RESEARCH ARTICLE

Rural communities coping strategies with flood-driven food insecurity in Delta state, Nigeria

Albert Ukaro Ofuoku*, Precious Omesiri Abushe, Oghenekevwe Martha Enughure

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This study was conceived to examine the coping strategies adopted by rural communities with flood driven food insecurity in delta state, Nigeria. While there are incidences of major flood every year in some communities, in other communities it happened every two years, every three years and every five years. The flood was very severe in all the locations because of the soil properties and the topography of the locations. Loss of fish (3.62 ± 0.21); submersion of natural ranching of and farming habitats (3.56 ± 0.33); destruction of crops (2.61 ± 0.51); disease outbreak (2.53 ± 0.42) loss of livestock (2.50 ± 0.48) and loss of home (2.51 ± 0.75 were experienced during flood. The incidences of flood affected food security. the communities used in this study popularity coped with flood event by constructing flood ways; adopting early maturing crops; relocating to either area not affected by flood or neighboring communities; diversifying their source of livelihood; constructing dykes around their fish pond; placing of sac bags around the farms and houses; keeping their valuable on shelves and tables; and transferring their valuables to relations/neighbors who live in advantaged area of the communities. It is therefore recommended that government should make effort to extend extension service to the study area so that they can benefit from their wealth of experience as well. Male farmers should help their wives in developing various strategies in coping with flood instead of going to urban settlement for employment and greener pasture when their families and properties are at risk. The trend of flooding should be studied and farming activities adjusted accordingly.

Keywords: Flood; Food security; Rural communities; Food insecurity; Copping strategies

INTRODUCTION

During flood, dry lands are completely or partly inundated with water as a consequence of tidal or inland water emanating from abnormal and speedy collection of runoff. In Nigeria, floods are most frequent, widespread and disastrous natural disasters. A little above half of disasters in Nigeria and accounts for 40% of deaths attributed to disasters [1]. The increasing flood incidents in various parts of Nigeria have been indicted for loss of lives and properties, displacement of people, and general damage to the environment [2]. Madzwamuse; Speranza; Nzeadibe and Ajaero, observe that Nigeria among other developing nations of the word is most vulnerable to impacts of flood because of their poor adaptive capacity.

In Cameron, unprecedented rainfall was experienced in the year 2012. This brought about flood in the areas around the Ledja dam, to the extent that the dam could not accommodate the volume of water. The consequence was flow of water into Nigeria *via* river Benue and into the Atlantic Ocean through river Niger. During this period, the eleven states through which the two rivers traverse experience flood. This flood prompted displacements of people, death of some animals and disruption of economic activities. The 2012 flood was noted as being the worse ever experience for the past 40 years in Nigeria [3].

Population is not above figures, but about people. An estimation of people who were affected in Nigeria were put at 7,705,378 persons and out of these people, 2,157,419 became internally displaced [4]. About 90% of Nigeria 36 states were affected by the flood from July to October, 2012, resulting to 363 recorded deaths and damage of well over 618,000 houses [5]. The increasing flood incidents in various parts of Nigeria have been indicated for loss of human lives and properties, displacement of people and general damage to the environment [6]. Flood incidents destroyed crops, mostly food crops in the affected areas and triggered food insecurity.

The united nation development program predicted that climate change would slow down human development progress that has been achieved over the last 20 years in the extinct threats about availability of water, food insecurity developing agricultural productivity. Syaukat asserted that climate change contributed abnormal climatic conditions which are capable of affecting agricultural production through their impact on temperature alterations and availability of water. This has been said by Ibok, et al. To prompt intensification of the already extent hunger and food insecurity challenges in developing countries of the world. In fact, Amball, et al. suggest that enormous population of the people is currently hungry and malnourished. This was corroborated by FAO that gave an estimate of 217.8 million people who are under nourished in sub-Sahara Africa. Above 70% of these under nourished persons (including children, women and men) dwell in rural settlements that form the home of agricultural activities and rely on them directly or indirectly for their livelihood and survival [7].

About 1.2 billion people fall short of meetings of meeting their most basic needs of food sufficiency daily, particularly the indigenous populations who dwell in rural communities in developing countries Nigeria [8]. Arising from this, Nigeria has been classified among 55 Low Income Food Deficit (LIFD) countries because of the high level of impoverished population among farming households [9]. Therefore, juxtaposition of poverty level and vulnerability to climate change included flood incidents threaten food security in Nigeria. Stability and enhanced utilization of productive factors, especially land has to be achieved for food secured status to be realized. Many flood incidents have affected delta state, especially the rural communities which constitute the home of farming and other agricultural activities. This is mostly so because of the challenges associated with climate change, particularly flooding. It was on mass media that the state government made efforts to alleviation the conditions of the affected rural population. However, it should be noted that the efforts put in by governments during incidents like this is always not enough. How affected rural population survives flooding incidents has not been fathomed. This knowledge gap makes this study worthwhile especially as it involves the agrarian amenities of Delta state, Nigeria.

Department of Agricultural Extension, Delta State University, Delta State, Nigeria

Correspondence: *Albert Ukaro Ofuoku, Department of Agricultural Extension, Delta State University, Delta State, Nigeria; E-mail: ofuokua@delsu.edu.ng*

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This study is therefore conceived to examine the coping strategies adopted by rural communities with flood driven food insecurity in delta state, Nigeria. In specific terms the study area; assessed the effect of flood on agricultural activities, the environment and food security; ascertained the food security status of the rural households before and during flood; determined the effect of flood on rural household's food security status; and assess the adaptive methods and capacities to flooding. It was hypothesized that There was no significant difference in food security status of the rural community dwellers during and after flood incidences; flood incidents do not have significant effect on food security status of rural households and that the adaptive capacities to flooding do not significantly contribute to food security status of rural households during the flood incidents.

MATERIALS AND METHODS

This study was done in delta north agricultural zone of Delta state, Nigeria. This area was chosen because of being over 40% food insecure, a situation that is directly linked to adverse climatic condition with unrelenting flood as the main driver. As a result, many of the households depend on relief food and food for assets, which are insufficient, and not sustainable. The area has a population of 15,378 people with 1922 households [10]. It has an area of 707 km^2. With an average cultivated farm size is 2 hectares per household, while pressure on land is increasing. The rainfall range though 400-700 mm per year is erratic and unreliable and hence the high risk of crop failure despite several adaptive strategies in place.

The rural poor, who are dependent on agricultural systems and natural resource base, constituted the target population. A cross-sectional survey design was used in this study. The rural poor, that are dependent on agricultural systems and natural resource base, will constitute the target population while the unit of analysis was the household. The household heads will be the unit of observation. Purposive sampling will be used to select Ebuh, Illah, Ugbolu, Oko, Uchi, and Aboh because they have the highest incidents of flood and are located along the Bank of River Niger and according to Ofuoku, a good percentage of the people are food insecure. A representative sample size of 340 households will be used as respondents in this study.

Data were collected using focus group discussion, field observations, household survey interview schedule, and questionnaire survey. While interview schedule will be used to elicit information from the respondents with little or no formal education, questionnaire will be used to access information from those with reasonable level of formal education.

Variables in objective i was measured in percentages by dividing the frequency by sample size and multiply the product by 100 thus, f/n 100). Variables in objective ii will be by computing the means using the following application 4 point Likert-type scale of strongly agree=4; agree=3; disagree=2 and strongly disagree=1, with a cut-off score of 2.5. Standard procedures with focus on descriptive statistics will be used in data analysis. Objective i was met with frequency counts and percentages. Objective iii will be met with the adoption of the USDA (2000) method of measuring food security status as adapted by Ofuoku by using the 4-point Likert type scale of food secure=4; food insecure without hunger=3; food insecure with moderate hunger=2; and food insecure with severe hunger=1.

The mean security status was computed by dividing the food security status score by the number of respondents. The grand food security status mean will be computed by dividing the total mean score by the number of local government areas covered. The food security status index will be calculated by dividing the grand food security status mean by the number of food security status categories. According to the US Department of Agriculture, "food secure" Households are Households (HHs) that display no or marginal proof of food insecurity; "food insecure without hunger" HHs are those where insecurity is manifest in household member's concerns about sufficiency of the household food supply and in modifications to household food management, including reduced value of food and improved unusual coping patterns (little or no reduction in member's food intake is reported). "Food insecure with moderate hunger" HHs is those where food consumption by adults has been reduced so much that the adult members frequently experience physical feeling of hunger. "Food insecure with severe hunger" HHs refers to those where children's food consumption is reduced to a level where children experience hunger. Objective v was addressed with hypothesis 1 (Ho_1). Objective v was achieved with the application of 4 point Likert-type scale of very able to adapt=4; able to adapt=3; fairly able to adapt=2 and poorly able to adapt=1.

The hypotheses were tested with the use of Pearson Product Moment Correlation (PPMC). The formula is given as follows:

rxy is given as:

$$r=n(\sum xy)-(\sum x)(\sum y)/\sqrt{[n\sum x^2-(\sum x)^2]\,[n\sum y^2-(\sum y)^2]}$$

With:

Ho_1

X=HH food security status

Y=incidence of flood

Σ=summation

Ho_2

X=HH food security status

Y=adaptive capacities

Σ=summation

√=square root

RESULTS AND DISCUSSION

Socioeconomic characteristic of respondents

Table 1 indicates that respondent had an average of 50 years in age. This implies that the adult population in the study area was predominantly the aged. This is in consonance with Ekong. Who assert that old folks form the major adult population in the rural areas? This trend is as a result of the fact that most of the young adults and youths have embarked on rural-urban migration in search of white collar jobs and higher level of living. The female population (57.69%) was higher than that of the male household heads. This situation was created by the migration of their husbands to urban areas for work in manufacturing, extractive, hospitality or processing industries. Ofuoku and Emuh, suggest that in many rural settlements, the role of the household heads fall on the shoulder of women, who their husbands have migrated to urban settlement for various jobs. These men only come home once or twice a month to spend weekends with their families. They further explain, they had an average household size of 8 persons. This indicates large household sizes. Ekong, reminds us that the average Africa, especially in the rural areas is polygamous with many children by different wives, these large household size form household farm labor. Those who had no formal education form the model class of the rural area studied [11]. The formally illiterate members are mostly left behind in villages. Many of them engage in various farming activities ranging from arable crop farming, livestock, production fish farming, fishing and plantation agriculture. They had mean farming experience of 19.17 years. Most (54.73%) did not describe to membership of farmers association. Many of them (54.73%) had farms that were close to their homes. In this case many of them do not work or ride long distance before getting to their farms.

TABLE 1

Socioeconomic characteristics of respondents (n=338)

Variable	Frequency	Percentage (%)	Mean/Mode

21-30	46	13.61	50 years
31-40	49	14.5	
41-50	63	18,64	
51-60	151	44.67	
60 and above	49	8.58	
Sex			
Male	143	42.31	Female
Female	195	57.69	
House hold size			
1-3	39	11.54	8
4-6	78	23.08	
7-10	99	29.29	
Above 10	122	36.09	
Formal level education			
No formal education	162	47.93	No formal education
Primary education	76	22.49	
Secondary education	69	20.41	
Tertiary education	31	9.17	
Marital status			
Single	71	21.01	Married
Married	267	78,99	
Farming activity (majors)			
Arable crop production	101	29.88	
Perennial crop production	46	13.61	
Livestock production	99	29.29	
Fish farming	93	27.51	
Fishing	69	20.41	
Years of farming experience (years)			
1-5	19	5.62	19.17
6-10	42	12.43	
11-15	77	22.78	
16-20	57	16.86	
21-25	81	23.96	
Above 25	62	18.34	
Membership of farmers association			
Yes	73	21.6	
No	265	78.4	
Distance farm			
Far	153	45.27	
Near	185	54.73	

Frequency of major floods

Major floods occurred in the study area on various frequencies. In some of the communities, it occurred every year (32.84%), every two years (15.09%), every three years (18.93%), and every five years (33.14%). While there are incidences of major flood every year in some communities, in other communities it happened every two years, every three years and every five years. This trend is attributed to the nearness of the communities to the river and other bodies of water. Apart from the frequency and amount of rainfall for particular years, nearness to banks of bodies of water determines the frequency of major flood. In some places, amount of rainfall is at its highest in trends based on years while in some locations the amount of rainfall and nearness to source or body of water causes yearly major flood. The report given by irigation department, ministry of agriculture and rural development indicates that flooding is prompted inabilities to absorb water for the fact that most lands are marshy and wetlands that had become occupied by buildings. When the major water bodies over flow, flood occurs in the communities along the river banks. The same trend was found by Samarawerce in Kolomna area Sri Lanka (Table 2).

TABLE 2
Frequency of major flood

Incidence	Frequency	Percentage %	Mode
Every year	111	32.84	
Every two years	51	15.09	
Every three years	64	18.93	
Every five years	112	33.14	

Magnitude of flood

The magnitude of major flood incidents is always very severe in the communitie's study (Table 3). This is evident in the measures of their responses Ebuh (mean=3.45); Illah (mean 3.41); Ugbolu (mean=3.33); Okoh (mean 3.65); Uchi (mean=3.64) and Aboh (mean=3.62). However, it is most very severe in Okoh Uchi and Aboh. It is expected that such magnitude of flood will impact on their livelihood activities and welfare. The magnitude of flood is determined by the frequency and amount of rainfall. The flood was very severe in all the locations because of the soil properties and the topography of the locations. It was observed that the soil in the various locations were either clay loam or clay. The structure and texture of the soil retain water for long as a result of the capillarity and elastic nature of the soil. In some locations there exists the peaty soil. And of course, the peaty is a mixture of more than 40% clay and decayed organic matter. The advantage of flooding in this community is that as the flood come, they come with dissolved soil nutrients as it receives this nutrient are deposited and left in this locations, hence these places have fertile farm lands. This implies that their communities' citizens are expected to save money as a result of the nutrient deposits. However, Danso and Addo state that in Sekondi-Takoradi metropolis in Ghana, flooding is caused by closing of drainage channels due to irresponsible waste disposal. However, the difference in causes of flooding is location based. While communities studied in delta north agricultural zone, Delta state, Nigeria, are rural settlements, along river Niger bank, Sekondi-Takoradi metropolis in Ghana is urban [12].

TABLE 3
Magnitude of flood by community

Community	Score	Mean	Standard deviation
Ebuh (n=62)	214	3.45	0.63
Illah (n=99)	338	3.41	0.46
Ugbolu (n=15)	50	3.33	0.31
Okoh (n=51)	186	3.65	0.26
Uchi (n=53)	193	3.64	0.13
Aboh (n=58)	210	3.62	0.12

Note: Cut-off score=2.50 (2.50=not severe; 2.50-2.59=moderate; 2.60-2.99=severe;3.00 and above=very severe)

Effect of flood

Loss of fish (3.62 ± 0.21); submersion of natural ranching of and farming habitats (3.56 ± 0.33); destruction of crops (2.61 ± 0.51); disease outbreak (2.53 ± 0.42) loss of livestock (2.50 ± 0.48) and loss of home (2.51 ± 0.75 were experienced during flood (Table 4). Flooding leads to escape cultured fish from earth ponds into the wild, meaning a big loss to the fish farmers. During floods natural ranching and farm lands are submerged into water causing the shielding of pastures from livestock and rendering farm land inaccessible for crop farmers. There is an increased incidence of diseases such as malaria fever as a result of the volume of water which forms breeding ground for mosquitoes of various strains. Mosquitoes are the vector that transmits malaria plasmodium to humans. Livestock like goat and sheep and poultry get drown in flood water especially when the flooding comes up unexpectedly of inhabitants of the communities are lost temporally as such homes are always submerged in flood as flood water into the building, rendering them inhabitable. Vander Zaag observed that yields of grains remain stagnant in Africa as a consequence of flood. This scenario played out in 2012 when many farms were submerged with flood in Adamawa, Edo, Kogi, and Oyo state of Nigeria. These findings are congruent with that of Nwigwe and Emberga who found that flood causes diseases, destroyed farms, food and cash crops, shielded farmlands, destroyed human life animal life and buildings. Ashraf et al. found that shill level, overall education, shelter and food were destroyed by flood. The people could not work because of severity of flood and complications that accompanied it.

TABLE 4

Effect of flood in the communities

Effect	Mean	Standard deviation	Rank
Loss if human life	2.14	0.72	7th
Destruction of crop/flood	2.61	0.51	3rd
Loss of live stock	2.5	0.84	6th
Disease outbreak	2.53	0.42	4th
Submersion of natural ranching and farming	3.56	0.33	2nd
Loss of fish in earthen pond	3.62	0.21	1st
Destruction of homes	2.51	0.75	5th

Food security status before and during flood incidences

Table 5 indicates that all the communities studied had food security before flood incidences, with Ugbolu having the highest food security status. The food security index of 0.7475 implies that 75.75% of the respondents in the study area were food secure.

Table 6 shows that Ebuh, Okoh and Aboh were food insecure during flood incidents. Illah, Ugbolu, and Uchi had food security, but their food security status dropped during the flood. The food security index of 0.63 while the flood lasted indicates that 63% of the community citizen were food secure.

TABLE 5

Food security status before floods

Community	Food secure (4)	Food insecure without hunger (3)	Food insecure with moderate hunger (2)	Food insecure with severe hunger (1)	Score	Mean
Ebuh (n=62)	21 (84)	26 (78)	9 (18)	6 (6)	186	3
Illah (n=99)	36 (144)	41 (123)	11 (22)	11 (11)	300	3.03
Ugholu (n=15)	5 (20)	7 (21)	3 (6)	7 (7)	54	3.6
Okoh (n=51)	15 (60)	18 (54)	13 (26)	5 (5)	145	2.84
Uchi (n=53)	17 (68)	21 (62)	6 (12)	9 (9)	151	2.85
Aboh (n=58)	12 (48)	23 (69)	11 (22)	12 (12)	151	2.6

Note: Cut-off score=2.50 (≥ 2.50=food secure; <2.50=food insecure), total mean=17.92, grand food security mean=2.99, food security index=0.7475

Flood security index indicates that 75.10% of community citizens were food secure before the flood incidences. The food security index dropped by 11.75% while the flood lasted. This is in consonance with ashraf et al. who found out that rural communities in Southern Punjab, Pakistan became food deficit and food insecure during incidents of flood. This is attributable to the damage caused by the flood. Productive and food resource, including capital resources which are often affected by such floods. Food deficit and food insecurity may eventually result to hunger and malnutrition in cases like these (Table 6).

TABLE 6

Food security status after flood incidents

Community	Food security (4)	Food insecure without hunger (3)	Food insecure with moderate hunger (2)	Food secure with severe hunger (1)	Score	Mean
Ebuh (n=62)	13 (52)	16 (48)	18 (36)	15 (15)	151	2.41
Illah (n=99)	33 (132)	36 (108)	17 (34)	13 (13)	287	2.9
Ugbolu (n=15)	5 (20)	4 (12)	3 (6)	3 (3)	41	2.73
Oko (n=51)	12 (48)	14 (42)	9 (18)	16 (16)	124	2.43
Uchi (n=53)	13 (52)	18 (45)	6 (12)	16 (16)	134	2.53
Aboh (n=58)	8 (32)	13 (39)	15 (30)	22 (22)	123	2.12
Total mean						15.12

Note: Cut-off score=2.2.50 (≥ 2.50=food secure, <2.50=food insecure), grand food security mean=2.52, food security index=0.63

Deficiencies of basic needs like warm clothes, shelter, safe water and stable access to food give rise to food insecurity. Everything ranging from human life, food items, and shelter could not be kept safe. Communities where people live with disease incidents, occasioned by the flood, increasing the productive capacities of the citizens are further jeopardized. Ashraf, et al. as well found that rural community dwellers experienced difficulty keeping every of their properties and resources safe while flood lasted.

Food consumption pattern during flood event

Table 7 indicate that food consumption pattern decreased among the farm families during the period of flood, as all of the mean score were <2.0; according to the decision rule. This affirms the reduced food security during the flood. This decrease food consumption is attributed to food deficits as a result of people's migration and damage done to food and crop in the field. This is expected to cause nutrition and health problem. This is more so when their sources of water are polluted, crop and food destroyed. Ahmad et al. found a similar trend in their earlier study.

In the presence of shortage in food supply, the farm families had option than cutting down the food consumption. This they did in other to have for consumption in the future. This is more so when these rural farmers are totally dependent in farming. These farmers become vulnerable as shock compel them to selloff their asset.

TABLE 7
Food consumption pattern during flood incidents

Community	Increased food consumption (3)	Food consumption remained constant (2)	Decreased food consumption (1)	Score	Mean
Ebuh (n=62)	16 (48)	13 (26)	33 (33)	107	1.73
Illah (n=99)	30 (90)	33 (66)	36 (36)	192	1.94
Ugbolu (n=15)	4 (12)	6 (12)	5 (5)	29	1.93
Oko (n=51)	14 (42)	12 (24)	24 (24)	90	1.96
Uchi (n=53)	18 (54)	13 (26)	22 (22)	102	1.92
Aboh (n=58)	13 (39)	8 (16)	37 (37)	92	1.59

Note: Cut-off score=2.0 (2.0=food consumption remained constant; >-2.0=increased food consumption; <2.0=decreased food consumption.

Coping strategies against flood

Table 8 indicate that all the communities used in this study popularity coped with flood event by constructing flood ways; adopting early maturing crops; relocating to either area not affected by flood or neighboring communities; diversifying their source of livelihood; constructing dykes around their fish pond; placing of sac bags around the farms and houses; keeping their valuable on shelves and tables; and transferring their valuables to relations/neighbors who live in advantaged area of the communities. These findings are on consonance with those of Paul and Routray in their study of two villages in Bangladesh. Communities such as Okoh, Uchi and Ebuh used most of the coping strategies more than the other three communities. This implies that the adoptive capacity of the earlier mention three communities is higher than those of the later mentioned ones. This difference in adoptive capacities is attributed to the frequency and regular expectations of flood incidence by the communities earlier mentioned. Because of their proximity to river Niger.

It is of note that the coping strategies were carried out to save life of Humans, household properties, shelter, protect crops, poultry and livestock and cultured fish of interest in this study is the accompanying coping methods used by the people in order to live in greater safety. As a result of their previous experience of flooding. The people had the tendency to protect their shelter against flood and take shelter in relatively advanced area such as on elevated or higher ground.

Besides attempts made to save life, the communities' citizens likewise try to keep their assets safe. Such asset includes furniture, household intense, document electronics and clothes. These people also made attempts to protect their shelter as a result of the risk created by flood and accompanying erosion. It was observed that in most of the communities, the people build their shelter, on raised land or flat form made on events so as to prevent water from reaching plinth level in case of normal flood. This was also observed by Islam. Apart from raised flat form the community dwellers avoid usage of mud wall, instead they use cement block or corrugated roofing sheets. However, most times they use corrugated roofing sheets and bamboo which they find transferable. These ones can be dismantled bit by bit and transfer to safer areas.

The people used diverse indigenous coping method to protect crops. These include cultivation of early maturing varieties. They also developed the traditional farming calander which they follow. In this case, they sow arable crops during the post-flood season. Some took advantage of the flooding to plant sugarcane as also found by Paul and Routray in Bangladesh.

The people regard poultry and livestock as important assets. As the flood begins they keep their animals in raised pens. As the flood increases, they transfer them to places of advantage such as higher ground or sell them to people from non-flood prone communities. The people also raise fish in earthen ponds for income. In order to avoid loss of their cultured fish *via* flooding, they made dykes and other forms barricade using bamboo and fishing nets. Thompson and Tod; Paul and Routray had similar experience in their different studies.

TABLE 8
Coping strategies adopted

Strategies	Ebuh	Illah	Ugbolu	Oko	Uchi	Aboh
Planting of vegetables to take up excess water	0	0	0	0	0	0
Construction of flood ways	2.53	2.61	2.68	2.55	2.52	2.66
Planting of early maturing crops	2.75	2.64	2.81	3.11	3.19	3.31
Relocation	2.71	2.32	2.63	3.15	3.13	3.31
Livelihood diversification	2.55	2.59	2.57	3.18	3.16	3.25

Construction of dykes around fish ponds	2.61	2.66	2.72	3.1	3.02	3.12
Construction of ridge around houses	1.12	1.31	1.31	1.42	2.31	2.41
Sand filling to elevate land surrounding buildings	1.18	1.43	1.33	2.41	2.32	2.51
Placement of sand bags around farms and houses	2.51	2.62	2.54	2.61	2.66	2.63
Transfer of valuables on shelves and tables	2.55	2.59	2.57	2.63	2.68	2.63
Transfer of valuables to relatives/neigbors	2.53	2.5	2.61	2.67	2.62	2.61

Note: Cut-off score=2.50 (≥ 2.50=adopted coping strategy, <2.50=not adopted coping strategy)

Difference in food security status before and after flood

There was significant difference in food security status between after the flood and before the flood at 5% level of significance (Table 9). The food security status was however, higher before the flood incidences than after the flood incidents. The difference in mean of food security status before flood incidence (mean=164.5000) and after flood incidence (mean=143.3333) is indicative of fallen food security status after the flood incidents. This drop in food security status was prompted by the exhaustion of food in storage and destruction of food crops in the field that would have served as food and source of income for the rural households. Flood incidents destroyed crops, mostly food crops in the affected areas and triggered food insecurity.

TABLE 9

Estimation of difference in food security status during and after flood incidences

		Paired differences					t	df	Sig. (2-tailed)
		Mean	Std. deviation	Std. error mean	95% confidence interval of the difference				
					Lower	Upper			
Pair 1	After-before	-21.1667	8.81854	3.60015	-30.4212	-11.9122	-5.879	5	0.002

Effect of flood on food security status

Table 10 indicates a significant effect of flood on household food insecurity. However, the relationship is an inverse one (r=0.663), implying that flood incidents household food insecurity in the study area during the period of flood. As the magnitude of flood increases, food security status of households decreased. Paul and Routray, observed that flood adversely affected.

TABLE 10

Estimation of the effect of flood on household's food security

Variable	Household food security	Magnitude of flood
Households food security status	1	-0.663
Magnitude of flood	-0.663	1

The flood security of households in two villages on Bangladesles. This adverse effect of on household's food security was caused by the destruction of food items under storage and destruction of crops in the field and livestock the reared. Their source of water for consumption was also polluted by the flood thereby making the water unfit for consumption.

Contribution of adaptive capacity to rural household's food security status

Table 11 shows a significant contribution of adaptive capacities of households on household food security status (r=0.707). The contribution made was positive. This means that the adaptive capacities of the households were enhanced, their food security statuses also increased. Adaptive capacity of each household enhanced the food security status of such household. The adaptive measures ensured aversion of loss of food items in storage, crops on the field, livestock reared and protection of or sourcing of alternative consumable water sources.

TABLE 11

Estimation of the contribution of adaptive capacities to food security status

Variable	Food security status	Adaptive capacity
Food security status	1	0.707
Adaptive capacity	0.707	1

CONCLUSIONS

Rural community farmers in Delta North agricultural zone, Delta state, Nigeria have adopted various strategies of coping with flood driven food insecurity. The measures were taken to address various effect of flood that has led to loss of live, destruction of crops, loss of livestock, loss of shelter etc. Such measures indicate that all the communities used in this study popularity coped with flood event by constructing flood ways; adopting early maturing crops; relocating to either area not affected by flood or neighboring communities; diversifying their source of livelihood; constructing dykes around their fish pond; placing of sack bags around the farms and houses; keeping their valuable on shelves and tables; and transferring their valuables to relations/neighbors who live in advantaged area of the communities.

Arising from the afore said, it is recommended that:

- The farmers confirmed that they have not come in contact with extension agents in the study area. It is therefore recommended that government should make effort to extend extension service to the study area so that they can benefit from their wealth of experience as well.
- Male farmers should help their wives in developing various strategies in coping with flood instead of going to urban settlement for employment and greener pasture when their families and properties is at risk.
- The trend of flooding should be studied and farming activities adjusted accordingly.

REFERENCES

1. Adewuyi TO, Olofin EA. Spatio-temporal analysis of flood incidence in Nigeria and its implication for land degradation and food security. J Agric Sci. 2014;6(2):150-159.
2. Ambali OI, Adewuyi SA, Babayanju SO, et al. Expansion of rice for job initiative programme: Implications for household food security in Lagos State Nigeria. Adv Econ Bus. 2015;3(3):99-106.
3. Ashraf S, Iftikhar M, Shahbaz B, et al. Impacts of flood on livelihoods and food security of rural communities: A case study of Southern Punjab, Pakistan. Pak J Agric Sci. 2013;50(4):751-758.
4. Bashir MK, Schilizzi S. Determinants of rural household food security: A comparative analysis of African and Asian studies. J Sci Food Agric. 2013;93(6):1251-1258.
5. Danso SY, Addo IY. Coping strategies of households affected by flooding: A case study of Sekondi-Takoradi Metropolis in Ghana. Urban Water J. 2017;14(5):539-545.
6. FAO. Regional overview of food insecurity: African food security prospects brighter than ever. Food and Agriculture Organisation of the United Nations. 2015.
7. Fasoranti M. A Stochastic Frontier Analysis of Effectiveness of Cassava-Based Cropping Systems in Ondo State, Nigeria (PhD Dissertation). Federal University of Technology, Akure. 2006.
8. Ibok OW, Idiong IC, Brown IN, et al. Analysis of food insecurity status of urban food crop farming households in Cross River state, Nigeria: A USDA approach. J Agric Sci. 2014;6(2):132-141.
9. Nwigwe C, Emberga TT. An assessment of causes and effects of flood in Nigeria. Standard scientific research and essays. Stand Sci Res Essay 2014;2(7):307-315.
10. Ofuoku AU. Contributions of rural-urban migrant's remittances to farming household (HH) food security in Delta Central Agricultural Zone, Delta state, Nigeria. J Agribus Rural Dev. 2017;45(3):655-663.
11. Ofuoku AU, Uzokwe UN. Acceptance of climate change by rural farming communities in Delta State, Nigeria: Effect of science and government credibility. Asian J Agric Rural Dev. 2014;4(393-2016-23772):372-380.
12. Okoloye CU, Aisiokuebo NI, Ukeje JE, et al. Rainfall variability and the recent climate extremes in Nigeria. J Meteorol Climat Sci. 2013;11(1):49-57.