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Coping Techniques of Local People to Flood and River Erosion in *Char* Areas of Bangladesh

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Abstract
This study is designed to explore the local people survival strategies and assesses variation in people's ability to cope with flood and riverbank erosion of two *char* land (Mid-channel Island) villages of Bangladesh. The data were collected by the application of social survey, key informant interview, focus group discussions and field observation. Most of the people of the *char* land villages were affected by both flood and river erosion. The result of the study showed that devastating river erosion occurred in Shushua *char* as compared with Degreer *char* in 2010 and people tried to adapt with adverse situation by their own techniques. People of both the *chars* were experienced flooding more than two months in the same year. Household's ability to adapt with flood and river erosion depends on people's socioeconomic and environmental conditions, such as education, income and occupation. Though, flood and river erosion cause the loss of lives and properties, people's indigenous coping techniques could significantly reduced their vulnerability without outside assistance. Effective early warning system, integrate local coping practice with modern technology and improve socioeconomic condition in a sustainable way are necessary to reduce the losses from flood and riverbank erosion.

Keywords: Bangladesh, C*har* land, Coping techniques, Flood, River erosion

Introduction

Char land is the Bengali term for Mid-channel Island that periodically emerges from the riverbed as a result of accretion (Elahi, 1991). The *char* lands of Bangladesh can be divided into five sub areas such as the Jamuna, the Ganges, The Padma, The Upper Meghna and the lower Meghna River. The old Brahmaputra and Tista also constitute some *char* land areas. The whole of the *char* land is unstable and prone to annual flooding. The *char* dwellers are some of the poorest and most vulnerable people particularly those who live on the Island/attached river *chars* although people living on the unprotected riverbanks experience similar difficulties (Roy *et al*., 2007). Floods are the main natural hazard faced by *char* dwellers and, in recent years, there were severe floods in 1987, 1988, and 1998 and more recently in 2004 and 2007. In 1987 and 1988, less than 10% of the *char* area was above water during peak flood. By comparison, in the 'high normal flood' of 1991, about 50% of *char* land was flooded. Over 90% of houses were flooded in 1988 compared to about one third of the houses in 1991. Normal monsoon floods in the *chars* tend to be last for weeks rather than months, but floods can occur several times during the monsoon season (Tod, 2007).

The environmental disaster of riverbank erosion is a recurrent phenomenon in riverine Bangladesh which displaced one million people annually. The riverbank erosion displaces formulate and undertake corrective rather than preventive strategies for adapting to their hazardous riverine environment in their own ways. They usually tend to design multiple corrective measures, as none of those is adequate and effective for their purpose (Islam, 2009). From 1981-92 an estimated average of 36,220 people were displaced by erosion of mainland and attached *chars* every year. Island *char* erosion and accretion result more households being displacement Ninety percent (90%) of the within-bank area had changed between *char* and water at least once during the period 1973-1992, with the consequence that the majority of *char* dwellers are likely to have been forced to move at least once during this period due to erosion (Kar and Hossain, 2001). Vulnerability comprises a set of attributes that circumstance turns into susceptibility to impacts (Lewis, 1999), and centers on the *char*acteristics of a group or an individual in terms of their ability to predict, cope with, resist and recover from the shocks caused by natural hazards (Blaikie *et al*., 1994). This study, though, takes vulnerability mean the susceptibility of an individual to the negative impacts of flood and riverbank erosion hazards. Vulnerability depends on several factors like flood and erosion *char*acteristics, physical infrastructure, geographic location, geomorphologic setting and people's cultural, political and socioeconomic condition.

Flood and riverbank erosion is common phenomena in different parts of Bangladesh. People in a flood and erosion affected locality adopt different measures to

reduce the losses. Preventive measures are taken before the event while mitigative or corrective measures are taken during and after flood or riverbank erosion. Various structural (embankment, levee, polder etc) and non-structural (awareness raising, flood warning etc) measures have been taken for flood prevention and mitigation 12. In recent years it become evident that structural methods are neither economically viable, requiring extensive financial investment, nor environmentally friendly (Wescoat and Jacobs, 1993). Moreover, the country's top-down approaches to planning have repeatedly failed to deliver timely and effective flood mitigation (Adnan, 1991) and no specific attention either by social scientist or by government on the land dislocation and population displacement due to riverbank erosion (Abrar and Azad, 2004; Zaman and Wiest, 1985). Therefore, now emphasize on local coping measures is increased and integrate those measures to mitigate flood and riverbank erosion. However, there is very limited and narrowly focused literature available on local people's traditional means of coping with floods 22, 23 and riverbank erosion. This study explores different preventive and mitigative or corrective measures taken by the people of two *char* land villages of Bangladesh to cope with the flood and riverbank erosion. In addition, it evaluates how different enabling attributes, such as education, income and occupation, affect the overall flood-coping strategy.

Materials and Methods

Study area

The study was conducted in two *char* land villages of Degreer *char* and Shushua *char* of Gobindashi and Arjuna union in Bhuapur upazila, Tangail district, Bangladesh. Both villages are located north-western part of the Bhuapur upazila at a distance of 7.5 and 13 Km and are situated in the womb of the Jamuna River. In both villages, the majority of the households are either directly or indirectly dependent on agriculture for their livelihoods.

Data collection and analyses

Primary data related to flood and riverbank erosion were collected separately through key informant interviews, field observation, household questionnaire surveys (open and close ended), unstructured interviews, as well as via focus group discussion with household members from two study villages. Key informants were selected purposively while simple random sampling was used to identify households. A total of 100 households were selected from each study villages for data collection. Secondary data were collected from the Union Parishad office, Upazila Land Office, BWDB (Bangladesh Water Development Board). Data were collected from September, 2010 to February 2011 and analyzed by using SPSS V.12 and Microsoft Excel.

Results and Discussions

Differences in flood-proneness in Degreer and Shushua char

Both *chars* experience frequent flooding, but severity is higher in Shushua than in Degreer due to its low topographic feature. The Shushua *char* suffered high flooding in 2010 experienced average two to three months flooding while flood duration was two months in Degreer *char*. Thus, evidence of flood impacts shows that Shushua is more prone to flooding than Degreer. Table 1 represents different attributes pertaining to flood impacts in the study area.

Table 1. Impacts of flood in Degreer and Shushua *char*

Flood impacts	Degreer *char*	Shushua *char*
Availability of drinking water	45% tube-wells safe	22% tube-wells safe
Loss of earnings	7992.50 Tk./ household	10215.75 Tk./ household
Loss of assets	12040.01 Tk./ household	14650.08 Tk./ household
Food security during flooding	37% of households	18% of households
Access to safe drinking water	48% of households	32% of households
Common diseases and conditions	Fever and diarrhea found in usual manner	Catch cold, fever, diarrhea, chicken pox and typhoid found in severely
Sickness during floods	1.4% of household	1.6% of household
Common flood shelter	Raised school field and roadside	Unsafe own house and roadside
Temporary migration during flooding	24% of households	27% of households
Impact on social mobility	68% absent from school	77% absent from school

Indigenous flood prevention and coping strategies

People of both *char* villages practice their own adaptation techniques to cope with the flooding. People are used to relaying various indigenous strategies; the adoption of a particular set of techniques depends on people's socioeconomic circumstances and the characteristics of the flood. Our study found that, people use various preventive techniques includes the placing of barriers around the house, raising the platform of the house and preparation of *Jagon* (a float made out of water hyacinth and thatch). Other techniques like using *muchan* (an indigenous structure made out of bamboo or wood that is used as a platform) and *Pataton* (houses build with either bamboo or wooden ceiling in the upper part of the shelter where people live), reducing the number of meals and relying on inexpensive food, depending on relief, taking shelter along raise part like road, neighbor house, searching for alternative sources of income, selling assets, borrowing and selling land and other productive assets to mitigate the negative impacts of flood. The following subsections discusses overall preventive and mitigative strategies.

Coping techniques to save human lives

Previous works suggest that in flood-affected localities, coping starts with efforts to save people's valuable lives, such as raising a homestead before a flood. Our study found that, people of both *chars* used *muchan* frequently to rise up their homestead and save their lives. Survey also confirmed, preparation of *jagon* and its application during a sever flood are frequent in Shushua compare to Degree *char*. In Shushua vast amount of water hyacinth deposit during monsoon because of low topographic feature and people can easily collect those to prepare *jagon.* In case of worst situation people of both villages take shelter in relatively safe places like on embankment, roads or nearby *chars*. Though strategies are common in both *char* but it may vary depending on the nature of flood, socioeconomic conditions and geographic location.

Coping techniques to save household items

Earlier study suggest that people try to rescue their assets (e.g. furniture and household products) initally by kepping them on a *muchan* or *pataton* besides to save valuable human lives. Our study also found that, most of the people of both villages used *muchan* to keep their household items during flood. Practice of this technique is relatively higher in Degreer *char* compare to the Shushua mainly because of its high topography. However, 6% people of Degreer and 16% of Shushua mentioned that they moved to safer places with their household items (Fig. 1) by boat or any other available means when the flood water rise.

Coping techniques to save shelter

Villagers in flood prone areas built their house on raised land so that water could not enter into the house during flood. In both villages, people use bamboo, corrugated iron sheet, thatch and wood for constructing their house which are easily to separate and transferable during flood as disaster. In addition, sometimes people make barriers by water hyacinth or place sandbags around the house to guard against the current. Use of water hyacinth barrier around the house is more frequent in Shushua than Degreer *char* because of its avialability. Raising homestead is another option for both villages to protect their shelter from flood. About 5 and 2% respondent of Degreer and Shushua *char* said that they moved their shelter to a safer place during worst cases. Interstingly about 47 and 24% of Degreer and Shushua *char* people do not take any measure to protect their shelter during flood (Fig. 2). In Degreer this is mainly for high topography along with strong household structure but in Shushua, poor economic condition is prime reason for this condition.

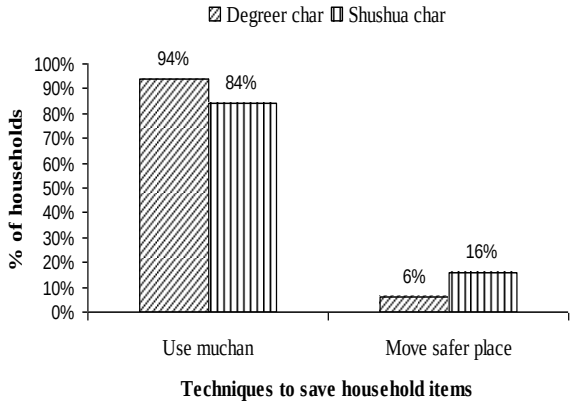

Fig. 1. Coping techniques to save household items during floods

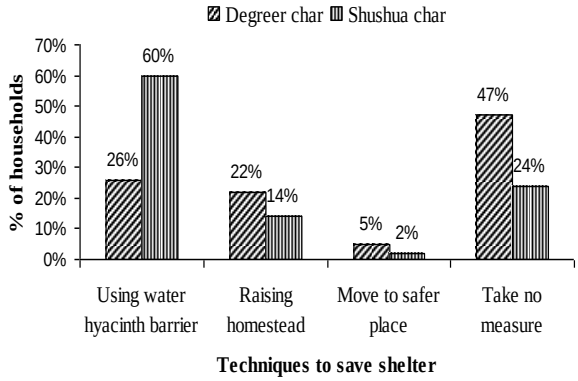

Fig. 2. Coping techniques of local people to save shelter

Water purification techniques

Due to lack of awareness most of people of both villages do not take any measure to purify water for drinking during and immediately after flood. Only about 27% and 19% respondents of Degreer and Shushua *char* boil water for drinking pourpose. Few people of both villages use water purifying tablets and potassium alum for purification of drinking water. Different methods for water purification that are adopted by the both villages is presented in Fig. 3.

Local medicinal practices during and after flood

Suffering from water-borne diseases and related conditions, such as cold, dysentery, diarrhea, fever and skin ailments, are common during and after a flood. It was found that a majority group of people in both villages (69% in Degreer and 62% in Shushua *char*) have taken medicine from local pharmacy without consultation a doctor and similar result was also found in previous study. Furthermore, people of both villages (5% in Degreer and 4% Shushua *char*) use herbal medicine on the basis of their indigenous knowledge to cure from diseases. The most commonly used in both villages are *tulshi* (Ocimum Sanctum), *basak* (Adhatoda Vasica), *thankuni* (Centella Asiatica), *gando vadal* (Gaultheria Fragrantissima), *durba* (Eragrostis Cynosuriodes) and *pudina* (Mentha Arvensis). *Basak* and *tulshi* are used to treat colds and fevers, whereas *durba*, *gando vadal*, *pudina* and *thankuni* are used for stomach problems such as diarrhea and dysentery. About 15% people of both villages do not take any measure during illness (Fig. 4).

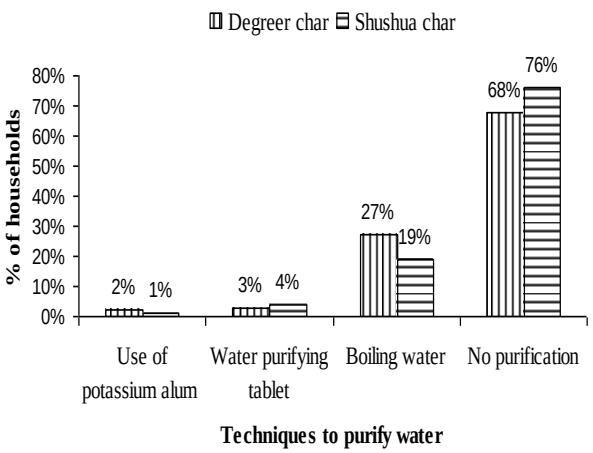

Fig. 3. Techniques to purified water during and after flood affected areas

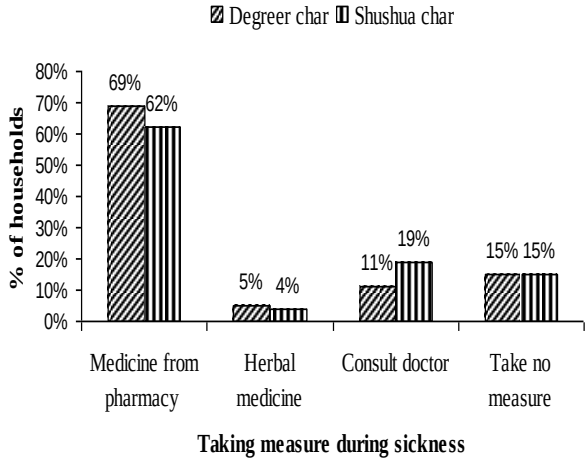

Fig. 4. Local medicinal practices during flood in

Changes in eating behavior

Scarcity of food during and after a flood is a common phenomenon in flood-affected areas. People generally try to cope with food shortage by taking several techniques like reduce the number of meal, depends on less expensive food (flattened rice, Jute leaf as a vegetable). Our study finds that, people of both villages reduce the number of per day meal and rely on less expensive food. About 75 and 95% of people in Degreer and Shushua *char* had decreased their number of meals and increased their dependency on inexpensive food. However condition is more sever in Shushua *char* because of low income level of the most people.

Relation between copping techniques with different variables

Earlier study suggested that, local techniques have a positive result to improving people's adaptability to a flood hazard but it depends on different complex factors like physical and socioeconomic variables. Therefore, the discussion of variations in the adoption techniques considers endogenous factors such as education, income and occupation and exogenous factors, such as external assistance, flood characteristics and riverbank erosion. Our study findings also suggest the same results and there is a practical relation between some variables with coping techniques taken by the affected people of both villages which discussed below.

Relation between household's income levels with coping techniques

Household's income level has a close link to coping strategies. Households with a higher income or with savings can readily help themselves in a flood event and hence are less vulnerable to flood impacts (Penning-Rowsell and Fordham, 1994). Table 2 represents the household's income level is associated with availability of food during and after a flood of

both villages. The findings reveal that in both villages have negligible amount of higher level income group and food is available for them during and after flood. In case of upper middle class, about 50% of them from both *chars* had the storage of food during flooding while most of the low and lower middle income groups of both villages have inadequate food to tackle the situation. However, scarcity of food during flood is higher in Shushua *char* because of its high number of lower and lower middle class income group households. In addition eating behavior varies on the basis of income level. The study found that, except higher income group, all people of both villages reduce the number of meal and depends on less expensive food to cope with the flood. People of Shushua practices these coping strategies more compared to Degreer *char* because of its high number of poor people. Interestingly, the behavior of higher groups is quite different. They prefer to reduce the number of daily meals than consume inexpensive food. The reason for this could be that this group is very aware of susceptibility to water-borne diseases during and after a flood 27.Selling of various assets to cope with flood generally depends on the income level of the affected people. Study showed that tendency to sell various productive and non-productive assets during flood is higher in lower income group of both villages while compare to rest of the income group (Table 2).

Table 2. Relationship between household head's income level and food availability, changes in eating behavior and the selling of assets in Degreer and Shushua *char*

Response	Level of income (Tk.) of household head (HH)									
	LL (0-2000)		LM (2000-4000)		UM (4000-6000)		HL (>6000)		Total	
	HH	%	HH	%	HH	%	HH	%	HH	%
Availability of food										
Yes	3	12	35	29.4	22	42.3	3	75	63	31.5
No	22	88	84	70.6	30	57.7	1	25	137	68.5
Total	25	100	119	100	52	100	4	100	200	100
Chi-square Test: Sig. value = 0.012 with degree of freedom = 3										
Changes in eating behavior										
a) Reduce number of meal										
	12	26.1	33	33.5	25	45.5	5	83.3	75	37.5
b) Reduce meal and rely on less expensive food (both)										
	34	73.9	60	64.5	30	54.5	1	16.7	125	62.5
	46	100	93	100	55	100	6	100	200	100
Chi-square Test: Sig. value = 0.022 with degree of freedom = 3										
Selling of assets										
Yes	14	53.8	26	21.8	10	19.2	0	0	50	25
No	12	46.2	93	78.2	42	80.8	3	100	150	75
Total	26	100	119	100	52	100	3	100	200	100
Chi-square Test: Sig. value = 0.003 with degree of freedom = 3										

Note: LL= Low level, LM= Lower middle, UM= Upper middle, HL= Higher level

Relation between level of education and capturing flood forecasting information

Education level is very important in generating awareness of flood forecasting. Flood warnings can reduce the tangible and intangible damage experienced by flood victims (Parker and Tunstall, 1991). The findings shows that almost all household heads with higher secondary level education of both villages are able to capture flood forecasting information, whereas the numbers gradually decrease among household heads with secondary and primary school level education and among those who are illiterate. Hence, the higher the education level, the greater one's capacity to understand flood forecasting and to reduce one's vulnerability to flooding. Interestingly, literacy rate and different education level of the household heads of Degreer *char* is slightly higher compare to Shushua. Table 3 shows various education level and understanding of flood forecasting information of the people of both study villages.

Table 3. Household head's (HH) education level and capacity to capture flood forecasting information in Degreer and Shushua *char*

Capture forecasting	Illiterate		Primary		SSC		HSC		Total	
	HH	%	HH	%	HH	%	HH	%	HH	%
Degreer *char*										
Yes	13	28.9	12	37.5	14	70	3	100	42	42
No	32	71.1	20	62.5	6	30	0	0	58	58
Total	45	100	32	100	20	100	3	100	100	100
Chi-square Test: Sig. value = 0.003 with degree of freedom = 3										
Shushua *char*										
Yes	21	32.3	8	40	10	83.3	3	100	43	42
No	44	67.7	12	60	2	16. 7	0	0	57	58
Total	65	100	20	100	12	100	4	100	100	100
Chi-square Test: Sig. value = 0.002 with degree of freedom = 3										

Relation between occupation and availability of food

The occupation of the household head is another important factor that influences the adoption of adaptation techniques. The study found that food was available to a household head of both villages engaged in business and it is gradually decreased in fisherman, laborers, and farmers (Table 4). The study also shows that taking loan during and after a flood is highest among laborers in both *chars* (Table 4). This is because the laboring class becomes jobless during long-lasting flooding and mostly loan from moneylenders, bank and nongovernmental organizations at a high rate of interest to meet food consumption requirements, increasing vulnerability due to a flood disaster. Scarcity of food and take lone during and immediately after flood is higher among the various occupation group of Shushua *char* compare to Degreer. However, our study shows that factors like higher income, higher education, alternative job during and immediately after flood, awareness etc can reduce the susceptibility of people during flood.

Table 4. Relationship between occupation of household heads (HH) with availability of food and borrowing of money in Shushua and Degreer *char*

	Farming		Fisherman		Laborers		Businessman		Total	
	HH	%	HH	%	HH	%	HH	%	HH	%
Degreer *char*										
Availability of food										
Yes	20	38.5	2	28.6	5	31.3	17	68	44	44
No	32	61.5	5	71.4	11	68.7	8	32	56	56
Total	52	100	7	100	16	100	25	100	100	100
Chi-square Test: Sig. value = 0.042 with degree of freedom = 3										
Loan to meet expenditure										
Yes	13	24.5	2	28.6	8	53.3	9	36	32	32
No	40	75.5	5	71.4	7	46.7	16	64	68	68
Total	53	100	7	100	15	100	25	100	100	100
Chi-square Test: Sig. value = 0.19 with degree of freedom = 3										
Shushua *char*										
Availability of food										
Yes	12	18	0	0	1	6.3	7	46.7	20	20
No	55	82	2	100	15	93.7	8	53.3	80	80
Total	67	100	2	100	16	100	15	100	100	100
Chi-square Test: Sig. value = 0.026 with degree of freedom = 3										
Loan to meet expenditure										
Yes	29	44	0	0	8	53.3	5	27.8	42	42
No	37	56	1	100	7	46.7	13	72.2	58	58
Total	66	100	1	100	15	100	18	100	100	100
Chi-square Test: Sig. value = 0.37 with degree of freedom = 3										

Riverbank erosion as environmental disaster

People of Both Degreer and Shushua *char* were severely affected by the riverbank erosion in 2010. It causes losses of lives, property (land and crop), displaces people from their original homestead plot. We divided the erosion attack into very quick, quick, slow and very slow 4. Our survey findings confirm that 92% displacees of Shushua *char* have experienced very quick erosion attack and rest of the displacees experienced quick erosion attack (Table 5). In case of Degreer *char* most of the displacees were affected by quick erosion attack while others have experienced very quick erosion followed by slow and very slow riverbank erosion. In addition, displacees also estimated the distance of their original homestead plot from the bank of Jamuna River during their last displacement. Majority of displacees (37% of 200) from both villages established their houses at a distance up to 5 meters from the riverbank. Within this range all displaces experienced quick erosion attack and most of them did not get any proper opportunities for moving their livestock and other tangible properties and goods as well to a safer place from their original homestead plot. Only 13% displacees of both *chars* made their houses at a distance of greater than 15 meters (Table 5) and got the chance of moving to nearby safer places with their possessions.

Table 5. Nature of erosion-attack and distance of homestead from riverbank

Categories	Degreer *char*		Shushua *char*		Both *chars*	
	HH	%	HH	%	HH	%
Nature of erosion attack						
Very quick	20	20	92	92	112	56
Quick	62	62	8	8	70	35
Slow	16	16	0	0	16	8
Very slow	2	2	0	0	2	1
Distance (m)						
≤5	38	38	36	36	74	37
>5-≤10	44	44	20	20	64	32
>10-≤15	16	16	20	20	36	18
>15	2	2	24	24	26	13

Adapting techniques of the displacees

Displaces of Degreer and Shushua *char* undertake their adapting techniques at the individual level, as they are not responded by any organizational sources in this regard. Large scale technological control of structural engineering works are required to prevent riverbank erosion 4 which is absent in both *chars*. Displacees take some corrective measures like shift lives and properties, sell their housing materials and livestock to reduce the loss during and after riverbank erosion. The micro-level social, economic and political environment significantly influences the displacee's local adjustment strategies (Zaman, 1989).

Loss reduction

Several loss reduction techniques such as salvaging housing structure, sale livestock, cutting trees and standing crops are taken by the displacees of both villages to minimize from erosion attack. Our study finds that majority of the displacees of both villages (68% in Degreer and 48% in Shushua *char*) sell their livestock to reduce losses from erosion. Cutting standing crops is another option for the displacees of both *chars* (Fig. 5) though most of the crops are unusable. The loss reduction techniques of salvaging housing structure were practiced by the displacees of Degreer and Shushua *char* (29% in Degreer and 19% in Shushua *char*). This technique helped them to build a house on the nearby *char* or on the land owned by kin or neighbor after their displacement (Fig. 5). Few displacees of Degreer (20%) and Shushua *char* (19%) cut down their trees and saved it from riverbank erosion.

Shift of lives and properties

The shift of lives and properties from erosion threatened homestead to a safer place is one of the corrective strategies taken by the displacees of Degreer and Shushua *char*. It encompasses some measures- the shifting of family members, tangible properties and livestock from the erosion affected area to erosion free area. Earlier study suggested that people of erosion affected area shift their family member first than tangible properties and livestock 4, 33. A perusal of data explores that all the displacees (100%) of both villages shifted their family members from their affected homestead plots to the

embankment, roads, nearby *char* land, relative's shed, neighbor's land etc and to other villages as well (Table 6). The loss reduction strategies of moving tangible properties and livestock accounted for 70% and 84% respectively of both *chars* during erosion.

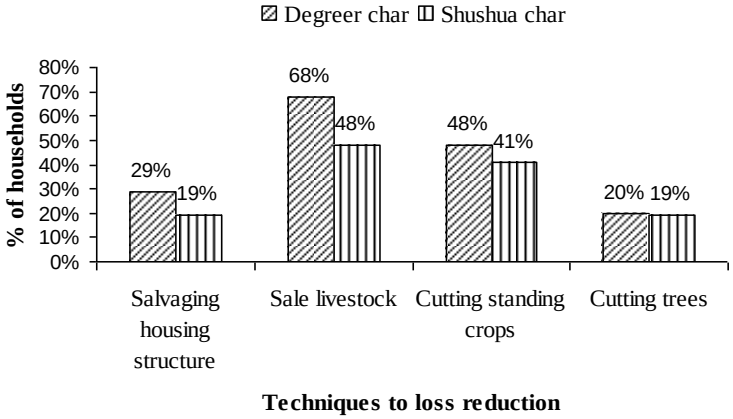

Fig. 5. Loss reduction techniques of displacees during riverbank erosion

Use of movable housing materials

Displaces of both villages widely use the movable housing materials in constructing their houses on the *char* land. It is a purposive type of adaptation techniques (Elahi *et al*., 1991). Study shows that the housing materials were usually traditional in both villages. Housing structure was constructed of local roof materials, e.g., thatch, *Sola (*Jute Stick*)*, CI sheet (tin made sheet) or corrugated iron sheet etc. and wall materials, e.g., mud-dough, thatch, bamboo, CI sheet etc. These materials are easily movable and less susceptible to the damage caused by riverbank erosion and have reusable and resalable value during and after erosion attack. Maximum number of people in two villages use CI sheet as their both roof and wall material. CI sheet is tin made sheet. This is widely used because this is very easy to move and could be used for many years rather than any other materials. Majority of the displacees (90% in Degreer and 98% in Shushua *char*) used corrugated iron sheet (CI sheet) as roof material in constructing of their houses (Table 6) and rest of the displacees used thatch. In Shushua a large number of displacees (48%) use CI sheet as wall material and others use jute stick and bamboo for this purpose. Interestingly, bamboo is mostly used as wall material in Degreer *char* followed by CI sheet and jute stick (Table 6).

Table 6. Coping techniques of displacees during riverbank

Coping techniques		DC		SC		Both chars	
		HH	%	HH	%	HH	%
Shifting lives and properties							
Family members		100	100	100	100	200	100
Tangible properties		64	64	76	76	140	70
Livestock's		90	90	78	78	168	84
Use of movable housing materials							
Roof materials	CI sheet	90	90	98	98	188	94
	Thatch	10	10	2	2	12	6
	Tile	0	0	0	0	0	0
	RCC	0	0	0	0	0	0
	Jute stick	0	0	0	0	0	0
	Others	0	0	0	0	0	0
Wall materials	Bamboo	41	41	12	12	53	26
	Mud-dough	0	0	0	0	0	0
	Brick	0	0	0	0	0	0
	Jute stick	20	20	40	40	60	30
	CI sheet	39	39	48	48	87	44

Note: DC= Degreer *char*, SC= Shushua *char*

Investment pattern

Investment pattern is quite different in two study villages during and after riverbank erosion. In Degreer *char* majority of the displacees invested their capital for purchasing livestock while in Shushua land lease which is locally known as *Medi* is the major investment option. Land lease is frequent in Shushua mainly for its poor economic condition. Displacees of both villages also invested in purchasing movable properties and land and few displacees of Shushua invested their own land. Distribution of different investment pattern to cope with riverbank erosion is presented in Fig. 6.

Stay in the place of shelter

After displacement, the displacees of *char* villages located in the Jamuna River moved to safer part like different riparian villages or in the other safe *char* land. They take shelter on the embankment of the river, on neighbor's land, nearby *char* villages and under the shed of kin or neighbors. They were also supported by their kin or neighbors in having drinking water and sanitation facilities to some extent. Study found that majority of the displacees of both villages sheltered under their kin's shed (39% in Degreer and 39% in Shushua *char*) and on their neighbor's or relative's land (15% in Degreer and 29% in Shushua *char*) and they are locally called *Uthulis*. It is noticeable that 24% of Degreer and 11% displacees of Shushua *char* were sheltered on the roads in the *char* land which is safe from the erosion attack (Fig. 7). They are suffered from the lack of drinking water, sanitation facilities and emergency health care services, and in addition to food crisis and lack of employment.

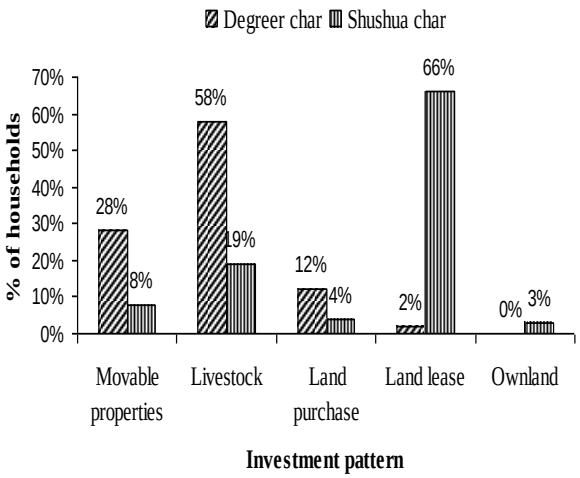

Fig. 6. Investment pattern to cope with erosion attack

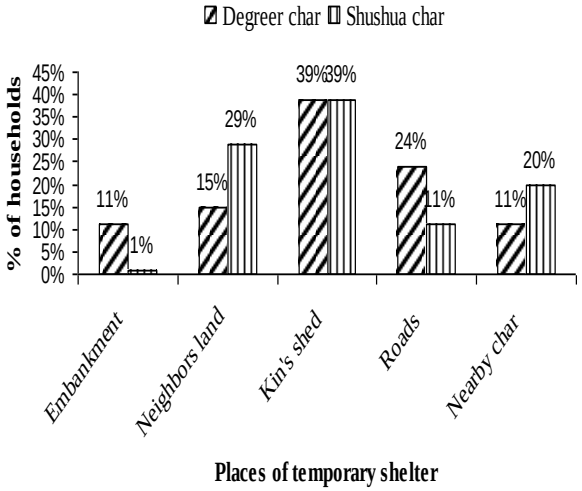

Fig. 7. Temporary shelter of displacees of riverbank erosion

Drinking water use and sanitation situation

It is the inhuman condition that most of the displaces did not access to safe drinking water as the study villages had tube wells but washed away by the erosion. In the sheltered place displacees did not get sufficient safe drinking water in the neighbor's land or kin's land or in the embankment or in the nearby *char*. It is tough to get tube wells in the new *char*. Moreover the owners of such water sources allow displacees to fetch drinking water. It is accounted that 61% Degreer and 39% in Shushua *char* displaces had the safe drinking water availability after erosion attack. It was found that 58% in Degreer and 48% in Shushua *char* displacees had no access to latrine (Fig. 8). From the data exploration shows that only 7% displaces of Degreer *char* got hygienic latrine while 2% of Shushua *char* and rest of displaces got unhygienic latrine (35% in Degreer and 50% in Shushua *char*).

Erosion and displaces ..

Table 7 demonstrates the frequency of shifting of household structure average in year and in the lifetime of the respondent household. Most of the displacees of both villages experience erosion attack in several times. All the settlements in the two study *chars* recorded displacement of dwelling units ranging from 1 to 15 times. Study explored that in Degreer *char* 63% households experience 1-2 time erosion attack every year and 80% in Shushua *char* (Table 7). Most of the respondents in Degreer *char* experienced 7-9 times erosion attack (83%) in their lifetime while only 13% in Shushua *char.*

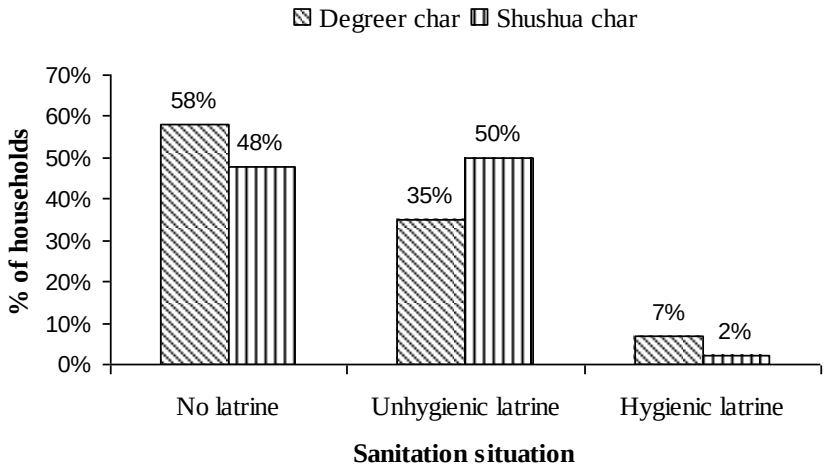

Fig. 8. Sanitation status of two *chars* during and immediately after erosion attack

Table 7. Experience displacement in a year and in a lifetime by the river erosion

Displacement frequency	No. of house holds		Percentage (%)	
	DC	SC	DC	SC
Yearly				
1-2 times	63	80	63	80
3-4 times	36	20	36	20
5-6 times	1	-	1	-
Total	100	100	100	100
Lifelong				
1-3 times	-	43	-	43
4-6 times	17	43	17	43
7-9 times	83	13	83	13
10-above times	-	1	-	1
Total	100	100	100	100

Note: DC= Degreer *char*, SC= Shushua *char*

Floods and Riverbank erosion in the deltaic valley is no small problems. This study finds that flooding and erosion have disastrous impacts on people's socioeconomic condition as well as on the environment The present study relates to two *char* villages in the middle of the country of Bangladesh, both adapting to flooding and erosion by means of a wide range of practices. In the study areas it is seen that the most of the houses is built on CI sheet, bamboo and thatch. People adopted multiple techniques in accepting loss, reducing loss, and in shifting their lives and properties due to flood and riverbank erosion. Finally, this study confirms that although flooding and river erosion in Bangladesh always generates socioeconomic and health related hazards and environmental and infrastructural damage, people's indigenous coping techniques can significantly reduce their vulnerability to disaster. …

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