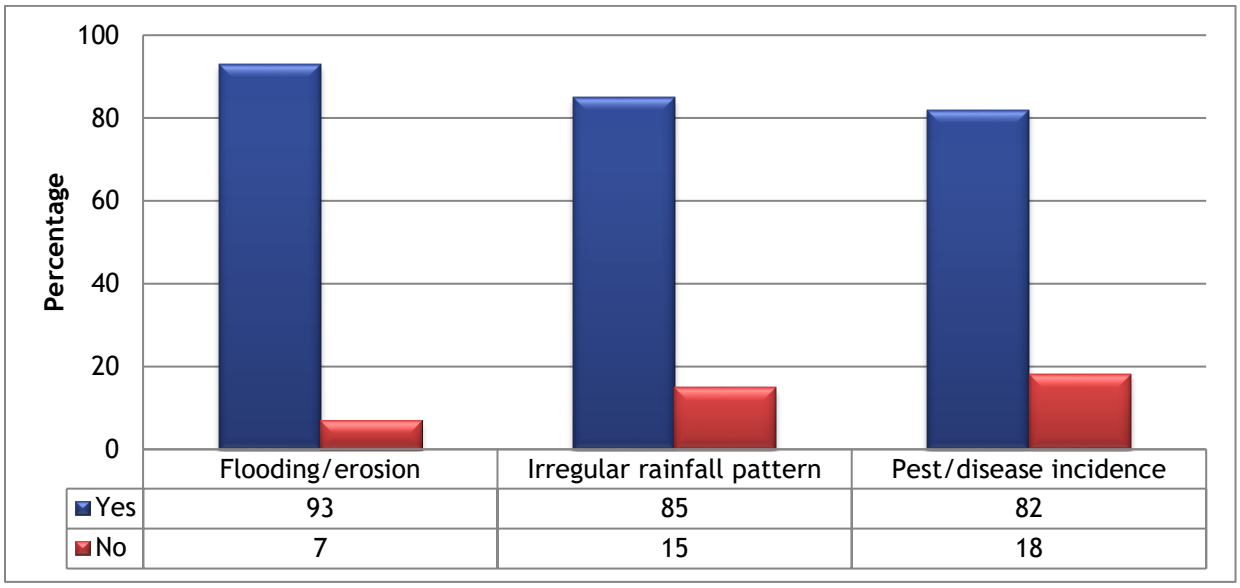

FIGURE 1: DISTRIBUTION OF RESPONDENT BASED ON HOUSEHOLD PERCEPTION OF CLIMATE CHANGE INCIDENCE

Adaptation Measures Adopted by Farming Households in the Study Area

The adaptation measures adopted by farming households in the face of climate change event are shown in Figure 2. The result showed that 43% of the households do nothing in the form of adaptation in the face of extreme weather events while 35% of the respondents had one or more of their household members engaged in migration as a form of adaptation. Additionally, 14%, 5%, and 3%, respectively adapted by means of chemical application, blocking entrance of flood into the farm, and constant monitoring and clearing of the farm. For resilient households, migration is one of a variety of adaptation measures. IFPRI, (2015) noted that most vulnerable households that have few or no livelihood diversification opportunities, have no access to assets such as land and are characterized by low skillsets, use migration as a survival strategy

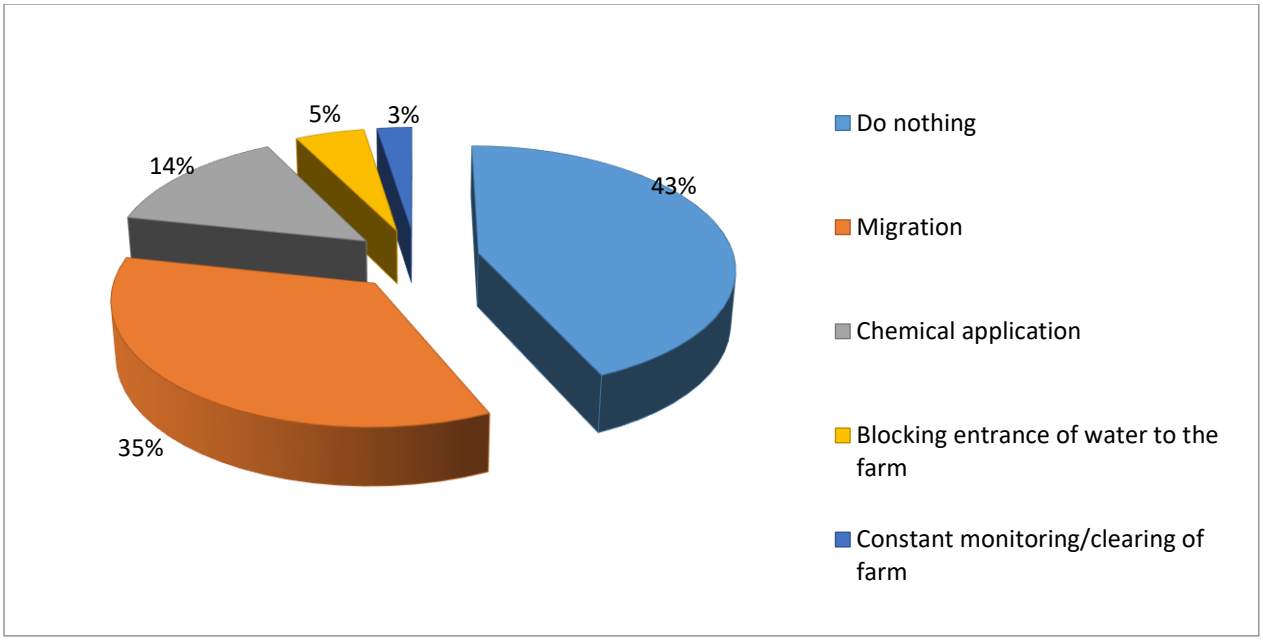

FIGURE 2: ADAPTATION MEASURES ADOPTED BY RURAL FARMING HOUSEHOLDS IN THE STUDY AREA

Food Security of Households in Relation to their Migration Status

The food security of households in relation to migration status is presented in Table 2. Using the Foster, Greer and Thorbecke (FGT) model and as specified in the study methodology, households were categorized into food secure and food insecure based on their migration status.

TABLE 2: FOOD SECURITY OF HOUSEHOLDS IN RELATION TO THEIR MIGRATION STATUS

Variable	Food Secure	Food Insecure
% of Migrant Households	47.40	52.60
% of Non-migrant Households	31.00	69.00
Head Count Ratio	0.42	0.58
Mean food expenditure of Migrant Households	₦49535.13	
Mean food expenditure of non-migrant Households	₦40493.12	
2/3 Mean per Capita Food Expenditure	₦29345.79	
P-Value	2.24**	

Source: Field Survey, 2018, ** statistically significant at 5% level

The food security of households based on their migration status shows that 47% of migrant households were food secure while about 31% of non-migrant households were food secure. This shows that migrant households were more food secure that non-

migrant households in the study area. The head count ratio of the households in the study area showed that 42% were food secure while 58% were food insecure. This means that more farming households were food insecure. This is consistent with the result of Okpokiri *et al.,* (2017) who found that 63% of the farming households in Abia State were food insecure. The mean monthly food expenditure of migrant households was ₦49535.13 while non-migrant households was ₦40493.12 with p-value of 2.24. This shows that the difference between the mean food expenditure between migrant and non-migrant households was statistically significant at 5% level. By implication, migration significantly influenced food security of households in the study area. The result agrees with Saleh and Mustafa, (2018) who found that 78% of farm households in Kaduna State were food insecure. This suggests that farming households embark on climate-induced migration to improve the food security status of members left behind.

Effect of Climate Change-Induced Migration on Food Security of Households

The Probit regression result used to examine the effect of climate change-induced migration on food security is presented in Table 3. The coefficient of climate change-induced migration was positive and significantly influenced the food security status of household left behind at 5% level. This implies that households with migrants have high probability of being food secure than household without migrants. In rural areas, expectations of inadequate rainfall and its impact on rain-fed agricultural production increase the risk of hunger and can drive migration. According to Afifi *et al*. (2014), households use migration to manage climatic risks like rainfall variability; and migration (seasonal, temporal, or permanent) plays an important part in families struggle to deal with rainfall variability and livelihood insecurity.

The coefficient of education of household head was positive and significantly influenced food security at 1% level. This implies that the higher the educational level of the household heads the higher the probability of being food secure. Educational attainment of the household head could lead to exposure and awareness of the possible adaptation and mitigation strategies to climate change thereby increasing yield, income and food security of the entire households. This is consistent with Irohibe and Agwu (2014) who found that the higher the number of years the household head spends in school, the probability of the household being food secure.

The coefficient of access to credit was positive and significant at 5% level. This implies that access to credit facility improves the food security status of farm households in the study area. Credit has often been canvassed as necessary requirement to help farmers in rural communities overcome production constraints. Also, credits encourage farm households to invest in land conservation practices that enable them adapt to climate change events. This is consistent with Osuji *et al.* (2017) who stated that the more access the farmer has to credit, the probability of the households being food secured.

The coefficient of farm size was positive and significant at 5% level. This implies that the larger the farm size of the farmer, the higher

the probability of the households being food secured. This also suggests that the larger the farm size, the better food security status of the farming household. As farm size increases, income increases with better climate change adaptation practices and food security as well also increases. FAO (2016) noted that farm size is considered critical for the determination of the size of crop harvest. It is expected with increased farm size and subsequent crop yield, food security level of households will improve.

The coefficient of remittance was positive and significant at 10% level. This implies that the increase in remittances as a result of migration have the probability of increasing household's food security in the study area. This is consistent with the findings of Ofuoku (2018) and Narges *et al.* (2018) who separately found that remittances from migrated household member had significant and positive relationship with household security.

TABLE 3: PROBIT MODEL ESTIMATE OF THE EFFECT OF CLIMATE CHANGE-INDUCED MIGRATION ON FOOD SECURITY

Food security	Coefficient	Std. Err.	P-value
Age	.0049639	.0135885	0.37
Sex	-.49216	.4277991	1.15
Education	.1520628	.0447842	3.45***
Credit Access	1.366153	.5471081	2.57**
Farm size	.0154113	.0072774	2.12**
Household size	-.0167935	.0839784	0.29
Off-farm income	.3434314	.2996643	1.26
Induced migration	.6458176	.3046365	2.12**
Remittance	1.7381	0.9932	1.75*
-cons	-1.59264	.7994172	1.99*
/sigma	1.333846	.133837	
Log likelihood	-141.3342		
Pseudo R^2	0.0924		

Source: Field Survey, 2018 *, ** and * indicate statistical significance at 1%, 5% and 10% level respectively**

CONCLUSION AND RECOMMENDATIONS

The study showed that migrant households were more food secured than non-migrant households in the study area. Migration in the face of climate change disruptions was to cushion the effect of food insecurity on the households left behind. Perception of climate change incidences (flooding and erosion, irregular rainfall patterns, and incidence of pest and disease) were high amongst farming households in the study area. Adaptation was far from favorable as large percentages, in spite of the overwhelming awareness of the changes in climate and the incidences thereof, do nothing in the form of adaptation. The study further revealed that climate change-induced migration enhanced food security status of rural farming households left behind in the place of origin. Also, education, access to credit and farm size and remittance significantly influenced the food security status of the households in the study area.

The study therefore, recommends the need for the government to provide the necessary incentives for people living in climate ravaged communities to encourage them relocate from high risk areas to low risk areas.

In addition, there is a need to increase investment in climate resilient infrastructures to boost farmers' adaptation to climate change events.

Educational level of household head was a significant determinant of food security status of the farming households. Improving the educational attainment of the household heads could lead to exposure and awareness of the possible adaptation and mitigation strategies to climate change thereby increasing yield, income and food security of the entire households.

Access to credit was also a significant determinant of food security of the households. Policies should be aimed at ensuring that Institutional credit sources are made available and the procedural difficulties in securing credit facilities are reduced, so as to encourage farmers access to such credit facilities for increased agricultural production and hence, food security.

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