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Impacts of Flood and River Bank Erosion on People's Livelihood in Northern Bangladesh

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Abstract

Bangladesh is a natural hazard prone country and flood is one of the most concerning hazards which is happened almost every year in different parts of the country and it has adverse impact on people's livelihood. The study focuses the impacts of flood and river bank erosion on the people's livelihood. The research area is located in the flood-prone region of the Teesta river basin in Rangpur district of Bangladesh. Lakshmitari union of Gangachara upazila and Kaunia Balapara union of Kaunia upazila were selected purposively as flood-prone area. In this research, primary and secondary data were used. The study results represent that flood is occurred every year in the areas, which is the cause of river bank erosion and affects the local people in the most of the villages. As a result, most of the people lose their dowelling house, cultivated land, fisheries, trees and many other assets. Besides, people are suffered in various types of water borne diseases during and post flooding time due to impure drinking water and vulnerable sanitation system. Moreover, the study shows the impacts of 2017 flood on different sectors of people's livelihood in Northern Bangladesh.

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Introduction

Bangladesh is the most disaster-prone country in the world. In every year various types of disasters are affected here. It is said that Bangladesh is a land of rivers. Mahtaj, 2014 said that, more than 700 rivers, with their tributaries and distributaries have crossed the country forming a network of river system.

Bangladesh is mostly flat except some hilly part in the southeast and the northeast and about all rivers are come in our country in mature stage. This country was formed due to sedimentation of the large river systems. For these reason some 30 to 35% of the total land surface of the country is being flooded every year during wet monsoon (Milliman et al., 1989). Flooding is one such water related environmental problem magnitude of which is very much dependent on land-use practices in the watershed of each rivers or streams (Khalequzzaman, 2000).When water flow of the river or other channel exceeds certain stage, spreads the bank area or adjoining high land and damages the environment and man-made things this situation is enumerated as flood (Rumana, 2020).

Flooding causes death and injuries to people and every year more than 300 to 500 people die and millions of other people become homeless and suffer in starvation. Flooding brings too much water which leads to the damages of roads, collapse of bridges or traffic congestion, which affects the daily life of all concerned. It also destroys farmland in rural areas. Flooding causes economic loss of about approximately USD 30 billion every year and after big floods government has to input many resources for aiding and reconstruction, which also bring extra economic stress to the public (Khan, 2007).

2. Methodology

For this research Lakshmitari union at Gangachara upazila and Kaunia Balapara union at Kaunia upazila of Rangpur district were selected purposively and simple random sampling techniques was applied to get proportionate household number. Primary and secondary data were used in current study to fulfill research objectives. Primary data was collected from reconnaissance survey, questionnaire survey, interview with key informant and field observation. Secondary data was collected from different government offices of Gangachara, Kaunia upazila and Rangpur district. Secondary data was also collected from different books, journals, articles, statistical reports, unpublished M.S and Ph.D thesis, newspapers, internet etc. Method of krejcie and Morgan (1970) was applied to select sample size and 361 household have been selected from two study unions as sample for questionnaire survey. For data analysis and interpretations, different type of statistical methods such as chart, tabulation, percentage, average and graphic presentation have been used.

3. Result and Discussion

3.1. Flood Scenario in the Study Area

Gangachara and Kaunia upazila of Rangpur district is face flood about each year. The Table 1 describes the impact of flood in 2016 and 2017. It is seen here in 2016, the number of affected union was 07 and 02 at Gangachara and Kaunia respectively. As like number of affected village and affected family was less than the flood of 2017. On the other hand in 2017 all of unions at two upazilas were affected by flood and number of affected village and affected family was higher than 2016.

Table 1. Flood scenario in the study area (2016 and 2017).

District	Date of report	Upazila	No. of affected union	No. of affected village	No. of affected family	No. of affected people
Rangpur	01.9.16	Gangachara	7	33	5550	19435
		Kaunia	2	14	2100	8400
	01.9.17	Gangachara	9	59	24850	-
		Kaunia	6	31	10000	-

Source: Office of district administrator, Rangpur, 2019

N.B: 2017:- Flood affected unions of Gangacharaupazila are Betgari, Kolkanda, Barabil, Lakshmitari, Gangachara, Gajaghanta, Marania, Alambiditar and Nohali.

2017:- Flood affected unions of Kauniaupazila are Kursha, KauniaBalapara, Shahidbagh, Haragach, Sarai and Tepamadhupur.

3.2. Flood Affected Fields at Gangachara and Kaunia Upazila.

Flood has destructive impact on various sectors at Gangachara and Kaunia upazila. Many crop lands, fisheries, institutions and infrastructures were fully or partially affected due to flood of 2017. The Table 2 explains the affected fields, number of affected family/population and amount of loss in both upazilas.

Table 2. Flood affected fields at Gangachara and Kauniaupazila-2017.

Upazil	Affected fields	No. of affected family/population	No/amount of loss	Data source
Gangachara	Flood affected family	15000	-	Dainik Bayannor Alo, 11.7.17
	Flood affected family of Laksmitari union	3500	-	Ibid
	Flood affected family	20000	-	Dainik Bayannor Alo, 13.7.17
	Flood affected people	100000	-	DainikBayannor Alo, 13.8.17 and DainikJuger Alo, 13.8.17
	Damage of crop land	-	10000 (ha)	DainikJuger Alo,13.8.17
	Number of submerged Pond	-	200	Ibid
	Number of affected village road	-	50	DainikBayannor Alo, 13.8.17
	Number of stopped educational institution	-	50	DainikBayannor Alo, 15.8.17
	Damage of embankment	-	2 km.	Ibid
	Submerged fish	-	1500000 (Tk)	Ibid
	Damage of crop land	-	15000 (ha)	DainikJuger Alo, 17.8.17 and DainikBayannor Alo, 18.8.17
Kaunia	Affected family	20000	-	DainikBayannorAlo, 13.8.17
	Affected family of KauniaBalapara union	3000	-	Ibid
	Damage of crop land	-	12000 (ha)	Ibid
	Damage of seed-bed	-	10 (ha)	Ibid
	No of submerged pond	-	200	Ibid

Affected family	25000	-	DainikBayannorAlo, 14.8.17
Affected family of Kaunia Balapara union	5000	-	Ibid
Damage of seed-bed	-	11 (ha)	DainikJugerAlo, 14.8.17
Number of submerged fisheries	-	100	Ibid
No of submerged pond	-	300	Ibid
Damage of crop land	-	14000 (ha)	DainikJugerAlo, 16.8.17
Submerged fisheries	-	5000000 (Tk)	Ibid
Number of damaged educational institution	-	28	DainikJugerAlo, 17.8.17
Damaged railway	-	Some points	DainikJugerAlo, 19.8.17

3.3. Damage of House due to Flood and River Bank Erosion.

The Table 3 discloses that more than fifty percent (51.92 %) of total respondent's houses were damaged due to flood at Lakshmitari which is higher than Kaunia Balapara (44.88 %). 42.31% and 52.19% respondents at Lakshmitari and Kaunia Balapara respectively said that, their houses were not affected by flood or river bank erosion in 2017 flood. Total 47.92 % respondents in both unions said that their houses were damaged due to flood. Because of river bank erosion houses of 4.16 % of total respondents were damaged. This was 5.77 % at Lakshmitari and 2.93

% at Kaunia Balapara. From the overall discussion we can say that at Lakshmitari union more houses were damaged and destroyed by flood and river bank erosion. At Kaunia Balapara it was little bit lower than Lakshmitari. Actually houses are more or less damaged by flood water but assets of people are totally destroyed due to river bank erosion.

Subaschandra, a farmer of Nijpara village at Kaunia Balapara union said that the Teesta already devoured his house and one bigha of cropland. Presently he is passing days in acute misery (The Financial Express, 2017).

Table 3. Damage of house due to flood and river bank erosion-2017.

Damage of house (TK)	Number of respondents (%)					
	Lakhsmitari		KauniaBalapara		Average	
	Flood	RBE	Flood	RBE	Flood	RBE
<500	-	-	2.93	-	1.66	-
501 – 1000	16.03	1.28	21.95	-	19.39	0.55
1001 – 1500	2.56	-	3.90	0.49	3.33	0.28
1501 – 2000	14.74	1.28	11.22	-	12.74	0.55
>2000	18.59	3.21	4.88	2.44	10.80	2.77
Sub total	**51.92**	**5.77**	**44.88**	**2.93**	**47.92**	**4.16**
No damage	42.31		52.19		47.92	
Total	100		100		100	
Average (TK)	2174	5566	1493	5333	1812	5473

Source: Field survey, 2017

3.4. Area, Family and Houses Affected by Flood.

The Table 4 shows that 145 sq. km. rural area and all char land (9.09 sq. km.) were sunk under the flood water at Gangachara, whereas at Kaunia 7.65 sq. km. rural area and 5.84 sq. km. char land (this is the total area of char land at Kaunia) were affected by flood.

Table 4. Area, family and houses affected by flood-2017.

Upazila	Date of report	Affected area (Sq. km.)			No. of affected family		No. of affected house	
		Rural area	Char land	Total	Fully	Partially	Fully	Partially
*Gangachara	13.9.17	145	9.09	154.0	531	21568	529	21558
**Kaunia	8.10.17	7.65	5.84	13.49	95	9905	95	9905

3.5. Loss of Crop due to Flood and River Bank Erosion.

Most of the lands of Bangladesh are used to produce different types of crops and most of the people in rural area are involved in agriculture sector. So agricultural land and cultivated crops are mostly affected by any kind of disaster. The study area is a rural area and most of the people of this area are involved in agriculture sector. As if flood and river bank erosion are occurred almost every year in this area, many people lose their agricultural land and many types of crops. The Table 5 presents that, average 29.36% respondent's crops were damaged by flood and 25.21% respondent's crop fields were affected by river bank erosion. On the other hand total 45.43 % respondents were not affected from crop damage by flood or river bank erosion. Actually some of them do not have any crop land, some people are daily worker in others person's crop field, some people are involved in small business etc.

Table 5. Loss of crop due to flood and river bank erosion-2017.

Loss of crop (TK)	Number of respondents (%)					
	Lakshmitari		Kaunia Balapara		Average	
	Flood	RBE	Flood	RBE	Flood	RBE
<3000	6.41	-	8.78	-	7.76	-
3001 - 6000	7.69	2.56	9.76	2.44	8.86	2.49
6001 - 9000	0.64	2.56	3.90	3.90	2.49	3.32
9001 - 12000	5.13	3.85	1.95	1.46	3.32	2.49
12001 - 15000	1.92	4.49	-	2.44	0.83	3.32
15001 - 18000	-	1.92	1.95	2.44	1.11	2.22
18001 - 21000	2.56	5.13	-	2.93	1.11	3.88
>21000	3.85	5.77	3.90	8.78	3.88	7.48
Sub total	**28.21**	**26.28**	**30.24**	**24.39**	**29.36**	**25.21**
No loss	45.51		45.37		45.43	
Total	100		100		100	
Average (TK)	10250	15682	8258	17340	9084	11526

Source: Field survey, 2017.

3.6. Flood Impact on Agriculture Sector.

The Table 6 provides the information about impact of flood on agriculture sector in some flooding years. It is seen from this table ropaaman and different types of vegetables were badly affected in all flooding years. Except this some seed bed were affected by the flood of 2016. In above flooding years all types of crops were highly affected at Gangachara than Kaunia upazila. From the analysis of Table 5 and 6 it can be said that, floods affected two upazilas and many types of crops were fully or partially affected by floods and sometimes river bank erosion which increased the poverty level for the rural dwellers.

Table 6. Flood impact on agriculture sector (2009, 2014, 2016 and 2017).

District	Year	Date of report	Upazila	Name of affected crop	Cultivated crop land in field (ha)	Affected crop land (ha) Fully	Affected crop land (ha) Partially	Loss of production (MT)	Total loss (TK)	No. of affected family
Rangpur	2009	-	Gangachara	Ropaaman	18860	80	3620	235	5566000	850
				Vegetables	420	3	97	50	600000	50
				Total	19280	83	3717	303	6166000	900
			Kaunia	Ropaaman	10950	80	6420	537	11814000	3520
				Vegetables	260	80	20	900	10800000	1780
				Total	11210	160	6440	1437	22614000	5300
	2014	02.9.14	Gangachara	Ropaaman	19410	80	120	319	9889000	350
			Kaunia	Ropaaman	11270	20	-	56	1736000	270
	2016	03.8.16	Gangachara	Ropaaman	6490	147	513	753.08	24098560	2100
				Seed bed	1018	21	29	31	1531400	825
				Vegetables	820	10	-	150.00	2250000	325
				Total	8328	178	542	934.08	27879960	3250
			Kaunia	Ropaaman	3890	20	380	107.20	3430400	400
				Seed bed	650	1	9	2	98800	60
				Total	4540	21	389	109.20	3529200	460
	2017	20.8.17	Gangachara	Ropaaman	19150	4280	2720	13888	472192000	19840
				Vegetables	809	125	-	1875	28125000	2500
				Total	19959	4405	2720	15763	500317000	22340
			Kaunia	Ropaaman	10850	800	700	2800	95200000	9500
				Vegetables	335	40	-	600	12000000	1000
				Total	11185	840	700	3400	107200000	10500

Source: Agriculture extension office, Rangpur, 2019

N.B: 2009:- Ropaaman: Production 2.58 MT/ha (in rice), price = 22000/MT
      Vegetables: Production 10.00 MT/ha, price = 12000/MT
   2014:- Ropaaman: Production 2.90 MT/ha (in rice), price = 31000/MT
   2016:- Ropaaman: Production 2.68 MT/ha (in rice), price = 32000/MT
      Seed bed: Price = 49400/ha
      Vegetables: Production 15 MT/ha, price = 15000/MT
   2017:- Ropaaman: Production 2.80 MT/ha (in rice), price = 34000/MT
      Vegetables: Production 15 MT/ha, price = 15000-20000/MT

3.7. Health Impacts of Respondents.

Most of the people of the study area said that they and their family members suffered in different types of diseases in flooding time. The Table 7 displays that every disease is divided into three segments like low, moderate and high. Here low means when people take ordinary treatment such as from medicine store and sometime people do not take any treatment for their diseases. Moderate means when people go to emergency medical team, village community clinic, hospital or private clinic for treatment and people are admitted in hospital or clinic for better treatment that means they are highly affected by diseases.

Table 7. Health impacts of respondents-2017.

Diseases	Nature	Number of respondents (%)		
		Lakshmitari	Kaunia Balapara	Average
Diarrhoea	Low	3.21	9.27	6.65
	Moderate	17.95	15.12	16.34
	High	5.13	3.41	4.15
Skin diseases	Low	0.64	1.46	1.11
	Moderate	4.49	0.98	2.49
	High	2.56	0.98	1.66
Stomach problem	Low	-	0.98	0.55
	Moderate	3.21	0.98	1.94
	High	0.64	-	0.28
Cold	Low	1.28	1.46	1.39
	Moderate	12.18	8.78	10.25
	High	2.56	5.85	4.43
Fever	Low	0.64	6.34	3.88
	Moderate	14.74	8.29	11.08
	High	6.41	9.27	8.03
Others	Low	-	-	-
	Moderate	2.56	1.95	2.22
	High	-	-	-
Sub total		**78.21**	**75.12**	**76.45**
Not suffer by diseases		21.79	24.88	23.55
Total		100	100	100

Source: Field survey, 2017.

3.8. Impact on Different Institutions and Infrastructures.

In flood period excess water is spread in both side of the Teesta river. Houses of people, agricultural land, village road, school, college, mosque, temple, tube-well, toilet etc. are affected by flood and sometime river bank erosion. The Table 8 demonstrates the damages of all institutions and infrastructures in three categories. These are low, moderate and high. When field and wall of institutions and infrastructures are damaged in low intensity due to flood and only ordinary repairing is needed for recover these problems, this nature of damage is low. Flood water damages the field, vegetation, wall, furniture etc. of institutions and infrastructures and huge amount of money is needed for repairing these problems that is called moderately affected. When flood and river bank erosion seriously damage

institutions and infrastructures and these institutions and infrastructures are shifted to other safe zone due to flood and river bank erosion, this nature of damage is high

Table 8. Impact on different institutions and infrastructures-2017.

Institutions and infrastructures	Nature of damage	Number of respondents (%)		
		Lakshmitari	Kaunia Balapara	Average
Village road	Low	5.77	28.29	18.56
	Moderate	46.15	37.07	41.00
	High	48.08	34.63	40.44
	No comment	-	-	-
School / college	Low	25.64	2.44	12.47
	Moderate	18.59	8.78	13.02
	High	7.05	0.49	3.32
	No comment	48.72	88.29	71.19
Mosque / temple	Low	7.69	1.95	4.43
	Moderate	15.38	2.44	8.03
	High	5.77	-	2.49
	No comment	71.16	95.61	85.04
Govt. or non Govt. offices	Low	2.56	-	1.11
	Moderate	1.28	-	0.55
	High	-	-	-
	No comment	96.16	100	98.34
Tube-well	Low	1.92	14.15	8.86
	Moderate	12.82	6.83	9.42
	High	17.95	1.46	8.59
	No comment	67.31	77.56	73.13
Toilet	Low	26.28	27.32	26.87
	Moderate	36.54	20.49	27.42
	High	17.94	13.66	15.52
	No comment	19.23	38.53	30.19

Source: Field survey, 2017

3.9. Flood Impact on Road, Bridge, Culvert and Embankment.

The Table 9 gives information about the impact of flood on different infrastructures in the research area. Flood impact on pacca and kancha road, number of affected bridges, culvert and embankment at Gangachara and Kaunia upazila is shown in this table.

Table 9. Flood impact on road, bridge, culvert and embankment-2017.

Upazila	Date of report	Affected road (Km.)					No. of affected bridge			No. of affected culvert			Affected embankment (Km.)	
		Pacca road		Kancha road										
		Partially	Loss (Lak TK)	Fully	Partially	Loss (Lak TK)	Fully	Partially	Loss (Lak TK)	Fully	Partially	Loss (Lak TK)	Partially	Loss (Lak TK)
*Gangachara	13.9.17	6.7	375.2	43	50	272.0	-	150	450.0	-	10	50.0	2.0	20.0
**Kaunia	8.10.17	12	84.0	-	36	72.0	2	-	120.0	3	4	5.0	-	-

Source: *PIO, GangacharaupazilaRangpur, 2019   **PIO, Kauniaupazila, Rangpur, 2019

3.10. Flood Impact on Different Institutions.

The Table 10 appears that mosque and temple were partially affected by 2017 flood in both upazilas but the number of affected mosque and temple was higher at Gangachara than Kaunia upazila. Again the number of affected primary, secondary and others community school were higher at Gangachara upazila.

Table 10. Flood impact on different institutions-2017.

Upazila	Date of report	No. of affected religious institutions				No. of affected educational institutions									
		Mosque		Temple		Primary school			Secondary school		Madrasa		Others community school	
		Partially	Loss (Lak TK)	Partially	Loss (Lak TK)	Fully	Partially	Loss (Lak TK)	Partially	Loss (Lak TK)	Partially	Loss (Lak TK)	Partially	Loss (Lak TK)
*Gangachara	13.9.17	15	30.0	3	3.0	2	34	158.0	2	40.0	-	-	6	30.0
**Kaunia	8.10.17	7	0.35	1	0.05	-	17	54.0	-	-	1	3.0	-	-

Source: *PIO, Gangachara upazila Rangpur, 2019 **PIO, Kaunia upazila, Rangpur, 2019

3.11. Flood Impact on Tube-well and Sanitation System.

Pure drinking water and a hygienic sanitation system are very important for every people. During the flooding time, those sectors are highly affected. That's why many people are suffered by various types of diseases because of lacking pure water for drinking and an unhygienic sanitation system. The Table 11 discusses that tube-wells and sanitary latrines were fully or partially affected by the 2017 flood at both upazilas.

Table 11. Flood impact on tube-well and sanitation system-2017 .

Upazila	Date of report	No. of affected tube-well						No. of affected sanitary latrine		
		Not deep tube-well			Hand pump					
		Fully	Partially	Loss (Lak TK)	Fully	Partially	Loss (Lak TK)	Fully	Partially	Loss (Lak TK)
*Gangachara	13.9.17	40	54	87.0	75	750	11.25	1200	3100	72.90
**Kaunia	8.10.17	-	-	-	-	50	250	-	7	2.80

Source: *PIO, Gangachara upazila Rangpur, 2019 **PIO, Kaunia upazila, Rangpur, 2019

3.12. Positive Impacts of Flood.

In both study areas those people who told about positive impacts of flood they mainly said the three types of positive impacts. These are fish availability in flooding period, soil fertility and better crop production for soil fertility in post flood. The Figure 1 expresses the positive impacts of flood. Average 24.65 % respondents told about the fish availability in their locality during flood. Many fisheries are submerged with flood water

in flooding period. That time fishes can move easily from one place to another with the flood water and people catch more fish in this time. For this reason fishes are available at market in flooding period. Total 26.32 % respondents said that soil fertility is increased in post flood. Actually more particles come into lower stream from upstream with the flood water. As if Bangladesh is situated in the bottom of the river channel. Water flow of river is decreased here from the upstream. When the water flow is decreased, those particles are deposited in the country as well as in the Teesta basin and increased soil fertility. In the study area crop production is increased according to 25.48 % of total respondents. When soil fertility is increased, crop production is increased naturally.

Table 12. Overall impact due to flood and river bank erosion in the study area-2017.

Sectors of impact	Status	Level of concern	Remarks
Damage of house	Increased	High	In both research areas many houses were fully or partially damaged due to flood and river bank erosion.
Income	Decreased	High	Income was highly decreased due to flood.
Damage of crop	Increased	High	Due to flood and river bank erosion crop production was decreased.
Health problem	Increased	Moderate	Many people were attacked in various types of diseases during and post flooding time.
Damage of different institutions and infrastructures	Increased	Moderate	Many institutions (school/collage, mosque/temple etc.), infrastructures (road, bridge, culvert, embankment, GOs and NGOs office, tube-well, toilet etc.) were affected due to flood and river bank erosion.
Pure drinking water	Decreased	Moderate	Due to flood many tube-wells were fully or partially affected.
Sanitation problem	Increased	High	Many toilets were damaged/destroyed due to flood. For this reason people faced sanitation problem.
Food availability	Decreased	High	During flood people faced food insecurity.
Available occupation	Decreased	High	People faced lack of occupation during flood.
Poverty level	Increased	High	Poverty level was increased for lacking of occupation and loss of income due to flood.
Education	Decreased	Moderate	During flood education access was decreased due to damage/destroy educational institutions.
Fish availability	Increased	Moderate	Although many fish pond/farm is submerged due to flood but fish availability is increased in natural water body for available water.
Soil fertility	Increased	High	Huge particles come with flood water from upstream and deposit in the flood affected area which particles increase soil fertility in post flooding period.
Crop production in post flood	Increased	Moderate	Crop production is increased for soil fertility in post flood.
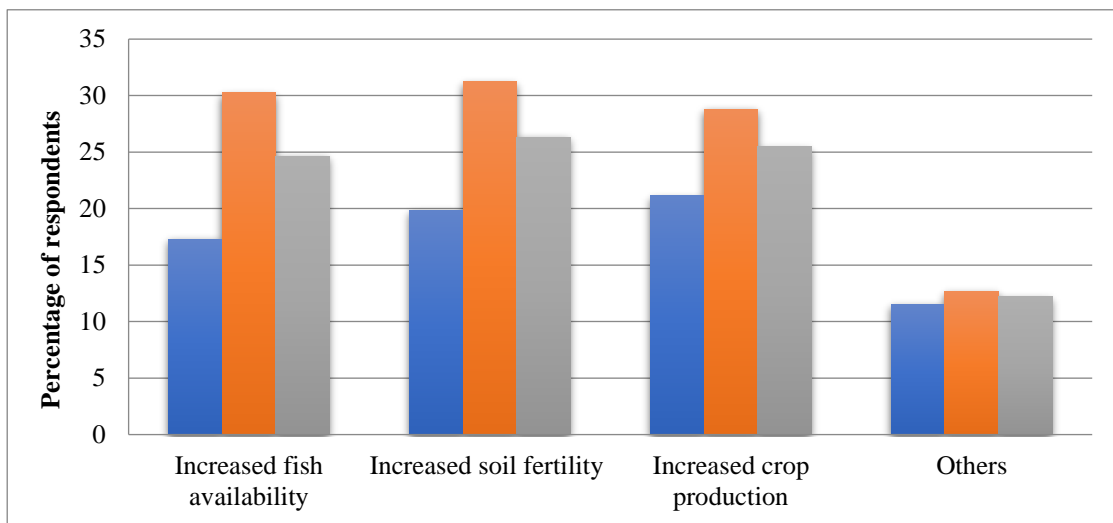
Source: Field survey, 2017

Figure1. Positive impacts of flood

3.13. Overall Impact due to Flood and River Bank Erosion in the Study Area.

The Teesta river has a marked agricultural and economic impacts on its adjoining areas. People's livelihood, culture, life patterns etc. are influenced by this river. Gangachara and Kaunia upazila of Rangpur district are influenced by the Teesta river. Almost every year people of these areas suffer the flooding problem in monsoon season. Flood damages peoples homestead, crop, agricultural land, livestock, poultry etc. Scarcity of pure drinking water and food are common problems in that time. Besides, people suffer different types of health problems during and the post flooding period. The Table 12 shows the flood impacts on people's livelihood at a glance in the research area.

4. Conclusion

The research area is affected by flood and sometime river bank erosion more or less almost every year. Excess water flow from upstream is the main cause of flood in that area. Besides, heavy rainfall, lack of water

drive management, low carrying capacity of river, low land etc. are also responsible for happening flood. Various socio-economic sectors are affected by flood and river bank erosion in the 2017 flood. Huge number of houses mainly kancha houses are damaged fully or partially, cultivated crops are highly affected, during and post flooding time many people suffer different types of water borne diseases, various types of institutions and infrastructures are fully or partially damaged by flood and river bank erosion. In spite of huge negative impacts, flood has some positive impacts like increase fish availability during flood, increase soil fertility and crop production in post flood.

Although flood is happened for some days but people are sufferer in long day with great difficulties. Government and nongovernment organizations are active in that place to overcome from various types of problems which are created by flood and river bank erosion. But these are not sufficient. So it is very urgent to develop long-term flood management policies and implementation these policies in affected

area. Bitter preparation before flood, emergency action during flood and proper management in post flood can decrease the damage of flood as well as any kind of disaster.

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