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Perrenial Flooding and Coping Strategies of Residents along Taylor Creek Channel in the Niger Delta Region, Nigeria

Dr. V.C. Obinna

Lecturer, Department of Urban and Regional Planning,
Rivers State University, Nigeria

Dr. I.I. Weje

Lecturer, Department of Urban and Regional Planning,
Rivers State University, Nigeria

Z.E. Eli

Post Graduate Scholar, Department of Urban and Regional Planning,
Rivers State University, Nigeria

Abstract:

Flooding particularly river flooding is among the most devastating natural disasters in the world, that claim more lives and cause damage on more property than any other natural phenomenon. Though not the leading cause of death in Nigeria, flooding affects and displaces more people in flood prone areas and along river banks than any other known natural disaster. This study examined the constant flooding of the Taylor Creek and the coping strategies adopted by residents living along the Creek in the event of flood incidence. The study adopted the passive observational research design while data for the study came from both primary and secondary sources. The primary sources of data were collected through the administration of questionnaire, interview granted to key informants and ground trotting, while the secondary data were sourced from published material in the study area. The sample is made up of 360 respondents carefully selected from six (6) selected communities in the area using the systematic sampling technique. The finding of this study shows that flood precipitates diverse negative impacts on the socio-economic well being of residents along the Taylor Creek. It was also observed that the most important strategies adopted by victims of flood in the area is by relocating to primary schools designated as Internally Displaced Peoples Camps (IDPs) and distant places where close relatives reside. It was also observed that the most important factor that induces force moment of flood victims is the disruption of agricultural activities during flood events. The paper advocates for the introduction of a participatory approach involving the government, residents, and corporate organisations in finding solutions to the problem of flooding in the area. Also important is the introduction of land use planning and flood management system so as to avert some of the consequences of flooding. There is the need for early warning, flood data gathering, emergency preparedness and political will to combat flood menace in the area.

Keywords: Taylor Creek, flooding, natural disaster, land use planning; flood management, early warning system

1. Introduction

Natural disasters have occurred worldwide but their occurrence and intensity have, in the recent past, increased, occasioned by mans actions that often times give room for disasters. Though, Flooding is a global environmental issue, their occurrence is unequally distributed in both time and space among world nations (Ladan, 1998). Flooding as a natural disaster is generally associated with social, economic, and environmental consequences that often times threaten the ecosystem and human survival. (Geoscience Australia, 2013). Flooding can also be likened to a situation that results when a part of the earth's surface that is regularly dry is inundated and covered with water due to high amount of rainfall or the overflowing of a water body. River floods occurs when rivers overflow their banks due to varied reasons ranging from prolonged intense precipitation, rainstorms, dam failures, collection of water in low-lying areas (Roger, 2003) amongst others and the intrusion of sea waters on land due to tidal actions (Handmer, Dovers, and Downing, 1999).

The consequences of floods are always devastating, though their degree of intensity and scope vary depending on terrain, intensity of human activities, and volume of water and level of preparedness by the government/stakeholders. Abubakar, (1993) opined that flooding, particularly river flooding, is among the most devastating natural disasters in the world, which claim more lives and causes more property damage than any other natural phenomenon. Though not the leading cause of death in Nigeria, flooding affects and displaces more people in flood prone areas and along river banks than any other known natural disaster (Usman, 2012).

River flooding is a natural phenomenon, but it becomes a basis for grave concern when it goes beyond the coping ability of the affected communities, destroying lives and damaging properties. River flooding affects all types of settlement,

from small huts, villages and market places and service centers to large cities. Vulnerability to flood incidence is made worse when people move from rural areas and settle at marginal spaces that exposes them to the severe impact of flooding thus making them highly susceptible (Jha., Bloch, and Lamond, 2012).

Taylor Creek is located within the Niger Delta Region of Nigeria. The area is prone to inundation. At the slightest occurrence of intense rainfall, the Creek surges and inundates the surrounding area owing to the low-lying nature of the terrain precipitating severe environmental consequences to the vulnerable population along the bank. Some of these negative effects of flooding in the area include: soil erosion, biodiversity loss, public health challenges like pollution and contamination of surface and underground water sources, and socio-economic burdens like loss of lives, loss of properties, means of livelihoods, severe displacement effect social disorder and outmigration of the vulnerable people (Jeb and Aggrawal, 2008).

This research is an attempt to examine the vulnerability to flood and coping strategists adopted by communities along the Taylor Creek in the Niger Delta region, Nigeria.

2, Study Area

Taylor creek is a river channel that runs through Rivers and Bayelsa states (See Fig. 1). The creek transverses about ten communities in Rivers and Bayelsa States to include: Zarama Yambiri, Zarama Epie, Agbobiri, Akuboni, Ayamabele, Kalaba and Ikarama, Edagberi and Betterland Communities. Taylor Creek is situated between 5° 01'N; 6° 17'E and 5° 02'N; 6° 18'E (Abowei, Ezekiel. and Hansen, 2012). There are several creeks and freshwater swamps, linking to the Taylor Creek at various points and which form a massive water body during high flood.

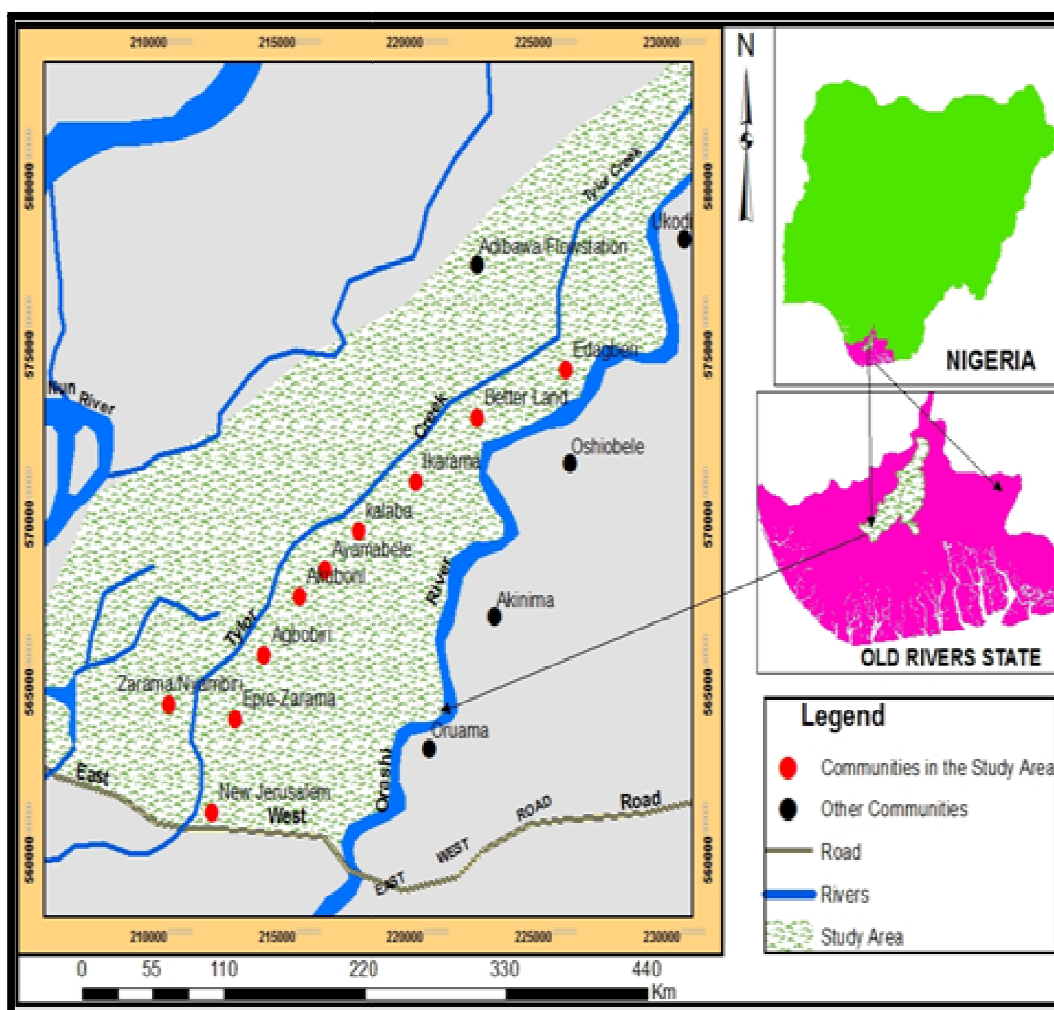


Figure 1: Taylor Creek Showing Communities
Source: Adapted from Google Earth, (2018)

Taylor Creek is subject to mild tidal influence in the dry season. At the hit of the highest point of the dry season, the direction of flow is slightly reversed during the rising tide, while at full tide, the flow almost stagnates (Abowei, et.al, 2012). Presently, there are oil exploration and production activities in most communities housing the creek. These activities while contributing to the socio-economic well being of the people also leads to the production of 'concrete surfaces that reduces the percolation of water into the subsurface. Farming, exploitation of timber products, non-timber

within the lower delta plain assumed to have been formed during the Holocene of the Quaternary era by the accumulation of sedimentary deposits. The main geological feature of the area is sedimentary alluvium. The entire area is formed of derelict beach ridges and due to many tributaries of the River Niger in this plain, significant geological changes still abound (NDEBUMOG, 2008)

The creek is a low-lying area and is characterized by tidal flats and beaches, beach ridge barriers and flood plains. The fact that the Creek lies between the upper and the lower Delta plain of the Niger Delta suggests a low-lying relief. The broad plain is gentle-sloping. The elevation decreases downstream. There are several streams and tributaries though of varying volumes and velocities in the area which empties at the Taylor Creek. The state experiences equatorial type of climate in the southern most part and tropical rain towards the northern parts. Rain falls almost every month of the year with heavy downpour.

The climate is tropical i.e. wet and dry season. The amount of rainfall is adequate for all-year-round crop production. The mean monthly temperature ranges from 25°C to 31°C. Mean maximum monthly temperatures ranges from 26°C to 31°C. The mean annual temperature is uniform for the entire State. The hottest months are December to April. Flooding is one of the major environmental challenges that communities along the creek have to contend with. Low lying areas sitting over aquifers may annually get flooded as ground water level rises. The primary reason for flooding in the study area is the general rise in water level which occurs annually when rains, and ground water fills river basins and the river overflows its bank, due to global warming as well as the saturated nature of the wetlands in the Niger Delta Region. (Abowei, et.al. 2012).

3. Methods and Materials

This study adopted the passive observational research design (Cook and Campbell, 1979) since there was no experimental manipulation of the variables involved. Data for this study were collected at one-time and came from both primary and secondary sources. The primary sources of data were collected through administration of questionnaire, interviewing granted to key informants and ground trotting, while the secondary data were sourced from published material in the study area. The target population for this study consists of all households in the total of ten (10) communities along Taylor Creek that make up the study area. For the purpose of sampling, each of the communities was regarded as a Primary Sampling Unit (PSU). Multi-stage sampling (Kish, 1965) was then applied to select respondents. The study area is made up of ten (10) communities (PSUs) and 60% of them were selected, yielding six (6) communities for the survey.

The 1991 population figures were projected to 2018, using an average yearly growth rate of 3.5% (the growth rate found for rural areas by the National Population Commission (NPC)). The number of households in each of the six (6) PSUs was obtained through listing/enumeration to be 3,606 households and 10% of the total listed household was taken for the study which gave a sample size of 360 respondents. The head of households in each case served as the respondents. Systematic sampling technique was used to select households to be sampled using a sampling interval of every 10th element (household). Table 2 shows the projected population and sample size for the study

S/No.	Sampled Communities	1991 Population	2018* Population (Projected Using 3.5% Growth Rate)	No. of Households (HH) (Obtained from Listing)	No. of Households selected
1	Edagberi	2129	5207	743	74
2	Betterland	170	415	59	6
3	Zarama Epie	2483	6073	867	87
4	Agbobiri	2266	5542	791	79
5	Kalaba	2067	5056	722	72
6	Ikarama	1214	2969	424	42
	Total	10329	25262	3606	360

Table 1: Sample Size Determination.
Source: National Population Commission, (1991
Authors Computation, (2018)

Again, interview was granted to selected key informants including members of Council of chiefs/community leaders, staff of government agencies/institutions who may have useful information about challenges of river flooding in the area. Due to the nature of data collected, simple statistics such as percentages, mean were used for data analysis. The multiple classification test was used to predict the most important flood effect that produces the desire in flood victims to move out of a flood prone area.

Mathematically, the MCA is given by:

$$Y_{ij...n} = \bar{Y} + a_i + b_j + \dots + e_{ij...n} \dots\dots\dots (1)$$

Where

$Y_{ij...n}$ = The score (on the dependent variable) of individual n who falls in category i of predictor A, category j of predictor B, etc.

\bar{Y}	=	Grand mean on the dependent variable.
a_i	=	the "effect" of membership in the i th category of predictor A.
b_j	=	the "effect" of membership in the j th category of predictor B.
$e_{ij} \dots n$	=	error term for this individual.

4. Literature Review

There exists quite some works on the effects of flooding on man and his environment. While flood effects produce direct and indirect impacts on lives and livelihoods they translate to impacts on various sectors of the economy. For example, the negative impact of flooding on the agricultural sector leads to submersion of farmland and destruction of food crops on farms as well as seeds stored for replanting; but eventually culminate into a decline in food production; starvation and decline in environmental quality, fuels the desire for migrating out of these rural areas (Saleh, 2014). The reduction in food production resulting from floods also means loss of income for many in these communities, which further reduces their ability to purchase food and thereby contributes to increasing the problems of food shortages and starvation within the household.

The destruction of crops by flood makes it imperative for the community members to shift dependence on agriculture income to non-agriculture income or diversify their agricultural livelihoods. Flood has negative impacts on the sector of health and education also. During flood, the flood water increases the incidence of different types of water-borne diseases. Children and the elderly are more vulnerable to these impacts. There is a rising worry on river flood risk in various communities/villages and cities around the globe. River floods account for almost half of the deaths and one-third of all economic losses from natural hazards worldwide (UNESCO, 2008). According to Smith, in a space of twenty years (1990-2010) river flooding were to blame for 200,000 deaths and negatively impacted about 3 billion citizens by making them to be without a roof over their heads (Smith, 2013). Increasing uprising of river flood incidences globally has led environmental scientists to contemplate on what could be the likely factors behind this environmental problem and what the feasible measures against it are.

Several research works have diverse findings regarding factors to blame for flood risk. However, river flood risk has been conceptualized as a function of the changing climate, and some time a combination of both climate and the built environment. Some environmental researchers argue that global warming and climate change is directly and or indirectly increasing the amount of rain and ice melting and thereby increasing the magnitude of runoff and subsequent flooding. For instance, river flood in Zimbabwe occurs as a result of two different phenomena: heavy seasonal rainfall and seasonal flood (Smith, 2013). According to Karley (2009) the common causes of flooding in Ghana are intense rainfall leading to run-off, dam-burst and tidal waves. However, flood hazard and its risk can be attributed to other factors. Some scholars (e.g. Leopold, 1968) claim that cultural activities have considerably affected the working of the physical natural environment and that the environment is only responding to these actions. For Leopold, (op cit) increase in impermeable surfaces will lead to flooding during rain falls due to poor percolation. Smith, (2013) argued that the removal of vegetated land cover and replacing it with concrete surfaces in a living environment will reduce.

The degree of flood damage of a specific flood event depends on the susceptibility of the affected ecological and socioeconomic systems (Cutter, 1996, Mitchell, 1989). In general, when an element at risk of being harmed is susceptible, the more it is exposed to a danger, the more it is susceptible to its forces and impacts. Therefore, any flood exposure analysis requires information regarding these factors, which can be specified in terms of, element-at risk indicators, exposure indicators and susceptibility indicators. The review brings to the fore, the facts that Flooding occurs all over the world, though their degree of impact vary depending on type, topography, level of concentration of activities, amount of water and level of preparedness by the authorities concerned. Past studies on flood for in the study area (Gobo and Abam, 1991) posit that flooding will continue to be a problem to communities along the Taylor Creek, hence the need to respond to threats of floods as they happen and to protect lives and properties throughout these tragedies. One thing that has become manifest is the fact that with increasing changes in climate occasioned by both natural and anthropogenic causes, settlements are expose to flood incidence and man has also over time applied different coping strategists in dealing with the impact of flooding. The present study concentrates on flood vulnerability and coping strategies by residents along Taylor Creek in the Niger Delta region of Nigeria.

5. Results and Discussions

5.1. Personal Characteristics of Respondents

Males accounted for 65.6% of the 359 respondents while females accounted for 34.4%. The mean age of respondents was 30 years. The modal age-sex category was '15 - 19 years' representing 18.6% of the total population (table 2 and fig 2). The predominance of the male population may be understood against the background that the study area is more or less fishing settlement carried out mostly by the male folk. In terms of marital status, 54% of respondents were 'Never Married' and 46% were married as shown in fig. 3. The educational attainment of respondents also shows that most of the respondents (43.1 %) did not complete tertiary education followed by secondary completed (38.2%). (table 2)

Age Category	Male		Female		Total	
	N	%	N	%	N	%
0 – 4	116	5.6	108	5.2	224	10.8
5 – 9	112	5.4	140	6.7	252	12.1
10 – 14	162	7.8	136	6.5	298	14.3
15 – 19	187	9	199	9.6	386	18.6
20 – 24	107	5.1	64	3.1	171	8.2
25 – 29	56	2.7	46	2.2	102	4.9
30 – 34	61	2.9	73	3.5	134	6.5
35 – 39	36	1.7	54	2.6	90	4.3
40 – 44	63	3.0	65	3.1	128	6.1
45 – 49	46	2.2	33	1.6	79	3.8
50 – 54	22	1.0	47	2.3	69	3.3
55 – 59	29	1.4	26	1.2	55	2.6
60 – 64	22	1.0	23	1.1	45	2.2
65 and Above	27	1.3	22	1.0	49	2.3
Total	1,046	50.2	1036	49.7	2,082	100

Table 2: Age-Sex Distribution
Source: Author's Field Survey, March 2018

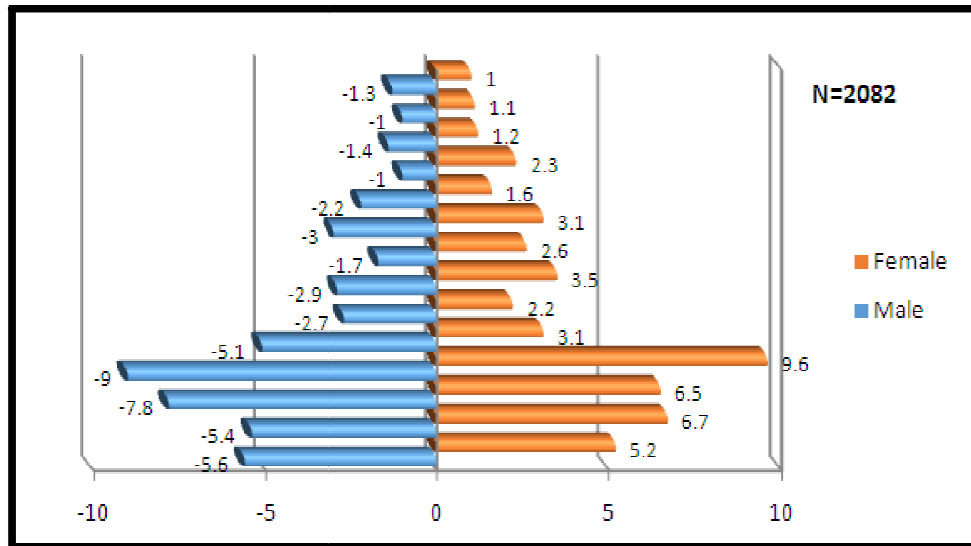


Figure 2: Age-Sex Distribution of Respondents
Source: Author's Field Survey, 2018

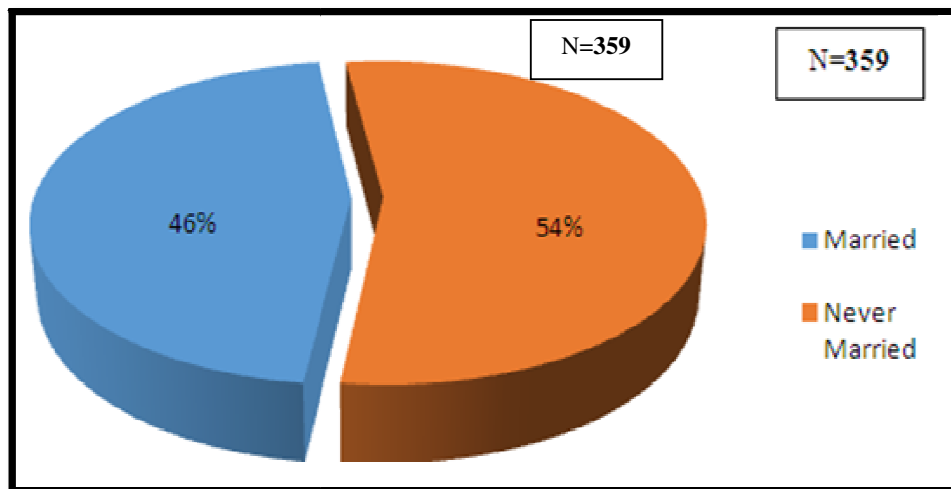


Figure 3: Marital Status of Respondents
Source: Author's Field Survey, 2018

Educational Attainment	N	%
No formal education	3	1.1
Primary (completed)	1	0.4
Secondary (uncompleted)	38	14.2
Tertiary (uncompleted)	115	43.1
Tertiary (completed)	3	1.1
Secondary (Completed)	102	38.2
Trade Test Certificate	5	1.9
Total	267	100

Table 3: Educational Attainment of Respondents

Source: Author's Field Survey, 2018

Table 4 shows employment status of household members. For male and females, the modal employment status for male is 54.6% and female 47.6%, respectively. More so a good number of the respondents are farmers accounting for 29.1% for male and 26.8%, for female respectively (see table 4)

Status	Male		Female		Total	
	N	%	N	%	N	%
Employed	240	37.2	166	30.3	406	34.0
Unemployed	352	54.6	261	47.6	613	51.4
Retired	53	8.2	36	6.6	89	7.5
Housewife	0	0	85	15.5	85	7.1
Total	645	100	548	100	1193	100

Table 4: Employment Status of Household Members

Source: Author's Field Survey, 2018

Occupation	Male		Female		Total	
	N	%	N	%	N	%
Farming	239	29.1	189	26.8	428	28.1
Fishing	148	18	76	10.8	224	14.7
Hunting	22	2.7	9	1.3	31	2
Artisan	52	6.3	45	6.4	97	6.4
Trading	68	8.3	141	20	209	13.7
Business	57	6.9	32	4.5	89	5.8
Junior Civil Servants	76	9.3	59	8.4	135	8.9
Senior Civil Servants	68	8.3	59	8.4	127	8.3
Junior Workers in Private Companies	26	3.2	28	4	54	3.5
Senior Workers in Private Companies	47	5.7	49	7	96	6.3
Other	18	2.2	17	2.4	35	2.3
Total	821	100	704	100	1525	100

Table 5: Occupation of Household Members

Source: Author's Field Survey, 2018

5.2. Socio-Economic Effects of Flooding on Residents along Taylor Creek

Respondents were asked to state the effect of the flood on some aspects of their life. Table 6 shows their responses. The table reveals that, 'Agriculture', 'Transport and accessibility', 'Health and Education', 'Housing and Culture' and 'Other Infrastructure', have been affected 'Very severely', representing 94.1%, 63.7%, 83.8%, 82.8% and 78.3% respectively. Table 15 presents how flood has affected different aspects of respondent's household. The most affected aspect of the household for the first, second and third mentions were, 'House', 'Farmland' and 'Farmland', representing 42.2%, 22.7% and 27.2%, respectively.

Considering the effect of flooding, respondents were asked if they would prefer to move out of the study area. Most of them responded in the affirmative, representing 95.3% of all responses. The severity of the impact of floods on various livelihood domains of people was what gave rise to the decision to move. Agriculture, transport and accessibility, health and education, housing and property and other infrastructure were very severely impacted due to flood incidences in the area

Aspect of Life	Very Severely	Severely	Don't Know Uncertain	Mildly	Very Mildly	Total
Agriculture (N=341)	94.1	3.2	2.6	0	0	100
Transport and accessibility(N=341)	63.7	31.3	5.0	0	0	100
Health and Education (N=346)	83.8	11.6	4.3	0.3	0	100
Housing and Property (N=348)	82.8	9.8	6.3	1.1	0	100
Other infrastructure(N=318)	78.3	14.5	5.0	2.2	0	100

Table 6: Table Showing Effect of Flood on Aspects of Life of Respondents

Source: Author's Field Survey, 2018

Aspect of Life	First Mentions		Second Mentions		Third Mentions	
	N	%	N	%	N	%
House	140	42.2	59	19.7	23	9.5
Furniture	0	0	3	1.0	1	0.3
Farmland	54	16.3	68	22.7	66	27.2
Health	0	0	9	3.0	3	1.2
Education	41	12.3	26	8.7	0	0
Roads	12	3.6	19	6.4	16	6.6
Property	46	13.9	67	22.4	57	23.5
Drainage system	0	0	0	0	1	0.4
Medicare	0	0	7	2.3	1	0.4
Business	19	5.7	7	2.3	4	1.6
Transportation	9	2.7	3	1.0	3	1.2
Public utility	2	0.6	3	1.0	9	3.7
Death of loved ones	0	0	2	0.7	4	1.6
Food	5	1.5	9	3.0	28	11.5
Death of livestock	0	0	14	4.7	0	0
Trading	4	1.2	0	0	1	0.4
Total	332	100	299	100	243	100

Table 7: Effect of Flood on Household

Source: Author's Field Survey, 2018

5.2. Coping Mechanisms Employed by the Communities during Floods

Table 8 shows respondent's coping strategy during any flood event. The two modal responses by respondents in order of importance were 'Relocate to Primary school' and 'Relocate to Distant places', representing 53.0% and 24.4%, respectively. Other coping strategies are relocated to the church (2.4%), construction of wooden bridges (6.7%), sand filling of some of the flooded areas with mud (1.2%), channeling water to the river (7.9%) and relocate to town hall (1.8%).

Strategy	N	%
Relocate to primary school	87	53.0
Relocate to church	4	2.4
Relocate to distant places	44	26.8
Construction of wooden bridges	11	6.7
Sand filling of some of the flooded areas with mud	2	1.2
Channeling water to the river	13	7.9
Relocated to town hall	3	1.8
Total	164	100

Table 8: Coping Strategy Adopted During Flood Events

Source: Author's Field Survey, 2018

To statistically determine the possible relationship between flooding impacts and the most important sectors that induces the desire of flood victims to move, the multiple classification analysis was carried out and the results is as shown in table 9. From the table, impact of flood on agriculture is the most significant factor predicting flood victims desire to move to safer areas in the event of flooding. This implies that the driving force that makes flood victims to move to other areas is due to their inability to continue with their agricultural activates after every flooding. The single explanation provided by agriculture on respondent's desire to relocate is 0.302 while the overall explanation of the factor is 5.4 %.

Predictors (Perceptions of flood Effects Regarding)	Eta	Beta
Agriculture	0.218	0.302*
Transportation and Accessibility	0.148	0.178
Health and Education	0.169	0.176
Housing and Property	0.162	0.236
Variance Explained (R^2) = 5.4%		

Table9: Predicting Desire to Move Using Perceptions of Flood Effects
(Multiple Classification Analysis, N= 240)

* Most Important Predictor

Source: Author's Field Survey, 2018

6. Conclusion and Recommendation

Floods are major disasters affecting many countries of the world annually especially in most flood plain areas. Floods do not only damage properties and endanger the lives of human and animals but also produce other secondary effects like outbreak of diseases such as cholera and malaria as well. The presentation made from the outset of this work points to the fact that flooding has adverse impact on the social and economic environment of people along Taylor Creek. Flooding destroys agricultural farmland as well as seeds stored for replanting; that eventually culminate into a decline in food production; loss of income for many in the affected communities. Reduction in personal income further reduces house hold ability to purchase food leading to starvation. Also observed is the fact that flooding induces and in fact fuels the desire for out migrating of people into areas of higher elevations and safety.

The study also revealed that in any event of flooding residents of flooded area usually prefer to move to primary schools while others relocate to distant places in search of safety and relieve. The reason for these may not be unconnected to the fact that primary schools serve as internally displaced persons camps (IDPs) usually provided by government with relieve materials (food, clothing) provided. In the absence of IDPs camps, flood victims prefer to move to very distant places in search of relatives who can provide some succor. An interesting picture revealed in this study is the fact that though victims of flood moves to safer places in the event of flood they tend to return to their ancestral homes once the flood subsides. This implies that the provision of IDP camps and relieve materials may not the final solution to the incidence of flooding and its effects on the residents of flood prone areas. In view of the above, it is usually better to deal with the flood rather than run away from it.

This paper advocates for the introduction of a participatory approach involving the government, residents, and corporate organisations in finding solutions to the problem of flooding in the area. Also important is the introduction of land use planning and flood management system so as to avert some of the consequences of flooding. There is the need for early warning and rapid response systems, flood data gathering and modeling, flood emergency preparedness and political will to combat flood menace.

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