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ASSESSMENT OF FLOOD EXPOSURE IN GANGETIC ISLAND : A CASE STUDY OF NARAYANPUR MAUZA NWABGANJ, BANGLADESH

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Abstract : The assessment of flood at a local scale is an important tool for identifying the potential damage and loss of households and local communities to manage and overcome emergencies and disaster situations. A semi quantitative tool is used to assess flood exposure of a community in a Gangetic Island. People, infrastructure and elements are highly exposed to flood hazard in Narayanpur Mauza and that results in not only devastating flood disaster but also a higher level of flood exposure. Data related to the exposure were collected through household interview using questionnaire, focus group discussion and observation and analyzed using quantitative techniques with the help of SPSS and Microsoft excel. A final presentation of composite exposure index was prepared to realize the potential flood damage situation in Gangetic Island.

Introduction

By number and economic losses flood disaster account for about a third of all natural catastrophe throughout the world. More than 520 million people are affected by flood per year in the world. It gives result in estimates up to annual deaths of 25,000, extensive homelessness, disaster induced disease, crop and livestock damage and other serious harm (UNU, 2004). Bangladesh is a remarkable flood prone area in the world (Chowdhury, 2010). This country is situated in the confluence zone of Ganges-

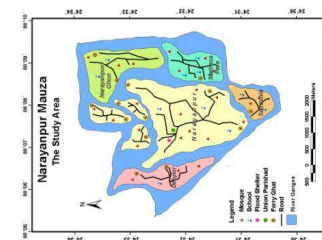
Brahmaputra-Meghna(GBM). There are 257 rivers in Bangladesh, of which 59 are Transboundary Rivers (Miah, 2001). Ganges delta is very susceptible to river flood and often goes under water once or twice a year. More specifically, Char or islands or islands are more frequently exposed to flooding.

Flood in Bangladesh is almost an annual scenario of peoples' life that is to a large extent because of its geographical locations and natural drainage system. Floods inundate a major part of Bangladesh every year from July to September. In a "normal" year approximately 20 percent of the country is affected but under extreme flood events as much 60-70 percent of the country would be inundated. Frequent flooding impacts badly especially on poor families in low-lying areas, who either lose their lives or lose few assets they have accumulated by hardship. The main objective of the present study is to assess flood exposure. Assessment of flood exposure consists of the exposure people, infrastructure and economy.

It is the fact that abnormal flood events make the life and livelihoods of people more risk prone. As a result people and elements are at risk in this country especially in Gangetic islands. Due to repeated flood hazard people and elements are highly exposed to flood disaster in Bangladesh. Exposure means the people, household contents and outside contents at risk.

The Study Area

Narayanpur Mauza is situated in Narayanpur Union in Nawabganj Sadar Upazila which is in Nawabganj district. There are five villages in Narayanpur Mauza: Narayanpur, Satrashia, Madrasa Para, Debpur, and Narayanpur Ghon. The study area, Narayanpur Mauza, lies between 24°30'10" to 24°33'50" North latitude and 88°05'10" to 88°09'40" East longitude. Narayanpur Mauza is situated in the south side of Shibganj Upazila, west of Joyandipur Mauza and in the northern side of the river Ganges. There is the west Bengal of India in the west side of the study area. Total area of Narayanpur Mauza is 17.05 square kilometer



Map: Study Area

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Methodology

The research of flood exposure assessment is focused on the analysis of element and people risk. In order to achieve the goals of this research, the methodology used in this research is divided into three main phases: (1) Pre-Field (2) Fieldwork, (3) Post Field.

In the present research, the first activity was to review the related literatures. The literature review was conducted to strengthen the concept of this research. The literature review activity consisted of the problem identification, research objectives and research question formation, study area delineation, the identification of required data availability. Administrative map was collected and the present study area was selected in this phase. The fieldwork was conducted to collect primary data by doing observation, household interview using questionnaire and focus group discussion to assess flood exposure. The post field phase is the final phase in this research. Data collected during preparation and fieldwork phase were analyzed according to the purpose of this research. Questionnaire were double checked for differences and corrected, records linked using SPSS 18 software.

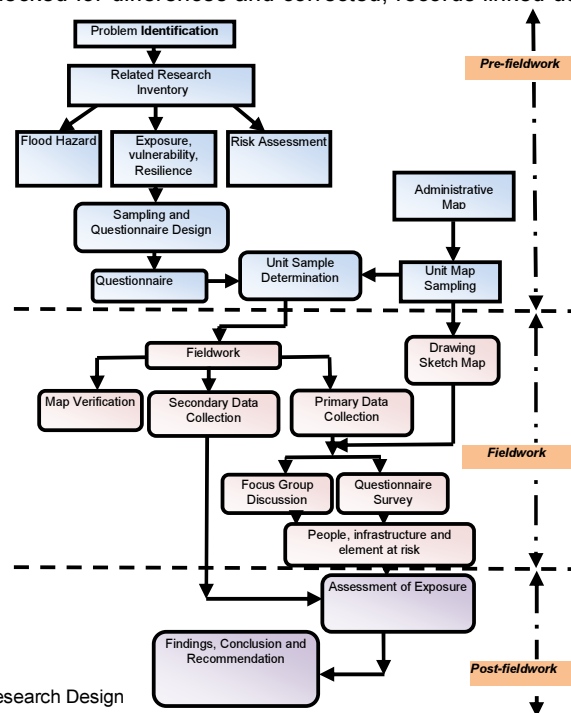


Figure 1: Research Design

Indicator and Factor Score

Firstly, different measurements of the individual indicators have to be made comparable through scaling. Five point Likert scale has been prepared by assigning a value 1, 2, 3, 4 and 5. "0" is given when the indicator does not apply. The collected data have been analyzed and all the indicators got a single value. Then separate composite index can be calculated for exposure.

Factor component	Indicator name	Indicator
Population	(E1)people at risk	% of affected population(every year)
Structure	(E2)Construction material of house	% of house made of flood resilient construction material
	(E3)Infrastructure at risk	money value of infrastructure at risk
Economy	(E4)Household content at risk	Money value of household content at risk
	(E5)Outside properties a risk	Money value of outside properties at risk

Source: Author

Indicators that are related to the exposure are integrated to the exposure index. The factor score vary between 0 to 100. Depending on the scaled indicator value, factor scores vary. This can be achieved by distributing a total of 20 weighting points according to the believed importance of the indicators for exposure.

Results and Discussion

Respondents affected by flood

Flood is a very common phenomenon in an island. More specifically, in Narayanpur Char flood is not only common but also a catastrophic event. Based on respondents' opinion, almost all of them get affected by flood every year. According to the observed data, In Satrashia village inhabitants are greatly affected by flood.

Table 1: Respondents Affected by Flood Every Year

Respondents affected by flood every year	Villages										Total (HH)
	Narayanpur		Satrashia		Madrasa Para		Debpur		Narayanpur Ghon		
	HH	%	HH	%	HH	%	HH	%	HH	%	
Yes	97	99	22	96	29	97	11	92	14	93	97%
No	1	1	1	4	1	3	1	8	1	7	03%
Total	98	100	23	100	30	100	12	100	15	100	178

Source: Field Survey 2012

Information on structural types of houses

Type of building material determines flood exposure. The combination wall-roof-floor materials determine the resilience of the building. The less the resilience of the building material is the more the building expose to flood. This research uses detailed classification of structural types of building (table- 2, 3, and 4)

Table 2: Cross Tabulation of Number of Wall with Roof Materials

Wall Material	Roof Material				Total
	Straw	Polythene	Tally	Tin	
Bamboo/ Straw	43	0	0	0	43
<i>Chatai</i>	42	0	0	0	42
Mud	45	7	27	3	82
Tin	0	0	1	10	11
Total	130	7	28	13	178

Source: Field Survey 2012

Based on the cross tabulation of wall-roof material, there are apparently four types of wall-roof material mainly found in the study area. The highest frequency of occurrence was those main four types of wall-roof materials i.e. mud wall with straw roof, bamboo/straw wall with straw roof, *chatai* wall with straw roof, mud wall with straw roof and mud wall with tally roof (table 2). 73% of the household use straw as roof material.

Table 3: Cross Tabulation of Number of Floor with Roof Materials

Floor Material	Roof Material				Total
	Straw	Polythene	Tally	Tin	
Mud	130	7	27	7	171
Wood	0	0	1	5	06
Cement	0	0	0	1	01
Total	130	7	28	13	178

Source: Field Survey 2012



Plate: Less resistant construction material of house (Left in village Madrasa Para and right in village Narayanpur Ghon)

Source: Field Survey 2012

Based on the cross tabulation of floor-roof material, there are apparently two types of floor-roof material mainly found in the study area. The highest frequency of occurrence was those main two types of floor-roof materials i.e. mud floor with straw roof and mud floor with tally roof (table 3). There are

some buildings with mud wall and polythene roof, mud wall and tin roof. 96% household uses mud as floor material.

Table 4: Cross Tabulation of Number of Floor with Wall Materials

Floor Material	Wall Material				Total
	Bamboo/Straw	<i>Chatai</i>	Mud	Tin	
Mud	43	42	80	6	171
Wood	0	0	1	5	6
Cement	0	0	1	0	1
Total	43	42	82	11	178

Source: Field Survey 2012

Based on the cross tabulation of floor-wall material, there are apparently four types of floor-wall materials mainly found in the study area. The highest frequency of occurrence was those main four types of floor-roof materials i.e. mud floor with mud wall, mud floor with straw wall, mud floor with *chatai*, mud floor with tin wall (table 4).

Infrastructures at Risk

Based on observation and questionnaire survey data, in the present study area more than half of the respondents think that more than 80% of the infrastructures are exposed to flood. One third of the respondents think that more than 60% of the infrastructures are exposed to flood hazard

The higher is the percentage of infrastructure exposed to flood the higher is the level of flood risk. In village Narayanpur comparatively more infrastructure are exposed to flood. Village Madrasa also represents high value. One of the respondents name Bilkis Begum said that almost all of the infrastructure in village Satrashia are exposed to flood hazard. Based on observation Narayanpur mauza is not structurally developed as a result infrastructures are highly susceptible to repeated flood event and damaged due to the attack of flood water.

Table 5: Infrastructures Exposed to Flood Hazard

Infrastructure exposed to Flood		Villages					Total (HH)
		Narayanpur	Satrashia	Madrasa Para	Debpur	Narayanpur Ghon	
		HH	HH	HH	HH	HH	
<20%	Very low	4	2	1	1	1	9
20%-40%	Low	2	2	1	1	2	8
40%-60%	Moderate	3	3	1	1	2	10
60%-80%	High	42	5	7	2	4	60
>80%	Very high	47	11	20	7	6	91
Total		98	23	30	12	15	178
Mean		4.29	3.91	4.47	4.08	3.80	4.21
SD		0.942	1.345	0.973	1.379	1.320	1.079
Criteria of assessment							
Very low		Low		High		Very high	
0-1		1-2		3-4		4-5	

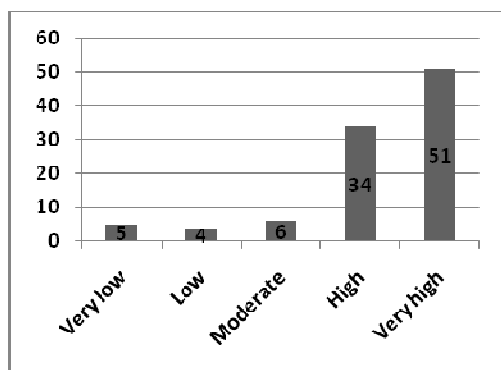
Source: Field Survey, 2012

Percentage of the exposure of infrastructure is very high in Madrasa Para. Here Almost 90% of the infrastructures are normally exposed to flood hazard. This is an important determinant of flood exposure (Table 5). No steps have been taken to limit the exposure of flood because of that infrastructures face adversities every year.

Flood visits the present study area every year and this results in very high exposure of infrastructure. According to the questionnaire survey data the exposure of infrastructure to flood hazard is relatively less in Narayanpur Ghon village.

From focus group discussion data, almost 100% of the infrastructures were affected by flood in the year 1988 and 1998. But usually, More than two third of the infrastructures are exposed to flood hazard in Mauza Narayanpur.

Figure 2: Percentage of Infrastructure Exposed to Flood Hazard

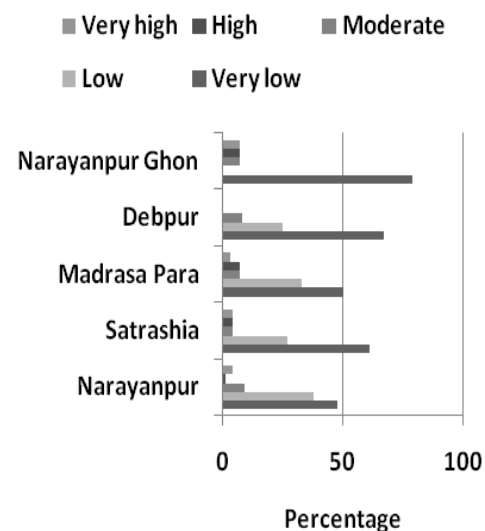


Source: Field Survey, 2012

Household Contents at Risk

Another important indicator to assess exposure is household content at risk. In a flood prone island like Narayanpur Mauza household contents are greatly exposed to flood hazard. Some important household contents are considered in this study. More specifically, data regarding the quantity and money value of beds, tables, chairs, cookerries and utensils are collected as well as analyzed. Based on observation, living standard of the char people is very low and they get very few household contents in their house. So, the money value of the household contents does not sound very big but for the char people it is a big deal.

Figure 3: Value of Bed



Source: Field Survey, 2012

Bed is the most common household content the char people have in their house. Two third of the houses have one bed in their house and rests have more than one bed. Nobody has more than four beds in the study area. Only one household has four beds. Comparatively in the village Narayanpur less than half of the respondents use bed with a very low value.

Table 6: Value of bed of the Households

Money value of bed(in TK)	Villages					Total (%)
	Narayanpur	Satrashia	Madrasa Para	Debpur	Narayanpur Ghon	
Sum	71500	11650	16330	5390	7850	112720
Mean	730	507	544	499	523	633
Standard Deviation	1724	371	301	186	380	1299

Source: Field Survey, 2012

Char people generally use cheap beddings so that the value of a bed is not more than 600 hundred taka. More than half of the respondents use bed with a value of less than 500. Another important household content which brought under consideration is cooker and utensils. Each and every surveyed household has some cooker and utensils as a daily necessity.

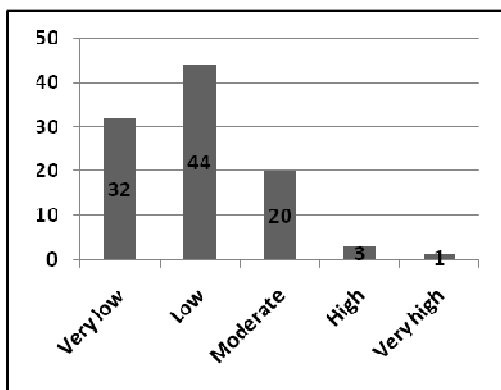


Figure 4: Percentage of money value cooker and utensils
Source: Field Survey, 2012

Table 7: Value of Cooker and Utensils of the Households

Money value of Cookeries and Utensils(in Tk)		Villages										Total (HH)
		Narayanpur		Satrashia		Madrasa Para		Debpur		Narayanpur Ghon		
		HH	%	HH	%	HH	%	HH	%	HH	%	
900-1200	Very low	24	25	9	39	13	43	5	42	7	46	58
1200-1500	Low	49	50	8	35	13	43	5	42	4	27	79
1500-1800	Moderate	19	20	6	26	4	14	2	16	4	27	35
1800-2100	High	5	5	0	0	0	0	0	0	0	0	5
2100-2400	Very high	1	1	0	0	0	0	0	0	0	0	1
Total		98	100	23	100	30	100	12	100	15	100	178
Sum		127300		28700		36300		14800		18400		225500
Mean		1299		1248		1210		1234		1227		1266
Standard Deviation		261		233		160		182		221		136

Source: Field Survey, 2012

The third important household content is chair. More than two third of the households have chair (Figure 5). Most of the households use cheap chair. At Narayanpur village three fourth of the households does not have chair and almost half of the surveyed households have chair with money value less than 500 taka.

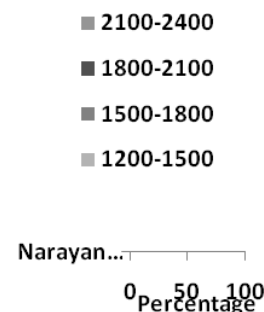


Figure 5: Value Of Chair
Source: Field Survey, 2012

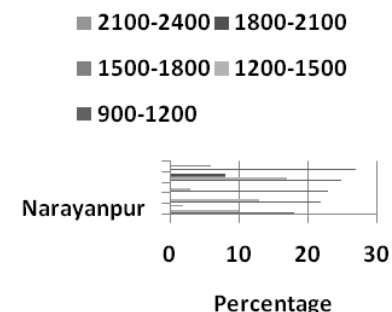


Figure 6: Value Of Chair
Source: Field Survey, 2012

Tables used by the char dwellers are greatly exposed to flood hazard. When flood occurs tables become damaged. Narayanpur is the most vulnerable village in Narayanpur Mauza in this aspect (Figure 6). Figure shows that Deppur is in second position. In Madrasa Para village the exposure of table to flood hazard is least.

Outside Properties at Risk

In the present study area no household was found without outside properties. Not only household contents but also outside properties are exposed to flood hazard. Especially domestic animals, trees, shops and family transports are more considerable in this aspect. Based on observation and household interview, the money value of outside properties is quite high than the money value of household contents. Domestic animal, tree and family transport was selected for analysis because these are much more exposed to flood.

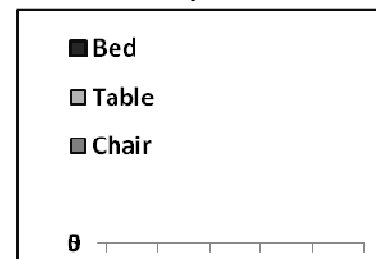


Figure 7: Mean Index of Household contents at risk

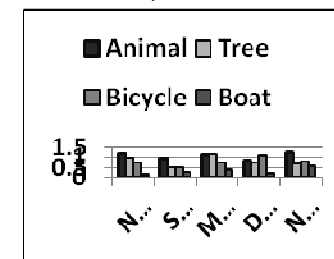


Figure 8: Mean Index of outside Properties at risk

Analyzing mean index it is clear that the exposure of outside properties to flood hazard is higher than the household contents. Among the household contents exposure of households and utensils is comparatively high. On the other hand, among the outside properties the exposure of animal is comparatively high (Figure & 8). Grand mean value of house contents is higher than that of outside properties (Figure 9).

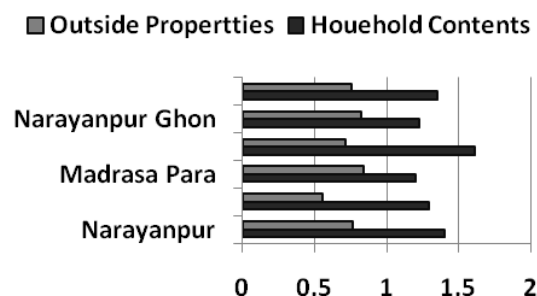


Figure 9: Grand Mean index of outside properties and Household contents at risk

Domestic animals are the most common outside properties found during survey. Two third of the surveyed households have domestic animals in their households (table 8). Mainly char people have goat, cow, hen and duck in their house. These animals become unsafe during flood hazard. The money value of cow is much higher than the other domestic animals.

Table 8: Value of Animal of the Households

Money value of Animal(<i>in TK</i>)		Villages										Total
		Narayanpur		Satrashia		Madrasa Para		Debpur		Narayanpur Ghon		
		HH	%	HH	%	HH	%	HH	%	HH	%	
'0' or No table		29	30	9	39	10	33	6	50	5	33	59
<5000	Very low	26	26	6	26	8	27	2	17	1	7	43
5000-30000	Low	38	39	8	35	11	37	4	33	9	60	70
30000-55000	Moderate	3	3	0	0	1	3	0	0	0	0	4
55000-80000	High	1	1	0	0	0	0	0	0	0	0	1
>80000	Very high	1	1	0	0	0	0	0	0	0	0	1
Total		98		23	100	30	100	12	100	15	100	178
Sum		776500		101500		166000		31500		103000		1178500
Mean		7923		4413		5533		2625		6067		6620
Standard Deviation		14123		5039		8281		3038		7443		11468

Source: Field Survey, 2012

Among the respondents with domestic animals two third have goat in their house. Based on household interview, most of the respondents got goat from the NGOs, some from Government organization and few bought. The table shows that the money value of the animals is highest in the village Madrasa Para. Comparatively Satrashia shows the second highest value and Debpur the least value. Less than 2% of the respondents have animals with a value of less than 55000 taka. The higher the money value of the animals the higher the exposure is.

Table 9: Value of Tree of the Households

Money value of Tree (in TK)		Villages										Total HH
		Narayanpur		Satrashia		Madrasa Para		Debpur		Narayanpur Ghon		
		HH		HH	%	HH	%	HH	%	HH	%	
'0' or No table		48	49	9	39	10	34	5	42	8	53	80
<5000	Very low	4	4	3	13	3	11	1	8	1	7	12
5000-15000	Low	26	27	7	3	15	52	3	25	3	19	54
15000-25000	Moderate	12	13	2	9	1	3	1	8	1	7	17
25000-35000	High	4	4	2	9	0	0	1	8	1	7	8
>35000	Very high	4	4	0	0	1	3	1	8	1	7	7
Total		98	100	23	100	30	100	12	100	15	100	178
Sum		480000		48000		118000		33500		51000		181000
Mean		4898		2086		3933		2791		3400		1016
Standard Deviation		7749		2070		3664		3962		5288		3432

Source: Field Survey, 2012

More than half of the respondents possess tree. Less than 10 % of the households have trees with a value of more than 25000 taka (table 9). The table shows that the sum of money value is highest in Narayanpur village. Transport is another outside property which is exposed to flood hazard specially bicycle. The village Narayanpur shows the highest sum of money value and village Madrasa Para is in second position.

Table 10: Value of Transports of the Households

Money value of Transports(in TK)		Villages										Total HH
		Narayanpur		Satrashia		Madrasa Para		Debpur		Narayanpur Ghon		
		HH	%	HH	%	HH	%	HH	%	HH	%	
'0' or No table		40	41	8	35	10	33	3	25	4	27	64
<5000	Very low	36	37	12	53	18	60	5	43	6	40	78
5000-15000	Low	20	20	1	4	2	7	1	8	5	33	28
15000-25000	Moderate	1	1	1	4	0	0	1	8	0	0	3
25000-35000	High	1	1	1	4	0	0	1	8	0	0	3
>35000	Very high	1	1	0	0	0	0	1	8	0	0	2
Total		98	100	23	100	30	100	12	100	15		178
Sum		335500		71000		125000		47500		76500		655500

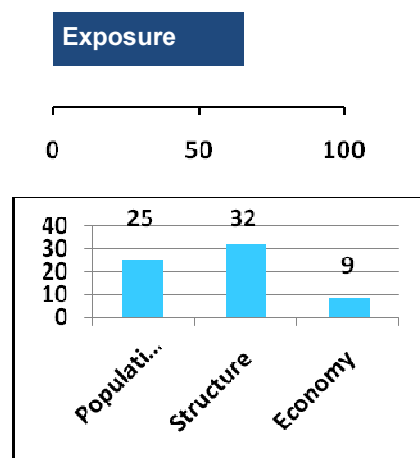
Source: Field Survey, 2012

Almost half of the respondents have transport with a value less than 500 taka (table 10). Flood brings a great loss for the respondents because of the exposure of cycles to flood hazard because it is the only means of transport in the present study area.

Composite Exposure Index

Finally, over all factor score of exposure or composite exposure index was calculated. This score represent higher level of exposure in the present study area. The breakdown of exposure score shows that among the indicator of exposure the score of structure is highest. Because of flood prone construction material of house structure shows the highest exposure. Score of population shows the second highest score. People in the present study area are residing in unsafe and unprotected place. As a result they are highly exposed to flood hazard. Hazardous location enhances susceptibility to flood hazard. Economy represents comparatively low score. The money value of the household contents and outside properties at risk was not that much higher in Narayanpur mauza so that economy score is lowest among the exposure scores (figure 10).

Figure 10: Factor Score of Exposure and Breakdown of it Narayanpur Mauza



Source: Author

Conclusion

People, infrastructure and elements are directly related to flood exposure and are determinant of exposure as well. The more these things have the potential of damage the higher is the level of flood exposure. In Narayanpur mauza almost all the people are regularly affected by flood hazard in rainy season. This study also revealed that the house made of less resistant construction materials are highly susceptible to flood. In This Island most of the people have few assets which are in state of potential damage due to repeated catastrophic flood hazard. The mean money value of household contents and outside elements at risk is comparatively high in village Narayanpur and comparatively low in Satrashia and Debpur among the villages in Narayanpur Mauza. The more is the money value of household contents and outside properties at risk higher is level of community flood risk. Although the money value of household contents and outside properties is not very big amount to hear but the inhabitants have accumulated these properties through much hardship and because of that the level of exposure is very high in the present study area.

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