

Socioeconomic assessment of flooding among farm households in Anambra state, Nigeria

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Abstract

Purpose – The purpose of this paper is to describe the extent of agricultural losses incurred by the farm households due to flood; to assess the farm households gender-based vulnerability to flood; to identify the coping strategies used by them; and to estimate factors that drive the choice of these coping strategies.

Design/methodology/approach – Using both purposive and simple random sampling techniques, the paper selected 120 farm households from the flood prone areas of the state, using the list of the State Agricultural Development Project (ADP) contact farmers as a sampling frame. Data for the paper were collected using a set of structured and pre-tested questionnaire. The information collected included the extent of agricultural losses incurred by the farm households, farm household's level of asset base, flood coping strategies adopted by the farmers and so on. The data were collected in August 2013.

Findings – More than 70 per cent of the farmers' farmlands were affected by flood, resulting in more than 80 per cent of their staple crops (cassava, rice, yam, maize and vegetables) and livestock (sheep/goat and chicken) being lost. Women were generally more vulnerable than men to the effect of flood. Selling of assets, borrowing of loans to diversify the means of livelihood, short-term migration, support from social network, compensation of losses from National and/or State Emergency Management Agencies, planting of agro-forestry trees, change of date of planting, land terracing, construction of drainages, cover cropping and making of ridges across slop constituted the flood coping strategies of the farmers. On the factors influencing the choice of these coping strategies, the level of education of the household head, frequency of extension visits in a year and tenure security status were positively and significantly related with land and crop management strategies, such as planting of agro-forestry trees, planting of cover crops and construction of drainages across farmland. Age, access to credit, farm size and membership of cooperative societies had negative relationships with selling of assets and short-term migration. In addition, membership of cooperative societies and flood experience were positively and significantly related with institutional measures, such as support from social network and National and State Emergency Management Agencies. These observations underscore the need for training, cooperatives and enhanced farm capacity (credit and farm size) in coping with flood by the farmers. It is recommended that governments and non-governmental organizations (NGOs) should assist the farmers in these regards.

Originality/value – Climate change induced flooding has become a developmental issue across the world. As countries continue to be hit by massive flooding, food production also continues to be hit adversely. Nigeria has joined this league because of the rampage flooding across the country in recent



times. Anambra State is down stream of both rivers Niger and Benue and, hence, one of the states vulnerable to flooding in Nigeria. Available literature suggests that greater efforts have been made to quantify the economic implications of flooding on agriculture and the concomitant coping strategies in developed than in developing countries. This paper, therefore, assesses the extent of losses suffered by farm households, their level of vulnerability and flood coping strategies.

Keywords Nigeria, Vulnerability, Climate change, Flooding, Coping strategies, Agricultural losses

Paper type Research paper

Introduction

Climate change-induced flooding has become a developmental issue across the world. As countries continue to be hit by massive flooding, drought, extreme cold snaps, extreme heat, tornadoes and hurricanes, food production continues to be adversely affected. Nigeria has joined this league because of the rampage flooding across the country in recent times. The flood occurrence in Nigeria has been linked to combined effects of natural, environmental and anthropogenic factors, including heavy rains coupled with releases of excess water from dams (Hula and Udoh 2015). The exact relative roles of these natural, environmental and anthropogenic factors in the Nigerian flooding are not very clear and remain the subject of debate and continued study. However, damages and losses associated with the flooding are more observable and discernible. These include the loss of human lives, physical displacement of equipment and buildings, loss and damage to crops and crop lands, livestock and livestock farms, fish and fish ponds. Others include the disruption of economic activities, risks to human health, environmental degradation and deterioration of other sources of household livelihoods across the affected areas of the country.

In addition, the abrupt loss of incomes, productive resources and livelihoods (cropping, livestock, agro-processing and fishing) puts the affected farming and fishing households at risk of increased poverty and vulnerability. An important dimension is the temporary destruction/loss of wooded lands which reduces access of households (particularly women) to fuel wood for cooking, without an alternative source of cooking energy. In addition, flood has impacts not only on food production, but also on food distribution, infrastructure and incidence of food emergencies. The relevant questions are: what is the extent of losses associated with the flooding, and what are these farm households doing to minimize the impacts of flood. This study was aimed at assessing the extent of losses and the coping strategies of farm households in Anambra State, Nigeria. The state is one of those that have suffered devastating floods in the country. Available literature suggests that greater efforts have been made to quantify the economic implications of flooding on agriculture and the concomitant coping strategy, in developed than in developing countries (Zambia, 2008).

The specific objectives of the paper were to:

- describe the extent of agricultural losses incurred by the farm households due to flood;
- assess the farm households gender-based vulnerability to flood;
- identify the coping strategies used by the farm households; and
- estimate factors that drive the choice of these coping strategies.

Methodology

The study was conducted in Anambra State. Three agricultural zones, namely, Anambra, Awka and Onitsha, were purposively selected out of four in the state, because they were the most flood prone areas, judging from previous flooding episodes. Six flood-affected local governments were next, also purposively selected, two from each of the selected agricultural zones. Thereafter, 2 communities were randomly selected from each of the local governments, making 12 communities. In all, 2 villages were then randomly selected from each of the communities giving a total of 24 villages. In each of the villages, 5 farm households were randomly selected from a list of the State Agricultural Development Project (ADP) contact farmers, making a sample size of 120 respondents.

Data for the study were collected using a set of structured and pre-tested questionnaire. The information collected included the extent of agricultural losses incurred by the farm households, farm household's level of asset base, flood coping strategies adopted by the farmers and so on. The data were collected in August 2013.

Estimation procedures

Multivariate discrete choice model. The Multinomial logit (MNL) model for choice of flood coping strategies specifies the relationship between the probability of choosing option A_i and a set of explanatory variables X as:

$$\text{Prob}(Y_{i=j}) = \frac{e^{\beta_j X_i}}{1 + \sum_{k=0}^6 e^{\beta_k X_i}}, j = 0, 1, 2, 3, \dots, 10$$

Where β_j is a vector of parameters that relates the socio-economic, farm and institutional characteristics X_i to the probability that $Y_i = j$. The Y_i is the probability of choosing a flood coping strategy. Because the probabilities of the 11 main flood coping strategies must sum to 1, a convenient normalization rule is to set one of the parameter vectors, say β_0 , equal to 0 ($\beta_0 = 0$). The probabilities for the 11 alternatives then become (Greene, 2000):

$$\text{Prob}(Y_{i=j}) = \frac{e^{\beta_j X_i}}{1 + \sum_{k=1}^J e^{\beta_k X_i}}, j = 0, 1, 2, 3, \dots, 10$$

$$\text{Prob}(Y_{i=j}) = \frac{1}{1 + \sum_{k=1}^J e^{\beta_k X_i}}, j = 0$$

Following Miller (1997), the following six flood coping strategies were among those specified:

- (1) selling of assets;
- (2) borrowing of loan to diversify means of livelihood;
- (3) planting of agro-forestry trees;

- (4) short-term migration;
- (5) terracing of land; and
- (6) support from social network.

However, additional strategies, based on other literature (Enete *et al.*, 2011) and the authors' practical experience of the area, were added. These were:

- compensation of losses from NEMA and SEMA agencies;
- changing of date of planting;
- planting of cover crops to conserve soil moisture;
- making ridges across farms to reduce flood effects;
- construction of drainages across the farmland;
- minimum tillage;
- crop rotation; and
- crop switching.

The explanatory variables (X_i) consisted of socio-economic, farm-specific and institutional variables. These were:

- (1) Socio-economic variables:
 - X_1 = Household size (number of persons in the household).
 - X_2 = Age of the household head in years.
 - X_3 = Educational level of household head (years of formal schooling).
 - X_4 = Flood experience (number of times flood occurred in the season).
 - X_5 = Sex category of household head (dummy; 1 for male; 0 otherwise).
- (2) Farm-specific variables:
 - X_6 = Farm size measured in hectares (area cultivated by household).
 - X_7 = Average distance from farm to the river bank.
- (3) Institutional variables:
 - X_8 = Number of formal extension visits in the cropping season.
 - X_9 = Tenure security (dummy; 1 if the farmer owns the land or has the right to transfer the farmland to the next generation; 0 otherwise).
 - X_{10} = Social capital (dummy; 1 if farmer belongs to farmers' cooperative society, 0, otherwise).
 - X_{11} = Access to formal credit (dummy; 1 if farmers has access to credit; 0 otherwise).

Household vulnerability analysis

Vulnerability index analysis. To achieve Objective 3, which aimed at assessing the farmers' vulnerability to the effects of flood, vulnerability analysis was used. Using household adaptive capacity approach, gender disaggregated data were collected on human, economic and institutional capacity of farmers in coping with flood problems. The data collected were arranged in the form of a rectangular matrix with rows

representing agricultural zones/gender of household head and columns representing adaptive capacity indicators.

Indicators of Vulnerability

Gender of HHOLD Head	1	2	·	·	S	K
Zone <i>i</i> MHHID	X_{11}	X_{12}	·	·	X_{1j}	
FHHID	X_{21}	X_{22}	·	·	X_{2j}	

The obtained data from the vulnerability indicators (adaptive features) as will be used in this study will be normalized to be free from their respective units so that they all lie between 0 and 1. The gender with the higher value corresponds to higher vulnerability and vice versa. Hence, the normalization is achieved with this formula following [UNDP \(2006\)](#) in assessing Human Development Index:

$$y_{ij} = \frac{Max\{X_{ij}\} - \{X_{ij}\}}{Max\{X_{ij}\} - Min\{X_{ij}\}} \tag{1}$$

Where,

X_{ij} = represents the value of the vulnerability indicator j for the farm household i ; and
 Max & Min = represent maximum and minimum values of indicators, respectively.

We assume that all the vulnerability indicators (adaptive capacity indicators) have decreasing functional relationships with household vulnerability and contribute equally toward its reduction. Hence, equal weights were given to each of the indicators, so that simple average of all the normalized scores was computed to construct the vulnerability index (VI) using:

$$VI = \frac{\sum_j y_{ij}}{k} \tag{2}$$

VI represent the vulnerability indicator; and
 k represents the number of indicators used.

After normalization, the average index (AI) for each source of vulnerability was worked out, and then, the overall VI is computed by using the following formula:

$$VI = \left(\left\{ \sum_{i=1}^n (AI_i)^\alpha \right\}^{1/\alpha} \right) / n \tag{3}$$

Where n is the number of sources of vulnerability and $\alpha = n$. The vulnerability indicators that were used to measure adaptive capacity of farm households in flood prone areas of Anambra State include:

- X1 = farm income (in Naira);
- X2 = years of formal education (in years);
- X3 = farm size (in ha);
- X4 = land ownership status (Yes or No);

X5 = number of persons available for farm labor per household;
X6 = number of extension contacts in the year (number of visits);
X7 = access to farm credits or loan (Yes or No);
X8 = access to remittances (Yes or No); and
X9 = membership of cooperative (Yes or No).

Results and discussion

Agricultural losses incurred by the farm households due to flood

The flood-induced losses took various forms, including the loss of growing crops in varying degrees of maturity. In the rice sector, 76.67 per cent of the respondents lost above 80 per cent of their entire rice farms, 18.33 per cent lost from 40 to 70 per cent, while only 5 per cent lost 0 to 30 per cent of their rice farms to flood (Table I). About 75 per cent of the respondents that grew yam indicated that they lost above 80 per cent of the crop, 19.17 per cent indicated losing about 40 to 70 per cent of their yam farms, while only 5.83 per cent indicated 0 to 30 per cent loss. In the cassava section, 62.50 per cent of the farmers indicated above 80 per cent lost, 30 per cent indicated 40 to 70 per cent loss, while 7.50 per cent indicated only 0 to 30 per cent loss. About 71.67 per cent of the respondents lost above 80 per cent of their maize farms to flood, while 16.67 lost 40 to 70 per cent and 15 per cent lost 0 to 30 per cent. In the cocoyam farms, 36.67 per cent of the respondents indicated above 80 per cent loss, 18.33 per cent indicated 40 to 70 per cent, while 45 per cent indicated 0 to 30 per cent loss. For crops in storage, 88.33 per cent of the respondents indicated they lost above 80 per cent, 9.17 per cent indicated 40 to 70 per cent loss, while only 2.50 per cent indicated 0 to 30 per cent loss. This confirms the assertion made by Food and Agricultural Organization (FAO) that crop losses in Anambra State after the 2012 flood could be as high as 80 to 100 per cent (FAO, 2012).

In the livestock sector, 91 per cent of the respondents lost above 80 per cent, 14 per cent lost 40 to 70 per cent and 15 per cent lost 0 to 30 per cent of their sheep and goats to the flood. Finally, 80 per cent lost above 80 per cent of their chickens, 13.33 per cent lost 40 to 70 per cent, while 6.67 per cent indicated 0 to 30 per cent loss.

In financial terms, the respondents indicated that they lost between 28, 000 and 167, 000 on the average covering items, such as seeds, fertilizers, labor and herbicides. Out of the 358.95 hectares of farms cultivated by the sampled respondents, 251.3 hectares were affected by the flood.

Gender-based vulnerability to the effects of flooding among the farming households

Table II below showed the result of gender-based vulnerability analysis regarding adaptive capacity of the farmers to the effects of flooding. As expected, women (index = 0.62) were, overall, more vulnerable than men (index = 0.32). In addition, women were generally more vulnerable than men for almost all the adaptive capacity indicators but remittance, for which the reverse was the case. In assessing gender-based determinants of vulnerability to food insecurity among farm households in Nigeria, Babatunde *et al.* (2008) found that male-headed households possessed more resources than their female counterparts. The report of USAID (2010) also showed that women, who constitute major food producers in developing countries, generally have lower incomes, less access to credit and limited control over resources, resulting in their increased vulnerability to many climate change impacts. The case of remittance being the other way round is surprising; however, most remittances usually come from children of the household

Table I.
Percentage
distribution of
respondents by
percentage of various
agricultural losses
incurred

Losses (%)	Rice plots		Cassava plots		Yam plots		Maize plots		Vegetable plots		Storage crops		Goat/sheep		Chicken		Cocoa yam plots	
	Frequency (%)	(Resp.)	Frequency (%)	(Resp.)	Frequency (%)	(Resp.)	Frequency (%)	(Resp.)	Frequency (%)	(Resp.)	Frequency (%)	(Resp.)	Frequency (%)	(Resp.)	Frequency (%)	(Resp.)	Frequency (%)	(Resp.)
0-30	6	5.00	7	5.83	9	7.50	14	11.67	18	15.00	3	2.50	15	12.50	8	6.67	54	45.00
40-70	22	18.33	23	19.17	36	30.00	20	16.67	16	13.33	11	9.17	14	11.67	16	13.33	22	18.33
> 80	92	76.67	90	75	75	62.50	86	71.67	86	71.67	106	88.33	91	75.83	96	80.00	44	36.67
Total	120	100	120	100	120	100	120	100	120	100	120	100	120	100	120	100	120	100

Note: *(Resp.) = Respondents

Zones	Gender	Adaptive capacity indicators																Total score	Average score		
		Education		Labor		Extension		Credit		Coop member		Farm size		Own land		Income				Remittance	
		Actual value	Score	Actual value	Score	Actual value	Score	Actual value	Score	Actual value	Score	Actual value	Score	Actual value	Score	Actual value	Score			Actual value	Score
Anambra	MHHD	8.167	0.00	9.036	0.00	1.671	0.09	0.500	0.18	0.671	0.39	3.442	0.30	0.607	0.36	632,946	0.05	0.500	0.64	201	0.22
	FHHD	7.583	0.33	8.167	0.20	1.167	0.51	0.333	0.89	0.583	0.64	3.117	0.48	0.417	1.00	530,083	0.28	0.583	0.11	4.44	0.49
Awka	MHHD	8.148	0.01	8.704	0.08	1.778	0.00	0.370	0.74	0.815	0.00	4.000	0.00	0.593	0.41	654,704	0.00	0.444	1.00	2.24	0.25
	FHHD	7.923	0.14	6.385	0.62	0.978	0.67	0.308	1.00	0.538	0.76	3.269	0.40	0.538	0.59	203,462	1.00	0.538	0.40	5.49	0.61
Onitsha	MHHD	7.321	0.48	6.250	0.65	0.786	0.83	0.543	0.00	0.521	0.81	2.429	0.86	0.714	0.00	572,250	0.18	0.514	0.55	4.36	0.48
	FHHD	6.393	1.00	4.750	1.00	0.583	1.00	0.383	0.68	0.450	1.00	2.163	1.00	0.500	0.72	482,500	0.38	0.600	0.00	6.78	0.75
Total score	MHHD		0.49		0.73		0.92		0.92		1.20		1.16		0.77		0.23		2.19		
	FHHD		1.47		2.18		2.18		2.57		2.40		1.88		2.31		1.66		0.51		
Average score	MHHD		0.16		0.24		0.31		0.31		0.40		0.39		0.26		0.08		0.73		0.32
	FHHD		0.49		0.61		0.73		0.86		0.80		0.63		0.77		0.55		0.17		0.62

Notes: MHHD = Male headed farm household; FHHD = Female headed farm household

Notes: MHHD = Male headed farm household; FHHD = Female headed farm household

Table II.
Actual values and
vulnerability indices
of gender-sorted
adaptive capacity
indicators of
respondents by
agricultural zones

residing abroad, whose natural affinity to their mother is well known. This affinity may become even stronger when the woman is now in charge of the house back home.

For both men and women however, vulnerability declined consistently from Onitsha through Awka to Anambra, where it was smallest (Table II). This trend appears to follow the status of urbanization in these three areas; Onitsha is the most urbanized of the three, followed by Awka and then Anambra. However, it has been widely reported that farm households in rural areas are not only among the poorest, but also among the most vulnerable group in the world (Ellis, 2000; Adepoju *et al.*, 2011). Could the trend observed above be suggesting that climate change and its agents (such as flood) may be reversing the trend of vulnerability? This may, particularly, be correct for farm households in urban areas in developing countries where poor urban planning, poor waste and drainage management and pollution are helping to push up climate change events, such as flooding and high temperature. This will further complicate the adaptive capacity of urban farm households, especially because urban agriculture in these areas is practiced by the poor (Enete and Achike, 2008).

Flood coping strategies

From the results presented in Table III below, 70.8 per cent of the respondents sold their assets to cope with the effects of flood, while 77.5 per cent borrowed loans to diversify means of livelihood. About 62 per cent resorted to short-term migration, and 40 per cent indicated support from social network as their flood coping strategies. Majority of the respondents (about 84 per cent) admitted receiving compensation from National and State Emergency Management Agencies.

Regarding land and crop management measures, about 74 per cent of the respondents indicated planting of agro-forestry trees as a coping strategy, 25 and 43.3 per cent used terracing of land and changing of planting dates, respectively, while 39.2 per cent used planting of cover crops to conserve soil moisture as coping strategies. Making of ridges across slope was used by 72.5 per cent of them, while 58.3 per cent used construction of drainages across the farmland. Minimum tillage, crop rotation and crops switching attracted fewer responses (about 23, 10 and 7 per cent, respectively).

To ascertain the extent to which the aforementioned Institutional, land and crop management measures were used by the farmers as flood coping strategies, the level of intensity of use of the measures were examined using a three-point Likert rating scale, graded as 3 = very intensive, 2 = intensive and 1 = not intensive. The result is presented in Table IV. The respondents suggest that the following measures were highly intensified, with their mean scores greater than or equal to 2.50 (i.e. $MS \geq 2.5$), borrowing of loan to diversify means of livelihood (2.56) and compensation of losses from National and State Emergency management Agencies (2.68). The remaining Institutional measures that were intensified (i.e. $1.5 < MS < 2.5$) were selling of assets (2.13), short-term migration (2.16) and support from social network (1.59). Literature report suggests that due to floods in Bangladesh, Ethiopia and Malawi, borrowing of loans were intensified, as people struggled to make ends meet after key income sources (usually crops and livestock) were destroyed and competition for alternatives (usually casual and migrant labor) due to displacement and forced temporary migration, became keener (Zambia, 2008). It also agrees with the dynamics of forced assets, increased indebtedness and switching to off-farm and migrant labor as were common in the

Sr. No.		Frequency*	(%)	Socioeconomic assessment of flooding
<i>Variables (institutional measures)</i>				
1	Selling of assets	85	70.8	105
2	Borrowing of loans to diversify means of livelihood	93	77.5	
3	Short-term migration	74	61.7	
4	Support from social network	48	40	
5	Compensation of losses from NEMA and SEMA agencies	101	84.2	
<i>Land and crop management measures</i>				Table III. Frequency distribution of respondents by flood coping strategies
6	Planting of agro-forestry trees	89	74.2	
7	Terracing of land	30	25	
8	Changing of date of planting	52	43.3	
9	Planting of cover crops to conserve soil moisture	47	39.2	
10	Making ridges across farms to reduce flood effects	87	72.5	
11	Construction of drainages across the farmland	70	58.3	
12	Minimum tillage	27	22.5	
13	Crop rotation	12	10	
14	Crop switching	8	6.7	

Note: *There were multiple responses
Source: Field Work, 2013

Sr. No.		Mean	SD	Remarks	
<i>Variables (institutional measures)</i>					
1	Selling of assets	2.13	0.88	Intensified	Table IV. Mean and standard deviation of level of intensity of flood coping strategies used by the farmers
2	Borrowing of loans to diversify means of livelihood	2.56	0.66	Very intensified	
3	Short-term migration	2.16	0.89	Intensified	
4	Support from social network	1.59	0.79	Intensified	
5	Compensation of losses from NEMA and SEMA agencies	2.68	0.65	Very intensified	
<i>Land and crop management measures</i>					
6	Planting of agro-forestry trees	2.33	0.79	Intensified	
7	Terracing of land	1.91	1.78	Intensified	
8	Changing of date of planting	2.23	0.76	Intensified	
9	Planting of cover crops to conserve soil moisture	2.04	0.76	Intensified	
10	Making ridges across farms to reduce flood effects	2.25	0.79	Intensified	
11	Construction of drainages across the farmland	2.29	0.80	Intensified	
12	Minimum tillage	1.48	0.69	Not intensified	
13	Crop rotation	1.23	0.49	Not intensified	
14	Crop switching	1.15	0.46	Not intensified	

aftermath of Cyclone Nargis on Myanmar, the Mozambique floods of 2000, the Bangladesh floods of 1996-1997 among many others (Rashid, 2000).

In the land and crop management measures, the following strategies were indicated as being intensified: planting of agro-forestry trees (2.33), terracing of land (1.91), crop

management practices like change planting dates (2.23), panting of cover crops (2.04), making of ridges across slope (2.25) and construction of drainages across the farm land (2.29). Others like minimum tillage (1.48), crop rotation (1.23) and crop switching (1.15) were reported not to be intensified. During the field work component of this study, the farmers did suggest that they did not think crop rotation and crop switching were appropriate flood coping strategies, given the magnitude of flood in the area.

Factors that drive choice of flood coping strategies

The MNL model was used to determine the factors that drive the farmers' choice of flood coping strategies. It is possible for a farmer to have more than one flood coping strategy at a time; hence, the respondents were also asked, for purposes of this analysis, to indicate the most important strategy from among those listed. As a result, some of the listed strategies (borrowing of loans to diversify means of livelihood, crop rotation and switching) that were not mentioned here naturally dropped for this analysis. The result of the analysis is presented in [Table V](#). The explanatory powers of the specified variables seem low (Pseudo $R^2 = 0.2866$), but this is not uncommon in cross-sectional analysis. Other published studies with comparable coefficients of determination include [Enete \(2008\)](#); [Enete and Igbokwe \(2009\)](#); and [Enete \(2013\)](#). However, the overall goodness of fit as reflected by Prob > Chi² (0.026) was statistically significant at less than 5 per cent level.

Gender of the household head had a positive and significant relationship with the probability of choosing short-term migration and planting of agro-forestry trees as against borrowing of loans to diversify means of livelihood. This suggests that men were more likely to engage in off-farm income-generating activities and planting of agro-forestry trees to adapt to flood than women. Domestic responsibilities, which women usually combine with farm work, may make it difficult for them to engage in off-farm work activities ([Allanana, 2013](#)). In addition, agro-forestry trees are most often cash crops, in which men are generally dominant ([Hill and Vigneri, 2009](#)).

Age was significantly and negatively correlated with the probability of choosing short-term migration as a flood coping strategy. This implied that older farmers were less likely to engage in off-farm income-generating activities to cope with flood. This is to be expected, because combining farm with off-farm work would be a lot more demanding in terms of energy and coordination, which the older farmers may not be able to cope with. Besides, adults are more risk averse.

Education of the household head had an inverse and significant relationship with the probability of a farm household choosing selling of assets and short-term migration as against borrowing of loans to diversify means of livelihood. Education, according to [Enete et al. \(2002\)](#), enhances one's skills and capacity to take healthier production decisions, such as risk spreading and portfolio diversification. The educated farmer could, therefore, afford to take loans instead of selling assets or migrating, because he/she has the capacity to pay back. Also, there was a positively significant relationship between education and the probability of getting support from social network, planting of agro-forestry trees, planting of cover crops to conserve soil moisture and construction of drainages across farmland. Educated farmers are generally more knowledgeable on, and equipped with the requisite skills for, using superior farming techniques ([Nhemachena and Hassan, 2007](#)).

Table V.
Result of the
multinomial logit
model

Explanatory variable	SLASSETS	STMIGRA	SCNETWK	NEMA/SEMA	PATREE	TLAND	CHDPLT	PCCROPS	MKRIDGES	CDRGN
Gender (male = 1, else 0)	1.456 (0.144)*	0.049 (0.038)**	1.859 (0.138)*	1.356 (0.068)*	-3.597 (0.024)**	-0.849 (0.639)*	1.752 (0.057)*	8.829 (1.000)*	2.083 (1.000)*	13.908 (0.999)*
Age of household head (years)	0.029 (0.518)*	-6.014 (0.042)**	0.472 (0.497)	-0.004 (0.924)*	-0.017 (0.710)*	-0.053 (0.539)*	0.029 (0.541)*	-4.705 (0.994)*	1.018 (0.999)*	-0.399 (1.000)*
Years of education	-5.859 (0.044)*	-0.591 (0.236)*	1.722 (0.031)**	0.083 (0.841)*	1.811 (0.000)**	-1.343 (0.298)*	3.597 (0.024)**	1.722 (0.031)**	26.801 (0.997)*	1.952 (0.020)**
Household size (number)	0.167 (0.192)*	0.189 (0.090)	0.934 (0.063)*	-0.102 (0.442)*	0.134 (0.280)*	-0.274 (0.400)*	0.056 (0.704)*	-0.654 (1.000)*	5.606 (0.998)*	2.196 (0.999)*
Extension contact (number)	0.041 (0.940)*	0.626 (0.159)*	0.325 (0.663)*	0.739 (0.063)*	0.134 (0.437)*	1.722 (0.031)**	1.952 (0.020)**	3.597 (0.024)**	1.972 (1.000)*	0.049 (0.038)**
Access to credit	-1.562 (0.119)*	-3.704 (0.046)**	-0.449 (0.778)*	-1.542 (0.084)*	0.407 (0.361)*	0.422 (0.863)*	0.613 (0.641)*	-22.041 (1.000)*	-35.897 (1.000)*	-4.494 (1.000)*
Cooperative society	-2.227 (0.050)**	0.158 (0.860)	0.616 (0.685)	-3.384 (0.036)**	1.220 (0.282)*	-2.665 (0.199)*	-0.445 (0.666)*	-1.852 (1.000)*	-35.897 (0.999)*	6.392 (1.000)*
Farm size (ha)	-2.353 (0.000)**	0.142 (0.468)*	-0.019 (0.956)*	0.012 (0.953)*	-1.116 (0.847)*	-2.152 (0.127)*	-0.321 (0.288)*	1.495 (0.999)	-1.488 (0.999)*	-0.338 (1.000)*
Average distance (km)	0.199 (0.040)**	1.871 (0.023)	0.432 (0.581)*	-0.378 (0.413)*	0.042 (0.331)*	-0.997 (0.431)*	0.114 (0.829)*	-28.712 (0.999)*	8.205 (0.999)*	7.423 (0.999)*
Tenure security	0.199 (0.040)**	-0.429 (0.398)*	0.084 (0.911)*	-0.588 (0.223)	5.859 (0.044)**	-2.827 (0.034)**	0.396 (0.493)*	1.658 (0.036)**	0.788 (0.032)**	0.538 (1.000)*
Flood experience	0.199 (0.040)**	-0.216 (0.495)*	2.827 (0.034)**	1.952 (0.020)**	0.199 (0.040)**	-0.636 (0.404)*	0.199 (0.040)**	4.175 (0.998)*	2.564 (0.999)*	1.878 (0.999)*
Constant	0.544 (0.910)*	-2.058 (0.613)*	-7.438 (0.273)*	3.073 (0.419)*	-0.466 (0.928)*	30.643 (0.994)*	-4.831 (0.267)*	184.064 (0.999)*	-241.671 (0.998)*	-65.123 (0.999)*
Statistics	Number of observations = 120 $\chi^2 = 140.61$ $\text{Prob} > \chi^2 = 0.0260$ Pseudo $R^2 = 0.2866$									

Notes: SLASSETS stands for selling of assets; STMIGRA stands for land fragmentation; SCNETWK stands for support from social network; NEMA/SEMA stands for compensation from national or state emergency management agency; PATREE stands for planting of agro-forestry trees; TLAND stands for terracing of land; CHDPLT stands change of date planting; PCCROPS stands for planting cover crops to help conserve soil moisture; MKRIDGES stands for making ridges across farms to reduce effects of flood; CDRGN stands of construction of drainages across the farmland; borrowing of loan to diversify means of livelihood was the base category; *** denotes $p \leq 0.01$; ** denotes $0.01 < p \leq 0.05$; while * $0.05 < p \leq 0.10$

There was a positive relationship between household size and the probability of selling of assets (perhaps because of greater food and financial needs), short-term migration (perhaps because of the need to support the financial needs of the household), support from social network (members of the large households may contribute their individual networks), compensation from National and State Emergency Management Agency (size of household may have been one of the criteria for compensation), planting of agro-forestry trees, change of date of planting, making of ridges across the farm and construction of drainages across the farmland; all of which may be because, members of large households could provide free labor for these options. There was also an inverse relationship between household size and terracing of land and planting of cover crops to conserve soil moisture.

Extension contact significantly and positively correlated with terracing of land, change of date of planting, planting of cover crops to conserve soil moisture and construction of drainages across the farm as against borrowing of loans to diversify means of livelihood. The study by [Birungi and Hassan \(2010\)](#) found a positive relationship between agricultural extension and adoption of inorganic fertilizer as land management technology in Uganda, and [Nhemachena and Hassan \(2007\)](#) found a statistical positive relationship between extension contacts and adoption of crop varieties.

Access to credit had a negative and statistically significant effect on the probability of engaging in short-term migration. This implied that increase in access to credit reduces short-term migration because it provides resources which enhanced the farmer's capacity to cope with flood effect.

Membership of cooperative society was negatively and significantly related with the probability of choosing selling of assets as against borrowing of loan to diversify means of livelihood. Also, positively significant relationship existed between cooperative membership and support from National and State Emergency Management Agency. The negative relationship between cooperative membership and selling of assets implied that farmers who belong to any cooperative society and received support from them are less likely to sell their assets to cope. The positive relationship between cooperative membership and support from National and State Emergency Management Agency suggested that farmers who belong to farmers' cooperative society were more likely to receive the intervention from them. This may be because the cooperative society may act as guarantors to ensure that the funds were channeled properly.

Farm size was negative and significantly related with selling of assets as against borrowing of loans to diversify means of livelihood. This result implied that farmers with larger farm size were also wealthier and can depend on other sources such as savings than selling of assets. This agreed with [Gbetibouo \(2009\)](#), who asserts that large-scale farmers are more likely to adopt agro-biodiversity adaptation strategies because they have more capital and resources.

Average distance of the farm to the riverbank was significantly negative to terracing of land as against borrowing of loans to diversify means of livelihood. If the average distance of the farm to the riverbank was far, then flood effect could be minimal.

Tenure security had a positive and significant relationship with selling of assets, planting of agro-forestry trees, planting of cover crops and making of ridges across the farm. This suggests that farmers that owned their plots or land had higher probability of choosing and using those flood coping strategies (perhaps because they were not

answerable to anyone about what they do) than their counterparts that were land tenants. This agrees with Ogada *et al.* (2010), who reported that landownership influences farmers' decision and had a positive influence on the probability of using land terracing as a farm technology in Kenya.

Flood experience had a positive and significant relationship with selling of assets, support from social network, compensation of losses from National or State Emergency Management Agency, planting of agro-forestry trees and change of date of planting as against borrowing of loans to diversify means of livelihood. Experience they say is the best teacher, with many years of flood experience, the farmers would have been best positioned for the choice of the most appropriate coping strategies in the prevailing circumstance.

Conclusion

This study assessed the flood coping strategies among farming households in Anambra State. The empirical results showed that agricultural losses associated with flood included loss of growing crops at various maturity stages, farms, storage crops, livestock and investments on the farm. Women were more vulnerable than men to the effect of flood in the area. To this effect, a list of flood coping strategies such as selling of assets, borrowing of loans, short-term migration and support from social network among others were used by the farm household to cushion the effect on them. The socio-economic characteristics of the respondents such as gender, age, education, extension contacts, access to credit, cooperative membership, farm size, tenure security and flood experience significantly influenced their choice of flood coping strategies. These observations underscore the need for training, cooperatives and enhanced farm capacity (credit and farm size) in coping with flood by the farmers. It is recommended that governments and non-governmental organizations should assist the farmers in these regards.

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Further reading

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