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Household Food Security Response to Climate Change Extreme Events in Taraba State, Nigeria

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Abstract
The study examined the response of household food security to climate change extreme events and socio-economics characteristics of the household in Taraba State, Nigeria. The primary data used in this work were collected from a random sample of 450 households. Data were collected using questionnaire containing the Household Food Insecurity Access Scale (HFIAS) module, which served as interview schedule. Data were collected on the household socio-economic characteristics, climate change extreme event happenings in the area and, food security conditions.Descriptiveand inferential analytical tools were employed in analysing the data. The results show that 92 percent of households in Taraba were food insecure, and 8 percent had high or marginal food security. Very low food security status was found to correlate with having a household head who is a farmer, less educated, divorced, and also with households with low household income and expenditure; large household size; and ownership of little or no plot of land. Results showed that households in Taraba were faced with the problems of climate extreme events.The Chi-square result showed thatgreater proportion of the households that experienced climate change extreme events had very low food security status. In simple terms, there were more extreme event affected households (more than three times the non-affected ones) in the very low food insecure category. Good weather forecast system was recommended and that government should make effort to enlighten the citizens on the dangers of these extreme event and proffer ways of improving the environment.
Keywords: Food security, climate change extreme events, HFIAS categories, socioeconomic characteristics.

Introduction

Humanity today faces many obstacles to the achievement of sustainable development; a term which has been widely adopted since it was originally defined by the 1987 Brundtland Commission as 'development that meets the needs of the present, without compromising the ability of future generations to meet their own needs' (World Commission on Environment and Development, 1987). Swilling & Annecke (2012) have referred to these obstacles to sustainable development as a 'polycrisis' and identified seven key issues that need to be addressed in order to resolve the polycrisis: ecosystem degradation, climate change, oil peak, poverty and inequality, material flows, urbanisation and food security.

Globally, about 805 million people are estimated to be seriously undernourished (FAO, IFAD, & WFP, 2014); despite the massive improvements in food production over the past six decades since the Green Revolution, and the fact that enough food is produced to feed over ten billion people (Holt-Giménez, Shattuck, Altieri, Herren, & Gliessman, 2012). The food insecure lack access to sufficient quantity and quality of food for a healthy and active life, which can compromise their health, wellbeing and productivity. A country with many food insecure citizens can even lead to a lower Gross Domestic Product for a country, making food insecurity an economic challenge, as well as a human rights problem (FAO 2012b; White & Masset 2007; Jones et al. 2013). To achieve the goal of hunger eradication in a sustainable manner, as proposed in the Sustainable Development Goals (United Nations Department of Economic and Social Affairs, 2014), there is a need for study the effects of climate change on the food security of households.

Food insecurity is a challenge to human society, affecting physiological, environmental and economic development. To address this challenge, there is a need for comprehensive information on the nature and prevalence of food security, and also a proper identification of how socioeconomic and climate change extreme event affects the food security status of the people. This will allow for more effective policies, programmes and food aid design and monitoring.

Climate change will result in additional food insecurities, particularly for the resource poor in developing countries who cannot meet their food requirements through market access (FAO, 2008). Impacts of climate change on food security are global and local. Climate change will affect agricultural food systems in all countries, including exporters and importers as well as those at subsistence level.

2. Literature Review

2.1Climate Change in Taraba State

Presently, the people in Taraba state and Nigeria as a whole are experiencing one form of problem or the other that are related to climate change. Many areas suffer from flood disaster, late onset of rains and early cessation of rainfall, increasing temperature, reduced river flow, declining water table, loss of some plants and animal species and outbreak of some climate related diseases such as malaria, meningitis etc, which affects human lives and

livelihoods (Oruonye, 2011).

FEWS NET (2011), predicted increase in rainfall that will lead to flood in the north east zone of Nigeria which will have adverse effects on the food security of the people, because of their low adaptive capacity. Taraba state has experienced so many cases of environmental disaster that can be linked to climate change. A case in point is the flood caused by heavy rain that lasted for eight hours on 7 August 2005, this led to the collapse of the theJalingo bridge, displacing 50,000 people from their homes and killing over 100 people. Another flood in September 2011 washed away the Tella bridge on the Federal road, which is the shortest route that connects thestate to the other parts of the country throughJalingo, the Taraba State capital. This led to untold hardship for the people of Taraba and Adamawa States, and, restricted the movement of goods to and from the States to other States of the Federation. In the same month of September, the Gashaka bridge that connects Saduana local government to the rest of the state also collapsed this can be seen as a pointer to the existence of climate change crises.

There is urgent need for a better understanding of the changing climate pattern and how they affect extreme weather events. With this initiative, Taraba State was the second State in Nigeria to implement Reduction of Deforestation and Land Degradation (REDD) after Cross River State. Notwithstanding the environmental degradation ravaging the world today, Taraba State still has large amount of standing natural forests that have been maintained and preserved over the years. As part of its intervention strategies aimed at mitigating the adverse effects of climate change in the northern part of the country, the Nigerian Conservation Foundation in partnership with the Canadian International Development Agency, has commenced activities towards the implementation of emission reduction through REDD in Taraba State (NEXT, 2011).

2.2 Climate change and extreme weather events

Extreme events are the clear evidences of climate change. Climate change are usually reported as a significant change in mean climatic conditions like average rainfall, rainfall pattern, average temperature, humidity, sunshine etc. climate change can be described by the drastic change in average conditions of the climate variable. However, climate change is clearly seen in the increase in frequency and intensity of extreme weather events (Eboh, Ozor, Onuoha and Chukwu, 2009).

Extreme weather events like droughts and flooding in Pakistan and Australia in 2010 contributed to increased level of food price volatility that is unprecedented for the past 40 years (OXFAM, 2011). Unfortunately, this could be just a little of what would come because of the build-up of greenhouse gases in the atmosphere. Climate change could greatly increase the risk of droughts, flooding, pest infestation and water scarcity for agriculture systems already under tremendous stress (OXFAM, 2011).

The outcome of these frequent extreme events will not be favourable especially to the poor due to their low adaptive capacity(FAO, 2008). It will lead to shortage of food, loss of crops in the farm, and store, increase in food price, and will also destabilize the market(Wu, Ho, Nah, & Chau, 2014). The effects of extreme events on food production and availability triggers food insecurity and increases food price in areas that are vulnerable to these events. These events do not only affect food production but also the infrastructure needed for the movement of these foods to the points of consumption. Extreme events can affect yield negatively and increase the incidence of pest and diseases, increase the growth of weeds (Rosenzweig, Iglesias, Yang, Epstein, and Chivian, 2001). West (2012), linked weather extreme events to climate change, he reported that though you cannot say with any certainty that any single weather event, no matter how extreme, is a direct effect of climate change but the trend of extreme events is linked to climate change. Extreme weather events have been in existence. What's different now is the increasing frequency of so many different kinds of extreme weather (West, 2012).

Methodology

To achieve the research objective of assessing how climate change affects the food security status of the households, a cross sectional survey was designed which included questions on household socio-economic characteristics and households experience of extreme weather events. The questionnaire was sent to food security experts for their review before being translated into the local languages in Taraba with the assistance of the tertiary institution students and Agricultural Development Programme staff who were hired as fieldworkers. The questionnaires were also adapted to the local conditions through seven focus group discussions with local people before being piloted. After adjustments were made, the questionnaires were then administered to 450 households across Taraba that were selected through multistage sampling to provide a representative picture of the food security status of the state.

3.1 Sampling strategies

The survey questions were designed for a household level study. The unit of analysis for this study is the household, and households in Taraba State constituted the sampling frame. Household, for this study, is defined as ‘all the people living together and sharing a common source of food, eating together and having a sense of belonging

together as a social unit' (National Population Commission (NPC) 2006). A household with children is considered one with member(s) who are below 18 years of age.

A multistage sampling technique was employed in selecting the respondents for the study. The choice of using a multistage sampling technique was informed by the need to get a representative sample of the population to be able to draw inferences from the sample about the state of food security in Taraba State. The sampling followed a purposive selection procedure at a higher level and a simple random selection at the household level. Simple random sampling was applied only at the household level, due to financial and time constraints. Setting the error margin at 4%, at a significance level of 0.05, Population= 438883 households (although there is massive outmigration in this area due to the crises that have persisted over the years (The Eagle Online 2014; Sahara Reporters, 2014); excluding people in transit and homeless persons, a sample size of 450 households was targeted.

Five stages were followed in selecting the 450 households for the study. Only 409 questionnaires were recalled with valid observations.

Stage 1 - three out of the four (4) agro-ecological zones of the state were purposively selected based on the number of Local Government Areas contained in each. The zones with more LGAs were chosen over the zone with only one LGA. The three selected zones - Wurkari, Zing, and Bali consist of three, six and six LGAs respectively, while Saduana, which was left out, has only one LGA in it, and is sometimes counted as part of the Bali zone.

Stage 2 - proportionally sampling was used to select five LGAs; Wurkari, Jalingo, Yorro, Bali, and Takum from the three zones, i.e. one LGA from Wurkari and two LGAs from each of the other zones.

Stage 3 - four communities were selected from each of the selected LGAs, making a total of 20 communities.

Stage 4 - two villages were selected from each of the 20 selected communities, making a total of 40 villages.

Stage 5 - twelve households were randomly targeted from each of the villages using the list of households provided by their *MeeAngwa* (village head).

The section of the questionnaire on household socio-economic characteristics included questions on household demographic data: household size; income; food expenditure; expenditure; household with children; age; years of formal education; extreme weather events experienced: massive floods, unusual drying up of rivers/streams, and outbreak of human/animal/plant pests and diseases (note that malaria and typhoid were not considered for this variable though they may be climate related, but are almost considered a common ailment for most people in Nigeria).

The principal investigator led the data collection process, with the assistance of 12 carefully trained enumerators proficient in the languages spoken in Taraba. The primary motivation for this large number of field workers was the need to collect enough data within a month amidst the conflict in the area whilst also catering to the multilingual nature of the state. The field workers were trained for a week on the use of the survey questions, using the field manuals for the food security modules. Afterwards, they actively participated focus group discussion and in the adaptation and translation of the survey questions, especially for the HFIAS module. Adaptation of the questions to the local context lasted for one week, thus the training and adaptation were completed in two weeks.

Seven focus groups to discuss the adaptation of the food security questions, were held in seven LGAs in the state- Jalingo, Gassol, Ibi, Yorro, Ado Kola, Donga, and Gashaka. The focus groups were made up of five to seven adults (Groups 1 – 7 were made up of six, five, five, six, seven, six, and seven individuals respectively), mostly women, because the requirement was for group discussants who are responsible for the household's food provision (cooking, buying food, and sharing of food among members). The adaptation of HFIAS basically involved the translation and interpretation of some of the words and phrases to make the survey questions as locally relevant as possible. Thirty-five (35) households in Jalingo and Bali were used for the pilot test. The pilot test result was used in testing the appropriateness of the questionnaire in capturing the data needed for this study.
The HFIAS categories derived from the survey are explained in the table 1.

Table 1: Description of the three HFIAS categories for the study

HFIAS 1n=32	HFIAS 2n= 95	HFIAS 3 n=282
Category 1 and 2 (High food security and Marginal food insecurity) - this group is made up of households with little/no problem or anxiety most of the time in accessing adequate food. Their food intake quantity, quality, and variety are not significantly reduced.	Category 3 (Low food security) – the quality, variety, and desirability of the food taken by these households are significantly disrupted, but the quantity and eating pattern of their meals are not significantly disrupted	Category 4 (Very low food security) – the eating pattern of one or more household members are disrupted at times during the survey period. Also the quantity of their food is reduced due to lack of resources or money for food

Adapted from United States Department of Agriculture 2014; United Nations 2014.

3.2 Analytical techniques

Data from the survey were analysed using descriptive and inferential statistics. Rasch model scoring (Coates, Swindale, & Bilinsky, 2007) was employed in categorising the households into levels of food security. RASCH model used in analysing the data collected using the HFIAS, has two components that can be used to derive attributes or characteristics of food insecure households. Respondents can therefore be objectively categorised through this strategy.

Food security has been measured in different indirect methods but a direct method of accessing food security is very important in understanding the experiences of the food insecure. Per capital income or sometimes food expenditure had been used by several author in assessing household food security. It is good to note that many households in the rural areas do not necessary buy all their food, so it is difficult to capture the value of what they get from their farms or as gifts from farmer friends and relatives. So using the food expenditure or income method will amount to wrong estimation of their food security status. The amount spent on food is generally influenced by the price of food which depends on geographical location of the household. If a household is in urban area or is located very far from the source of their food, their price, of a unit quantity of the same food will be higher than that of their rural counterpart. In this case the use of income or food expenditure method in estimating their food security will not give the accurate result (Opsomer, Jensen, & Pan, 2003).

Most often food security is analysed in terms of why people do not have it—i.e. why they are hungry or malnourished. Analytical literature explaining food security has evolved since the late 1970s from a focus on national food production and stocks (or the supply of food), which emphasized available food supply at macro levels, to a more nuanced and individual-focused approach, which emphasizes access to food along with consumption patterns and preferences (Maxwell, 2001). Food security is a broad concept that is more than food production and food accessibility (Agwu*et al.*, 2011). The measure of food security in the HFIAS was based largely on research that involved qualitative, in-depth interviews with low-income, rural women with and without children who had experienced food insecurity. The work of Opsomer, Jensen, and Pan, (2003) concluded that: (1) food insecurity is experienced differently at the household, adult, and child levels, (2) adults buffer the effects of food insecurity on children.

In developing countries, the food situation is often volatile. It is important to measure not only the current situation, but also uncertainty of the future situation (i.e., vulnerability) and to assess changes in risk status over time, taking account of the choices households make to allocate their resources over time in ways that try to balance ensuring current access without jeopardizing future food consumption (Coates,Swindale and Bilinsky, 2007).

HFIAS items are analysed using a one-parameter logistic item-response-model approach also referred to as a Rasch model. The fundamental idea of a Rasch model is that individual abilities and experience in doing a specific duty, and the difficulty level of the duty, can be measured (Newton et al., 2007). The nine HFIAS questions analysed using the Rasch, are dichotomous and have two categorical answers ("yes/no" or "true/false"). Administering these dichotomous questions, a Rasch model assumes that each of the households will answer each question based on their hidden experience (ability) of food insecurity: the more severe the food insecurity experience, the greater the chance of apositive response to any given food security question. Each of the items/questions in the HFIAS has an implied level of difficulty (food insecurity), with the more difficult questions having a greater chance of receiving negative answers than the less difficult ones, regardless of the level of food insecurity experienced by the household. Mathematically the Rasch Model for HFIAS dichotomous variables is expressed as:

$$\text{In}\left(\frac{P_{in}}{(1-P_{in})}\right) \equiv B_i - D_n \quad \text{..... Equation 1} \quad \text{or}$$

$$P_{in} = \frac{\exp(B_i - D_n)}{[1 + \exp(B_i - D_n)])} \quad \text{..... Equation 2}$$

(Wright & Mok, 2004)

P_{in} represents the probability of household *i*with experience or ability B_i, giving an affirmative answer to question *n* that has a food insecurity level D_n. The indicator variables B_n are assumed to be independent of each other (Opsomer et al., 2003; Wright & Mok, 2004). The rationale behind the Rasch model is that the chance that a household will give an affirmative answer, relative to giving a negative answer, depends on the extent of the food insecurity of the household and the level of food insecurity captured by the question. For easy interpretation, you should note that if $B_i=D_n$, then *i*household is 50% likely to answer "yes" to question *n*. If $B_i>D_n$, the *i* household is more than 50% likely to answer "yes" to the *nth* question, and correspondingly, if $B_i<D_n$ the household is less than 50% apt to answer "yes" (Opsomer et al., 2003; Wright & Mok, 2004).

Using the respondent's latent food insecurity ability (experience) and the question's hidden difficulty (food insecurity level), the Rasch will classify the households into consistent groups of food security (Ecosse, 2004; Illian, Parry, & Coloma, 2010). Rasch scoring assumes that a household's positive or negative response follows a logical distribution. This technique converts the positive and negative answers to the nine HFIAS questions into a single indicator. Two indicators are derived from the HFIAS analysis: HFIAS scale and HFIAS categories.

The HFIAS scale is estimated for each household by a simple summation of all codes for each item occurrence.

The occurrence items are coded as follows: 0 = no occurrence, 1 = rare occurrence, 2 = sometimes and 3 = often. So, if question one did not occur, then question 1 = 0 and, the next question, which is more difficult, is more likely to be zero, according to the arrangement of the question. The HFIAS scale gives a picture of households in different food security levels based on their position on the scale of 0 - 27. Food insecurity increases as the number of positive responses increases; zero (0) being most food secure and 27 being most food insecure. The HFIAS prevalence indicator, which is also derived from the same nine questions, divides the households into four categories of food insecurity using the Rasch model.

The HFIAS categories according to the United States Department of Agriculture (2014) are: Category 1 (High food security) - this group is made up of households with very little or no problem/anxiety about food. They had steady access to adequate food; Category 2 (Marginal food insecurity) - are households that had anxiety and problems at times/rarely in accessing adequate food, but their food intake quantity, quality, and variety were not significantly reduced; Category 3 (Low food security) – the quality, variety and desirability of the food taken by these households was significantly disrupted, but the quantity and eating pattern of their meals were not significantly disrupted and; Category 4 (very low food security) – the eating pattern of one or more household members were disrupted at times during the survey period and the quantity of their food was reduced due to lack of resources or money for food. Following Agresti (2007)this study derived three instead of four HFIAS categories, as the first two categories were merged due to the small sample size contained in them.

Measurement of the Extreme Events

There was no meteorological station in Taraba State, where data on extreme events could be found. This necessitated the collection of primary data on their climate conditions. The variables covered were:

Floods: flood frequency looked the number of times flood. Occurred around the households dwelling place or place of work

High rate of climate related pest/disease incidence: this variable captured the outbreak of climate related human, animal and plant pest and diseases, like lassa fever,cholera, crop pest etc.

Drying up of streams/rivers: This measured the number of streams/rivers used by the households that reduced significantly or dried up within one year and more,before the time of the interview. This did not include streams and rivers that normally dry up during dry season.

4.0: Results and Discussions

This section presents the results of data analyses and discussion of findings from the analysed data.

4.1 Distribution of household base on food security status

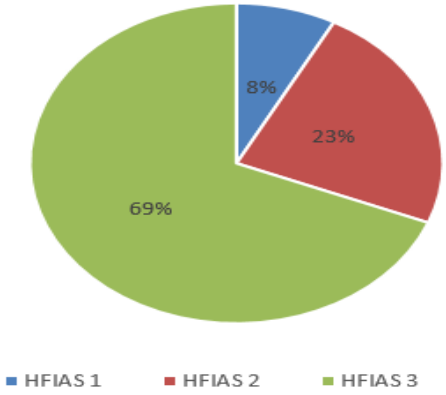

Fig 1 Distribution of household base on food security status

The result presented in figure 1 shows that greater proportion of the households (69%) in Taraba state had very low food insecurity status. According to HFIAS analysis, theeating pattern of one or more household members are disrupted at times during the survey period. Only 8% of the respondent could be considered food secure or marginally food secure. This result shows that there is high level of food insecurity in the study area.

4.1 Household food security categories and socio-economic profiles

The HFIAS indicator was adapted and used in ascertaining the prevalence of food insecurity in the state. The HFIAS categories obtain using the Rasch scoring, was adapted into three groups instead of the original four HFIAS categories to improve the reliability of the results. The first two categories for this study were merged due to the small percentage (2%) of households contained in the what supposed to be the first HFIAS group. Thus three

HFIAS categories were gotten in this survey: HFIAS 1 – high/marginal food security, HFIAS 2 - low food security, and HFIAS 3 - very low food security.

Household food security status varies in terms of the socio-economic status of households as reported in Table 2. Food insecurity prevalence was high among females headed households, having a greater proportion of them in HFIAS 3 than their male colleagues, although the difference between the food security of the female- and male-headed households was statistically insignificant. This result corresponds to the findings of Battersby (2011) that food insecurity for male or female headed households may not be statistically different.

The gender nature of poverty makes it easy to expect the female headed households to be more food insecure than their male counterparts (Battersby, 2011). In support of this general view households with a female head were certainly more in HFIAS 3 (77.3%). However the difference was not significant, giving credence to the observation of Battersby (2011) that the gender differences of food security are not as great as expected, though there exists significant correlation between gender and HFIAS scale.

Food insecurity was highest among divorced, separated, or widowed households as a greater proportion of them were found in HFIAS 3, followed by households headed by married persons. The result showed that households with unmarried heads were more food secure that the others. This may be as a result of the absence of children in such houses.

More than 70% of households that had children were in HFIAS 3, compared with only around 48% of those without children. Children in this work are household members below the age of 12, and are expected to be dependants. Hence having more dependants in the household may lead to more food insecurity (Coates et al., 2007).

Household food security categories and socio-economic profiles of the respondents Households that have a head of the females in the household[1] who is without any education, were more likely than those with educated females to be food insecure. This may be an indication that female education has significant influence on their household food security. It can be concluded from the result that the more educated the female in charge of the family food is, the more food secure the household.

Table 2: Household food security categories and socio-economic profiles of the respondents

Categorical Household Characteristics	HFIAS 1 n=32	HFIAS 2 n= 95	HFIAS 3 n= 282	Total no. of households	Chi-Square
	%	%	%		
Household head gender					
Male	8.62	24.62	66.77	325	3.88
Female	4.76	17.86	77.38	84	
Household head marital status					
Single	10.45	11.94	77.61	67	
Married	8.76	27.01	64.23	274	15.36**
Divorced/separated	1.47	19.12	79.41	68	
Household with children					
No	11.43	40	48.57	70	
Yes	7.08	19.76	73.16	339	15.63**
Educational qualification heads of females					
No education	0	16.04	83.96	106	
First school	0	17.65	82.35	85	
O level	3.7	26.85	69.44	108	87.58**
NCE/OND	16.95	40.68	42.37	59	
First degree/HND	32	20	48	25	
Postgraduate	50	30	20	10	
Household head primary occupation					
Civil servant	14.04	25.44	60.53	114	
Farmer	0.81	13.82	85.37	123	
Private sector employed	8.16	24.49	67.35	49	33.98**
Artisan	6.45	32.26	61.29	62	
Trader	10	32	58	50	

Source: Field work 2014

Households tend to be more food secure in line with an increased number of years spent in formal education by the household head. Food insecurity was highest with households headed by someone that spent an average of 8.5 years (did not complete junior secondary) in school, and lowest for those that spent an average of 14.4 years in school (may have completed a diploma course). This imply that improvement in education of the household

1 Head of the females is not necessarily the household head, but she is the head of the other females in the household. They are usually the mother, first wife, adult daughter or female in the household who has the responsibility of managing the affairs of the women in the household.

heads may have a positive effect on food security. (Ahmed, Fausat, John, & Naphtali, 2014; Liverpool-Tasie, Kuku, & Ajibola, 2011).

This result is not surprising as it followed an expected pattern. Nathalie (2012), Battersby (2011), Rose and Charlton (2002) and Haile et al. (2005) independently found that an increase in household head education, through increased income, leads to an increase in household food security. Education influences income, and therefore the ability of the household to access more food. Additionally, the survey revealed that female education is strongly linked with household food security status.

Among occupations of the household heads, the food security also differs across the three groups. Households headed by a civil servant were more likely than other household types to be food secure. For civil servant households, about 14% of them were in HFIAS 1, whereas less than 1%, 8%, 6%, and 10% of households headed by farmers, private sector employees, artisans, and traders respectively, were in HFIAS 1. The arrangement was almost reversed in HFIAS 3. The greater proportion of households headed by farmers (85%), private sector.

Though farming plays some important role in ensuring food security, especially in providing extra food to the household, this survey supported the findings of Mjonono et al. (2009) and Battersby (2011), revealing that households headed by farmers are more likely to fall into the very low food security category than those of other occupations. This shows that food security is not entirely about having farms and producing food. Policies only supporting agriculture may not automatically lead to food security even in rural settings like most of the sites of this survey.

Table 3: Socio-economic distribution of the respondents 2

Continuous Variable (Mean (Std))	**HFIAS 1 n=32**	**HFIAS 2 n= 95**	**HFIAS 3 n= 282**	**f-Value**
Household size	5.28 (5.27)	7.09(3.17)	8.88(5.43)	10.452**
Household head age	41.72(9.38)	47.99(10.19)	48.69(14.11)	4.1405**
Household head years of school	14.38(1.58)	11.72(4.27)	8.51(4.76)	36.918**
Number of income earner	2.34(2.34)	2.47(1.17)	2.16(0.82)	3.1248**
Household income (₦)	116861.35 (45259.12)	93873.77 (43828.45)	30134.64(30923.60)	172.6**
Head of females income (₦)	54844.56 (11507.25)	32497.69 (23354.24)	11551.77 13750.80)	123.79**
Number of plots of land owned (a plot = 463.6sqm)	5.47(4.05)	4.03(2.50)	2.79(2.30)	21.6v29**

Source: field work 2014

The result presented in table 3 shows that households tend to be more food insecure in line with an increased household size. Food insecurity was highest with households an average of about 9 persons in the household, and lowest with household size of about 5 persons.

Food insecurity shows a positive link with the age of the household heads; most elderly heads tend to be in very low food security categories, more so than the younger heads, however, the relationship was not significant. This supports Battersby (2011) who found a weak correlation between age and food security.

The household monthly income used for this study was calculated by totalling all the disposable income of the households' members in a month, so it shows the amount of money at the disposal of the household (disposable income). The monthly expenditure of the household (consumption expenditure) was calculated by summing up the money value of the households' spending in a month, excluding savings and investment expenditure.

Food security is usually linked to income especially urban food security (Battersby, 2011; Dube, 2013; Jacobs, 2010; Nathalie, 2012). And Mjonono et al. (2009), working with the farming households in the rural area, they also found that income is strongly related to food security. The survey result supports the evidence that households with a higher monthly income were more likely to be food secure. Households in HFIAS 1 earned an average of ₦116861.35 as against the households in HFIAS 2 and HFIAS 3 that earned ₦93873.77 and ₦30134.64 respectively. Households in HFIAS category 1 earned as much as four times the monthly income of those HFIAS 3.

The relationship between ownership of land and food security was explored. The Chi-Square result showed a significant difference in the land size owned across the different HFIAS categories at $p<0.001$. Those that owned an average of 5.47 plots (a plot = 463.6sqm) were found in HFIAS 1, whereas those that had an average of 3.79 plots where found in HFIAS 3. In line with Keyman (2014), this study found a strong relationship between land ownership and food insecurity. It is not surprising that households that own large amounts of land were more food

secure than others. As rightly observed by Igoe (2014), food security and land security go hand in hand. Most of the food insecure people always have these features: rural areas dwellers, depend on farm to survive, and own little or no land that they farm (Keyman, 2014).

Relationship between weather extreme events and food security. Due to the fact that most people in Taraba are involved in farming as both their primary and secondary occupations, and also the recommendation of OXFAM (2014) to study the link between the food security and weather events; this study tried to look at the link between food security and weather extreme events. The extreme event variablescovered in this study wereidentified by the ministry of agriculture office in Taraba, and also during the adaptation of the questionnaire. The number of times of occurrence of these extreme events was used in this study. The weather extreme events captured in this survey were flooding, outbreak of climate related human, animal and plant diseases and pests (malaria, cholera, diarrhoea, meningitis, typhoid fever, etc.), drying up of rivers and streams.

Table 4: Distribution of Households base on experience of Climate change extreme events

Climate change extreme events (Mean (Std))	**HFIAS 1 n=32**	**HFIAS 2 n= 95**	**HFIAS 3 n= 282**		**f-Value**
Flood	4.93	17.68	77.339	345	69.48**
Drying up of river and streams	3.93	17.82	78.25	331	69.90**
Outbreak of diseases and pests	4.30	18.05	77.65	349	82.42**

Source: Field work 2014

A greater proportion of those that experienced the weather extreme events were in HFIAS 3; Table 4 shows that most farmers who might likely be at the receiving end of these weather events were in HFIAS 3. The Chi-square result on the relationship between food insecurity and climate change was highly significant showing that the differences in the household food insecurity of the different categories were not a chance occurrence. For all Climate change extreme event capture – flood, drying of stream and rivers, and outbreak of pests and diseases, the result showed that greater proportion of the households experiencing these events had very low food security status. In simple terms, there were more extreme event affected households (more than three times the non-affected ones) in HFIAS 3.

Conclusion

There was significant difference in the household characteristics of the households in each HFIAS group. HFIAS 3 is characterised by: more experience of weather extreme events; household heads with the least schooling; ownership of smaller land size; large household size; large proportion of divorced/separate household heads; female household heads; lowest income and expenditure; and highest percentage of farmer household heads.

The fact that subsistence farmers were more food insecure than other household types, shows the need for improved food systems, a system of social protection, and a farming insurance scheme against climate extreme events. This study in consonance with some other studies, argues that supporting the agricultural sector alone might not automatically ensure that households consume adequate food for a healthy life. All the aggressive farmer support programmes targeted at farmers in this state have done very little in helping the poor farmers to improve their welfare. Hence institutional mechanisms should be put in place to help farmers out of their food insecurity situation. This mechanism may include training farmers on advanced and sustainable farming methods and techniques, providing educational and financial support that can help them to acquire the necessary skills and education that can increase their opportunity to do other jobs, early warning system on the occurrence of climate extreme events and educating the farmers on the available climate change adaptation mechanisms they can employ to ameliorate the effect of climate change on their welfare.

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