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Effects of Seasonal Characteristics of Kolo Creek Flooding on Farm-Plot Sizes in Central Niger Delta, Nigeria

[1]ELI, HD; *[2]BARIWENI, PA

[1]*Department of Geography & Environmental Management, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria*
*[2]*Department of Marine Environment & Pollution Control, Nigeria Maritime University, Okerenkoko, Delta State*
** Corresponding Author Email: pbariweni@yahoo.com; revelihorsfall@gmail.com*

ABSTRACT: Perennial flooding is a known environmental hazard in many parts of the Niger Delta. Concern about flooding increases when places of importance to man, such as farmlands and settlements, and food supply systems are affected. This study assessed the effect of Seasonal Characteristics of Kolo Creek flooding on farm-plot sizes and crop production during the flood and non – flood seasons. A direct contact survey methodology was employed to measure farm-plot sizes and their extent of inundation during flood and non – flood seasons, and 400 randomly selected farmers along the Kolo Creek, Central Niger Delta were interviewed with a semi – structured questionnaire. Results from the study showed a mean farm-plot size of 0.51±0.00 (Ha) during the non-flood period and 0.10±0.00 (Ha) during the flood period. The results obtained from the study also indicated that only 20.93% of the farm-plots available during the non – flood period was available for farming during the flood period; more than half of the farmlands of about 88.50% of the farmers was seasonally inundated by flood and only 1.75% of the farmers had less than half of the farmlands under the floodwaters. Although farmers adapted by owning many – but – small farm-plots, they cultivated only a few varieties of crops, most of which were not flood tolerant. The study concluded that Kolo Creek flooding greatly reduced farm-plot sizes and therefore recommended the planting of more flood-tolerant crops to maximize use of land and improve crop productivity in the area.

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Rivers and their characteristics have a close relationship with both the natural and human activities in the vicinity within which they flow. Until a specific river is studied, its peculiarity in basic characteristics such as flow patterns, velocity, volume, width, length, depth, turbidity, flooding extent, etc can hardly be fully understood. Flooding is a situation whereby, a land that is not normally submerged by water becomes submerged. It occurs when ponds, lakes, riverbeds, soil and vegetation cannot absorb all the water, or water runs off the land in quantities that cannot be carried within the channels or retained in natural ponds, lakes and manmade reservoirs (Bariweni *et al.*, 2012). The causes of flooding include excessive rainfall, or snow melt within a catchment area, blockages of water courses and flood channels, storms and tidal influences, etc. The type of flood notwithstanding (be it river flooding, flash flooding, flood pondage, urban flooding, coastal flooding, or tsunamis), the expectation at its occurrence is something destructive. It is as a result of this that flooding is generally accepted as an environmental hazard (Eli, 2012; Singh, 2014). The phenomenon of flooding is of concern when places of importance to man, such as farmlands, settlements, and food supply systems are affected. Following historical trends, floods have wrought great calamities on humans, destroying settlements, properties, and farmlands and inflicting great sufferings on the people concerned. The Hwang Ho River in China is nick- named "the Chinese sorrow" because of the havoc it has wrecked on the people through flooding (Eze and Abua, 2003). Deductions from Steel and Steel (1981), Ashton – Jones (1998) and Iloeje (2004) indicated that African rivers flood seasonally and do affect the lives of the surrounding people and their environment. Once flood water comes in contact with farmlands, it leads to loss of crops, reduction of cultivable lands and increase in food prices among others in any local economy (Mba, 1996).

However, river flooding is not all about disasters, but can also be beneficial and instrumental to physical (land) and agricultural development, as well as human civilization (Bariweni, et al., 2012; Eli, 2012). The records about Egyptian civilization and the Mesopotamian regional civilization were induced by floods of the Nile, Tigris, and Euphrates Rivers,

** Corresponding Author Email: pbariweni@yahoo.com; revelihorsfall@gmail.com*

respectively (Robinson, 1979; Ashton – Jones, 1998). This notwithstanding, the magnitude of disasters often associated with flood has increased global concern for flooding. Therefore, the occurrence of floods in the Niger Delta region of Nigeria in general, and the Kolo Creek in particular, call for concern from various quarters, both in Nigeria and outside.

Many studies have been carried out on flood recession farming (Nederveen, n.d; Saarnak, 2003; Sidibe *et al.*, 2016); and flood impact on farmlands (Das, 2012; Wilson *et al.*, 2012). However, there is no evidence of studies assessing the impact of floods on farm – plot sizes. Although, in 1961, a study on waters in the Niger Delta was carried out by Netherland Engineering Consultants (NEDECO), but very little was said about Kolo Creek. Also, in 1980 the services of flood experts from the Democratic Republic of Korea were imported to study the flood problem of Forcados and Nun Rivers catchment areas, yet, virtually, nothing serious was done about the Kolo Creek. Therefore, the objective of this study is to assess the seasonal characteristics of Kolo Creek and provide the non – existent data on the impact of flooding on farm – plot sizes in the Kolo Creek basin.

MATERIALS AND METHODS

The Study Area: Kolo Creek is located in the central Niger Delta (Alagoa, 1999). It extends between Latitude $4^0 23'$ and $4^0 36'$N, and Longitude $6^0 14'$ and $6^0 16'$E. It is the sixth longest river after Rivers Orashi, Ase, Forcados and Nun and Taylor Creek in the Forcados and Nun catchment areas of Niger Delta.

Kolo Creek takes its source from the Orashi River through a divergence at Okarki – Town in Rivers State as a fresh water stream, flowing North-South and terminating at Ekole Creek near Dorgu – Ama, Okoroma- Tereke in Nembe Local Government Area of Bayelsa State in a Mangrove environment. Much of the Kolo Creek (about 75 percent) lies in Ogbia Local Government Area of Bayelsa State (i.e from Otuegwe to Oloibiri). Apart from Orashi River as a major source, Kolo Creek also gets its source of water supply from many minor water courses as tributaries along its channel. The tributaries include Abonu-Creek between Imiringi and Otuegila, Otuoke Creek and Iyi – AKoloman Creek (NDBDA, 1980; Okonny *et al.*, 1999; Eli, 2012) (Figure 1).

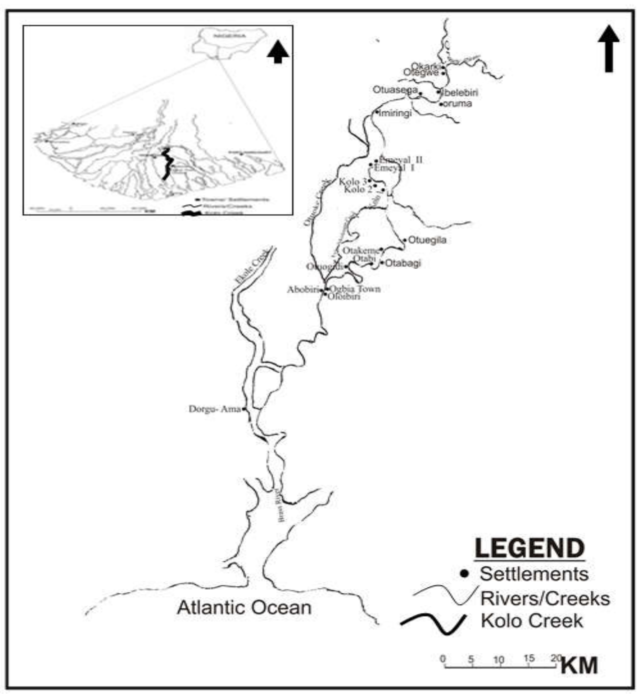

Fig 1. Kolo Greek and its tributaries in Bayelsa State, Nigeria: Source: Cartography Unit, Niger Delta University, Bayelsa State

The Kolo Creek basin lies within the equatorial climatic zone and is therefore hot and very humid, with Mean Annual Rainfall (MAR) of about 3,000mm. The dry season lasts from November to March, and the wet season from April to October. It is important to note that the driest months are December, January and February, while the rainiest months are June, July and September (Joint Industry Committee (JIC), 2001; Eli, 2012). With a relief of about 18metres above sea level at its highest point, Kolo Creek basin has a topography of relatively flat plain. Its alluvial soil type, which is generally sandy – clay (Eli, 2012), encourages subsistent agriculture. The presence of two important oil fields (namely Oloibiri oil field and Kolo Creek oil field) notwithstanding, the area is largely a rural landscape.

Field Method: The study utilized semi-structured questionnaires and Personal observation on the physical environment. A total of 400 questionnaires were administered to farmers in order to determine the impact of flooding on farm – plot sizes in the Kolo Creek Basin. Direct measurements of farm – plot sizes flood-depth were also carried out during the flood and non – flood period to determine the extent of flood coverage on farm-plots using calibrated ranging poles and measuring tape. Ten farm-plots each were assessed from 19 communities (Okarki, Otuegwe, Ibelebiri, Oruma, Otuasega, Imiringi, Emeyal II, Emeyal I, Kolo III, II, I, Otuegila, Otakeme, Otabagi, Otabi, Otuogidi, Ogbia-Town, Abobiri and Oloibiri) to determine the level of inundation of the farmlands by annual flooding in the Kolo Creek basin area. Sizes of the ten farm-plots were measured and averaged to obtain the mean size for each community. All direct contact survey was carried out for three years – 2015, 2016 and 2017 to assess the seasonal characteristics of floods in the Kolo Creek basin and its impact on farm – plot sizes.

Data Analysis: Data obtained from the study were analyzed with simple percentages, means and standard deviation.

RESULTS AND DISCUSSIONS

Information obtained from direct field observation showed that the Kolo Creek has a tidal and non-tidal flow pattern. The seasonality of these flow patterns is influenced by the flood regime. During the non – flood period, the Kolo Creek has a non-tidal flow (North-South), from its source at Okarki to after Kolo, while during the flood season, it exhibits a tidal flow pattern from around Otuegila to its mouth at Dorgu-Ama (where the flow pattern is both north-south and south-north). However, at the peak of the flood, the tidal flow withdraws to the neighbourhood of Otuogidi to its mouth. This finding is in line with those of Tagaka *et al.* (2013), who observed tidal damping of flood water during the rainy season. Direct observation of the study area from source (Okarki) to mouth (Dorgu-Ama) also revealed that Kolo Creek as a geomorphic feature, floods once a year, with peak flood period in September and October. By November, the flood-water recedes. Further observation and measurements showed that farms along the Kolo Creek begin to get inundated as early as May – June when heavy rain water collects in depressed points of the Kolo Creek flood plain as flood pondages. These get dried during the August- Break before getting inundated again in September when the actual flooding (induced by the Niger-Benue systems) of the Kolo Creek takes effect. We refer to this pattern of flooding from May-June before drying up in August break as 'false flooding of Kolo Creek'.

Table 1: Mean Farm-plot sizes in the Kolo Creek basin during non-flood and flood periods

S/No	Name of farm land	Farm-size in 2009 (Ha)		Farm-size in 2010 (Ha)		Farm-size in 2011 (Ha)		Mean farm-size (Ha)	
		flood period	Non-flood period	flood period	Non-flood period	Flood period	Non-flood period	Flood period	Non-flood period
1.	Okarki	0.22	0.89	0.21	0.9	0.2	0.91	0.21±0.01	0.90±0.01
2.	Otuegwe	0.21	0.87	0.19	0.9	0.2	0.9	0.20±0.01	0.89±0.02
3.	Ibelebiri	0.18	0.82	0.2	0.8	0.21	0.8	0.20±0.02	0.810.01
4.	Oruma(Yibama)	0.095	0.82	0.12	0.8	0.1	0.8	0.11±0.01	0.81±0.01
5.	Otuasega	0.09	0.69	0.09	0.7	0.091	0.7	0.09±0.00	0.70±0.01
6.	Imiringi	0.21	0.4	0.2	0.4	0.21	0.4	0.21±0.01	0.40±0.00
7.	Emeyal II	0.08	0.31	0.081	0.3	0.08	0.3	0.08±0.00	0.30±0.01
8.	Emeyal I	0.1	0.4	0.1	0.4	0.11	0.4	0.10±0.01	0.40±0.00
9.	Kolo III	0.071	0.39	0.07	0.41	0.069	0.4	0.07±0.00	0.40±0.01
10.	Kolo II	0.052	0.4	0.05	0.4	0.05	0.4	0.05±0.00	0.40±0.00
11.	Kolo I	0.05	0.3	0.054	0.3	0.05	0.3	0.05±0.00	0.30±0.00
12.	Otuegila	0.012	0.4	0.01	0.4	0.011	0.4	0.01±0.00	0.40±0.00
13.	Otakeme	0.079	0.42	0.08	0.3	0.082	0.4	0.08±0.00	0.37±0.06
14.	Otabagi	0.09	0.49	0.089	0.5	0.09	0.5	0.09±0.00	0.50±0.01
15.	Otabi	0.081	0.5	0.08	0.53	0.08	0.5	0.08±0.00	0.51±0.02
16.	Otuogidi	0.09	0.3	0.091	0.3	0.09	0.3	0.09±0.00	0.30±0.00
17.	Ogbia-Town	0.089	0.41	0.09	0.4	0.09	0.4	0.09±0.00	0.40±0.01
18.	Abobiri	0.08	0.4	0.08	0.4	0.081	0.4	0.08±0.00	0.40±0.00
19.	Oloibiri	0.11	0.39	0.1	0.4	0.1	0.4	0.10±0.01	0.40±0.01
Average Farm Size		0.105	0.51	0.104	0.51	0.105	0.51	0.10±0.00	0.51±0.00

Results from the study on mean farm-plot sizes in the Kolo Creek basin during the flood and non-flood periods are presented in Table 1, while Table 2 presents the percentage farm-plot sizes during the peak flood period and the extent of farm-plots inundation along the Kolo Creek basin. Results from the study showed a mean farm-plot size of 0.51±0.00 (Ha) during the non-flood period and a mean 0f 0.10±0.00 (Ha) during the flood period (Table 1). A cursory look at the results indicated that only about 20.93% of the farm-plots available during the non – flood period was available for farming during the flood period. This implied that about 79.07% of the farm-plots were inundated during the peak flood period and therefore lost to farming activities (Table 2). The observed results are similar to that of Enete *et al.* (2013). This means further that, all benefits from the farms along the creek are seasonally influenced by the flooding regime and associated behaviour of the stream. A further probe on the extent of flooding in the Kolo Creek Basin through semi – structure interview of 400 farmers in the area further confirms the situation. Results from the interview showed that the farmlands of about 4.50% of the farmers in the study area were completely flooded; one half of the farmlands of about 5.25% of the farmers were covered by the floods; more than half of the farmlands of about 88.50% of the farmers was seasonally inundated by flood and only 1.75% of the farmers had less than half of the farmlands under the floodwaters. The implication of the observed seasonality characteristics of the Kolo Creek is the small size of farm – plots in the area and the consequent low farm output as well as low income for the farmers in the area.

Table 2: Percentage farm – plot sizes during peak flood periods and extent of farm – plot inundation in the Kolo Creek basin

S/No	Name of Farmland	% farm-plot size during peak flood	% inundation of farm-plots
1	Okarki	23.33	76.67
2	Otuegwe	22.47	77.53
3	Ibelebiri	24.69	75.31
4	Oruma (yibama)	13.58	86.42
5	Otuasega	12.86	87.14
6	Imiringi	52.50	47.50
7	Emeyal II	26.67	73.33
8	Emeyal I	25.00	75.00
9	Kolo III	17.50	82.50
10	Kolo II	12.50	87.50
11	Kolo I	16.67	83.33
12	Otuegila	2.50	97.50
13	Otakeme	21.62	78.38
14	Otabagi	18.00	82.00
15	Otabi	15.69	84.31
16	Otuogidi	30.00	70.00
17	Ogbia- Town	22.50	77.50
18	Abobiri	20.00	80.00
19	Oloibiri	19.61	80.39
	Mean	20.93	79.07

Table 3: Number of Farm plots owned by individual farmers along the Kolo Creek

S/No	Number Of Farm Plots	Frequency	(%)
1	1 plot	-	0
2	2 plots	1	0.25
3	3 plots	18	4.5
4	4 plots	19	4.75
5	5 plots	86	21.5
6	6 plots	68	17
7	7 plots	24	6
8	8 plots	68	17
9	9 plots	116	29
	TOTAL	400	100

In order to survive the annual loss of farm produce and increase their harvest as well as income, farmers in the area have adopted a number of strategies including early farming and the cultivation of several small farm – plots. Results from the study also revealed that about 90% of the farmers in the area possessed at least five plots and more (Table 3) to boost their productivity and enhance their personal income. In view of the seasonal occurrence of flooding in the area, it was expected that farmers would cultivate flood resistant crops to survive the seasonal adversity. However, this was not the case as farmers in the area cultivated only a few varieties of crops, most common of which are not flood tolerant. Table 4 presents the major crops grown along the Kolo Creek.

Table 4: Major Crops grown along the Kolo Creek

S/N	Type Of Crop	Frequency	(%)
1	Cassava (Manihot *esculentu*)	400	100
2	Plantain (Musa *paradisiacal*)	400	100
3	Banana (Musa *accuminata*, Musa *balbisiana*)	400	100
4	Cocoyam (Colocasia *esculenta*)	400	100
5	Vegetables	6	1.5
6	Sugar Canes (Saccharum *officinarum*)	5	1.25
7	Water yam (Dioscorea *spp*)	-	0
8	Rice (Oryza *sativa*)	-	0

From the study, it was observed that rice and water yam which were more flood tolerant were not cultivated at all. This was found not to be in sync with recommended sustainable practice of cultivating flood tolerant crop cultivars (Verhoeven and Setter, 2009).

Conclusion: It may be concluded from this study that annual seasonal flooding greatly influenced farming activities along the Kolo Creek basin through massive annual reduction of available farm – plot sizes, which consequently lead to low output and low earnings. Farmers in the area did not adapt to the environment by cultivating flood tolerant crops. It is recommended that farmers in the area adopt sustainable farming practices through cultivation of flood tolerant crops, such as swamp rice, sugarcane, etc. side by side with the regular native crops. This will help maximize use of flooded landmass and increase their productivity as well as reduce poverty in the area.

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