

Flood-induced food insecurity and coping strategies: A gender-based analysis of agrarian households in South-eastern Nigeria

Thecla Iheoma Akukwe¹ — Onyinyechi Gift Ossai¹  — Alice Atieno Oluoko-Odingo² — Cletus Famous Nwankwo¹

¹Department of Geography, Faculty of the Social Sciences, University of Nigeria, Nsukka.

²Department of Geography and Environmental Studies, University of Nairobi, Kenya.

 onyinyechi.ossai@unn.edu.ng

Abstract

The study addressed flood-induced food insecurity and coping strategies in agrarian South-eastern Nigeria. Data were collected from 400 households in 8 communities. Food (in)security was measured using Household Food Security Survey Module (HFSSM) and 92.8% households were found to be food insecure. The most adopted coping strategies were compromising food quantity and quality namely; skipping meals; reducing meal frequency and reducing meal portion size in descending order. The study revealed a gender-based disparity in coping strategies adopted between female- and male-headed households and this has been linked to income and asset poverty gaps including differential household food insecurity levels. The coping strategies adopted were self-devised strategies that provided short-term means of survival in times of food shortages. Thus, policy measures, such as social security and food safety nets that are sustainable are recommended to reduce vulnerability to flood-induced food insecurity, thereby improving adaptation to help achieve Goal 2 of the Sustainable Development Goals by 2030.

Keywords

Food security,
Household,
Nigeria,
Coping strategies,
Gender,
Flood-induced

Received:
25 April 2022

Received in revised form:
29 December 2022

Accepted:
05 February 2023

Highlights for public administration, management and planning:

- Food (in)security may present severe impact resulting from flood events, calling for household coping measures.
- We measured Food (in)security using Household Food Security Survey Module (HFSSM).
- We found a gender-based disparity in coping strategies adopted by households, which are linked to income and asset poverty gaps.
- We assert that along with self-devised coping strategies for the short term, policy measures should be designed (e.g., social security and food safety nets).

1 Introduction

Food security, according to Food and Agricultural Organization (1996:4; 2008a:9) “exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”. Food security in the above context has four components namely; food availability, accessibility, utilization and stability, and realising a state of food security demands

meeting all the four components. In other words, it entails that food is adequately available; all people have economic and physical access to the food they need; food access and availability are guaranteed over time (stability), and the food is utilised efficiently. Thus, attaining food security requires not just reaching an adequate level of good nutrition and food consumption, but retaining them at low risk over time (FAO 2008b).

Consequently, food insecurity exists whenever one of the aforementioned conditions is not met or there is any negative change in any of the dimensions

of food security resulting from environmental, social, political factors such as drought, floods, conflict among others. In Sub-Saharan Africa, poor access to food emanates largely from a web of factors including poverty, livelihood losses, escalation of food prices, political instability and lack of implementation of policies (FAO 2015; Mitiku et al. 2012 in Aseseffa et al. 2018:1). FAO (2008b) has noted that all hungry people are food insecure, though, not all food insecure people are hungry, and the term hunger has been used to distinguish a subset of food insecure people while people suffering from hunger as a result of inadequate access to food may be considered currently food insecure. Poverty is undoubtedly a cause of hunger, hence a relationship exist between hunger, poverty and food insecurity. Understanding this relationship can clarify how poverty and hunger reduction programmes can contribute to strengthening food security and vice versa (FAO 2002).

Efforts had been made in the last decade to eradicate food insecurity and hunger in the world through a number of global agreements. For instance, the World Food Summit in 1996 and the Millennium Summit (Millennium Development Goals; MDGs) in the year 2000 had goals and particular targets set for joint action in minimizing the incidence of food insecurity and hunger. They both aimed to halve the number of hungry people by 2015 (FAO 2005, 2008a). In the same light, the recently adopted Sustainable Development Goals (SDGs) lays emphasis on ending hunger, achieving food security and improving nutrition and promoting sustainable agriculture by 2030 in Goal 2.

Similarly, about 1.2 billion people had been estimated not able to meet their most daily basic needs for sufficient food especially the poor subsistence farmers living in rural environments in developing countries (IFAD 2009). Nigeria is not an exception since subsistence farming is widely practised with up to 90% of food in the country being produced by rainfall-dependent micro-scale farmers, despite agriculture being the mainstay of the country's economy (IFAD 2012). However, food insecurity in Nigeria has been attributed to poor agricultural output and widespread poverty in the country (Orewa & Iyanbe 2009; Obayelu 2010; Kuku-Shitu et al. 2013). To a great extent, agrarian households including households in Southeastern Nigeria are particularly vulnerable to food insecurity since they depend on agriculture directly or indirectly and as noted by (Bashir et al. 2012) more than 70% of undernourished people live in rural areas where agriculture is their mainstay.

FAO (2011) has described agriculture as being vital to economic growth and food security particularly in Africa. Yaro (2004); McCusker and Carr (2006) adduced that an average of 70% of Africa's population lives by farming with 40% of all their exports earnings emanating from agriculture, and about one-third of the national income generated by the agricultural sector. In addition, women had been noted to make up 43% of the agricultural labour force as well as making significant contributions to the rural economy in developing countries. Yet, women constantly have less access than men to the resources and opportunities (e.g., access to land, technology, education, financial services) they need to be more productive (FAO 2011; Olabisi 2013 in Oyefara and Alabi 2016). The implication of this gender-based disparity in resource access is that Female-Headed Households (FHHs) are more probable to be vulnerable to poverty and food insecurity than Male-Headed Households (MHHs).

Floods have been noted to be "the most recurring, widespread, disastrous and frequent natural hazards of the world" (Odufuwa et al. 2012:: 70). Empirical studies have shown that, the increasing intensity and frequency of storms, flooding and drought definitely have implications on food security and agricultural production (FAO 2008a; Ngoh et al. 2011; Yaro 2013; Pacetti et al. 2017). Agrarian households residing in flood-prone areas are more vulnerable to flood-induced food insecurity (which sometimes is acute) since their livelihood sources are climate reliant. This argument is supported by Ajaero (2017:2) who argued that "households living in areas that are susceptible to floods, or are inaccessible or unsuitable for agricultural production, are also highly vulnerable to livelihood and food insecurity."

However, households and communities that encountered such acute food shortages are compelled to adopt coping strategies to meet their family's immediate food requirements. These extreme responses may have adverse long-term impacts on household's ability to have sustainable access to food as well as the environment (United Nations 2015; Tamiru et al. 2016 cited in Aseseffa et al. 2018:1).

The 2012 flooding in Nigeria was the worst flood case recorded in more than 40 years, and it had a greater impact on south eastern Nigeria since the region is largely agrarian, and vulnerable to flooding, hence the reason for studying flood-induced food insecurity. Our study focused on flood-induced food insecurity and coping strategies employed by households (of different gender

heads) to reduce their vulnerability and improve their adaptation to the stress caused by food insecurity. Available literature had shown recent studies to focus on food insecurity and its determinants, and coping strategies adopted against food insecurity (Mitiku et al. 2012; Gupta et al. 2015; Motbainor et al. 2016; Farzana et al. 2017; Aseseffa et al. 2018). Not much research has been carried out on flood-induced food insecurity and a gender-based analysis of coping strategies adopted by households which is the thrust of our study. This is imperative because a gender-based analysis would help in designing policy measures that would target the most vulnerable household type (FHHs or MHHs) as supported by Babatunde et al. (2008).

In this study, coping strategies are what households depend on to maintain their livelihood means during and after a disaster, thus, coping strategies are adopted when dealing with the hazard (Complete coping strategies analysis, 2018) such as flood and food insecurity. However, because there exists a variation in the experience and extent of the effects of flood-induced food insecurity across households, households are expected to adopt different coping strategies to maintain their livelihoods, and to survive.

In order to capture the different coping strategies used by households in Southeastern Nigeria, household headship was regarded as a significant aspect to be discussed, hence households were grouped into Female-headed households (FHHs) and Male-headed households (MHHs). The stratification was based on the premises that households react differently to food insecurity which agrees with Toulmin (1986) in Liwenga (2003:17) who stated that “households’ responses to food insecurity are often differentiated by socio-economic factors such as wealth and gender, and that this determines a range of coping options at the household’s disposal.” However, our study proposes organised coping strategies as means of reducing vulnerability and enhancing adaptation to food insecurity in addition to strengthening the achievement of Goal 2 of the SDGs with emphasis on ending hunger, achieving food security and improving nutrition and promoting sustainable agriculture by 2030.

2 Literature Review

Over the years, the impact of flood has attracted increasing attention among researchers and scholars. The inner connections between floods and food security are extremely obvious especially in de-

veloping countries (Tommaso et al. 2017). Several studies have highlighted the impact of flood on food security, nutritional security, child malnutrition and gender.

On Food insecurity, Week and Wizer (2020) agreed that flood increases food insecurity, inaccessibility of staple food and malnutrition in Nigeria. Similarly, Hamdiyah (2020) revealed that marital status, education, farm size and information on flood occurrence significantly influenced adaptation decision which eventually influence food security. Subsequent study by Akukwe et al. (2020) concluded that flooding affects food security negatively by increasing the number of food insecure households to 92.8% in the area of study. Moreso, Nkrumah (2018) noticed a worsened case of food security in Africa as caused by flood. The study concludes that African governments should create a conducive environment to encourage urban residents to engage in agricultural practices. Supporting these claims, Oskorouchi and Sousa-Poza (2020) added by focusing on the long-term effect of flooding and stated that exposure to flooding decreases daily calorie consumption while increasing the probability of Iron, Vitamin A and Vitamin C deficiency by 11, 12, and 27 percentage point respectively. Lastly, Smith and Floro (2020) and Dilshad and Muhammed (2021) revealed that migration significantly causes food insecurity because migration increases population which leads to mismanagement of waste, blockage of drainage system and water channels which eventually leads to flooding in rainy season. This leads to increase in the level and severity of food insecurity.

On the issue of vulnerability, Armah et al. (2010) revealed that some characteristics of the socio-cultural environment appears to mitigate risk and reduce vulnerability. Whereas, Sileshi et al. (2019) stated that about 54% of households were categorized as vulnerable to food insecurity in Ethiopia. According to MacNabb and Fletcher (2019), the more natural disasters the more vulnerable the community will be in terms of food insecurity. Furthermore, Douglas et al. (2008) agreed that the most vulnerable group of food security during flooding in South Africa under climate change is the poor, women and children. The study suggested innovative form of food production, distribution and storage will have to be developed to reduce vulnerability to food security while Kiah and Geoferey (2014) argued that vulnerability is due to reliance on long food supply chain and infrastructure as claimed by many studies.

Concentrating on the impact on children, Lieber et al. (2022) were of the opinion that to improve nu-

tritional interventions in children, climate change adaptation strategies like sustainable agriculture and water irrigation should be adopted. [Rodríguez-Lianes et al. \(2011\)](#) revealed that children in flooded households were more likely to be stunted compared with those in non-flooded one.

Focusing on the impact on gender, [Ajaero \(2017\)](#) revealed that higher income, marital status and larger household sizes are significant predictors of food security for both female and male headed households after the flood. The work concluded that income diversification far away from agricultural reliance, warning system which is early and prompt and higher educational level of women could help households, could assist households in the case of future floods to be food secure. Similarly, [Ajibade et al. \(2013\)](#) revealed that women in low income neighbourhood recorded higher impacts and slower recuperation compared to women of other social categories. Women of low income are placed at greater risk due to their class, employment status and access to healthcare.

Several studies suggested a way forward to improve the problem of food insecurity caused by flood. According to [Otaha \(2013\)](#), government should not only concentrate on the production of oil as major export product, food production should also be considered as everybody needs food to survive and make ends meet. [Clay and Ross \(2020\)](#) concluded that disaster policies and programs should address the disproportionate burden on households that relocate or have health conditions, as a result of high food insecurity prevalence among affected households. Likewise, [Bakhtar et al. \(2021\)](#) who suggested that the practice of local wisdom can still protect food needs. Communities who still practice local wisdom as a means of structural mitigation and adaptation, can still supply and protect their food needs even during floods.

From the foregoing, it is evident that most studies on flood induced problems focused on its impact on food security (urban areas, gender and vulnerable groups), malnutrition (general populace) and nutritional security. Its implication on ability to obtain food through coping strategies by different gender in Anambra state, Nigeria is where the interest of this study lies.

2.1 Theoretical Framework

2.1.1 Sustainable Livelihoods Approach (SLA) Framework

The sustainable livelihoods framework developed by the Department for International Development

(DFID) in 1999 is a tool that helps in understanding livelihoods, particularly those of the poor. It shows the significant factors that influence people's livelihoods in addition to their interactions. The SLA illustrates empowerment of the poor where the poor are treated as decision-makers (and not as victims) with their own individual sets of priorities. In other words, the SLA shows the relationship between poverty and vulnerability with emphasis on how the vulnerable and poor live their lives, and the help of institutions and policies in alleviating poverty.

According to the SLA paradigm, a livelihood consists of the skills, resources, and pursuits necessary for a means of subsistence. It is said to be sustainable when it can withstand stresses and shocks, recover from them, and retain or improve its capabilities, assets, and activities in the present and the future without compromising the natural resource base ([Serrat 2017](#)).

As it relates to households, vulnerability is demonstrated as changes in people's external environment which causes uncertainty regarding household well-being (e.g., flooding). The two sides of vulnerability are the external side which consists of shocks (such as floods, conflicts, storms, illnesses, droughts, and diseases), seasonality (such as food prices), and critical trends (e.g., governance, environmental, demographic, economic, and technological); the internal side of defencelessness brought on by incapacity to cope ([Serrat 2017](#); [Akukwe 2019](#)).

Shocks (e.g. flood, conflict) are shown to directly destroy assets as a component of coping mechanisms, they can compel people to leave their homes and prematurely dispose of assets (like land). Seasonal variations in costs, job prospects, and availability of food are some of the biggest and longest-lasting causes of misery for the poor in developing nations ([DFID 1999](#)).

In summary, the SLA framework lays emphasis on how informed livelihoods strategies translates into increased income, reduced vulnerability, improved well-being and most especially food security. The livelihood assets that people especially the poor could choose from including certain trade-offs are embedded in their natural, social, financial, human, and physical capital (Sustainable Livelihoods Framework is shown in [Fig. 1](#)). "The framework presents the livelihood assets pentagon from which multiple benefits are generated and how they can either increase or reduce vulnerability and poverty in addition to certain processes and structures with which the coping capacities of the people especially the poor can improve" ([Akukwe 2019:12](#)).

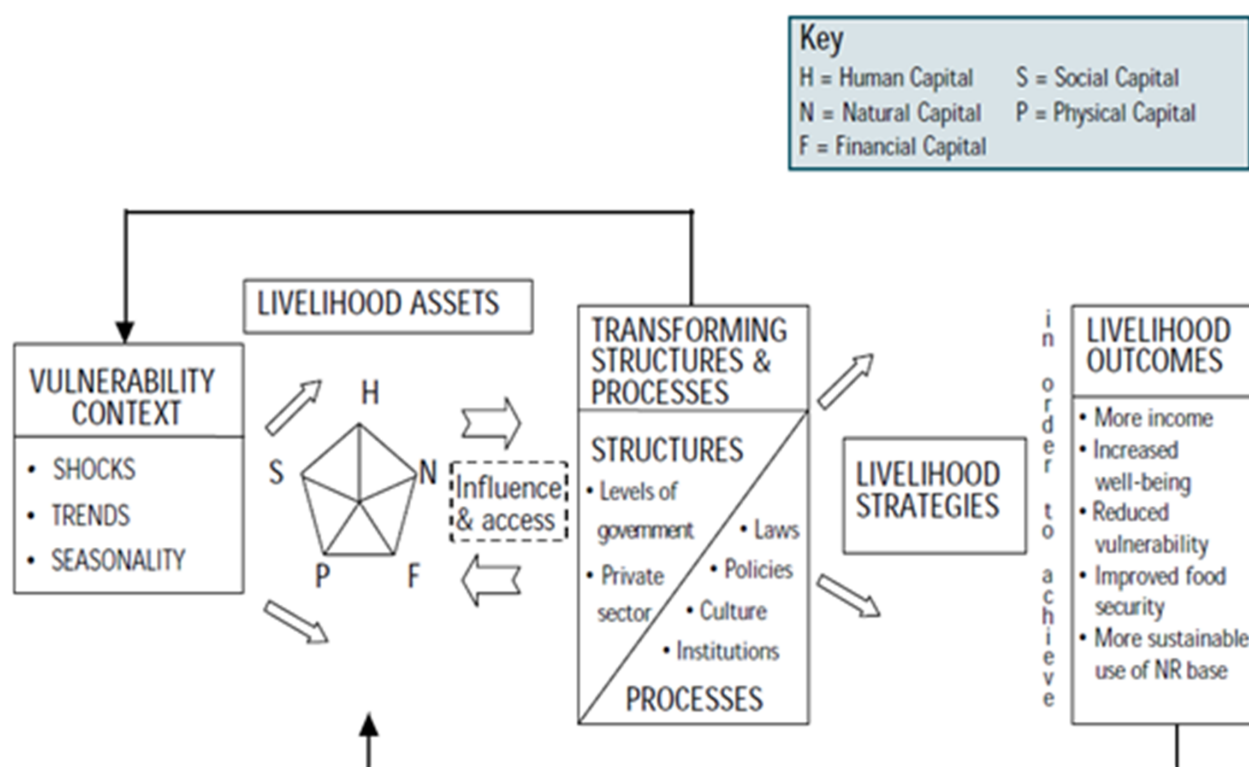


Fig. 1 Sustainable Livelihoods Framework (DFID 1999, 2009)

The SLA framework is pertinent in this study because it illustrates the relationship amongst poverty, vulnerability, eliminating food insecurity, livelihoods and coping capacities among different gender considered in this study. The SLA framework demonstrates how the incidences of flood in an area affects the ability of households to produce their own food, earn income and their coping capacities.

3 Methods

3.1 Study Area

Southeastern Nigeria consists of five States namely; Abia, Anambra, Ebonyi, Enugu and Imo. It is located between latitudes $4^{\circ} 20'$ to $7^{\circ} 10'$ north of the equator and longitudes $6^{\circ} 35'$ to $8^{\circ} 25'$ east of the Greenwich Meridian with a land size of about 28,983km². The region is bounded by Benue and Kogi States in the north, by Rivers State in the south, by Cross River State in the east and to the west by Delta state (Map of the study area is shown in Fig. 2). Because the focus of the study is on flood-induced food insecurity, the two affected States in Southeastern Nigeria by the 2012 floods noted as the worst in over 40

years in the country by UN-OCHA (2012) namely; Anambra and Imo States have been selected. Embedded in these areas are rivers and tributaries that flows directly to river Niger. The Omambala River is one of the main tributary found in Anambra state, it connects with Nkisi & Niger-kwora/Mgbakili Rivers in their journey to the Atlantic Ocean (Anyadike & Phil-Eze 1989). In Imo state, the Oguta Lake is a major tributary of River Niger. Anambra State is located between latitudes $5^{\circ}40'$ and $6^{\circ}46'$ north of the equator and longitudes $6^{\circ}35'$ and $7^{\circ}21'$ east of the Greenwich meridian with a spatial extent of about 4,816 km². Imo State lies between latitude $5^{\circ}10'N$ to $5^{\circ}25'N$ and longitude $6^{\circ}35'E$ to $7^{\circ}23'E$ of the Greenwich meridian (Map of the study area showing the sampled LGAs/Communities is shown in Fig. 2).

3.2 Sample size and sampling method

Two Local Government Areas (LGAs) were purposively selected each in Anambra State based on their vulnerability to flooding (as a result of the many rivers present in the area of study), road accessibility (working road from southern Nigeria to Northern Nigeria) and being agrarian (majority of its inhabitants practice agriculture), and since

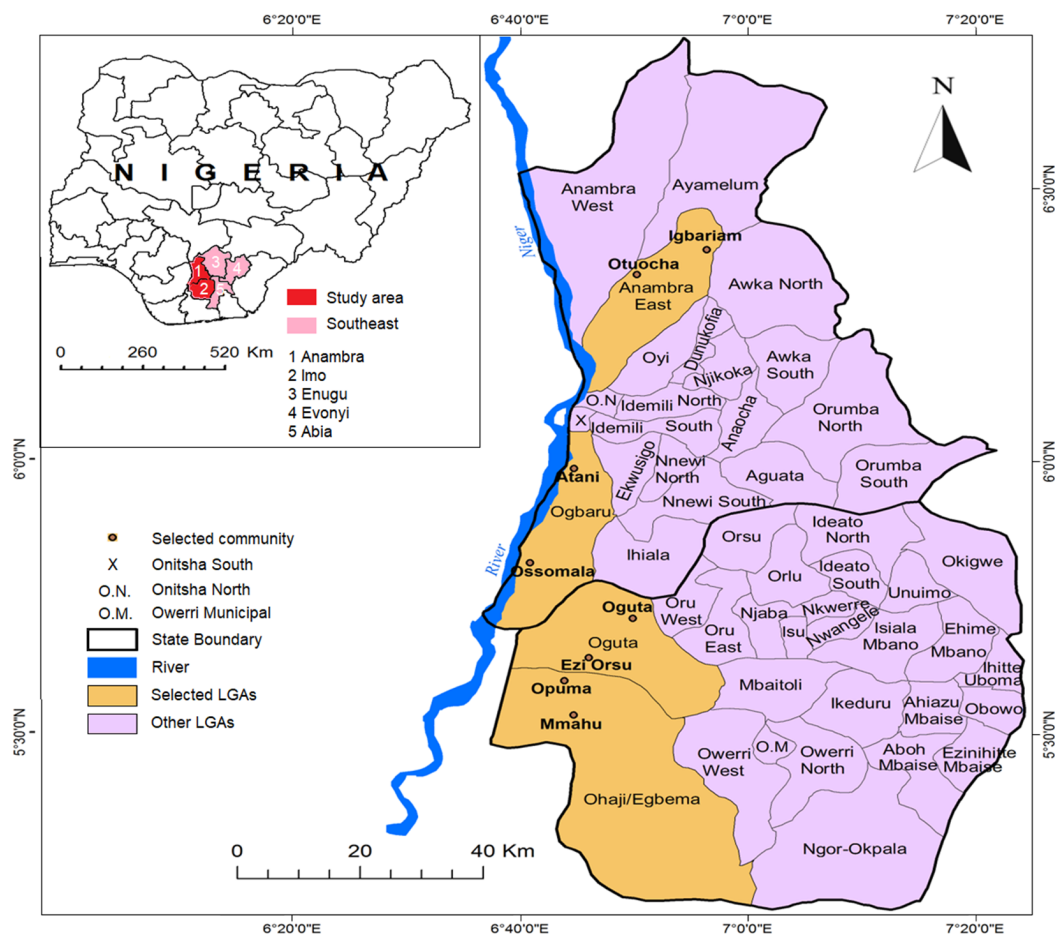


Fig. 2 Map of the States in Southeastern Nigeria and of the study area showing the sampled Local Government Areas (LGAs)/Communities (Anambra and Imo State) (GIS Lab., Department of Geography, University of Nigeria, Nsukka 2016)

only two LGAs were affected in Imo State during the 2012 devastating floods. In Imo State, Oguta and Ohaji/Egbema were the affected and selected LGAs while Anambra East and Ogbaru LGAs were selected in Anambra State (Fig. 2). Four hundred (400) copies of questionnaire derived from the sample size were administered through random sampling method with both the fill during interview and the drop and collect means. Furthermore, stratified sampling method was used to determine the number of households sampled in each LGA and community. The period of study was in 2017.

The sample size was determined using Yamane (1967) equation as given below:

$$n = \frac{N}{1 + N(e^2)} \quad (1)$$

Where n is the sample size, N is the population of Anambra East, Ogbaru, Oguta and Ohaji/Egbema LGAs and e - is the level of precision/sampling error i.e., 0.05.

3.3 Data Collection and Data Analysis

Data were collected through a composite structured and semi- structured questionnaire (Open and closed ended questions) where the respondents (households' heads) were requested to tick the appropriate responses as well as the coping strategies employed in times of flood-induced food insecurity and their responses were analysed. Descriptive statistics of percentages and charts were used in analysing the thirteen adopted coping strategies in the study area as well as on the household type (female- or male-headed).

The poverty line for the study area was calculated using the general benchmark by World Bank of <1.9USD per day for developing countries. As of the time the pilot survey was carried out, the official exchange rate for US Dollar and Nigeria Naira was \$1 = 263 Naira (N). Accordingly, \$1.9 = N500 per day. Therefore, any household with a monthly income of below N15,000 (obtained from N 500 daily x 30 days) was regarded as poor.

Table 1 Structured survey questions on household food security

S/N	Question	Responses		
		Often true	Sometimes true	Never true
1	Do you always enough food to eat?			
2	Do you always have the kinds of food you want?			
3	Do you worry if your food stock will run out before you get another to eat?			
4	Do you have enough resources to acquire enough food?			
5	Could you afford to eat balanced meals?			
6	Do you supplement your children's feed with low-cost foods?			
7	Can you afford to feed your children balance meals?			
8	Were your children not eating enough, because you couldn't afford enough?			
9	Do adults in your household skip meal or cut the size of their usual meals?			
10	Do you eat less than what you feel, you should?			
11	Were you ever hungry, but didn't eat?			
12	Did you lose weight, because there wasn't enough food to eat?			
13	Did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food?			
14	How often did this happen?			
15	Did you ever cut the size of your children's meal because there wasn't enough money for food?			
16	Did any of the children ever skip meal, because there wasn't enough food to eat?			
17	Did any of the children ever not eat for a whole day?			
18	Were the children ever hungry but you just couldn't afford more food?			

Wealth classes were constructed using monthly income. The first step was to calculate the mean of each income group/level. Thereafter, the minimum income value, the computed 1st, 2nd and 3rd quartiles, and the maximum income value respectively formed the five wealth classes (poorest, poorer, middle, wealthier and wealthiest).

Household food (in) security was measured using the Household Food Security Survey Module (HFSSM), developed by the United States Department of Agriculture (USDA) which categorizes households using a constructed food security scale. The scale consists of 18 questions (Table 1) used to assess the level of uncertainty and anxiety of householders, insufficiency of food, quality of food eaten and inadequate food intake (Bickel et al. 2000). The HFSSM adopted the Rasch model to classify households into four food security levels namely, food secure, food insecure without hunger, moderately food insecure with hunger and severely food insecure with hunger on a scale of 0 to 10 (Table 2).

The thirteen (13) coping strategies adopted by households in times of flood-induced food insecurity are skipping meals, buying less preferred/desired food, reducing portion size of meals, casual jobs, informal borrowing (money/food), reducing number of times food is eaten, collecting loan, eat seed stock or stocked seeds, church charity, begging, purchase food on credit, remittance, sale

of assets. These thirteen coping strategies used in the study were identified from the coping strategy index which was developed by World Food Programme in 2003 (CARE/WFP 2003), existing literature and respondents were asked to tick those they have employed. All data analyses were conducted using Statistical Package for Social Sciences (SPSS version 21).

Table 2 Standard values for assessing household food (in)security status/level (Bickel et al. 2000)

Scale Score Standard 0-10 Metric	Food Security Status/Level
0* - 2.32	Food secure
2.33 - 4.56	Food insecure without hunger
4.57 - 6.53	Food insecure with hunger (moderate/less severe)
6.55 - 10.09	Food insecure with hunger (severe/more severe)

* Means households that affirm no items are deemed to be food secure and are assigned a scale core of zero.

4 Results

4.1 Demographic and Socio-economic Characteristics of respondents

The study consisted of 56.2% male-headed and 43.8% female-headed households with a high literacy rate where 74.2% respondents had one formal education or the other.

Table 3 Socio-economic characteristics of respondents

Characteristic	Component	Frequency	Percentage
Sex	Male	225	56.20
	Female	175	43.80
	Total	400	100.00
Age (Years)	20–29	25	6.30
	30–39	83	20.70
	40–49	103	25.80
	50–59	84	21.00
	60–69	100	25.00
	70 & above	5	1.20
	Total	400	100.00
Primary sources of livelihoods	Farming	368	92.00
	Fishing	3	0.80
	Trading/ Business	3	0.80
	Civil servant	26	6.50
	Total	400	100.00
Marital status	Single	31	7.80
	Married	258	64.50
	Divorced	5	1.30
	Separated	27	6.70
	Widowed	79	19.80
	Total	400	100.00
Level of education	Non formal	103	25.80
	FSLC	115	28.70
	SSCE	98	24.50
	NCE/OND	64	16.00
	HND/B.Sc/ B.Ed/B.A	17	4.30
	M.Sc/M.A/ Equivalent	3	0.70
	Total	400	100.00
Monthly income (in Naira)	<15 000	95	23.80
	15 001–30 000	144	36.00
	30 001–45 000	90	22.50
	45 001–60 000	34	8.50
	60 001–75 000	24	6.00
	75 001–90 000	4	1.00
	90 & above	9	2.30
	Total	400	100.00

note: researcher's computation 2017

Majority of the households relied on agriculture (farming) as the key source of income/livelihoods making them highly vulnerable to flood-induced food insecurity since their primary livelihood sources were climate-related (Table 3).

Moreover, 64.5% of the respondents were married with 19.8% being widows while 7.8% were single and 8% were either divorced or separated. In terms of age, majority (50.8%) of the household heads were between the ages of 40 and 49 years and 60 and 69 years. Household heads between 20 and 29 years accounted for 6.3% while only 1.2% of respondents were 70 years and above.

However, the largest proportion (36%) of the heads of households earn between fifteen and thirty thousand Naira monthly while about a quarter of them earn either below fifteen thousand or between thirty and forty-five thousand Naira monthly and only 17.8% of all the household heads earned above forty-five thousand Naira monthly.

4.2 Wealth Ranking

Households were classified on the basis of their monthly income (in Naira) into five wealth classes namely; the poorest, poorer, middle, wealthier and wealthiest classes. Majority (59.7%) of households fell under the poorest wealth class as revealed by the wealth ranking results whereas only 14.5% and 2.3% fell under the middle and wealthiest classes respectively (Percentage Distribution of Wealth Classes is shown in Table 4).

Table 4 Percentage Distribution of Wealth Classes

Wealth Class	Monthly income (in Naira)	Percent (%)
Poorest	*15,000	59.7
Poorer	≥30,000	22.5
Middle	≥52,000	14.5
Wealthier	≥75,000	1
Wealthiest	≥90,000	2.3
Total		100

n = 400; Researcher's computation, 2017; *means < and ≥

A relationship was found to exist between the wealth ranking and the sources of livelihoods of the households in relation to their monthly income (Table 5). The results showed that households classified under the wealthier and wealthiest classes (high income earners) depended on other non-agricultural sources of livelihoods (e.g. trading/business, civil services) as opposed to the poorer and poorest classes that relied on mostly agricultural activities as their liveli-

hood sources. The implication of the sole reliant of the poorer and poorest classes on agricultural (climate-related) sources of income was, it made them more vulnerable to flood-induced food insecurity associated with reduced crop harvest and crop sales.

Table 5 An income analysis by household type (MHHs and FHHs)

Sex	Income					Total
	<15 000 (Poorest)	30 000 (Poorer)	52 000 (Middle)	75 000 (Wealth- ier)	>90 000 (Wealth- iest)	
Male	112 (49.8)	62 (27.5)	40 (17.8)	2 (0.9)	9 (4)	225
Female	127 (72.6)	28 (16)	18 (10.3)	2 (1.1)	0 (0)	175
Total	239	90	58	4	9	400

4.3 Monthly Income of Female-Headed Households and Male-Headed Households

The study found a disparity between the monthly income of male-headed households (MHHs) and female-headed households (FHHs) where 37.7% of FHHs fell below the poverty line as against 12.4% of MHHs in the study area (Distribution of monthly income by sex of household heads is shown in Fig. 3).

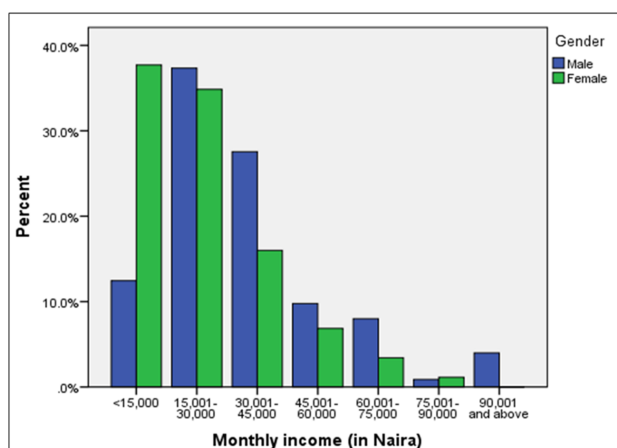


Fig. 3 Distribution of monthly income by sex of household heads

Accordingly, FH1: formed the largest proportion (70.2% i.e. 66 out of 94 of households) classified as “poor” that earned <N15, 000 or <\$30 monthly (An income analysis by household type

(MHHs and FHHs) is shown in Table 5). However, the observed gender gap in income distribution in favour of MHHs was partly the reason that FHHs were more vulnerable than MHHs to flood-induced food insecurity.

4.4 Analysis of Households’ Assets and Amenities

Table 6 illustrates a cross tabulation between household assets against the five wealth classes to examine asset poverty gap.

Table 6 Percentage Distribution of Household Assets within wealth classes

Asset		Frequency Wealth classes (in %)				
		*15,000 (Poorest)	≥30,000 (Poorer)	≥52,000 (Middle)	≥75,000 (Wealth- ier)	>90,000 (Wealth- iest)
Car	Yes	0.8	6.7	6.9	50	66.7
	No	99.2	93.3	93.1	50	33.3
Refrige- rator	Yes	1.3	13.3	31	100	77.8
	No	98.7	86.7	69	0	22.2
Genera- tor	Yes	3.3	40	29.3	100	88.9
	No	96.7	60	70.7	0	11.1
Phone	Yes	90.4	100	100	100	100
	No	9.6	0	0	0	0
Furniture	Yes	5	20	29.3	100	100
	No	95	80	70.7	0	0
Television	Yes	6.3	48.9	55.2	100	88.9
	No	93.7	51.1	44.8	0	11.1
Canoe	Yes	31.4	40	67.2	50	55.6
	No	68.6	60	32.8	50	44.4
Bank savings	Yes	6.3	34.4	48.3	100	88.9
	No	93.7	65.6	51.7	0	11.1
Motor- cycle	Yes	14.2	56.7	67.2	100	55.6
	No	85.8	43.3	32.8	0	44.4
Fan	Yes	9.6	28.9	34.5	75	77.8
	No	90.4	71.1	65.5	25	22.2
Bicycle	Yes	64	61.1	65.5	0	44.4
	No	36	38.9	34.5	100	55.6
Wheel barrow	Yes	92.5	88.9	94.8	100	100
	No	7.5	11.1	5.2	0	0
Radio	Yes	46.4	80	63.8	100	11.1
	No	53.6	20	36.2	0	88.9
Others	Yes	0	4.4	29.3	100	44.4
	No	100	95.6	70.7	0	55.6
Access to credit	Yes	1.7	22.2	20.7	0	11.1
	No	98.3	77.8	79.3	100	88.9
Amenity Electri- city	Yes	31.4	57.8	74.1	100	100
	No	68.6	42.2	25.9	0	0

note: *means < and ≥; author’s computation, 2017

The results showed that households in the poorest and poorer wealth classes (on the basis of in-

come) also suffered asset poverty, e.g. only 0.8% and 6.7% of households in the poorest class and the poorer class respectively owned a car while 66.7% and 50% correspondingly owned a car in the wealthiest and wealthier classes. The same asset poverty gaps are seen in the ownership of motorcycles, bank savings, access to credit, canoe ownership among others that play crucial role during times of flooding and flood-induced food insecurity, affecting mostly households in the poorer and poorest classes. The implications of household assets and access to amenities are related to vulnerability to flood-induced food insecurity.

4.5 Household flood-induced food (in) security levels

Table 7 shows the flood-induced food (in) security status/level of households. The table reveals that majority of households in the study were food insecure after flood events with only 7.2% being food secure. On the one hand, “food secure” households are those that reported very limited or no food insecurity or hunger experiences while “food insecure without hunger” households reportedly had concerns as regards adequate food supply as well as had anxiety over food sufficiency to meet their basic needs. On the other hand, “moderately food insecure with hunger” households repeatedly experienced hunger due to reduced food intake of their adult members only, while “severely food insecure with hunger” households repeatedly reduced food intake of all their members (children and adults).

Table 7 Flood-induced household in food security status/levels

Community	Category of food security status/level (in %)				Total
	Food secure	Food insecure without hunger	Moderately food insecure with hunger	Severely food insecure with hunger	
Atani	6.2	39.1	14.1	40.6	64
Ossomala	1.6	45.3	12.5	40.6	64
Otuocha	9.1	59.1	20.4	11.4	44
Igbariam	0	20.9	7	72.1	43
Oguta	22	19.5	43.9	14.6	41
Ezi-Orsu	7.5	40	12.5	40	40
Mmahu	7.7	40.4	13.4	38.5	52
Opuoma	7.7	44.2	7.7	40.4	52
Total (mean)	7.2	39.3	15.7	37.8	4000

note: author’s computation, 2017

4.6 Coping strategies adopted by households

The coping strategies adopted by households in times of food shortages as a result of flood-induced food insecurity are shown in Table 7 as disaggregated by household headship (FHHs and MHHs). Table 8 revealed that households mostly adopted skipping of meals (90%), reducing number of times food is eaten (82.3%) and reducing portion size of meals (80.7%) which collectively had been grouped as food compromise coping strategies by Farzana et al. (2017). In addition, the results illustrated that households that actively created strategies to cope and live with flood-induced food insecurity had comparative advantage in terms of adaptation, over others.

5 Discussion

The score position of households on the food (in)security scale is based on the overall pattern of response to the 18 questions (see Table 1) by households (Bickel et al. 2000). The findings of the study revealed that a substantial proportion of households’ position on the scale was between 2.33 and 10 indicating a high level of flood-induced food insecurity across the eight agrarian communities in Southeastern Nigeria (Table 6). This implies that more than a third of all households (39.3%) had uncertainty and anxiety over adequate food supply, about a quarter (15.7%) had food intake of their adult members reduced, and 37.8% households reduced the food intake of both children and adults as a result of flood-induced food insecurity. Igbariam community was the most adversely affected in terms of flood-induced food insecurity with 72.1% households experiencing extreme (severe) food insecurity with hunger making Igbariam a food insecurity hotspot that would be needing some organised assistance to cope with the flood-induced food insecurity. It could also be inferred from the results that a relationship exists between food insecurity, hunger and poverty. Most households were reported to have been hungry, others resorted to either cutting the size or skipping meals including adults and children’s meals. Households were reported to have supplemented with low quality food as a result of inadequate household resources to acquire more with associated hike in food prices which is in agreement with the findings of FAO (2015) and Mitiku et al. (2012).

In times of flood-induced food insecurity, households were forced to adopt various coping strategies for survival and our findings show that major-

Table 8 Coping strategies adopted by households in times of flood-induced food insecurity

Coping strategy	Frequency (Percent %) n = 400		Within household headship (For “YES” (valid) response only)	
	Yes	No	FHH	MHH
Skipping meals	360 (90.0)	40 (10.0)	160 (91.4)	200 (55.6)
Buying less preferred/ desired food	247 (61.8)	153 (38.2)	104 (59.4)	143 (63.6)
Reducing portion size of meals	323 (80.7)	77 (19.3)	153 (87.4)	170 (75.6)
Casual jobs	82 (20.5)	318 (79.5)	42 (24.0)	40 (17.8)
Informal borrowing (money/food)	126 (31.5)	274 (68.5)	45 (25.7)	81 (36.0)
Reducing number of times food is eaten	329 (82.3)	71 (17.7)	140 (80.0)	189 (84.0)
Collecting loan	10 (2.5)	390 (97.5)	6 (3.4)	4 (1.8)
Sale of assets	51 (12.8)	349 (87.2)	18 (10.3)	33 (14.7)
Church Charity	43 (10.7)	357 (89.3)	28 (16.0)	15 (6.7)
Begging	8 (2.0)	392 (98.0)	7 (4.0)	1 (0.4)
Purchase food on credit	84 (21.0)	316 (77.0)	42 (24.0)	42 (18.7)
Remittance	97 (24.3)	303 (75.7)	41 (23.4)	56 (24.9)
Eat seed stock or stocked seeds	229 (57.2)	171 (42.8)	99 (56.6)	130 (57.3)

note: author’s computation, 2017; figures in parentheses (“”) are the valid responses in percentage

ity of them reduced the quantity and quality of food eaten. The study found “skipping meals” to have been the most adopted coping strategies accompanied by “reducing number of times food is eaten” and “reducing portion size of meals” with 90%, 82.3% and 80.7% households respectively adopting them (Table 7). This is similar to the findings of Tefera and Tefera (2014) in Ethiopia, Gupta et al. (2015) in India and Farzana et al. (2017) in Bangladesh. Our study found “buying less preferred/desired food” a significant coping strategy adopted by a substantial proportion of households (61.8%) and this in line with the findings of Aseseffa et al. (2018) who found 72.4% of households in Jimma Town, South West Ethiopia to have adopted same in times of food insecurity. The least adopted coping strategies were “begging”, “collecting loan” and “church charity” in decreasing order (Table 7). The study revealed that 12.8% households sold their assets (e.g. motorcycle, livestock) to acquire food or settle some other households’ needs which corroborates the findings of Tesso (2015); Motbainor et al. (2016) and Aseseffa et al. (2018). Households were also found to have adopted some extreme strategies in order to cope with low food availability with associated high food prices. For instance, 57.2% households reported to have eaten their stocked seeds and/or seed sock (e.g. yam tubers, dried maize) generally kept for next planting season and these households were affected during subsequent planting season. As shown in Table 7,

remittance (sending money back home) was found to be a valid coping strategy adopted by households and this agrees with the findings of Babatunde et al. (2010) who found remittance increase to be associated with decreased food insecurity in Nigerian rural households, and Ponsot and Obegi (2010) who adduced that saved remittances served as insurance against unpredicted events for households. Informal borrowing (money/food), purchasing food on credit and casual jobs were other coping strategies employed by households in the study area to cope with low food availability as a result of destroyed farmland by floods, hike in food prices, seasonal migration caused by flooding. Nonetheless, a general analysis of the coping strategies adopted by households in the study area shows prevalence of poverty and that floods affect food availability and affordability, thereby inducing food insecurity. The percentage distribution illustrating the mean household coping strategies adopted in times of flood-induced food insecurity is seen in Table 1 with majority adopting skipping meals, reducing meal frequency and reducing meal portion while begging and collecting loan were the least adopted coping strategies in the study area. Our findings revealed a slight gender-based disparity in the coping strategies adopted by the FHHs and MHHs with the FHHs adopting the most extreme of the coping strategies such as begging and church charity and being mostly affected by the flood (Table 7).



Fig. 4 Percentage distribution of coping strategies to flood-induced food insecurity

Among the FHHs, the mildest coping strategy adopted skipping meals and reducing food portion. The MHHs on the other hand, also adopted begging and collecting loan as its most extreme coping strategies.

The variations in the coping strategies adopted with respect to household type is a function of income and asset poverty gaps as well as differential household flood-induced food insecurity levels. It could be adduced from our study that the FHHs adopted the most extreme coping strategies because they experienced severe flood-induced food insecurity and majority fell below the poverty line classified as “poor” (Table 4 and Fig. 5 ???) in addition to asset poverty experienced by the poorer and poorest wealth classes consisting of majority FHHs (Table 5). Our findings are in agreement with that of [Batunde et al. \(2008\)](#) who found FHHs to be more food insecure as a result of poverty in farming households in Kwara State, Nigeria.

6 Conclusion

Flood-induced food insecurity in Southeastern Nigeria was extraordinarily high, partly because households were mostly agrarian. Households adopted mainly coping strategies (skipping meals, reducing meal frequency and reducing meal portion) that compromised food quantity and quality in times of flood-induced food insecurity. This implies that flooding induces food insecurity which leads

to changes in household’s food consumption patterns. There was increased inability to obtain food especially good food with nutritional quality as households subscribed to strategies such as skipping meals, reducing food portions and number of times they feed, buying less desired food and so on.

The study found a gender-disparity in the adopted coping strategies with more FHHs adopting the most extreme coping strategies and the reasons have been linked to their income and asset poverty, and vulnerability to flood-induced food insecurity in the study area. The FHHs were more affected by the flood incidence than the MHHs. In addition, the study has illustrated coping strategies as means of reducing vulnerability and enhancing adaptation to food insecurity which is capable of strengthening the achievement of Goal 2 of the SDGs which lays emphasis on ending hunger, achieving food security and improving nutrition and promoting sustainable agriculture by 2030.

Finally, the study has shown the different flood-induced food insecurity levels of households, the strategies adopted by these households for survival and how the strategies vary according to household’s headship. The findings revealed that most of the coping strategies adopted were self-devised strategies that provided temporary means of survival in times of food shortages at the household level. Thus, policy measures geared towards sustainable strategies e.g. social security, food safety nets that are gender-specific and community-based, are recommended to reduce vulnerability to flood-induced food insecurity, thereby improving adaptation.

Funding

The authors received no direct funding for this research.

References

- Ajaero C (2017) A gender perspective on the impact of flood on the food security of households in rural communities of Anambra state, Nigeria. *Food Security* 9, (4):685–695.
- Ajibade I, McBean G, Bezner-Kerr R (2013) *Urban flooding in Lagos, Nigeria: Patterns of vulnerability and resilience among women*. Global Environmental Change, . doi: 10.1016/j.gloenvcha.2013.08.009.
- Akukwe T (2019) Spatial Analysis of the Effects to Flooding on Food Security in Agrarian Communities of South eastern Nigeria.
- Akukwe T, Oluoko-Odingo A, Krhoda G (2020) Do floods affect food security: A before and after comparative study of flood-

- affected households food security status in South East Nigeria. *Bulletin of Geography, Socio-Economic Series* 47, (47): 115–131. doi: 10.2478/bog-2020-0007. DOI:.
- Anyadike R, Phil-Eze P (1989) Runoff Response to Basin Parameters in Southeastern Nigeria". *Geografiska Annaler: Series A, Physical Geography* 71, (1-2):75. doi: 10.1080/04353676.1989.11880274. JSTOR 521009.
- Armah F, Yawson D, Yengoh G, Odoi J, Afrifa E (2010) Impacts of floodson livelihoods and vulnerability of natural resources dependent communities in northern Ghana. *Water* 2:120–139. doi: 10.3390/w2020120.
- Asesefa K, Tamiru D, Teshome M, Tamiru M, Feyissa G (2018) Household food insecurity and coping strategies among pensioners in Jimma Town, South West Ethiopia. *BMC Public Health* 18, (1373):1–8.
- Babatunde R, Omotesho O, Olorunsanya E, Owotokit G (2008) Determinants of Vulnerability to Food Insecurity: A gender-based analysis of farming households in Nigeria. *Indian Journal of Agricultural Economics* 63, (1):125.
- Babatunde R, Omotesho O, Olorunsanya E (2010) Determinants of vulnerability to food insecurity: A gender-based analysis of farming households in Nigeria. *Ind. Jn. of Agri. Econ* 63, (1): 116–125.
- Bakhtar A, Marzuki M, Yanis M, Ismail N (2021) Food security strategies towards flood hazards along the Cinendang River, Aceh Province. *IDP Conf. Series: Earth and Environment Science* 667, (2021):102040. doi: 10.1088/1755-1315/667/1/01012040.
- Bashir M, Schilizzi S, Pandit R (2012) The Determinants of Rural Household Food Security for Landless Households of the Punjab, Pakistan. In: *Workin Paper1208, School of Agricultural and resource Economics*.
- Bickel G, Nord M, Price C, Hamilton W, Cook J (2000) Guide to Measuring Household Food Security. Revised.
- Clay L, Ross A (2020) Factors associated with food insecurity following hurricane Harvey in Texas. *International Journal of Environmental Research and Public Health* 176762. doi: 10.3390/ijerph17030762.
- DFID (1999) *Sustainable Livelihood Guidance Sheets*. Department for International Development United Kingdom, .
- DFID (2009) *Sustainable Livelihood Guidance Sheets*. Department for International Development United Kingdom, .
- Dilshad A, Muhammed A (2021) Flood hazards, human displacement and food insecurity in rural riverine areas of Punjab, Pakistan: Policy implications. *Environmental Science and Pollution Research* 28:10125–10139. doi: 10.1007/s11356-020-11430-7.
- Douglas I, Alam K, Maghenda M, Mcdonnell Y, Mclean L, Campbell J (2008) Unjust waters: climate change, flooding and the urban poor in Africa. *Environment and Urbanization* 20, (1): 187–205. doi: 10.1177/0956247808089156.
- FAO (1996) *Rome Declaration on World Food Security and World Food Summit Plan of Action*. FAO Document Repository, Rome.
- FAO (2002) The State of Food Insecurity in the World 2001.
- FAO (2005) *Food and Agricultural Organization of the United Nations*. FAOSTAT, Statistical Database, Rome.
- FAO (2008a) *Climate Change and Food Security: A Framework Document – Summary*. The Food and Agriculture Organization of the United Nations, Rome.
- FAO (2008b) Food Security Concepts and Frameworks: Food Security Information for Action, e-learning manual. Retrieved from <http://www.fao.org/elearning/Course/FC/en/CourseViewer.asp?language=en>. at 01:20am Thursday 25/06/2015).
- FAO (2011) The State of Food and Agriculture, 2010–2011: Women in Agriculture—Closing the Gender Gap for Development.
- FAO (2015) Food Insecurity in the World Meeting the 2015 international hunger targets: taking stock of uneven progress. Available from: <http://www.fao.org/policy-support/resources/resources-details/en/c/469455/>.
- Farzana F, Rahman A, Sultana S, Raihan M, Haque M, Waid J (2017) Coping Strategies related to food insecurity at the household level in Bangladesh. *PLoS ONE* 12, (4).
- Gupta P, Singh K, Seth V, Agarwal S, Mathur P (2015) Coping Strategies Adopted by Households to Prevent Food Insecurity in Urban Slums of Delhi, India. *Journal of Food Security* 3, (1):6–10.
- Hamdiyah A (2020) Farm housholds flood adaptation practice resilience and food security in the Upper East region, Ghana. *Heliyon* 6, (2020). doi: 10-1016/j.heliyon.2020.e04167.
- IFAD (2009) International Fund for Agricultural Development. Dimensions of Rural Poverty. Rural poverty Portal. *Rural poverty Portal*. Retrieved from <http://www.ruralpovertyportal.org/topic>.
- IFAD (2012) International Fund for Agricultural Development. Enabling poor rural People overcome Poverty in Nigeria. IFAD: Rome. Retrieved from <http://www.ruralpovertyportal.org/topic>.
- Kiah S, Geoffrey L (2014) Flooding and security. A case study of community resilience in Rockhampton. *Rural Society* 23, (3): 216–228. doi: 10.1080/10371656.2014.11082066.
- Kuku-Shitu O, Mathiassen A, Wadhwa A, Myles L, Ajibola A (2013) *Comprehensive Food Security and Vulnerability Analysis in Nigeria (Discussion Paper 01275)*. The International food policy Research Institute/World Food Programme, Washinton D.C.
- Lieber M, Chin-Hong P, Knox K, Madhavi D, Weiser S (2022) A systematic review and meta-analysis assessing the impact of droughts, flooding, and climate variability on malnutrition. *Global Public Health* 17, (1):68–82,. doi: 10.1080/17441692.2020.1860247.
- Liwenga E (2003) *Food Insecurity and Coping Strategies in Semi-arid Areas: The Case of Mvumi in Central Tanzania*. A doctoral dissertation submitted to Stockholm University, Sweden.
- MacNabb E, Fletcher B (2019) Hurricanes, disasters and food security: Emerging voices in natural hazards research. doi: 10.1016/B978-0-12-815821-0.00012-6.
- McCusker B, Carr E (2006) The co-production of livelihoods and land use change: Case studies from South Africa and Ghana. *GeoForum* 37:790–804.
- Mitiku A, Fufa B, Tadese B (2012) Empirical analysis of the determinants of rural households food security in southern Ethiopia: the case of Shashemene District. *Basic Res J Agric Sci Rev* 1, (6):132–138.

- Motbainor A, Worku A, Kumie A (2016) Level and determinants of food insecurity in east and west Gojjam zones of Amhara region, Ethiopia: a community based comparative cross-sectional study. *BMC Public Health* 16:1-13.
- Ngho M, Teke M, Atanga N (2011) *Agricultural Innovation and Adaptations to climate change effects and food security in Central Africa: Case of Cameroon, Equatorial Guinea and Central African Republic*. African Technology Policy Studies Network Research, Nairobi.
- Nkrumah B (2018) Edible backyards: Climate change and urban food (in)security in Africa. *Nkrumah Agric and Food Security* 7, (45). doi: 10.1186/s40066-018-1096-Y.
- Obayelu A (2010) Classification of Household into Food Security Status in the North Central Nigeria: An application of RASCH measurement model. *Journal of Agriculture and Biological Sciences* 5, (3):26-41.
- Odufuwa B, Adedeji O, Oladesu J, Bongwa A (2012) Floods of Fury in Nigerian Cities. *Journal of Sustainable Development* 5:69-79.
- Olabisi Y (2013) Gender Issue and Urban Renewal Development: An Examination of Challenges of Evicted Market Women in Lagos State, Nigeria. *American Journal of Rural Development* 1, (2):19-25.
- Orewa S, Iyanbe C (2009) Household Food Security in Nigeria: An assessment of the present status of Protein-Energy Malnutrition among rural and low-income urban households. *Journal of Applied Sciences Research* 5, (10):1615-1621.
- Oskorouchi H, Sousa-Poza A (2020) Floods, food security and coping strategies. In: *Evidence from Afghanistan. Agricultural Economics*. doi: 10.1111/agec.12610.
- Otaha I (2013) Food security in Nigeria: way forward. *African Research Review* 7, (4):26 - 35. doi: 10.4314/afrrv.7i4.2.
- Oyefara J, Alabi B (2016) Socio-economic Consequences of Development-induced Internal Displacement and the Coping Strategies of Female Victims in Lagos Nigeria: An ethno-demographic Study. *African Population Studies* 30, (2): 2520-2532.
- Pacetti T, Caporali E, Rulli M (2017) Floods and Food Security: A method to estimate the effect of inundation on crops availability. *Advances in water resources* 110:494-504.
- Ponsot F, Obegi B (2010) Etude de capitalisation des initiatives et mécanismes en matière de transferts de fonds au Mali. Study conducted for Centre d'Information et de Gestion des Migrations (CIGEM) [Study on the capitalization of initiatives and mechanisms for remittances in Mali. Study conducted for Center for Information and Migration Management (CIGEM), Mali], Mali.
- Rodriguez-Lianes J, Ranjan-Dash S, Degomme O, Mukhopadhyay A, Guhasapir D (2011) Child malnutrition and recurrent flooding in rural eastern India: A community-based survey. *BMJ Open* 1:e000109. doi: 10.1136/bmjopen-2011-000109.
- Serrat O (2017) The Sustainable Livelihoods Approach. *Knowledge Solutions*. doi: 10.1007/978-981-10-0983-9_5.
- Sileshi M, Kadigi R, Mutabazi K, Sieber S (2019) Analysis of household's vulnerability to food insecurity and its influencing factors in East Hararghe, Ethiopia. *Journal of Economic Structures* 8, (41). doi: 10.1186/54008-019-0174-4.
- Smith M, Floro M (2020) Food insecurity, gender and international migration in low and middle income countries. *Food Policy* 91, (2020):101837. doi: 10.1016/j.foodpol.2020.101837.
- Tamiru D, Argaw A, Gerbaba M, Ayana G, Nigussie A (2016) Household food insecurity and its association with school absenteeism among primary school adolescents in Jimma zone, Ethiopia. *BMC Public Health* 16:1-8.
- Tefera T, Tefera F (2014) Determinants of Households Food Security and Coping Strategies for Food Shortfall in Mareko District, Guraghe Zone Southern Ethiopia. *Journal of Food Security* 2, (3):92-99.
- Tesso G (2015) Why the urban households remain foods insecure in developing countries? Empirical evidence from Nekemte town of Ethiopia. *Int J Manag Stud Res* 3, (10):108-17.
- Tommaso P, Enrica C, Maria C (2017) Flood and food security: A method to estimate the effect of inundation on crops availability. *Advances in Water Resources* 110, (2017):494-504. doi: 10.101611.advwatres.2017.06.019.
- Toulmin C (1986) Access to Food, Dry Season Strategies and Household Size amongst the Bambara of Central Mali. *IDS Bulletin* 17, (3):58-66.
- UN-OCHA (2012) United Nations Office for the Coordination of Humanitarian Affairs, Floods Situation Report. Retrieved from: <http://reliefweb.int/report/nigeria/floods-situation-report-no-1-06-november-2012>.
- United Nations (2015) United Nations economic and social council, economic commission for Africa: status of food security in Africa. <https://www.uneca.org/sites/default/files/uploaded-documents/RITD/2015/CRCI-Oct2015/>; Accessed 10 Dec 2018.
- Week D, Wizar C (2020) Effects of flood on food security, livelihood and socio-economic characteristics in the flood-prone areas of the core Niger Delta, Nigeria. *Asian Journal of Geographical Research* 3, (1):1-17.
- Yamane T (1967) Statistics: An Introductory Analysis.
- Yaro J (2004) Theorizing Food Insecurity: building a livelihood framework for researching food insecurity. *Nor. Geogr. Tidsskr* 58:23-37.
- Yaro J (2013) Building Resilience and reducing Vulnerability to Climate Change: Implications for Food Security in Ghana.