Flood Effects on Agricultural Productivity: Implications for Mangrove Forest Ecosystem in Akpabuyo, Cross River State, Nigeria

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Received: 7 December 2017 Accepted: 5 January 2018 Published: 15 January 2018

Abstract

Flood is a natural disaster that affects lives, livelihoods, household food security and natural ecosystems. Hence, the study sought to determine flood effects on agricultural productivity: Implications for Mangrove Forest Ecosystem in Akpabuyo, Cross River State, Nigeria. Specifically, the paper identified high and low-risks flood areas in Akpabuyo, determined the frequency of flood events and extent of agricultural land inundation, identifying the crops species affected by flooding, and assessed the income and food survival strategies of farmers affected by annual flood events. Descriptive statistics (frequency counts, percentages, and averages were employed to analyze the data derived from a structured questionnaire and field measurement of elevation of high and low-risk flood areas. Results revealed that the agricultural land at high risk of flooding is those with 1-44 metres elevation above sea level Table 1. Findings on Table 4show that, the food staple most affected are the root or tuber species with 77.52 percent annual destruction, vegetable species were also at high risk, and some economic crops like Musa spp (plantain) were also at high risks of destruction. The result further revealed that, income loss and food shortages occasioned from flooding of agricultural land are mitigated by Mangrove Forest Ecosystem Resources Extraction Table 6. Thus, conservation of the Mangrove Forest ecosystem in Akpabuyo and Cross River State is tied to the efficient management and mitigation of flood events in agricultural land.

Index terms— mangrove ecosystem, forest flood effects, agricultural productivity, elevation.

1 I. Introduction

lood is a global challenge in the face of a changing climatic pattern. Typically, floods are outcome of extreme weather events such as precipitation (e.g. prolong rainfall and melting snow from snowfall), which are exacerbated by the geographical location and human activities of a place. Abua, Ewara, Abua & Atu (2009) argued that these factors are responsible for the flooding events in Nigeria, as one-third of the landmass of Nigeria is at an elevation of less than eight meters above sea level. Areas liable to flooding are low-lying areas, but the southern parts of Nigeria are more vulnerable due to the double maxima rainfall experienced for a prolonged period, usually between March-October and as early as February-November in some southern states like Cross River and Rivers states.

Flood over the years has caused severe damage to property, infrastructure, crops and deaths across the country, and has been considered as a source of increased risks to disease and hunger (Baiye 1988; Edward-Adebiyi 1997), damage to property, loss of life, contamination, and spoiling of agricultural land (Umoh, 2008). Akpabuyo in Cross River State is an agrarian community dependant on optimal production of their farm enterprise for food security and livelihood needs, but, the undulating, low-lying topography enmeshed within the Great Kwa

and Calabar River makes Akpabuyo a candidate for frequent and prolonged inundation. The literature on flood events and the impacts on different sectors of the Nigerian environment is robust (see **??** 2006). The population is projected to be 307, 4117 as at 2017 using 3.0 growth rate of the region. A reconnaissance survey was undertaken before the actual field work to identify the areas prone to flooding, identify farmers and seek their consent for the sample. The study adopted the methodology of (Atu and Bisong, 2013) in selecting sample sites. Thus, 10 villages were purposively chosen out of the existing 28 villages to form the sample, based on their elevation and dominance in agricultural activities and flood events. Five of the villages are in areas prone to flooding and five in areas not too prone to flooding. The geographical coordinates and elevation were noted. Field observation and measurement, interview and household (HH) questionnaire were utilized in collecting data. A total of 400 questionnaire were administered by adopting the Yaro Yamane's formula given as: n = 11 + Ne2 Where: n=Sample Size; N=Population Size; e=Level of Confidence (taken as 0.05) and 1=constant. Hence, 400 copies of questionnaire were distributed, and 13 copies of the questionnaire were found to be inconsistent with the objectives of the study. Therefore, 387copies of the questionnaire were retained for the study. Two hundred and two copies of the questionnaire were those of communities at high risk of flood and 185 are from communities at low risks of flood. III. Results and Discussion

2 Source: (Atu & Iwuanyanwu 2017)

3 a) Identified High and Low Risks Flood Areas in Akpabuyo

The areas liable to annual flood event depicted on Table 1 lie within longitude 8 0 23 ' 39.6" and latitude 4 0 54' 11.6 " with an elevation of 18-44 meters above sea level. Therefore, Esuk Mba, Akans Oko, Ikot Ene Umo, Idebe and Atim Asam are the areas at risk of flooding annually. But the community with the highest risk is Ikot Ene Umo with only 18 meters elevation above sea level.

4 b) Frequency of Flood

Table 2 shows the frequency of flood events as responded to by the sampled population. 71.28 percent of the responses indicated that, the flood occur annually and the areas at high risks of flood have not experience any year without flooding. The annual flooding has implications for the variety of crops cultivated as the arable crops such as maize (Zea mays), cassava (Manihot esculenta), and cocoa yam (Dioscoreaspp) cannot withstand prolonged submergence. These crop types are highly susceptible to stagnant water as the roots of the crops rot easily.

5 c) Extent of Agricultural Land Affected by Flood Annually

The extent of agricultural land annually affected by flood on Table 3 between 51-100 hectares and above (The extent of farmlands annually affected by flood was estimated from calculating the sizes of the farmland of farmers that indicated that their farmlands are annually flooded (47.03 and 16.04% cumulatively to 63.07 %).

6 d) Crops Species Affected by Flood Waters

The major crop species affected by flood listed on Table 5 revealed that household food staples are at most risks. These food staples include: vegetables, spices, legumes, tubers, grains, and fruits. Loss crops translate to loss income Table 6 and household food security which must be met via alternate sources. The most viable option for make-up source of livelihood and income for the farmers is harvesting from the Mangrove Forest Ecosystem resulting in exacerbated degradation of the Mangrove ecosystem. The demand on Mangrove Forest Ecosystem in the face of the challenging flood event is massive. Over 77.52 percent of the population sourced their energy needs from the forest, 51.68 looked to the forest for their protein, and 90.34 percent augment their vegetable need from the forest when crops are destroyed by flood. These findings have implications for the Mangrove ecosystem management and conservation, because, unless the menace of flooding agricultural land is tackled by relevant agencies the pressure to meet the food and economic needs of farmers will be met by the Mangrove forest. This study is critical in the face of escalating extreme climatic events occasioned by changing global climate. The study revealed that the agricultural land at high risk of flooding is those with an elevation of 1-44meters above sea level and the community that is at the highest risk of flooding is Okot Ene Umo with an 18 meters elevation above sea level Table 1. Also, flood is an annual event implying that there is no respite from economic loss and household food shortages Table 2. From findings on Table 4, the crop types most affected are the root or tuber species with 77.52 percent annual destruction, vegetable species were also at high risk and some economic crops like plantain (Musa spp) were also at high risks of destruction from flood.

Furthermore, the finding demonstrated that the annual income loss of an individual farmer is as high as a hundred thousand naira, that is, about three hundred United States Dollar at current exchange rate of thirtyfive naira to a dollar. Income loss and food shortages occasioned from inundation of agricultural land are mitigated from Mangrove Forest Ecosystem Resources Extraction Table 6. Thus, conservation of the Mangrove Forest ecosystem in Akpabuyo and Cross River State is tied to the efficient management and mitigation of flood events in agricultural land.

The results of this research are critical to the sustainability of family livelihood and the conservation of the Mangrove Ecosystem of Cross River State. The relevance lies in the fact that several conservation strategies have failed to yield the desired outcomes in the past years because the pressure, demand and harvest of the Mangrove Forest Ecosystem Resources has not been linked to the flooding and destruction of agricultural land and crops. These findings therefore have implication for the Mangrove ecosystem management and conservation, because, unless the menace of flooding of agricultural land is tackled, the protection of the remaining Mangrove ecosystem in Cross River State, Nigeria would remain a mirage. [1]

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Figure 1: Fig. 1 :

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Therefore, the study:
1. Identified high and low-risks flood areas in Akpabuyo, Cross River State.
2. Determined the frequency of flood events and extent of agricultural land inundation.
3. Identify the crops species affected by flooding.
4. Examined the relationship between flood, cultivated crops and forest resource exploitation and degradation in Akpabuyo, Cross River State.
II. Methodology
Study Area: Akpabuyo is a Local Government Area (LGA) in the Southern axis of Cross River State, Nigeria. The LGA was created in 1991with an administrative headquarters located at Ikot Nakanda. Akpabuyo is made up of 28 villages of three major dialectical groups (the Efiks, Quas, and the Efuts), but, the English language is the official spoken language (Tip Top Globe, 2016). Akpabuyo is located between latitude 4 0 5' North and 5 0 4' South and longitude 8 0 25' West and 8 0 32' East Fig 1 and had a total population of 271,325 in 2006 (NPC

Figure 2:

1

	High-Risks Flood Areas				
	Esuk Mba	Akans Oko	Ikot Ene Umo	Idebe	Atim Asam
Longitude	8 0 23 ' 39.6 "	8 0 27 ' 51 "	8 0 35 ' 30 ' 8 "	8 0 26 ' 49.8 "	8 0 24 ' 47.2 "
Latitude	4 0 54 ' 11.6 "	5 0 2 ' 25.3 "	4 0 54 ' 24.9 "	4 0 51 ' 33 "	4 ' 57 ' 34.5 "
Elevation (M)	44	27	18	34	39
	Low-Risks Flood Areas				
	Akwa Ikot Effanga	Ikot Edem Odo	Ikot Effiong Essien	Ikot Ene	Ikot Offiong Amba
Longitude	8 0 29 ' 12.8 "	8 0 24 ' 31.9 "	8 0 24 ' 52 "	8 0 27 ' 41.9 "	8 0 26 ' 59.6 "
Latitude	4 0 57 ' 39.3 "	4 0 53 ' 15.7 "	4 0 52 ' 17.8 "	4 0 54 ' 54.6 "	4 0 55 ' 56.7 "
Elevation (M)	75	52	59	45	62

Figure 3: Table 1 :

2

	High-Risks Flood Areas						
Frequency of Flooding	Esuk Mba	Akans Oko	Ikot EneUmo	Idebe	Atim Asam	Total	%
Annually	45	32	16	23	28	144	71.287
Every 2 Years	13	8	3	10	6	40	19.802
Once in Three Years	4	2	1	0	2	9	4.455
Once in Four Years	1	2	0	0	0	3	1.485
Once in Five Years	1	0	0	1	2	4	1.980
Once in Six Years	1	1	0	0	0	2	0.990
Never	0	0	0	0	0	0	0
			Tallied Responses and Percentage			202	1000
	Low-Risks Flood Areas						
Frequency of Flooding	Akwa Ikot Ef-fanga	Ikot Edem Odo	Ikot Effiong Essien	Ikot Ene	Ikot Of-fiong Amba	Total	%
Annually	12	10	2	14	2	40	21.622
Every 2 Years	9	13	6	9	6	43	23.243
Once in Three Years	6	10	6	1	4	27	14.594
Once in Four Years	14	8	5	4	1	32	17.297
Once in Five Years	1	4	1	4	12	22	11.892
Once in Six Years	0	4	0	0	3	7	3.784
Never	2	6	1	1	4	14	7.568
			Tallied Responses and Percentage			185	100

Figure 4: Table 2 :

3

Farms Flooded in Hectares	Esuk Mba	Akans Oko	Ikot Ene Umo	Idebe	Atim Asam	Total	%
Less than 20	2	7	10	2	3	24	11.881
21-50	6	15	13	6	10	50	24.753
51-100	10	18	30	17	20	95	47.030
Above 100	2	5	12	5	9	33	16.337
			Tallied Responses and Percentage			202	100
Farms Flooded in Hectares	Akwa Ikot Ef-fanga	Ikot Edem Odo	Ikot Effiong Essien	Ikot Ene	Ikot Of-fiong Amba	Total	%
Less than 20	12	26	5	21	24	88	47.568
21-50	17	18	10	7	6	58	31.351
51-100	14	8	5	4	1	32	17.297
Above 100	1	3	1	1	1	22	3.784
			Tallied Responses and Percentage			185	100

Figure 5: Table 3 :

4

Crop Types	Local Name	Botanical Name	Frequency of Cultivation	Percentage Cultivation
	Fluted Pumpkin		202	52.20
	Waterleaf		187	48.32
Vegetables	Okro		160	41.34
	Green		66	17.05
	Bitterleaf		59	15.25
	Pepper		100	25.84
Spices	Tomatoes Curry		40 30	10.34 7.75
	Scentleaf		37	9.56
Legumes	Melon		69	17.83
	Cassava		300	77.52
Tubers	Yam Sweet Yam		101 200	26.09 51.68
	Water Yam		150	38.76
Grains	Maize		167	43.15
	Oranges		77	19.90
Fruits	Mango		86	22.22
	Banana		100	25.84
Economic	Plantain Oil Palm Fruit		200 47	51.68 12.45

Figure 6: Table 4 :

5

	High-Risks Flood Areas						
Income Loss (N)	Esukmba	Akansoko	Ikot Eneumo	Idebe	Atimasam	Total	%
? 20,000	5	4	4	3	4	144	71.287
20,000-40,000	5	4	3	3	4	40	19.802
41,000-60,000	7	5	2	5	8	9	4.455
61,000-80,000	13	11	5	10	8	3	1.485
81,000-100,000	15	14	5	8	6	4	1.980
? 100,000	20	7	1	5	10	2	0.990
			Tallied Responses and Percentage			202	1000
	Low-Risks Flood Areas						
Income Loss (N)	Akwa Ikot Effanga	Ikot Ede-mOdo	Ikot Effiong Essien	Ikot Ene	Ikot Offiong Amba	Total	%
? 20,000	3	4	2	4	3	40	21.622
20,000-40,000	10	13	7	10	7	43	23.243
41,000-60,000	18	22	6	10	6	27	14.594
61,000-80,000	5	8	5	5	5	32	17.297
81,000-100,000	3	4	0	2	5	22	11.892
? 100,000	5	4	1	1	6	7	3.784
			Tallied Responses and Percentage			185	100

Figure 7: Table 5 :

6

	Cross River State, Nigeria		
S/n	Mangrove Forest Ecosystem Resources Harvested	F	%
1.	Fuelwood (Use & Sale)	300	77.52
2	Fishing / Game Hunting (Use & Sale)	200	51.68
3	Palmwine Tapping	100	25.84
4	Periwinkle (Litorimalittorea) & Snail (Cornuaspersum)	260	67.18
5	NTFP (e.g. Afang,-Gnetum Africana; Mushroom-Agariscusbisporus)	350	90.44
6	Timber	40	10.34
7	Oil Palm Fruit	137	35.40
8	Raffia Palm (Raphia Farinifera) & Indian Bamboo (Bambusatulda)	200	51.67
9	None of the Above	10	2.59
10	All the Above	257	66.41

Figure 8: Table 6 :

6 D) CROPS SPECIES AFFECTED BY FLOOD WATERS

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