UPGRADING HOMESTEADS TO FLOOD SHELTERS IN CHAR KOCHKHALI, GAIBANDHA

A Dissertation for the Degree of Master in Disaster Management

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Dedicated to

my parents ...

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Abstract

Bangladesh is known as a riverine country, and has a dense concentration of water bodies. Every year flood inundates most of the part of the country. In this country, there are many rivers, with three major rivers, along with many of the medium size and a lot of small tributaries. Over 250 rivers exist in this country. With all these rivers flowing, there is the presence of many char areas adjacent to the rivers. Due to the flooding in a yearly basis, the char dwellers suffer directly from the devastating consequence. This is why, these people have to constantly acclimatize with the detrimental effects of the annual flooding.

A char is basically a pile of land which is formed by the deposition of sediment for a long period of time. The char land is extremely fertile and has an extremely efficient productivity due to the storage of sediment. The char land is generally not an even chunk all throughout, and has various undulations. Field visits were made on the `Char' area of `Fulchari' upazila of Gaibandha district. It was found that over 400 families live in the char, among which 150 families live on the higher land and around 50 families live in middle land. The rest of the dwellers live on the vulnerable low lands mostly prone to extensive flooding. Char dwellers livelihood mostly depends on agriculture, fisheries, daily labour works and other small business. People of the char lives on a char because they believe that even if they loose land after a flood, another piece of land will rise in return.

There were many occurrences of extensive flooding in the past, the flood of 1998 being one of the most devastating ones. The government and various other organizations have worked on the efficiency of rehabilitation of the flood affected people. But due to the lack of technology and the lack of co-ordination, the progress in addressing the problem is moving in a snail's pace. No work policies have been thought about for the char dwellers in the agenda. In the light of this objective being neglected, this study has been conducted. In the study char area, man;, resources and materials have been found which the people are generally using for their living and house-making.

In the particular char Kochkhali the dwellers are predicting that the chunk of land will survive for another 5 to 6 years. This prediction has drawn people from other chars to come and settle there. The generally accepted situation that the char dwellers have to cope with is the lack of communication, education and various activities that may generate income due to loss of valuable fertile land. All these culminate into the results which show that the lack of organized settlement pattern and the lack of technology of making stronger and safer homestead is an issue that makes the char dwellers vulnerable due to flooding.

Vegetation is profoundly found all over the char areas, owing to the fertility of the soil of the char. People do vegetation in their surroundings, on the roof and also on bamboo sheds, which fulfill their daily food need. Using all these resources and materials, there can be ways to make an individual homestead both flood protective and economically sustainable with a little bit of knowledge on technology and efficient usage of the available raw materials. So this can be a way of mitigation of flood.

This study was to find out a way of making an individual homestead as a flood protective shelter. Through the study, the needs, the habits, the daily life cycle, the hardships and the expectations of the char dwellers were observed and analyzed. The main purpose of the study was to come up with some ideas as to how these people can survive better in the worst possible conditions.

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List of Abbreviation and Glossary of Terms

CDC - Char Development Committee

FRIENDSHIP International (FI) - is a humanitarian organization based on Luxembourg. It works basically on health issues.

SKS - Somaj Kollan Songstha is a government organization of Bangladesh.

NGO - Non Government Organization

Char - A Char land is basically a pile of sediment brought by rivers from the Himalayan region and it forms in 2-3 years.

Kaisha - Is a locally grown plant which found everywhere in a Char, used as a material of house building.

Ghat - Is a place where boats stop sailing and people wait to go another place and do loading and unloading.

DPB - DIPECHO Partners in Bangladesh

ECHO - European Commission Directorate General Humanitarian Office

DIPECHO - Disaster Preparedness ECHO

Chapter 1

Introduction

1.1 Background of the Study

Human beings exist in this world in an adapted ecological relationship with the surrounding environment and have to live with a variety of natural hazards which threat life and property. River flood is the most common type of global hazard, encompassing a wide range of events from largely unpredictable and localized flash flood to anticipated widespread floods. Floods are the cause of most natural disasters affecting society. Flood accounted for about 30 percent of all natural disasters and 40 percent of the fatalities. Recently the occurrence of devastating flood has increased which may be caused by human interference with the nature. (Sheehan and Hewitt 1969, sited by Alain B.J. 2000).

Flood is a perennial problem for Bangladesh. Almost every year flood causes enormous damage to the people and economy of the country. To reduce the problem a lot of investment has been made to build embankments to protect important areas. The current records of damages by flood demonstrate that these measures could not bring about the desired results. Considering the geography of the country and amount of flood water in monsoon period, it may be concluded that only the structural measures to cope with flood may not be very successful. Together with structural measures such as building embankments and structures, other evasive measures may also prove to be highly effective. EN asive measures may include flood shelters which is similar to cyclone shelters (BUET-BIDS, 1992 as cited by Alam B.J. 2000).

Every year River Brahmaputra inundates the lower Char area of Gaibandha district specially the Fulchari and Saghata Upazilla. Due to this flooding, people of that particular area becomes vulnerable. They lose their land, livelihood and properties. Some of the people migrate to another Char or to City areas. During flooding people who have a stronger structure built on a higher ground, can survive and stay. But if they fall in a condition of erosion then they move to another char. In a char people make their house by very light and cheap materials (because of the financial ability) which are available. The materials with which the houses are built can barely withstand against the force of the strong winds. Another advantage is that people can easily dismantle their house and can take it to another place. Also they are not that much capable to strengthen their house. So there are some factors

which remains year after year and they remain in the same condition. Another drawback is that in most of the char areas there are very limited, if any, flood shelters. Within the Fulchari Upozilla, there is only one flood shelter which is situated at "Mollahr Char". Mollahr Char is the biggest Char of Fulchari Upozilla and has the highest population density. Interestingly, during flooding the male family members only send their women, children and livestock to the flood shelter but they themselves do not go there. The reason is that they guard their homestead and belongings.

Every year Bangladesh experiences flood in small or large scale. We can find many flood shelters in the flood prone zones. We have many flood shelters. But most of them are not adequate for all the village people living nearby, as a result most of the time the flood shelters become over-populated. A flood shelter is also very expensive to build. It needs many flood shelters to accommodate the maximum number of people. It is also not feasible to take all the flood affected people in the shelter. So the solution can be to improve individual homestead as a flood protective shelter. In order to find out a better solution to make individual homestead as a flood shelter this study has been conducted.

1.2 Definition of Flood

A definition given by J.B. Alam on Flood is

..... discharges which exceeds the channel capacity of a river and then proceeds to inundate adjacent flood plain ". (Alain B. J. 2000)

"A temporary rise of the water level, as in a river or lake or along a seacoast, resulting in its spilling over and out of its natural or artrftcial confines onto land that is normally dry. Floods are usually caused by excessive runoff from precipitation or snowmelt or by coastal storm surges or other tidal phenomena ". (littp:11www.thefreedictionary.com/flood)

1.3 Definition of Flood Shelter

From a report of J. B. Alain on `Village Infrastructure to cope with the Environment", his conceptualization of a flood shelter is a large masonry permanent structure which is defined as a place to take shelter during any disaster period especially during flood. Basic materials of a flood shelter are brick, iron, sand, cement and water. Sometimes it is made by concrete. A flood shelter is made for at least 20-25 years to serve. It should be built on a stable flood free high land. Construction cost of a flood shelter is very high. So it should be sustainable

with its extent. People take shelter during flooding for maximum 14 days. So it has to be that much functional that it can accommodate people and also can serve the function of cooking food, space for storage, relief materials space, the place of medical care and adequate toilet facilities for both male and female. But most of the time these flood shelters cannot take the overload of population at a time. As a result, the situation becomes severe. So it needs more shelter to protect people from flooding. One initiative can be taken to improve individual homestead. It is possible if people can prepare themselves by taking pre disaster preparation as precautionary measure. First they have to learn about the preparation before flooding. Char dwellers already know about flood and erosion hazards and impacts of these. People (char dwellers) already have the knowledge to store and keep their belongings safe. Another thing is that they already have some indigenous knowledge to protect their homestead from flood water. Sometimes they migrate to another char when they loose their homestead. But it can be improved if they think about strengthening their homestead.

1.4 The Creation of Char

A Char land is basically a big pile of'sediment brought by rivers from the Himalayan region, and it forms in 2-3 years. When it gradually becomes stable, people come to live there. A char also forms by erosion of river banks. It is a common nature of a river to change its course because of river meandering effect. A river cannot flow in a constant path; **as a result** it erodes on one side and piles earth at another side. When it gives a land it also gives the high quality of fertility. So the Char becomes a most ideal land for cultivation. But the thing is the farmer who cultivates the land cannot afford better seeds and fertilizer to grow a big **amount** of crops. Whatever they get is by the ultimate fertility of the soil. In a Char we can find vegetation around a homestead also. Women are the **main pioneer** of this vegetation. They do it for the daily family need. Sometimes they sell their vegetables to the **nearest** market. Many **Banana** tree surrounded by the homestead are seen in char **areas.** It is because these Banana tree fulfils their family need. Another advantage of having **Banana tree is, it** very much helps during any disaster especially during flood. People make rafts **using Banana** tree trunks in order to evacuate and go to another place. They also use it for transportation during flooding. Chars are nearly created from the river and are consequently low lying. This makes Char dwellers vulnerable to flood and erosions. The soil is relatively high salinity with low contents of organic materials, which causes low fertility compared **to mainland.**

Individual and household mobility is high and displacement is common in char areas. A fragile physical environment, limited assets, reduced income opportunities; remoteness and absence of mainland institutions and services together make char dwellers livelihood particularly vulnerable to extreme poverty and destitutions. M estimated 6.5 millions people live in 28 char Upazillas of five districts and 2 millions people living in the chars are extremely poor. This situation of Brahmaputra chars sub regions focused govt. attention for better integration of the regions into Bangladesh wider socio-economic development. Keeping this in view, rural development and Cooperative Division initiated the Chars Livelihood Program (CLP) with the financial assistance of UK Department for International Development (DFID). (Source: report on "Chars Livelihood Program")

Durability of char land depends on the movement and nature of the river. When it seems stable people go to the char and start living. Especially when they understand that the particular char is going to sustain for another 5-6 years if there happen no major hazard. People who already lost their land in the river they get the char again and try to find out their land if they are lucky. But the common scenario is different, because the original owner can hardly get their land back because of some hidden groups. So they (char dwellers) live in the char by taking the land for a lease basis from some owner who is not inhabitant of the char. They live far from the char and take money from the renter. But the sufferings are not finished yet because after the hazard people cannot recover the lost. After a disaster people becomes homeless, lose their livelihood, their assets, their communication, education and so many things. Then people try to just manage the food, even some financially stable family. Financially stable family can overcome the situation faster; they raise their homestead and can do vegetation. These are the information which has revealed from the interview. There is some family in the char, who are the victim of the recent flood event and came there to live. But they only got the temporary permission to live there. But they are still living there for four months and some of them for a year but still they are not permitted to live there for another several years. A lease is basically a contract between the land owner and the renter till the sustainability period of the char. People who are living the char have some plan to improve their homestead. But they cannot do because they are still living under temporary permission. Some of the NGO and social organizations are doing some help for those people. In particular they help char people to raise their homestead and make a better house; CLP (Char Livelihood Program) is one of them.

1.5 About Char **Dwellers and Their Livings**

In `Koachkhali' char area people are basically farmers. Some of them are daily laborer, who works near the char area. Sometimes they go to far off areas to find jobs. Some of the people are engaged in small business and some of them are fishermen. Char is basically an upland; a storage of sediment for a long time carried by the river from upstream mountainous region. Char is actually a return of the river. Because river erodes one part of it and makes land on the other part. When a river changes its path then it erodes one side of the settlement on stable land. It is because of the meandering effect of the river. So by this situation people who become victims of loosing land goes to another char area or town to settle there.

The living pattern of the char dwellers is very simple. The houses generally have thatch roofs and *`kaisha'* made walls. Some of the house roofs are made by Corrugated Iron (Cl) sheets. But the walls are made of *`Kaisha',* jute stick and Cl sheet. It depends on the financial ability of the household. Some homesteads are built on a higher and more stable ground. But most of them are on low land because the household is unable to raise the plinth. Below there shown some images of typical houses of the char.

Photo 1.1: Image of a thatched roof house

Photo 1 .2: Image of a Cl **(Corrugated Iron) sheet house**

Photo 1 .3: Image of a house made by two different **materials** (CI sheet and **Kaisha)**

Social bonding between the char dwellers is strong. This strong communal bondage is natural, because in a char the world is very small for them. Being physically detached from the outer world, they only have themselves by their side all the time. Every family on the char knows all the other inhabitants. Their scope of activities and thinking are quite limited. The social bond becomes stronger during the disaster period. In that time people help each other to rescue themselves. Generally people gather after the evening and gossip. In the whole day they do their work and keep themselves busy. At the evening they finish their

work and sit together to chat about their daily activities. Some of them take rest. Some go to the nearest bazaar which is basically *a 'Ghut'* of the river. Then at night they return from the *'Ghat'* to their respective houses and go to sleep. The same cycle of life repeats from the next day. This is the daily life of the char dwellers. There is only one primary school in that char area. But there is no high school for the students. The students have to travel by boat and then have to walk for miles to reach their school, which makes it harder for them to study with comfort. The inhabitants of the char have to travel at least 6-7 miles to a far away town in order to serve their purpose. This is the situation in which the char dwellers live.

Because of the flood, a char land naturally gets high level of fertility due to deposition of sediment. In one hand the river gives them flood and when the water recedes then it gives fertile soil. The soil of a char land is basically sandy loam soil. The soil produces many types of crops like paddy, wheat, sugarcane, pumpkin, tomato, potato and many other crops. But people can cultivate only for 8-9 months in a year because the rest of the year the seasonal flood doesn't permit the viability to produce crops. In these 8-9 months people produce crops. Banana tree is one of the top growing trees in a char area. The availability of *'Kaisha'* and other naturally growing plants is worth mentioning. People can easily take care of their cows and domestics by feeding them the *'Kaisha'*. Char people do vegetation over the year if they get chance. They plant various types of vegetables on the surroundings of their homestead. It fulfills their food requirement of daily need. Also they collect some fire wood from the char land and use them for cooking purposes. The river that surrounds char gives the char dwellers the advantage of fishing, which helps them, feed their families and also generates income. Despite these advantages, the char dwellers always face the scarcity of food. The families living there cannot fulfill their daily needs only by fishing, and the livelihood options are very limited. They cannot do various types of work because of the lack of communication, infrastructure, education, poverty etc.

Banana trees also help to protect people homestead from erosion during flooding. It acts like anchor for earthen upland. People of char cultivate some common crops which are cost effective and take short time and limited fertilizer and nurture. The common crops of the Char area are Paddy, Wheat, Golden Fiber, Jute, Sugarcane, Nuts, Sweet Pumpkin, Green pumpkin, some vegetables, and also vegetables of the winter season. They produce these crops with minimum cultivation and care. But if the proper amount of fertilizer is used in the

correct proportions along with proper nurturing, the production of the crops could be tripled by volume.

One good thing which found in those areas is that in some of the houses sanitary latrines were found in a good condition and being very well maintained. Most of them are a result of the intervention and contribution of some local and international NGO's. The names of some NGOs are SKS, Gono Unnayan, Action Aid Bangladesh, and FRIENDSHIP. These organizations have trained the local people and gave them loan to build a hygienic toilet for their families. And also they have trained those people to maintain the toilet well. Some of the cluster house community has built individual toilets and other families which are unable to build a toilet only use and maintain it. For the training these NGO's do some yard discussions and also focus on group discussions with the villagers. In those discussions they train them about how to use and maintain the toilets and give them guidance and ideas about the importance of hygiene and proper sanitary habits.

In that particular study char area some positive aspects of sustainability are found. They are like deep tube well, mosque, primary school, some raised homestead and cultivation and vegetation around the homestead. Especially women are the main pioneer of this vegetation. They do it both for their own and for the livestock.

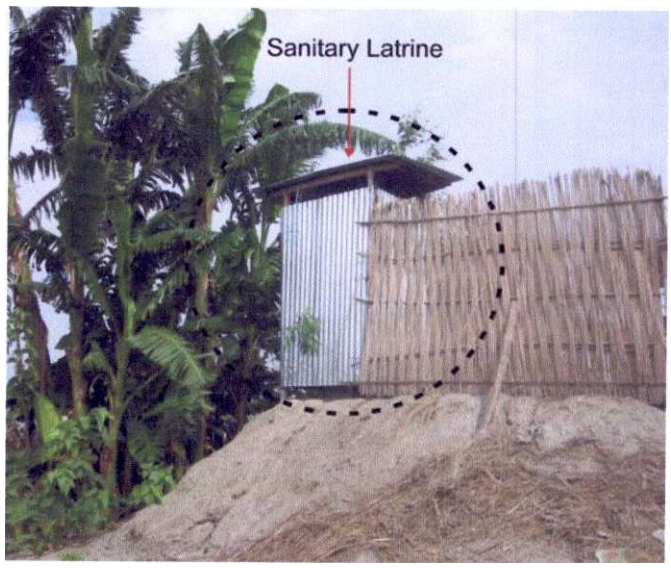


Photo 1.4: Sanitary Latrine of a homestead

In every homestead, people have planted various types of vegetations. The common vegetables of the char areas are Green Chilly, Onion, Garlic, sweet Pumpkin, water Pumpkin, several types of green vegetable, rice, wheat, Golden Fiber and Nuts. They do this around their homestead to protect their homestead from erosion. Below there are some pictures showing vegetation around the char dwellers' house.

Photo 1.5: Vegetation surrounding of the house

In char areas some people built their house on low land, which gets completely flooded during full monsoon. During the field survey in Jun-July of 2010, it was seen that the low land area went totally under water. Below, two pictures show two different scenarios. The left image shows the scenario of the low land areas during the full monsoon period, and the image on the right shows the scenario of the homestead built on the same land after the flood water receded.

Photo 1 .6: Two different scenario of the Lower **char area**

The images below depict the people of the area showing the level of rise of flood water during the full monsoon period.

Photo 1.7: A person is showing the water level of recent flood

From time immemorial, people of Bangladesh prefer to settle along the bank of the river. Fertility of soil and stableness of the river regime guide the density of the habitation. Habitation along the flood plain bank of the river decreases flood passage of the river. In the river there are habitations along the both bank of the rivers. People live in very close proximity to the active river channels and are exposed to high risks from erosion and channel changes. In a flood plain, land use practices depend mainly on the depth of flooding due to population pressure, crop variety and intensity has increased. And low-lying area, fallow and pastureland are being cultivated to cope with the increasing demand of the food gain. The flood peak of old Brahmaputra is in fluctuating in nature. (Alam *et al* 2007)

1.6 Objective of the Study

Char exists in many areas all over the country. A large number of populations live in those areas. These people mostly have a strong reason to settle in these regions. They might have some land that their forefathers have passed on to them. Or they might have some suitable kind of livelihood for which they tend to live at the Char. Another reason is that they have no relatives in the city area to take them there. They also have no such basic education to go to the city and find a job. Instead, they are living at their native places. It is positive for them that they are not migrating to somewhere else. But some of them migrate to another place

because of the flooding. Why do they leave? They leave because during flooding their house goes under water. As their house was built on a low land, they did not have the ability to make a better house for themselves. These observations have channeled the focus of this study. The study conducted was meant to find out a way of making individual homestead as a flood protective shelter to withstand flooding. The study has also focused on finding the structural issues on which the strength depends. A locally grown plant "K.aisha", which is readily available in char areas and very much useable of making the roof and wall of house, is considered within the study. The availability of the Banana tree and its multi-dimensional usage in day to day life is another aspect which is considered as a strong resource within the study.

The specific objectives of the study are:

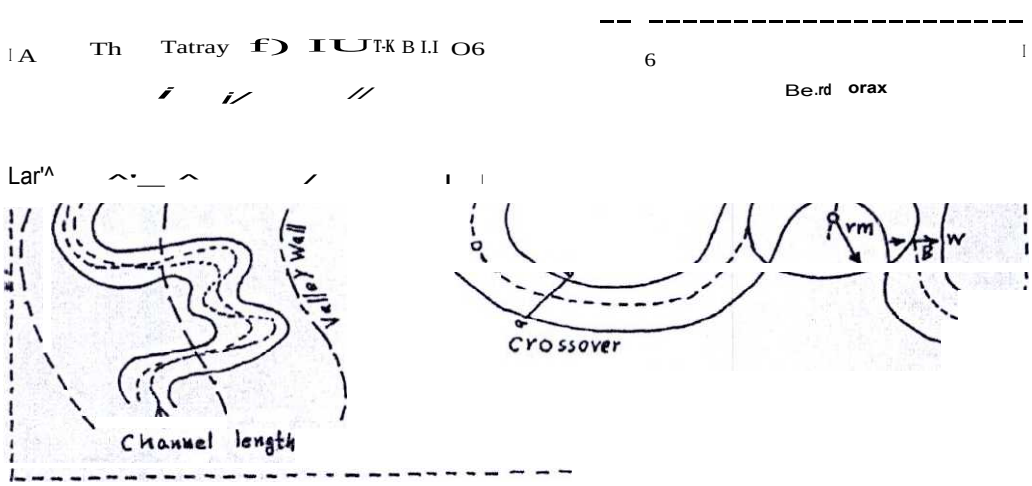
- **To find out the strength of** the Char **land and take it as a positive tool**
- **To find out a solution for making a strong and sustainable homestead against flood**
- **To find** a way **to make a homestead that can enhance the economy of the household**

1.7 The **Development** of Char in **Brahmaputra Rivet-**

Bangladesh stands on a thick alluvial deposit. It is the result of deltaic activity of the Ganges and the Brahrnaputra. These main rivers, their tributaries, and distributaries control its hydrological and morphological behavior. The Padilla, the Meghna, the Jamuna are the big and wide rivers of Bangladesh. The Buriganga, the Surma, the Kushiyara, the Monu, the Sitalakshya, the Dhaleswari, the Tcesta, the Gumati and the Karnafuli are small rivers. Rivers differ from one another in their physical characteristics and general behaviors. Among these small rivers, the old Brahmaputra is an active river and play important role in the morphological changes of the rivers of downstream. Constant changes of the river course constitute a significant factor in the hydrology of the Brahmaputra; the most spectacular of these changes was the eastward diversion of the Tista River and the ensuing development of the new channel of the Yamuna, which occurred in 1787 with an exceptionally high flood in the Tista. The waters of the Tista suddenly were diverted eastward into an old abandoned course, causing the river to join the Brahmaputra opposite Bahadurabad Ghat in Mymensingh district. Until the late 18`x' century the Brahmaputra flowed past the town of Mymensingh and joined the Meghna river near Bhairab Bazar(the path of the present-day Old Brahmaputra

channel). At that time, the course of the Yamun River (now the main Brahmaputra channel) was a minor stream called the Konai-Jenai, which was probably a spill channel of the Old Brahmaputra. The cause of morphological changes of the rivers is sediment transport. The rate of sediment transport in rivers depends on many variables, such as water discharge, average flow depth, flow velocity, energy slope, shear stress, stream power, particle size and gradation as well as temperature. Based on concept of dimensional analysis and similitude argument,, hossain

After being rainforced by the Tista flood of 1787, the Brahmaputra began to cut a new channel along the Konai-Jenai and gradually converted it after 1810 into the main stream, now known as the Yamuna. So the study is strictly focused on the old Brahmaputra river. The study provides the finding of morphological change, its cause, and its effects by using remote sensing and GIS. Channel morphology is the result of mutual interactions of four broad categories of variables such as fluid dynamics (which include velocity, discharge, roughness and shear stress), channel character or channel configuration (e.g. channe! width, channel depth, channel slope, channel shape, channel pattern etc.), sediment load and bed and bank materials (composition of character i.e. coarse, fine, medium etc.) bellow Figure 1.5 shows its different variables of channel morphology. Fig 1.6 shows the different types channel pattern. The rivers studied are meandering rivers in pattern. Different types of meander changes are shown in fig 1.7. Many researchers use remote sensing technology in studying **channel pattern** study. (Alain, *et al* 2007)



Figl.l: Channel from- valley walls, channel length, meander belt axis, crossover, curvature of radius (rm) and channel width. *(Source: Alum B.J. et al)*

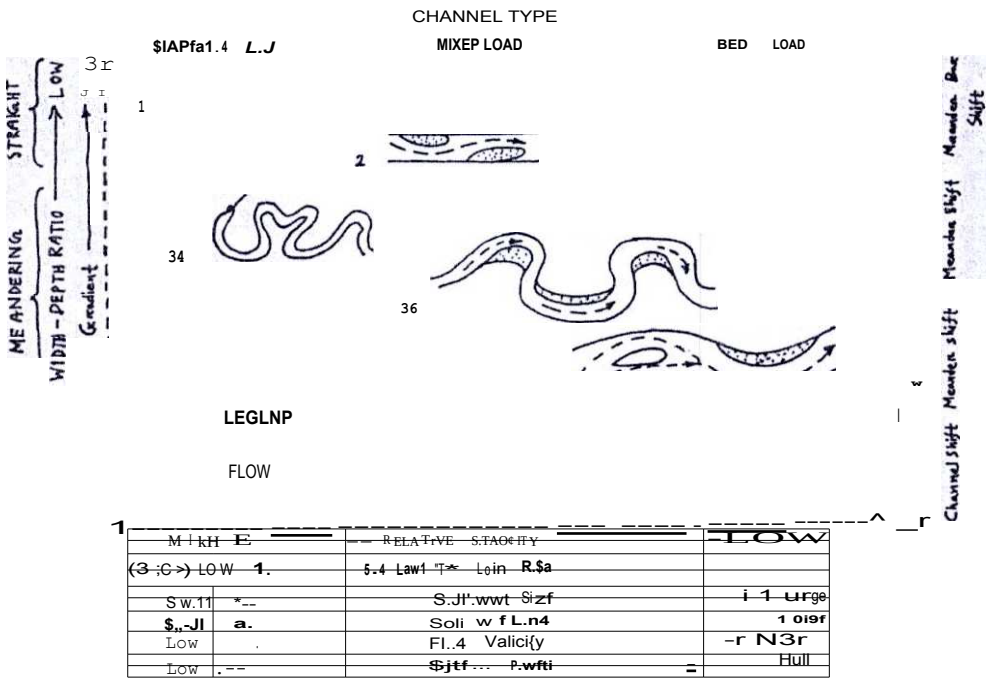


Fig 1.2: Channel type of Brahmaputra River *(Source: Alam B.J. et al)*

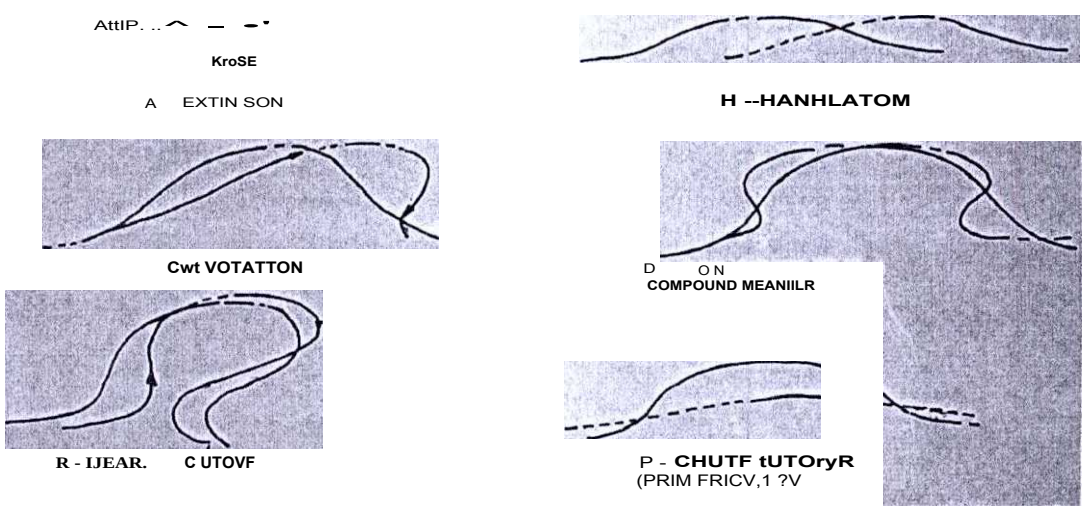


Fig 1.3: Different types of meander changes *(Source: Alam B.J. et al)*

1.8 Flood Scenario in Bangladesh and the Flood of 1998

Flood is a recurring problem in Bangladesh as it is a lower deltaic country. Some part of India and Bangladesh experience flood almost every year with considerable damage. Flood statistics for Bangladesh are available since 1954, 1955, 1974, 1987, 1988 all caused enormous damage to properties and considerable loss of life. During middle of 1998, Bangladesh experienced the most devastating and prolonged flood in the history which caused serious disruption on the economy of the country. The extent of damage cause by the flood is estimated to be around 3.0 billion US dollar (Annual Flood Report, 1998).

The prime reason of flood in Bangladesh is heavy rainfall in the upstream of the rivers going through the country. Three major rivers of the world discharge into the sea through Bangladesh. Heavy rainfall over the catchments of these rivers could produce an average runoff of about 1009000 million cubic meters (ibid).

In the monsoon of 1998, due to excessive and intermittent rainfall in the country and the upper catchment areas from July to September, all the rivers of the country experienced significant increase in flow far above the danger level. The flood situation started to become alarmingly worse from the middle of July and by this time the low lying areas of the country had already gone under water. At that time, about 45000 sq.km.of 37 districs of the country were affected by flood. Although flood situation started improving in early August, the flow of the two main rivers of the country-1 adma and Brahmaputra-Jamuna increased significantly in the middle of the august (ibid). This was caused by heavy rainfall in the upper catchment areas. By the end of August flood situation become worse and about 60000 sq.km area of 42 districts were affected. During the early September the flow of the major rivers increased adeptly worsening the condition. The flood situation become worse in the second week of September and about 75000 sq.km area of 52 districts were affected during that time (Alam B. J. 2000). The flooded condition existed from early July to the last week of September, for more that three months at different places in different magnitudes. Thus flood of 1998 became the most prolonged flood in the history of the country. The total flood inundates area was about 100250 sq.km (68 percent of the total area of the country) affecting 53 districts (Annual Flood report, 1998,)

1.9 Flood **Shelters in Bangladesh**

According to the DPB (DIPECHO Partners in Bangladesh) Research, generally three types of flood shelters are seen in Bangladesh: Individual homestead, Community Flood Shelter and School cum Shelter.

The Individual type is basically a house on a raised plinth. The plinth level is raised considering the perceived highest flood level and in a manner so that the household assets such as cattle can be accommodated and homestead gardening can be done on it.

The Community Flood Shelter is a large earthen mound with the provision of accommodating a large number of people. Some community shelters have structures erected on them where schools and other community functions are held during normal time. The other normal time uses of community flood shelters include play ground and local market. Usually community flood shelters keep provision of toilets and water supply for the shelter seekers and they can bring along their cattle during emergency.

The school **cum shelter** is a building structure standing on stilts. The ground floor is for cattle and people take refuge upstairs. During normal time the whole building is used as a school and in flood time the school functions are recognized.

According to the DPB research, SWOT analyses of different types of shelters are given below.

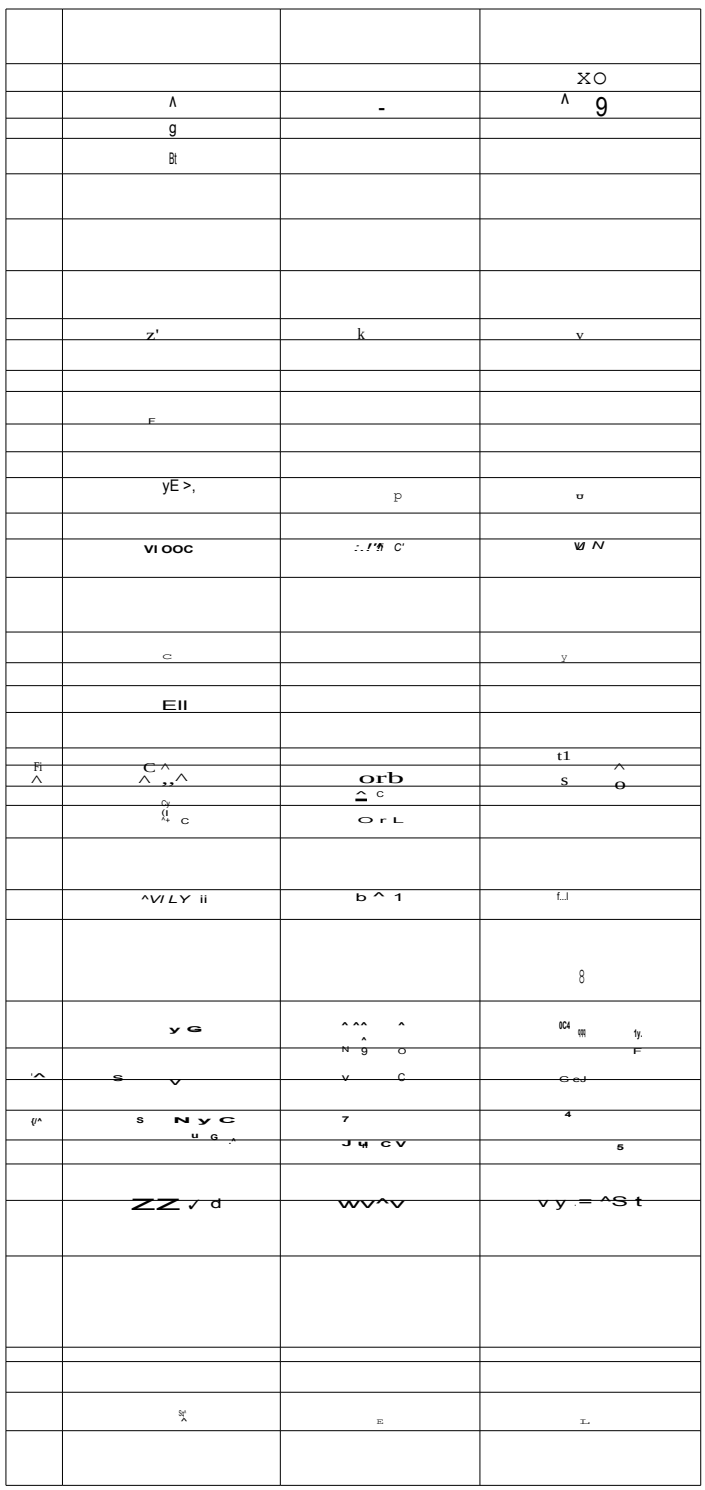


Fig 1.4: SWOT analysis of different types of shelters

Chapter 2

The study area

The name of the study char is `Kochkhali '. The original name is `Harodanga.'. The new name becomes famous among the populations of Kochkhali char which was another char in another area. In Bangladesh we have over 200 small and big rivers of which 3 are the major. The Ganga, the Meghna and the Brahmaputra. These three rivers carry all the water from the Himalayan region. The study area falls under the basin of the Brahmaputra river. Every year flood inundates most of the area of the river side. As a result people move to another place. Those who can take preparedness measures to stand against flood can survive. The basic reason of getting inundated is the low land which becomes the basin during rainy season.

2.1 Location

Char Kochkhali is situated in Fulchari Upazila of Gaibandha district. Gaibandha district is situated at the north western part of Bangladesh. It is surrounded by district Rangpur at the north, Dinajpur and Jaipurhat at west, Bogra at the south and Brahmaputra River at the east side. The area of Gaibandha district is 2179sgkm. Total population is 2130 (male 1079, female 1051) (Geo Consult 2008-9). There are seven upazilas in Gaibandha district. Fulchari and Saghata are the two upazilas, which are situated beside of Brahmaputra river. Some of the parts of these upazila belong to the char area of Brahmaputra River. In the char area most of the people are involved with seasonal cultivation of paddy and some agriculture. Sonic of them are living by fishing. Crop production is very high on these areas, because the soil is very much fertile. Every year a huge amount of sediment stores on these areas due to flooding and surrounded by water. Character of homestead is basically light. The roof is made of straw and *'Kaisha ' a* locally produced plant, walls are made by mainly bamboo sheet, because it is easier to dismantle and can be transported quickly. One thir1g is noticeable on those areas, that cow rearing and goat rearing is practiced widely. Each family of the char owns at least two cows and some goats. Ducks and Chicken are also reared. Because they have plenty of supply of green grass and *'Kaisha'* which are the main feed for the cow and goat of the char land, it is an ideal situation to rear the domestics. Plants are growing without any disturbance.

Study area:

`Kochkhali' Char of Fulchari Upazila of Gaibandha district

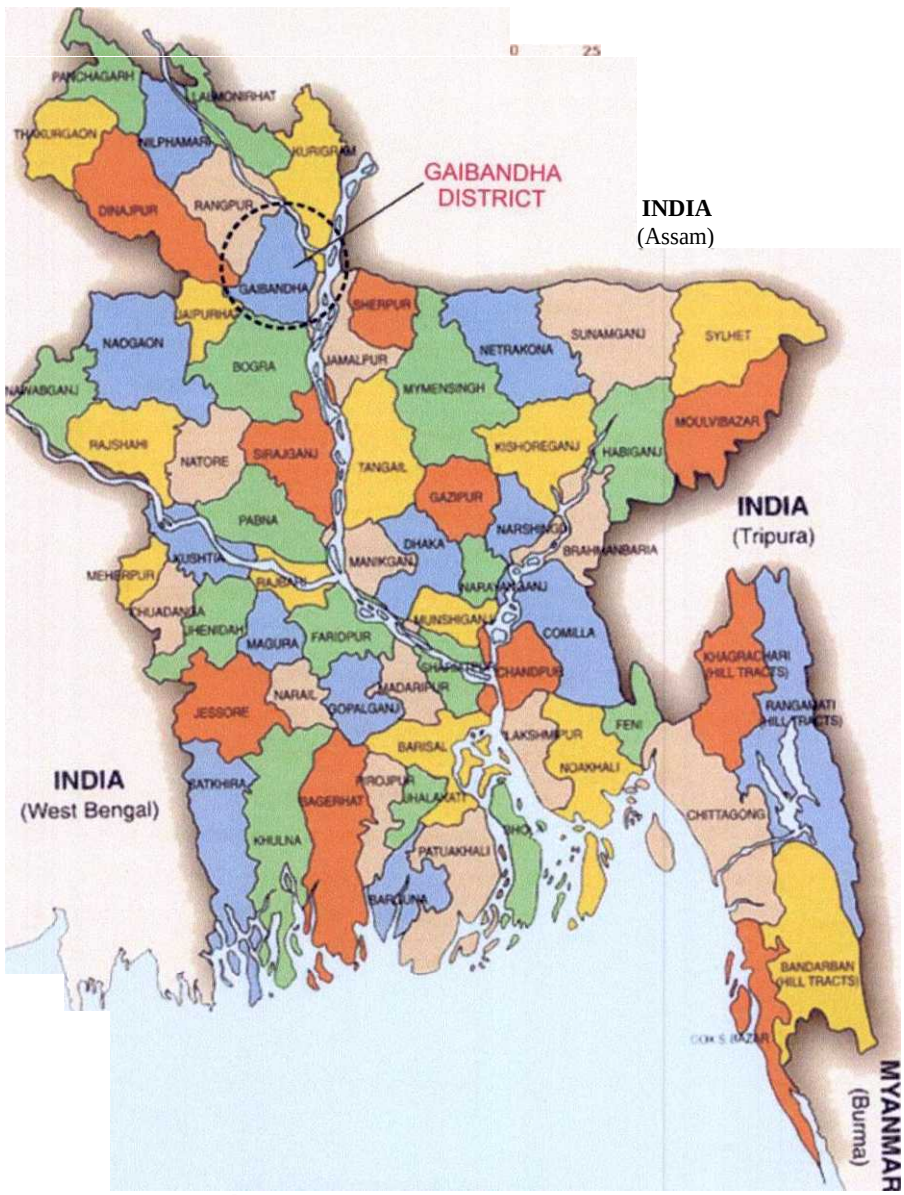


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Fig 2.1: Gaibandha district indicating map

Location of Kochkhali

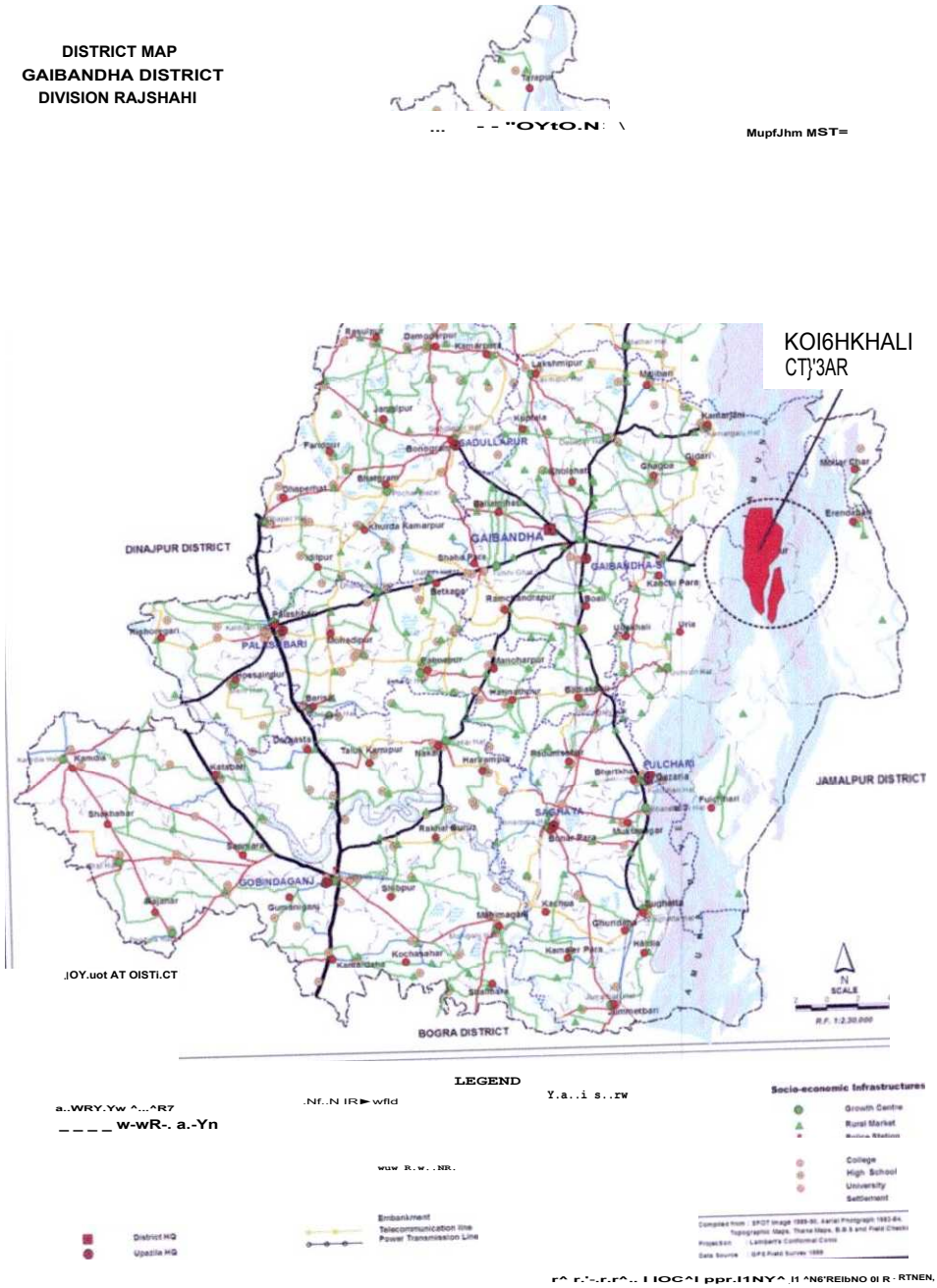


Fig 2.2: Kochkhali Char indicating map

Vegetation is noticeable around individual homestead. Vegetation is both for people and their domestic animals. It is a very big plus point for them to live. But very basic problems are also faced by the char dwellers. They have the problem of communication and electricity. They have the problem of educational facility, and also the absence of civic amenities. In spite of these problems, they are still surviving. They have some limitations like they have less land. In char area most of the char dwellers have taken their land in a verbal contract basis from some land owners, who have been encroached the land by muscle power or with some link with the local government.

2.2 Floods in Kochkhali and Resultant Activity

In our country we have three spells of rainfall. They are pre-monsoon, full monsoon and post monsoon. Pre-monsoon period starts from April-June. And this is the season for cultivation of Paddy. In this period there is little rainfall. Basically it is the starting season of rainfall. Then next period is full monsoon, its duration being July to September. In this period rain falls heavily throughout three whole months and water is stored in the basin of rivers. Because of continuous rainfall it takes place to the adjoining flood plain of the river. There is another period which is the post monsoon period. The period stands from October to November. In this period there is lesser rainfall, which is the sign of the end of the rainy season. In that period people prepare their land for Aamanm paddy cultivation.

In full monsoon period flood occurs due to heavy rainfall and it overflows the rivers and inundates the adjoining areas of the rivers. It also inundates the low areas of Chars. The people of the inundated areas move to another high place of char area. There they built their house again within their economic ability.

The other option for those who have no relatives is to take shelter beside he highway or embankment road for 3-4 months during the flood. When the flood water recedes, they return to their home. In the char, people build their houses in raised platforms so that they are protected from flood water. They **live there during flooding.** After **the flood water recedes, they resume cultivation on their land. But during flood they lead their life with their stored food. And also they try to do some small business.** Their **livestock comes in handy as**

Aaman is one kind of paddy usually grown in starting of \N inter season

alternate source of food. They sell their domestics and milk to the nearest market. Regular fishing is done as well during this period.

2.3 Erosion and its Effect in Kochkhali

Erosion occurs almost every year in the Fulchari Saghata Upazila. From the past record it is found that in Fulchari area erosion occurs almost every year but in less amount along the market of the river banks. When water comes from upstream it hits on the bank with high velocity and volume. The result causes erosion. It occurs at the river bank market of Gaibandha district, which is within Fulchari upazila. It happens in the pre-monsoon period. The heavy rainfall instigates increasing volume of water and results in huge flooding.

In Saghata Upazila flooding and major erosion occurs due to location near to the river. Saghata upazila is situated very close to the Brahmaputra River. Very recently it has started to erode and people are moving to nearest char. What happens in this time is that people cut their trees to at least get some money. They dismantle their houses, load them on a boat and move. People disconnect their electric connections to save the wire and pole. They become detached in terms of communication and facility. Erosion destroys their networks. Their children's educational future falls into a darkness. Institution's becomes far distant from their new settlements. So this becomes the common scenario of erosion.

2.4 Vulnerability of People in Kochkhali

Inhabitants of riverside and chars of Fulchari upazila arc mostly farmers, fishermen, small trades (small shop, poultry, goat rearing etc), and day laborers. Their working areas are restricted within the chars. The factors which have bound their lives with limitations are the hazards. There are basically flood, river erosion and limited livelihood options. And these hazards have a collective impact on the components of their living. The components **are their** livelihood patterns, infrastructures, household, livestock and crops. Village people have some capital with which they are still fighting and living in those areas. Their capitals **are social,** physical, economical, environmental and technical. In each capital they have a huge amount of lacking. Below there is a diagram showing how these social capitals are hampered by hazards and force people to migrate.

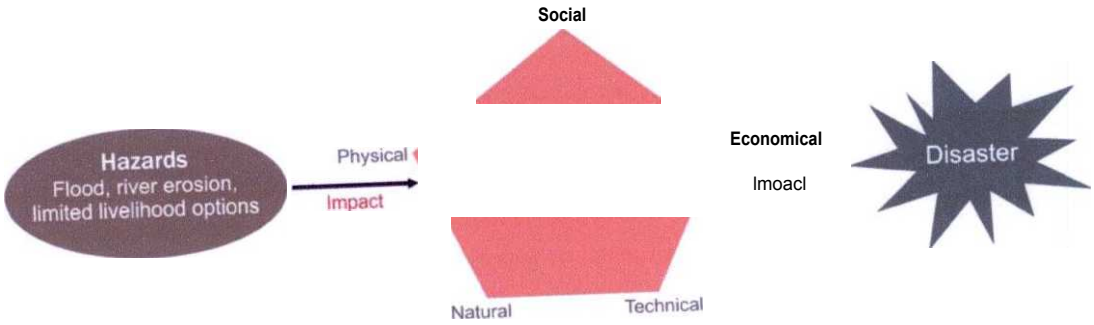


Fig 2.3: Figure showing hazard impact on capitals (Source: Author)

Almost every year char dwellers face flood hazard. There are some factors which increase magnitude of the flood, like depth of the flood. Another is the duration of the flood, which means how many days it takes till the flood water recedes. The time of the occurrence of flood is another point to consider. It is very important to observe when flood occurs. If it occurs in a crop season then the loss will be huge, and if flood occurs in rainy season then the situation will be devastating. If flood occurs in harvesting season then it will be very much effective for the farmer. The layer of sediment will make the cropland fertile for another 2-3 years. Slow recession is another factor influencing the increase of flood hazard. The important thing is, when it is receding, how long it takes to recede. These are the factors that directly influence the flood hazard.

2.5 Community based activities to cope with floods

In the study char a person was found who is a disaster volunteer. The name of that person is `Akkas Uddin Aka' he is a disaster volunteer of Kochkhali Char of Gaibandha district. He is basically a farmer, living at Kochkhali. He is concerned about the welfare of the society. He introduces himself as a disaster volunteer of "Action Aid Bangladesh". He becomes active in any critical situation of the char area. He helped the Union Perished and several NGO's to get better information in the past. He is active against any oppression or injustice of the char community. He is very well known to that particular locality. He rescued many people during flood disaster in 2004 and 2007. He managed boats to evacuate people to the safer places

during the flood of 2007. He helped people to take shelter in a safer place. He was also active in distributing relief materials in 2007 flood event. He is very much famous to the local NGO's because these people take information from him. He has a small piece of land on which he cultivates by himself. He has a good experience of working with the NGO people.

Photo 2.1: A disaster **volunteer** of `Kochkhali' Char

During site survey he was talking about many problems of their living. He also mentioned their needs, basically the infrastructures, like school, mosque and a flood shelter. He drew a map showing the potential ways in which the above mentioned facilities could be located in their char. He had developed a concept in his mind on how these infrastructures should be built. But, from the past experience, he had a pre-conceived idea that every infrastructure should be built on a higher ground, which has to be higher than the highest flood level.

2.6 Contribution of NGO's and some other Organizations

An organization is working on the Kochkhali char name is "FRIENDSHIP". It is a humanitarian organization based in Luxembourg. It works basically on health issues. They provide some basic facilities among the char people like helping people to build small mosque, small school or other kind of small structures. This organization also helps people to built small roads into the char. Also they help some selected people by priority to raise their houses. They also help people by mounting tube wells.

Photo 2.2: Tube well mounted by friendship

Char Development Committee is a committee which works for the development of char people, especially the economic development of the har people. CDC also gives information to the local government and several NGO's **to take their action. The most important duty of** CDC is **to inform government about their needs and demands. Char dwellers are the victim by nature. In Koachkhali char area some health representatives trained by several NGO's and the Government actively work on a regular basis.** They **come to the char and visit to give primary health care and medicine among the people.** They **also make people concern on child birth and pregnancy of women.** They **also give advice for adolescent girls. Health representatives also make the dwellers concerned about inoculation activity and vaccination of polio and other child diseases.**

It is very much appreciated that homestead raising is better for char areas, especially from the point of income generation activity. During earth work the homestead needs to be raised which requires a manual labor force. Men and women both have an equal share of labor in this process. But in most of the study area people have complained about some

mismanagement caused by the Members and Chairman of Union Parishad. There is a corrupted process of selection of the labor. They select laborers by their own choice. Only those laborer are able to bribe the concerned section authority are selected for the work, and the rest are neglected. The selected laborers pay up to 50% of their daily income to the Members or the Chairman.

Most of the time several donor agencies take the initiative of raising the individual homestead selecting from various groups (ultra poor, poor and small land owner). They give priority on the lower two groups. Donor agency does this work with the collaboration of Union Parishad Chairman and Member. But donor agencies leave the job of implementation on the concerned local authority then these particular authorities does corruption by charging a fixed amount of money from the daily labor. The laborer faces a constant threat of loosing their work if they refuse to pay the bribe that is charged. The charging amount is like 1000-1500tk from each labor. But a labor will earn hardly 3000tk for one month's labor. So then what happens? The poor people become even poorer.

Another drawback faced by the char dwellers is the lack of education of the children. During the field visit, only one primary school has been found in the char. This school was established by the government. But the school doesn't run properly. There are only 3 teachers, and still they do not take all the classes. They also tend to leave the char in search of better places to settle, leaving the school a place where no systematic education is provided. This has been complaining of the char inhabitants till now, but no steps have yet been taken to address this problem. Education of the children is very much related to the improvement in the overall awareness of the char people in how to tackle natural calamities such as flood. During the previous flood disaster emergency relief distribution was arranged by the local responsible persons along with participation of other people.

2.7 Survey **on use of Flood Shelters during floods**

This section presents the results of a survey to grasp people's perception about the flood shelter. For this purpose a survey was conducted after the flood of 1998. From the survey it is evident that the people who live in Kaisha made thatched roof house are the main users of the shelters. Among the users, about 75 percent of the houses are Kaisha made thatched roof

house and the rest are Tin shed houses. During the flood of 1998 about 27 percent of the houses were washed away, 18 percent were fully damaged and 55 percent were partially damaged. About 87 percent of the people had to leave their houses during the flood of 1998 among which 76 percent knew about the existence of the flood shelter in the locally beforehand. Of the people who left their houses during the flood, 58 percent went to flood shelter and 39 percent took shelter on high roads and embankments. Most of the people took their livestock with them, as it was the char people's only asset. Most of the users of the flood shelters had no other alternatives than to go to flood shelters. Although many of the users did not mention any specific problem, only few of them were satisfied with food supply and toilet facilities. A substantial portion of the people demanded separate arrangement for the women.

Although there were some complains, almost all the people mentioned that the shelters were of great help to them which assisted them to survive during the flood and to get rehabilitated afterwards. (Alam, *et al* 2007)

2.8 Indigenous Knowledge for Preparedness

There are some common technologies in every region to cope with the flood. These are the technologies to mitigate the damage of flooding. In the study char people use their indigenous technologies to prepare and mitigate the flood damage. When people sense the arrival of flood, they dismantle their houses and move to another char or take place beside a higher road. Some of them go to the city areas where their relatives belong. The people who have their house on raised earthen base try to prepare for the flood event by lifting their house a little higher to counter the raised water level. Basically those who are financially stable and can raise their homestead on a higher ground stay at the char during flooding. Some people who are not financially stable also stay in the char, because they have no relatives in other places. These people raise their roofs and lift their beds near to the roofs and survive in harsh conditions for all of the flood period.

During flooding, people make rafts using banana trees and rescue the affected people. They also use the raft for their transportation. There is another way)f preparation which is that people cut their banana trees and surround their homestead by strategically placing the trees. This minimizes the effect of the rush of flood water and does lesser damage to their homestead.

Chapter 3
Methodology

The first step of the research was to study some of the flood shelters and their components. One issue was to find out how many people can be rescued during any disaster event, there also had been found about the mechanism of the system. Some lackings also discovered during study, there is also a question of implementation. Some other examples are also studied. There found some positive and negative aspects which are considered during study. There also done a study on in country flood shelters. After all these study there has done the site survey and analysis. In which some of the issues also emphasized such as topography of the study char, settlement pattern of the study char, house typology, materials, construction techniques and household ability.

After all these study the design phase has started. In the design phase there studied the wall section and uses of materials. In design phase there also given some options of livelihood which are related with the resources of the char. Also some recommendations are also given to find better solution in the future. In the last phase there have discussed about the limitations of the design and after then there have discussed about the future research in conclusion.

3.1 Site Survey and Data Collection

The main methodology of data collection has been done by the following processes

- Survey of the particular areas (specially chars and erosion affected areas)
- Questionnaire session with the community and community leaders
- topography analysis of that particular area
- water flow and volume of water passing
- Inundation area (flood plain analysis)
- finding the relationship between that particular community and responsible person

The corresponding study area is situated at the northwestern part of **the Bangladesh in** Gaibandha district. Basically the Char area was the main focused study area with a 14 week

time limit. So the main process of study was on the basis of FGD (Focused Group Discussion). In this focus group there was the participation of all community leaders. And the village commoners had also participated actively. Study is based on the information and the data, collected from the field visit. Major causes of erosion are currents, strong river discharge, high waves, and increases of population. The historical maps had been used to analyze the complex pattern of sediment movements. Empirical data, site survey, interview, FGD were the basic tools to apply.

Step 1

First step was to form a questionnaire for the inhabitants. Then the physical survey was done on site using the prepared questionnaire. There had done a re:,onnaissance survey of the Kochkhali Char. Then a meeting had been arranged with the local guardians or leaders followed by a meeting with all the people of particular char areas. Then a classification of the community by livelihood, living pattern and types of the capitals they have was prepared. Sets of questions are answered, questions are - What types of hazard they face, what are their responses, what do they do, do they live there during flooding, how can they sustain in that time, do they raise their homestead according to highest flood level`?

Step 2

Second step included a surveying on the Char. During the study some lacking and needs were exposed. Findings had included some drawbacks of their living, lacking of their living status, limitations of their livelihood and ability of homestead raising.

Step 3

The third step involves an illustrated research on the materials they use to build their homestead. The study on type of soil, type of construction method, type of material of wall and roof, how they strengthen their house, vegetations, some intervention to protect their homestead and some study on livelihood options.

3.2 Activity **flow Diagram**

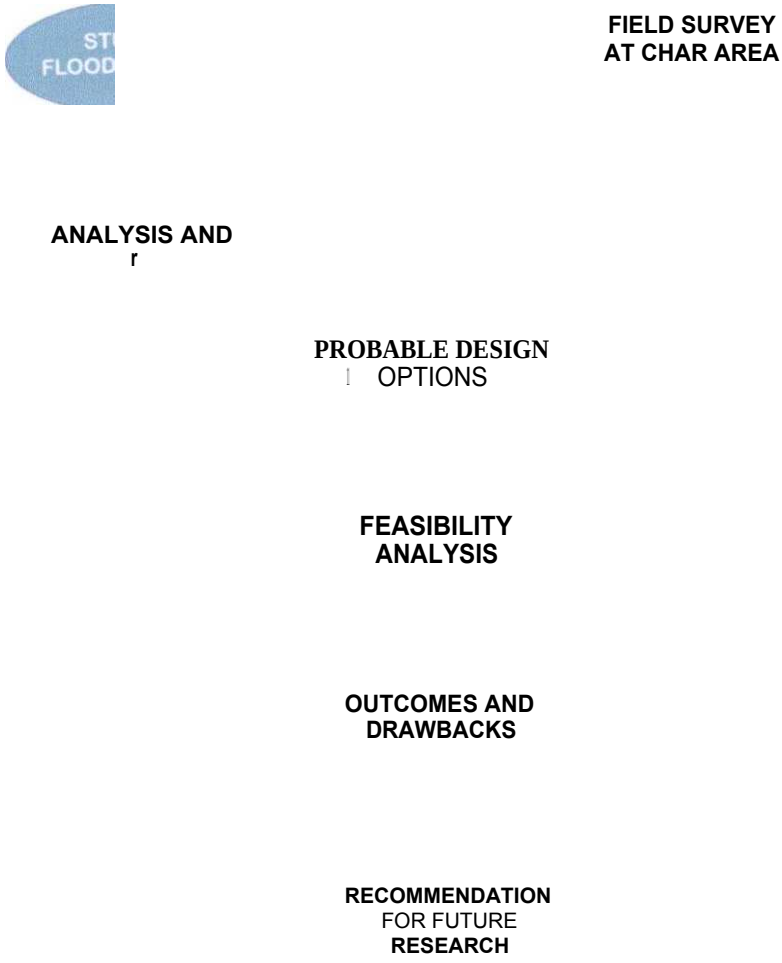


Fig 3.1: Activity **flow diagram**

Chapter 4
*Findings **and Recommendations***

4.1 Study of **flood shelters in our** country

4.1.1 Case study 1

A raised flood shelter at Shirajganj

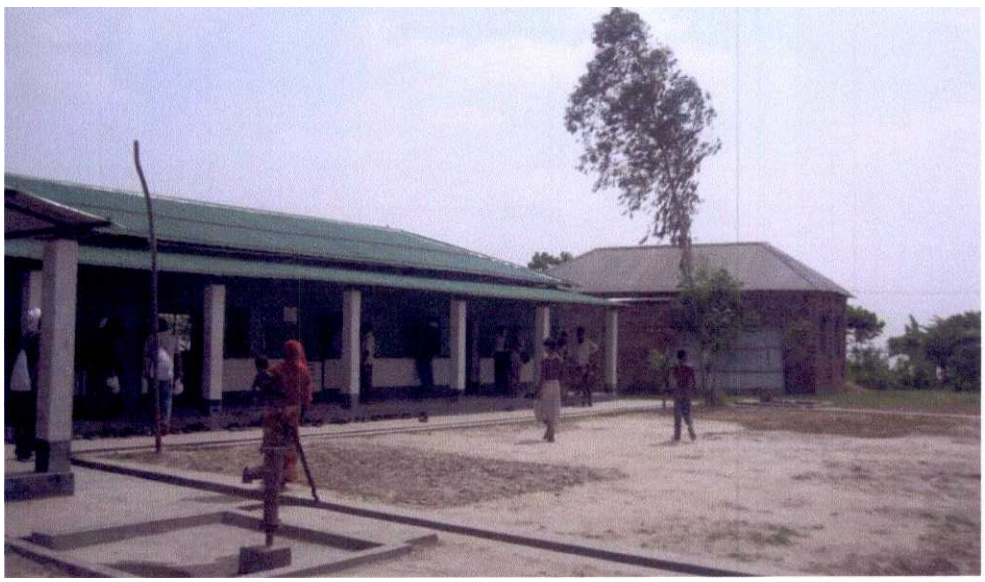


Photo 4.1: Flood shelter at `Shirajganj'

Strengths

- Place for holding any important meeting on any upcoming disaster
- Organized committee of volunteers
- Shelter on a raised earthen base
- Used as a primary school
- Privacy ensured because of the separate rooms

Weaknesses

- Less toilet facilities
- Space is not adequate to accommodate desired number of people

- No separate space for livestock
- Less provision for cooking

Opportunity

- Presence of trained disaster volunteer

  separate space for the pregnant woman

Threat

- Flood shelter is hardly 200m away from the river

4.1.2 Case study 2

Flood shelters in bangladesh

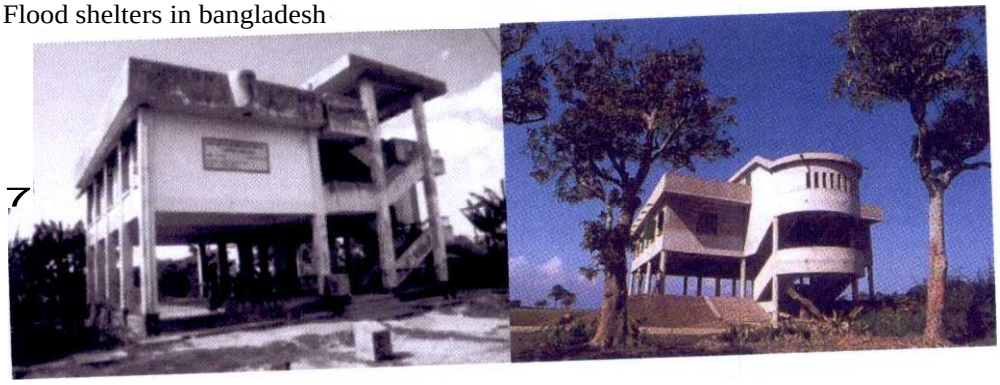


Photo 4.2 Flood shelters in Bangladesh

Strengths

- Organized committee of volunteers
- Shelter on a raised earthen base
- Used as a primary school

Weaknesses

- Less toilet facilities
- Space is not adequate to accommodate desired number of people
- Privacy is absent

  No separate space for livestock
- Less provision for cooking

Opportunity

- Presence of trained disaster volunteer

Threat

- Building maintenance procedure not properly done

4.2 Local Materials and Techniques of Ilouse Building

Techniques and materials vary by the ability of the household. Size of the house depends on the family size. Usually people build their house with whatever they have and can afford. Some of the char dwellers bring leftover materials from their previous settlement. Some of them buy materials from the locality. Craftsman and technicians are available in the `Char'. Even after having the necessary tools and technicians, the greatest challenge for the char dwellers is to manage everything within a limited budget. Some of the common materials of house making which have been seen during the study visit are mentioned below.

Locally found Materials:

Banana trees surround most of the households. It also becomes useful during flooding for evacuation. It gives fruit and people use the leaf to feed their cattle.

Bamboo is used as a material for making walls. People also make bamboo shed for seasonal vegetation. In the char there are no Bamboo bushes anywhere. People buy i,t from the nearest market to serve their need.

Kaisha is a locally grown plant which is found in almost everywhere in a char. People use it for making roof and wall. `Char' people also use it as firewood. `Kaisha' is also a common feed of cattle.

Wood is another material which is used only to support the Cl sheet roof and Cl sheet wall, because it is a costly material and is not available in a `Char' land,

Corrugated iron (CI) sheet is a material for slaking houses stronger. Very few number of houses have been seen which is built with Cl sheet.

Jute stick is another material which is used to make a layer at the inner side of the walls. It ensures the comfort of the house in terms of temperature by providing **insulation. `Jute**

Sticks' are produced from the seasonal cultivation of `Jute'. People also use `Jute Stick' as firewood.

Straw is another material of roofing. Sometimes people make walls using straw. It is a very common feed for the cattle. Straw is produced from the seasonal cultivation of paddy.

Cement pillar is a major element of the structure of a house. It is basically ano llug n made concrete and a layer of reinforcement. Government and some oter organizations provide this material in a char for making houses. government

Techniques

There is not that much variation of techniques in building the houses. A common method is used all over the `Char'. The method changes when people make their roof with different materials. The method of making the wall is almost same for every material.

4.3 Settlement Pattern in the Study Area

There are some common characteristics in every Char island. Findings of some common patterns of settlement are shown below.

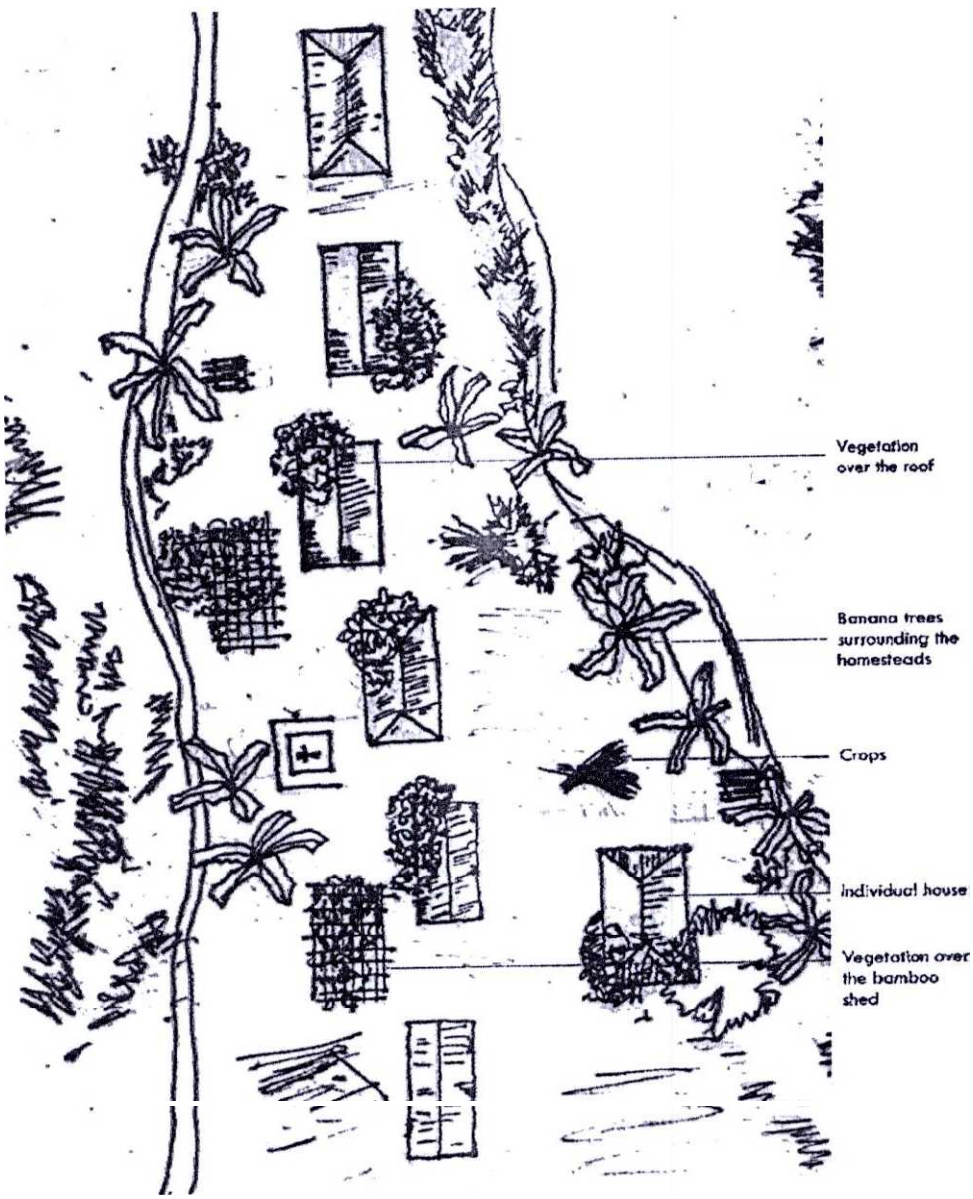


Fig 4.1: Linear settlement

In this type of settlement people usually build their homestead in a line or following an axis. The reason for creating this type of settlement is the formation of higher ground which is almost linear. Vegetation also can be seen along the settlement of the homestead. Another advantage of this type of settlement is that land owners have divided their land parallel to the high land.

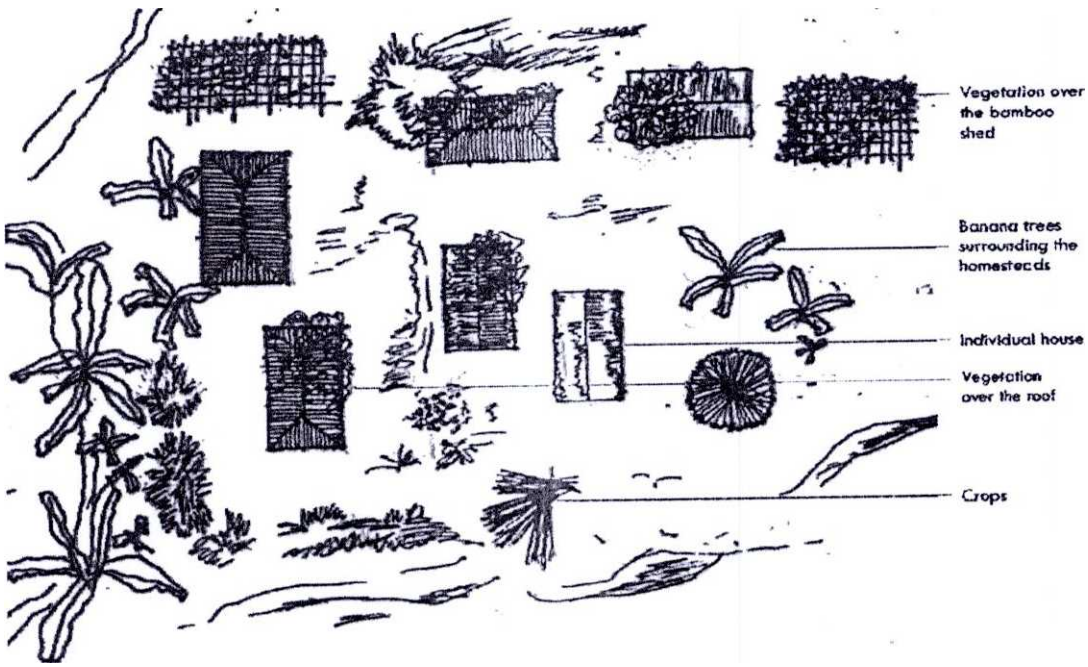


Fig 4.2: Random **settlement**

In this type of settlement people build their homestead without following any order or method. Those who live under temporary permission usually build their house just for living, because they are not permitted to settle there. This type of settlement can be seen on the lower area of the `Char'. Vegetation is found all over the places very randomly.

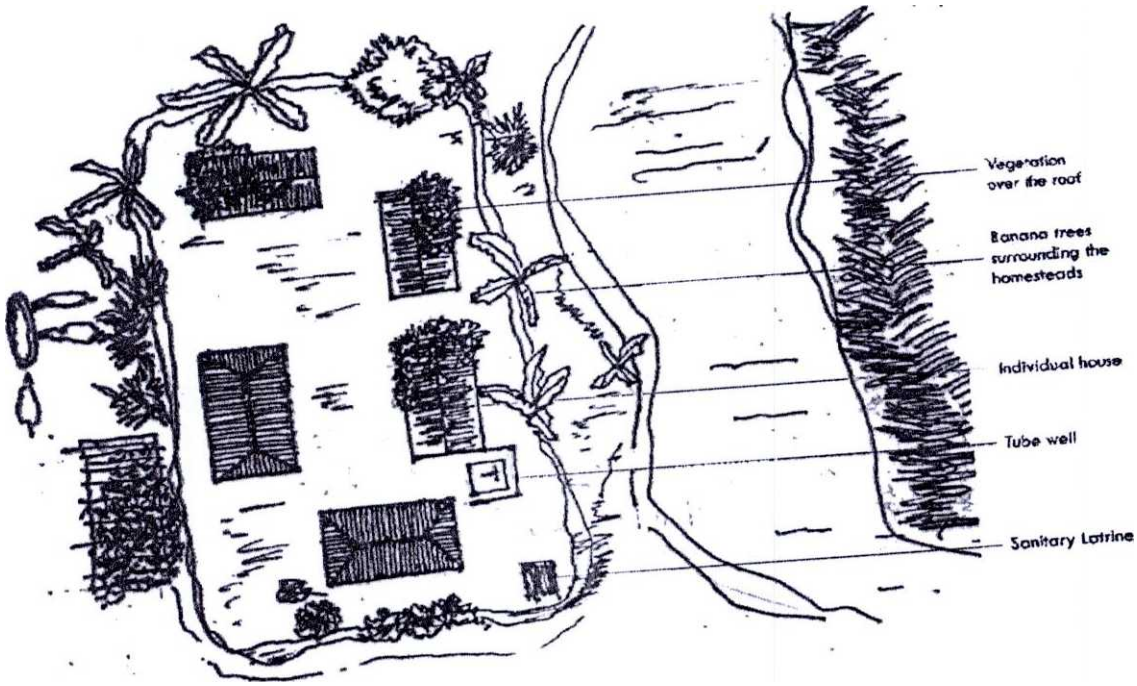


Fig 4.3: Cluster **settlement**

In This type of **settlement** the people who get permission from the **land owner raise their** **ground** **and live together** by sharing a comn'on yap''d Systematic andtcl l planned veg**etation** **also better in this** in this type of settlement. Tube well and sanitation sys **can be seen** type of settlement.

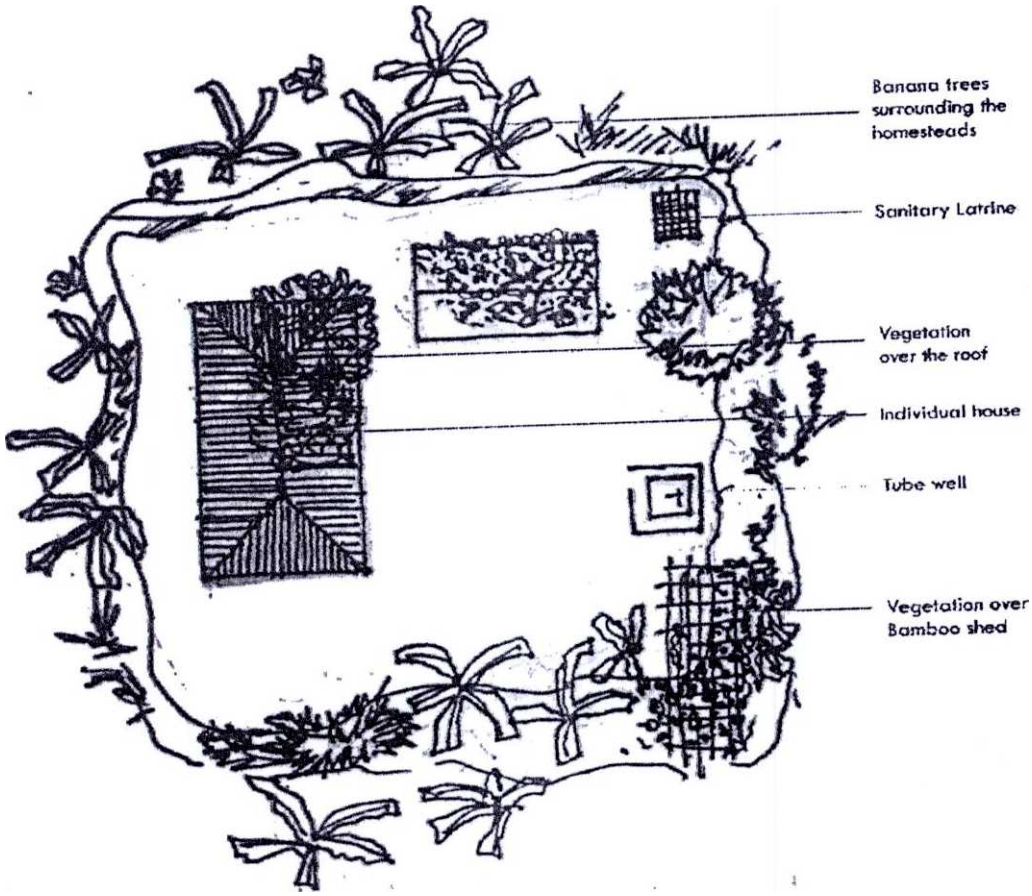


Fig 4A: Single house settlement

The people, **who can** afford, **lease a land and raise it to live separately**. They **basically give importance to their** privacy. They **do vegetation in a planned** way. For **ensuring the privacy they plant Banana trees around their** house. They do seasonal **vegetation on the nearest ground of their homestead**. **It is good it'this homestead stands just beside another settlement, but if it situated further then there is a risk** of robbery **in that settlement.**

4.4 The Single House Pattern

inthechar many types of houses made by dif tercet techniques and materials are found. Some of the different types of houses made by cfiffcrcnt materials are shown below.

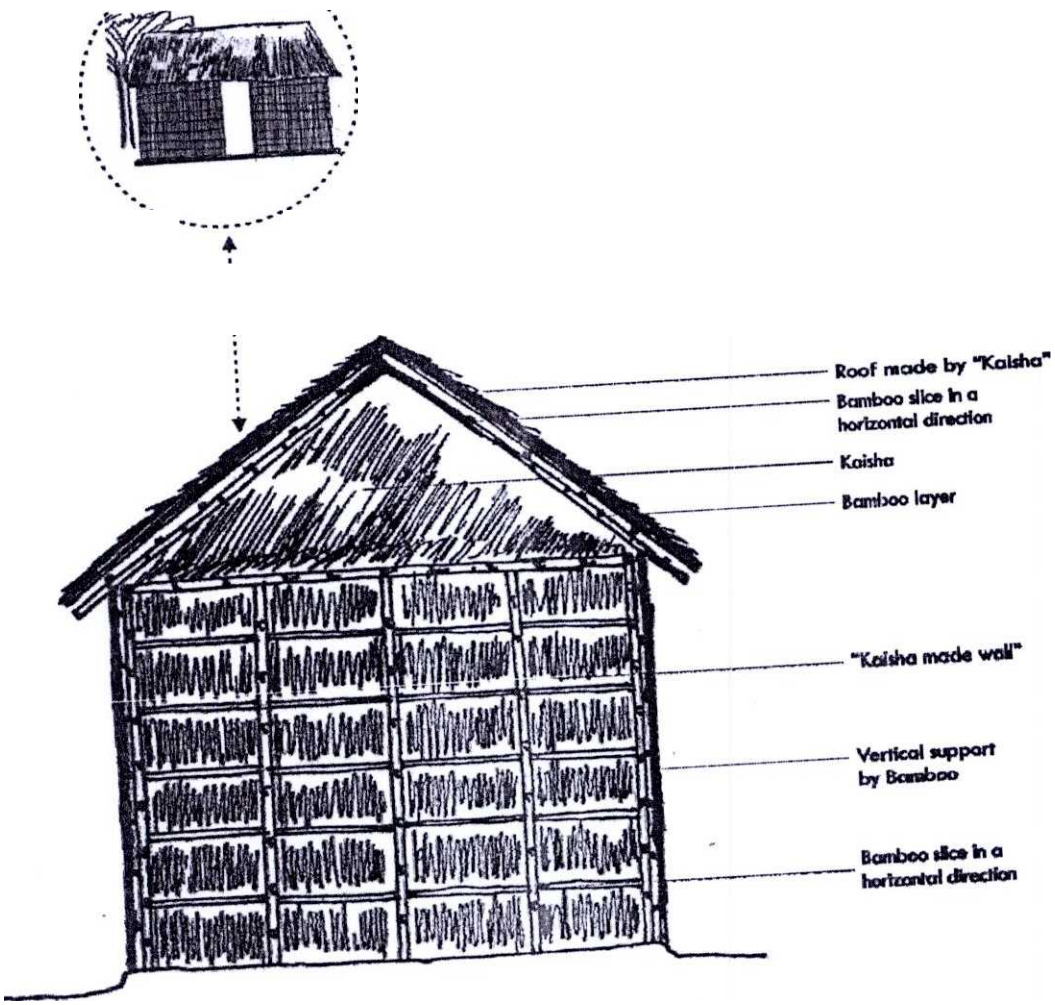


Fig 4.5: **'11hatclicd roof house**

The basic characteristics of this type of house arc, roof and **walls are made by** locally **available and grown plant** `Kaisha', which is a light material and creates **a comfortable** internal living **environment** when used as wall-making **material. It takes zero cost to collect. It grows almost** everywhere **in the** `Char' land. The roofs are **also made using** `**kaisha', but it needs to be changed** after every 2 years. `I'hc 'Kaisha' made house is easily **dismantle able and for being light it is easily** moveable. Construction method of **this `Kaisha' made thatched house** is also very easy. **Intervention** of some technique **and treatment such as replacement of cement pillar for strengthening** the house can be used, **but creates a problem in terms of dismantling and transportation**. Adding a layer of Jute Stick on **the inner side of the wall keeps the inner living environment** comfortable in contrast to the outer **temperature.**

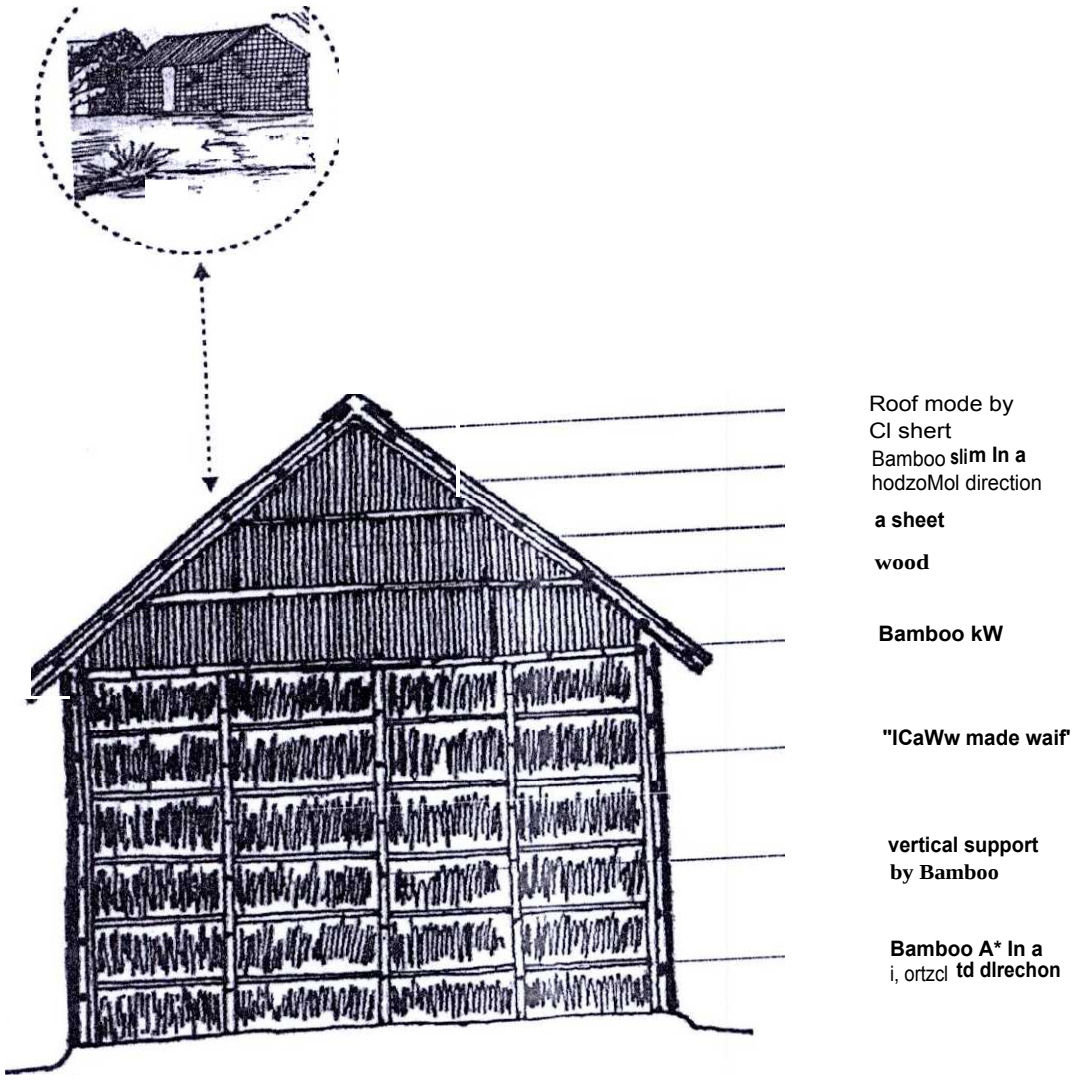


Fig 4.6: House made by composite materials (Cl sheet and `Kaisha')

In this type of homestead two dill- erent materials can be seen for making roof and wall. The roof is made by Cl sheet and the wall is made by `Kaisha'. Those people who are able to afford Cl sheet build this type of house.

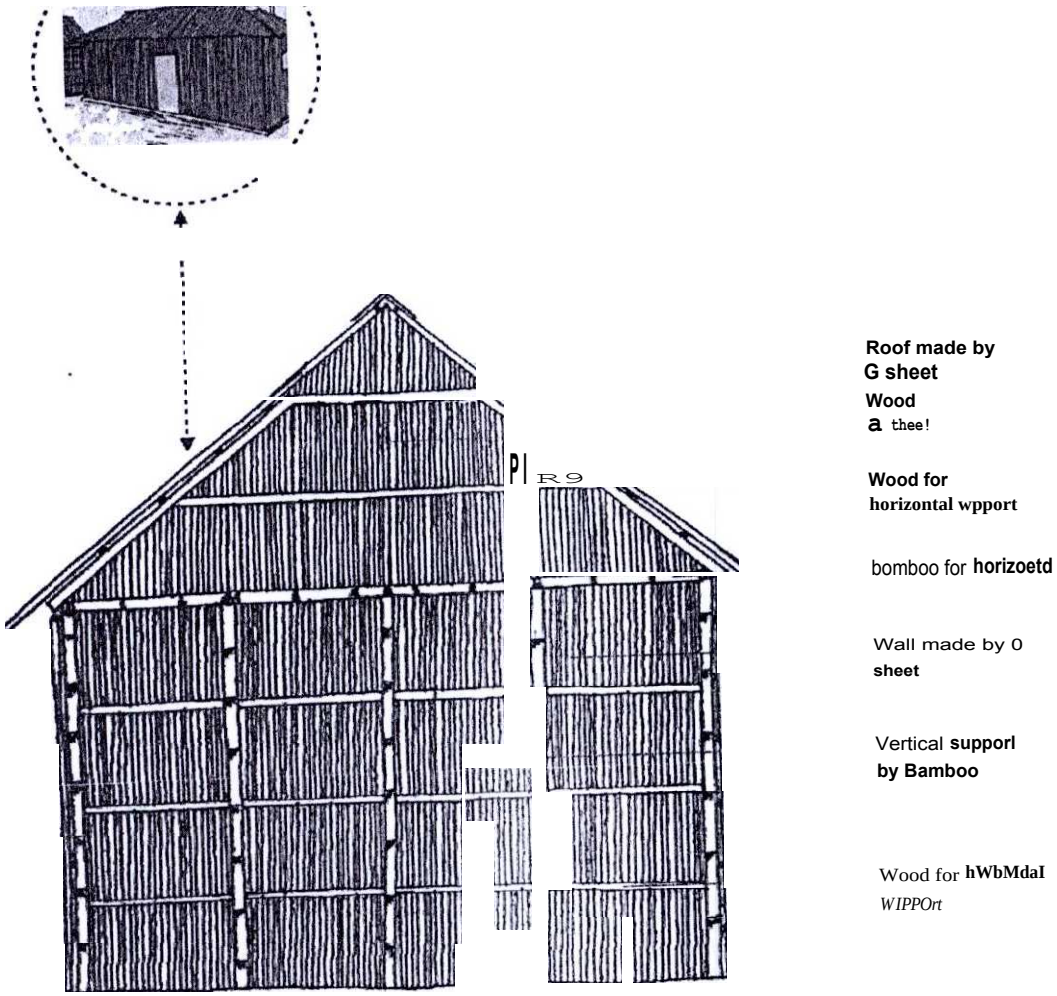


Fig 4.7: House made by Corrugated Iron sheet and Bamboo pillar

In this type of house both wall and roof is male by Cl sheet. This type of house expresses the status of the house owner. Those who can of Cord to buy CI sheet built this type of house. This type of house is stronger other than thatched root house, but there are some problems. During the time of moving this house to another place it loses the quality and needs many people to

dismantle. Due to the heavy nature of the Cl sheets and its complex construction system, 5-6 people are required to dismantle and carry the materials in case of migration to another place.

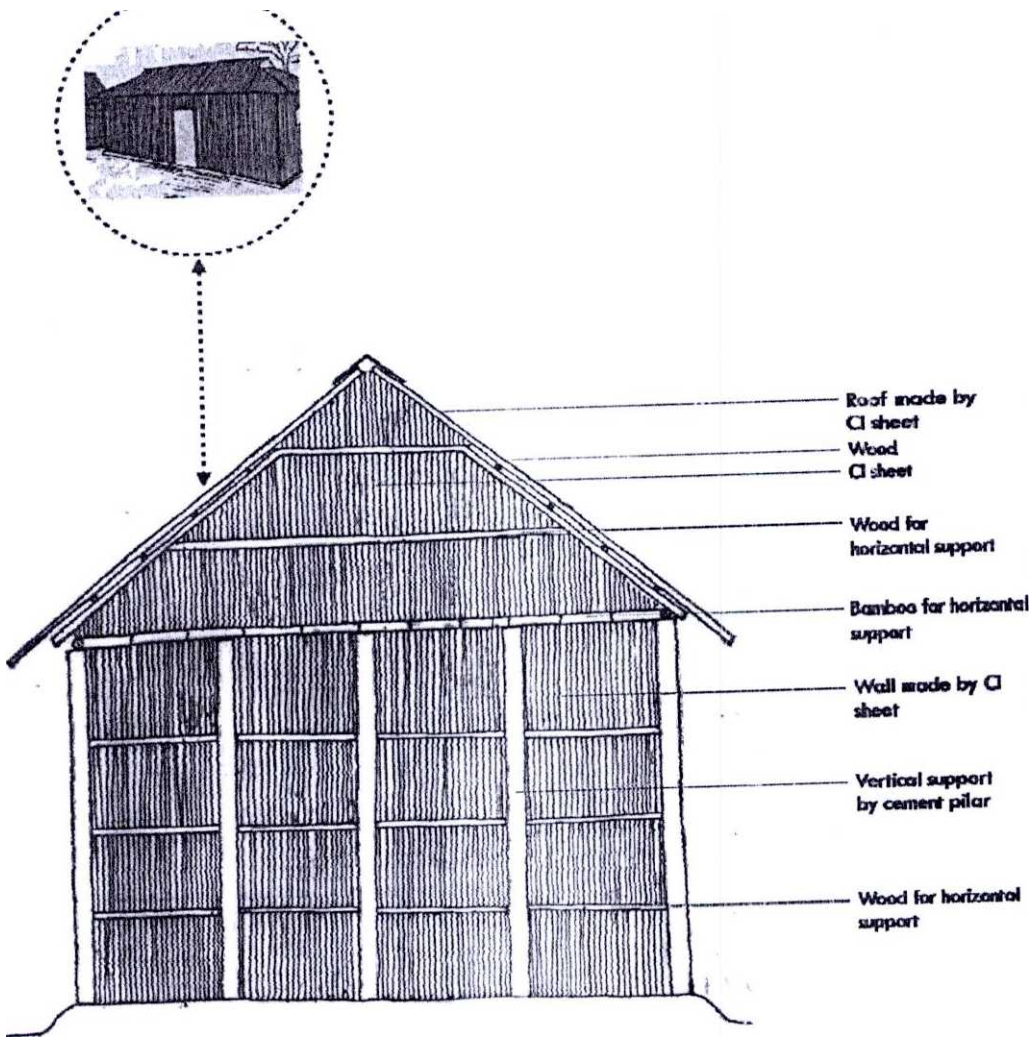


Fig 4.8: House made by Concrete pillar and Cl (Corrugated Iron) sheet

In this type of house both wall and roof are made of Cl sheet. This type of house is a status symbol. Those who can afford to buy Cl sheet built this type of house. This type of house is stronger other than thatched roof house. but there are some problems. Due to the heavy

nature of the Cl sheets and its complex construction system, 5-6 people are required to dismantle and carry the materials in case of' migration to another place. Also it is heavy and has sharp edges which can easily injure people. The internal living environment becomes hot during summer and cool during winter because of the property of metals as good absorbers and radiators of heat. As a result dwellers Feel uncomfbrtable.

4.5 Study of Different Types of Wall Section

In the study char area several types of walls for making house were found. Some of the common wall sections are shown in the figures bellow.

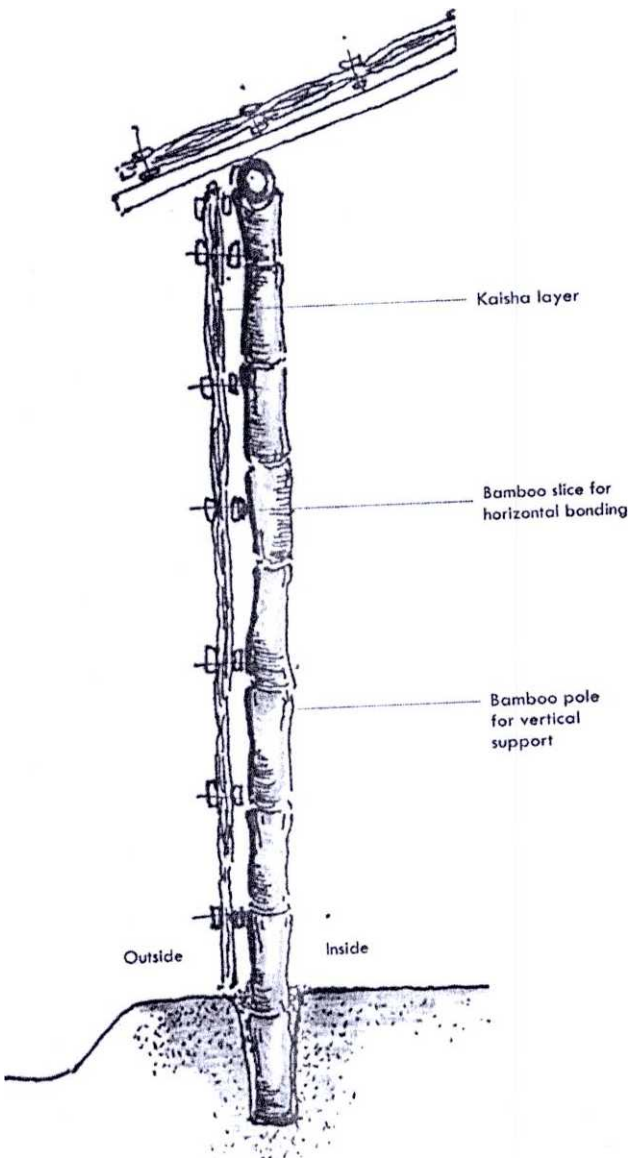


Fig 4.9: Wall made of `Kaisha'

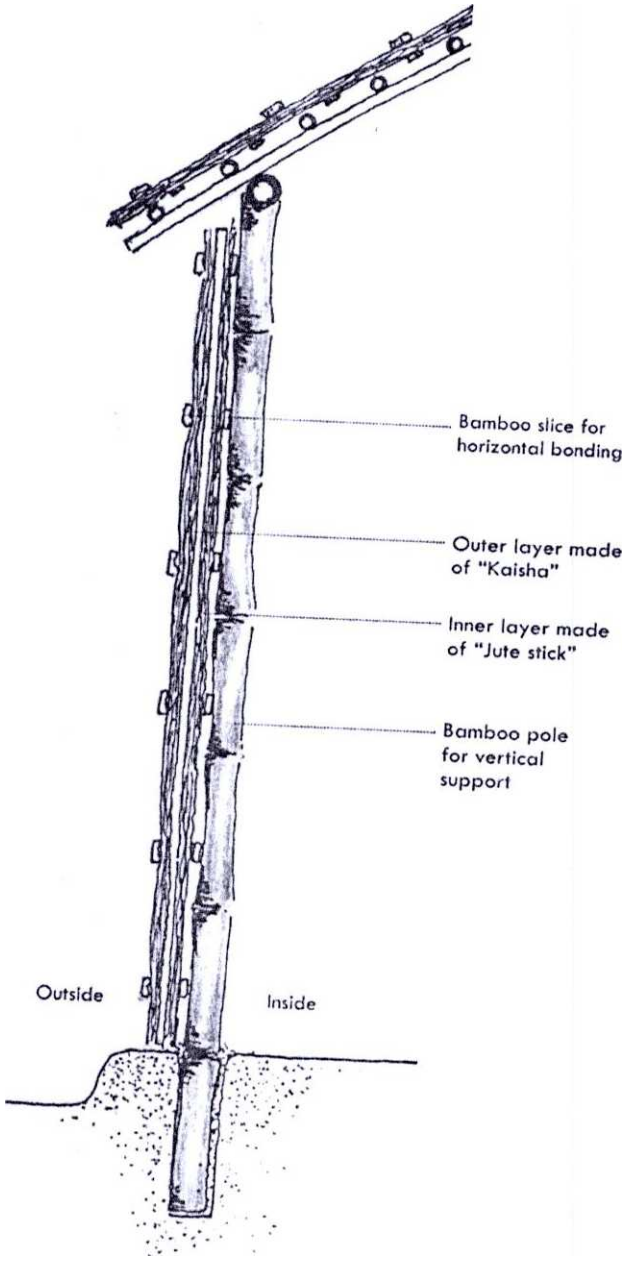
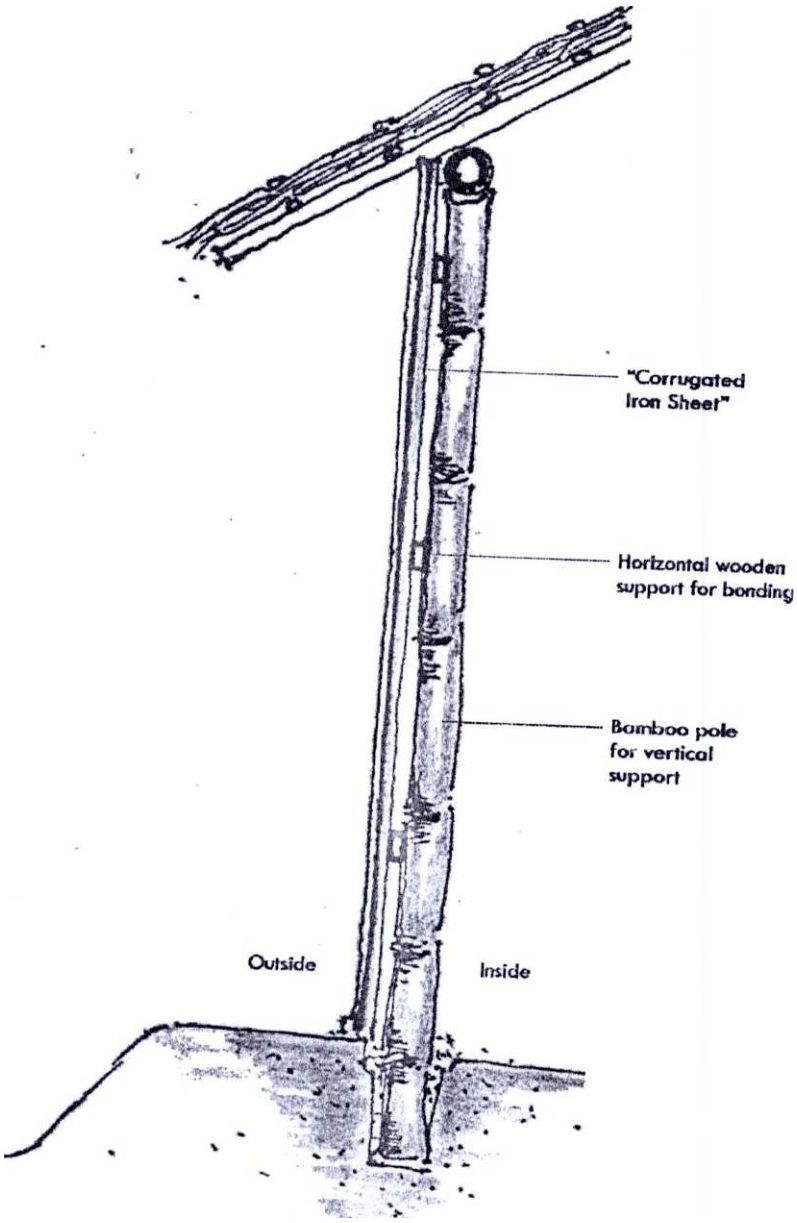


Fig 4.10: Wall mule of `Kaisha' and `Jute Stick'



Fib 4.11: Wall made of `Corrugated **Iron' (Cl) Sheet**

4.6 Recommended Conceptual Designs

Flood shelters have some basic components. If we observe the flood shelters in our country, we can find that they are not as functional as expected. Most of them lack to serve their actual purpose.

Basically a flood shelter is a missionary permanent structure. Most of them are two storied. The lower portion is open in all sides for passage of air and water and the upper portion is made to take shelter. But the living space is very small; it is designed usually for 200 people. In emergency period it accommodates almost 500 people. Another problem is the toilet facilities which cause a major problem for the women and adolescent girls. Privacy is very much limited. There is no separate place for livestock. There is no extra space for storage of food.

There **is no separate** space for cooking. livery flood shelter **in our country has these problems. Some** basic components of flood shelters are showing below.

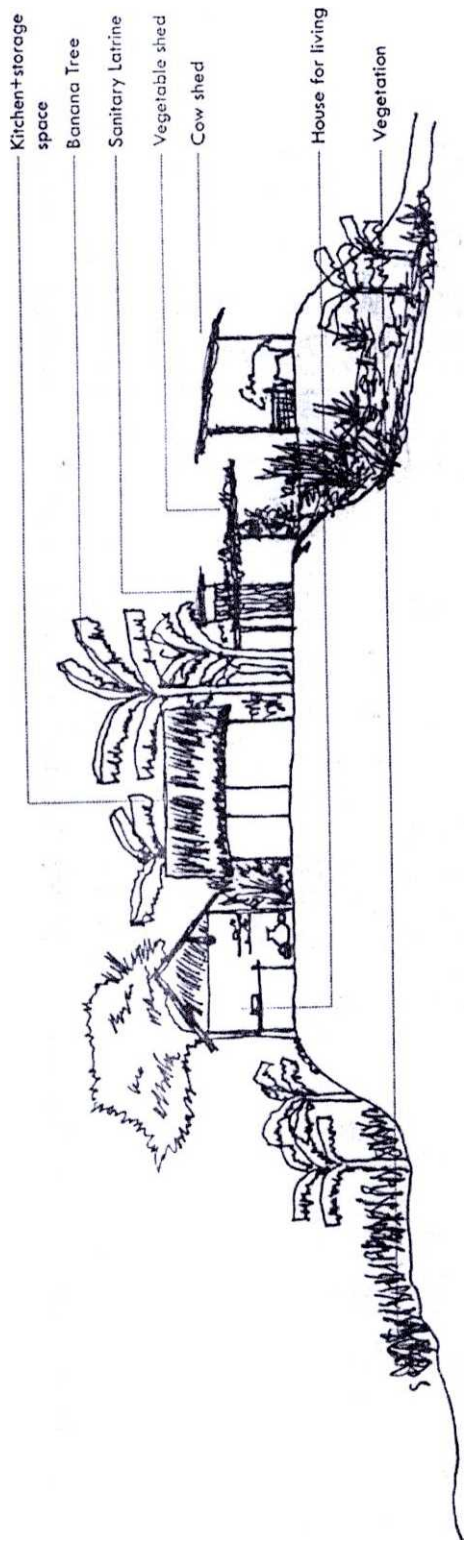
- Living space for male
- Living space for female + children
- Water supplies (tube wells)
- Toilets for male
- Toilets for female
- Storage facilities of relief materials
- Kitchen and dining space
- Medical center with storage facilities
- Reception room
- Office of shelter management committee with equipments
- Space for livestock
- Storage space for fodder and teed of livestock

Considering the basic components of a flood shelter **and the need of the char dwellers some functional space requirements have been** found which are considered **in the design proposal. The functional space requirements** are given below.

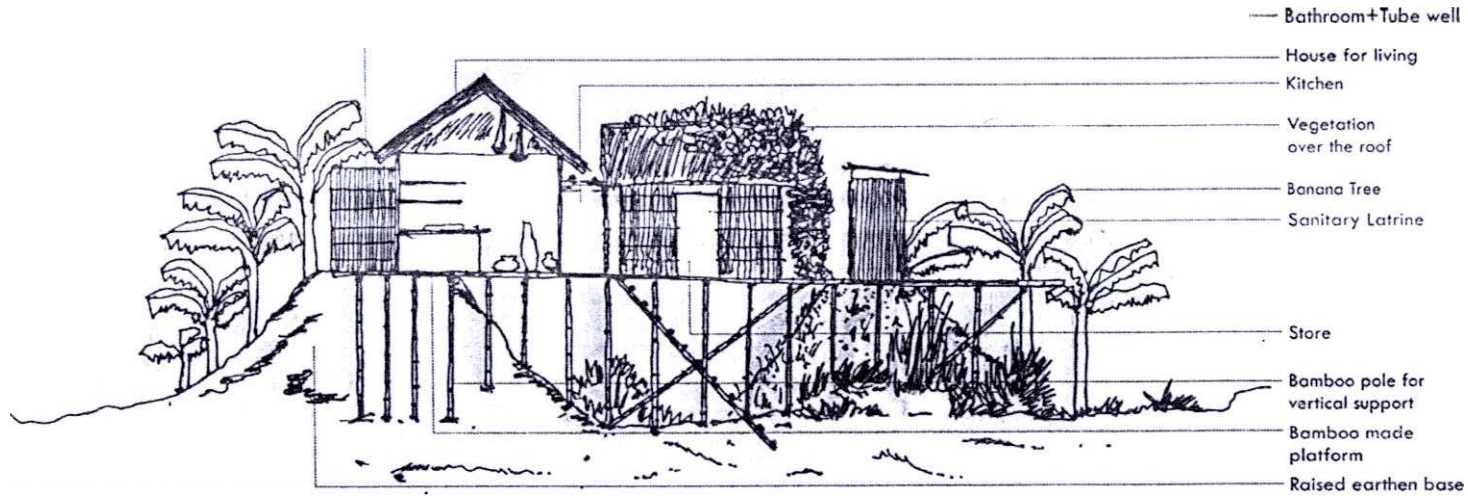
- Living space
- **Water supplies** (**tube wells)**
- Toilet
- Storage
- Kitchen
- **Space for livestock**
- **Storage space** for feed o f f ivestock

Char people are very much vulnerable because of flooding. Most of the time they need to go to a higher ground to take shelter. The reasons for this situation are, they were living on a low land, their house was not built by strong material and their financial ability is very much low. So considering these factors the character and design of the homestead follows. Another important reason is that char is not a place to Iive along 20 years. So from the need, settlement should have to be temporary in character. That is why the proposed character of homesteads is dismantle able. In every rainy season people live in a tension of flooding. But the people who have no other options to go another char only they stay in that particular char. So in this point the need comes. The character of the proposal is lighter and on a higher ground so that flood water could not reach. The materials are also very cheap which can be found within their ability. So considering these issues the design of the homesteads conics.

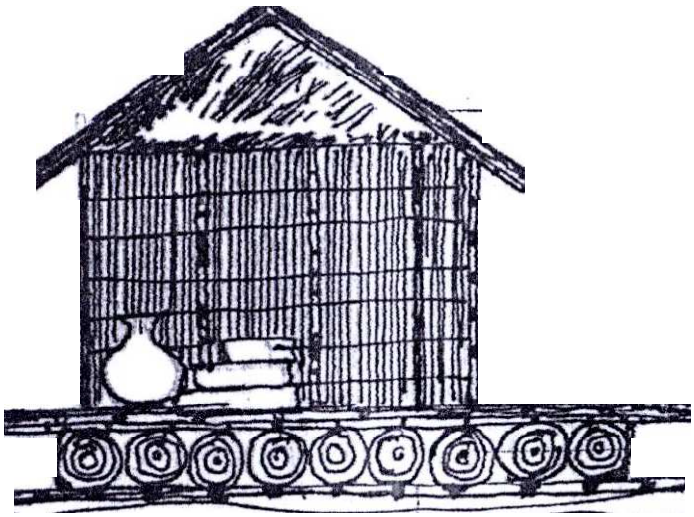
4.6.1 Homestead on Earthen Highland



Placing a homestead on a raised earthen base is mostly sustainable. Surrounding vegetation will protect the homestead from eroding of earth. Banana tree helps to make raft during flood. Vegetable shed will usually serve both daily food need and privacy. Seasonal crop cultivation beside the homestead will also serve the daily food need and help earning money. The kitchen and storage facilities will share the same space. The placement of the bathroom and the sanitary latrine will he placed in distance to ensure proper hygiene. A shed will be provided beside the vegetable shed as shelter for the domestics.


Bathroom+Tube well
House for living
Kitchen
Vegetation over the roof
Banana Tree
Sanitary Latrine
Store
Bamboo pole for vertical support
Bamboo made platform
Raised earthen base

the base of the house will rest. This can be an alternative way of raising a homestead instead of the earth filling process. The sanitary latrine and the tube well have to be mounted by earth filling. Cooking should be done using a movable burner made by mud. The design and placement of the other household facilities will remain similar to the previous design.



Home for IMNU

UNA& bows

Bone d Ui
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Banvio kme tom[

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._Randmo W di

Fig4_l4: I Iomcstcad on a raft

Homestead that floats on water can be made only during **flooding.** The base of **the homestead will be a raft made by trunks** of banana trees. The raft will be **made by aligning the banana trunks and sandwiched** by two layers of bamboo in **the top and bottom. On this base, the homestead can be placed, and the total** s\ stein would work **as a mobile house.**

This study proposes a few design schemes. It would be interesting to see though , as to how many houses can be modified as suggested. The feasibility of these design schemes will be put to test when implemented in the real case scenario. It is very important to also address the policy level work that has to be clone in order to organize this modification and adaptation of homestead schemes. In the particular char which has been studied , there was significant lack of big trees , even on higher land. Big trees help to anchor the newly filled upland. The char had several banana trees though, which is an immensely positive factor.

Evacuation method that was found during study is shown below with diagram. The diagram below is a pictorial representation of the mechanism of the roof that aids the evacuation process.

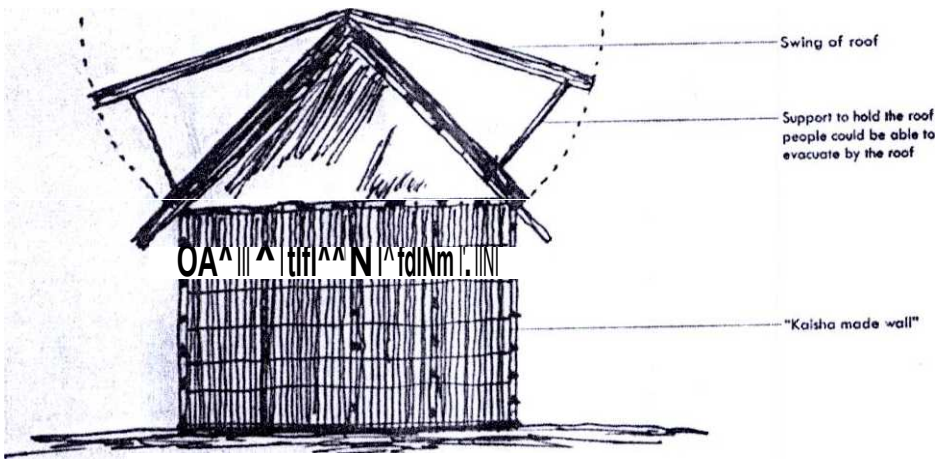


Fig 4.15: SliiJ of roof' for evacuation

evacuated from their house during flooding through the roof by cutting through it. This concept can be transformed into a modified roof- which can be swung open for evacuation when required.

Banana trees are very much multi-functional and have various uses especially for the char people. The field survey findings included usage of banana tree trunks as land leveling tool. The trunks are manually dragged along the surface of the land in order to level it and make it suitable for sowing the seeds for cultivation.

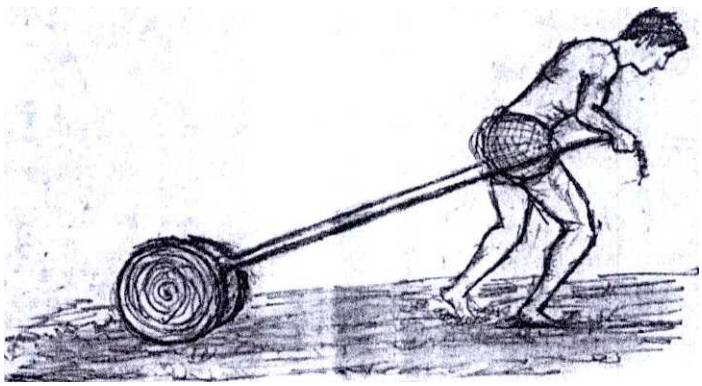


Fig 4.16: Cultivation **by Banana tree**

As mentioned previously, **banana tree trunks** are used to **make rafts which are used for evacuation and mobility in transportation** during flood.

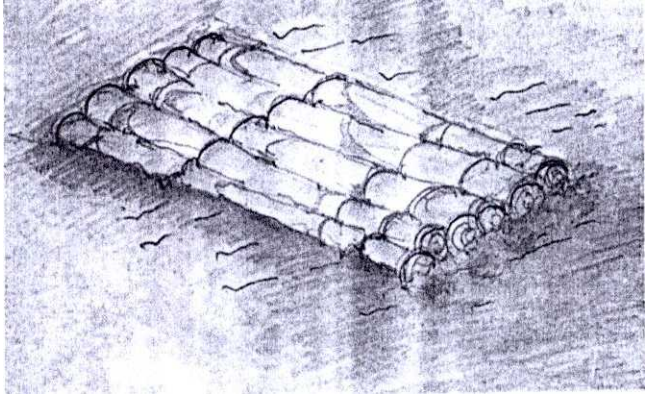


Fig 4.17: Raft made by Banana tree

Vegetation has been seen all over the char land. There were many ways of doing vegetation: vegetation over the roofs of households, vegetation over bamboo shed, vegetation on earth beside homestead, vegetation on the low land and so many other ways. But when flooding occurs, all these vegetation gets destroyed and washed away.

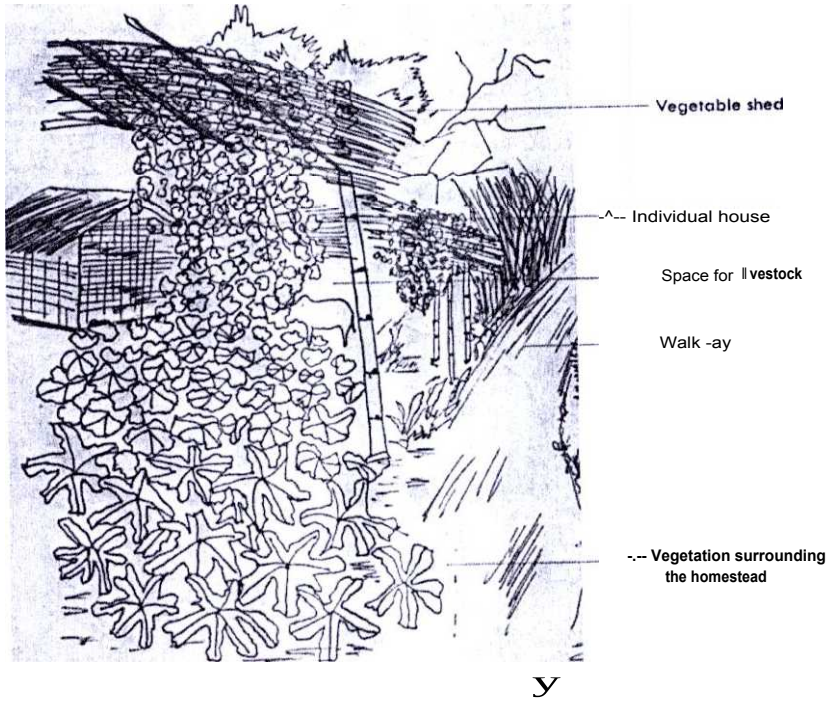
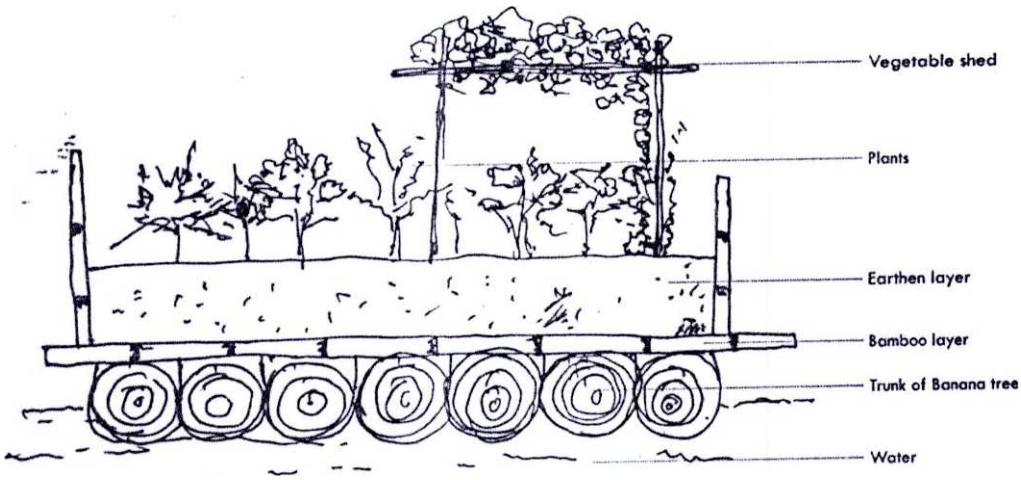


Fig.; 1. 18: Vegetation

people to save their vegetation even when flood occurs. The image **below shows how a floating system** of vegetation can be devised and implemented.



Pig 4.19: **Floating** Vegetable garden

This prototype floating vegetable garden can be made on a raft. The layer above the banana trunks will be made of bamboo. Over the bamboo layer, a layer of soil will be placed on which plantation will be done.

The various shortcomings of the proposed design schemes are discussed below.

IIomestead on Earthen 1 -li ghland: The design involved raising **the homestead adequately using earth filling system**. This system is a costly **procedure and might not b„ affordable to many of the char dwellers**, especially the ones who live **on a temporary permit. The shed for the cattle is also located quite** for away li om the main **house, and is prone to lack of security, as the domestics might be stolen any** ti me. People usually **prelcr to keep their domestics as close as possible hence keep** them in the sank room at night for security. **These drawbacks of the design can be addressed after further research in the future.**

Homestead on Bamboo stilt: the design uses bamboo very extensively. **But bamboo is not a** very long lasting material and has to be replaced at least every 2 years. **Replacing bamboo is also not very** cost effective. Besides, cooking has to be done using a **movable burner, which would create a hassle.**

House on a Raft: This design is based on very temporary living for a short period of time. Because of the floating character of the entire system, the homestead will always be in swaying motion and will lack stability and may hamper comfort. This design would also create an isolated homestead, which has to he anchored to remain closer to the nearby higher land to have access to facilities.

5.1 Conclusion

Flood is a part of life of the people of [3antigladesh. There is no way to permanently stop flooding. Because the geographical location of f3angladesh shows that it is the main basin through which river water is discharged from India, China and Nepal. That is why many rivers exist in this country. Although our country is known as a country of six seasons, due to the change in global climate, only 4 to 5 seasons can be observed at present. Flood water rises during full monsoon period. In this period people observe the weather condition before going for the seasonal cultivation. The people who are living in those particular areas are major sufferers of the flooding. The design proposals have provided insight into the process of creating a better homestead, which would he placed higher than the higher rise of flood water, would allow some sort of vegetation and security of livestock and also cater to the needs of proper hygiene. Char people have limited income or even most of them have no income source, so there is the need of a permanent income source. If they have no such income then it is difficult for them to spend 4-5 thousand taka to build a house. Even if they are able to build their basic shelter by borrowing money from others, it is extremely difficult for them to manage the cost of raising their homestead to a higher ground. So the process of snaking the homestead should have to be cost effective. In the design proposal there is the expression of using locally found materials to build the house. Char people already know how to prepare a homestead to withstand flooding. But they have the lacking of organizing their homestead in a better way. Char people always live under two basic threats one is the devastation of natural hazard and another is the poverty. People need the knowledge to make their homestead better. Char dwellers have no such education to prepare them before flooding. During flooding, water stays highest liar 3-4 months. In this time period, the only thing people can do is to sell their stored crops to the nearest market. So vegetation surrounding the homestead can help people to survive during flooding. Also there are many resources which they have can work as livelihood options.

In the process of going through this study, the biggest truth was unveiled. The amazing mental strength, patience and endurance of the people living in char areas to withstand the might of so many natural calamities and still survive has been an inspiring discovery.

Char people are the direct victim of flooding. Given the proper facilities and assurance of organized communal living, these people can lead it better life. First of all they need a permanent place to live. They need an income source to live. They need education for their children. They need communication to do their ollicial works. Al! these are possible if they can have access to all of these. Things will only work out for them if they are provided with a safe, organized and suitable homestead to live. Also they need some infrastructure which will cover all their social requirements. So for the future research these issues could be analyzed and addressed accordingly. This requires it better communication system which is usually lacking. In that particular char, no markets for trade was found. Since the char dwellers are predicting the char to stand for another 5 wars at the least, it is only obvious that the need of a market is paramount. The nearest ni arlket for trade is 3 -4 miles away from the char, and has to be reached by boat. It is extremely difficult for the char dwellers to go that far every time to trade their goods. In future, the importance of the presence of a market within the char has to be considered. [ducation is an important issue to consider. In the study char there have seen a Government Primary 'School which is committed to ensure the education of the children of char people. But in practical there found very poor co-ordination and poor situation of providing education. 'teacher comes to the char with their will and stay very short time. So the education of the children remains unfinished and unqualified. That is why there need a proper monitoring authority to report about the management system of the school.

Different policy-level decisions have to he considered involving the government, char land owners, char community and the other conccrnal NGO's and local organizations. The government could collaborate with the NGO's to raise fund for providing the earth filling facilities and the basic materials for building houses Ior the char dwellers. The land owners can be monitored by an impartial authority so that there is a fair distribution of land and work opportunities among the general char dwellers. [:\ cry concerned organization has to take honest attempts to help. This would not only ensure a better life for the char dwellers, but also create an efficient and inspired manpower % hick would act assets for the development of the country and its image in the world scene.

DPB (2010) A research on "A Comparative Analysis of Different Types **of Flood Shelters In Bangladesh"**

J. B. Alam, M. Udiin, J. uddin Ahmed. II.Cacovcan. M. I labibur **Rahman, B.K. Banik, N.** Yesmin 2007 "Study of Morphological Change of' River Old **I3rahmaputra and Iis Social** I **mpacts by Remote Sensing**

J. B. Alam, Nov-Dec 2000 a study on *"Pillage Ju/i•ustructirrc to cope with the* ***Environment".***

Definition of flood adopted from http:/^'^ ww.th efi-cedictionarv.com/flood *(Accessed* ***on 29"h*** *November 2010)*

Peter J. **Webster & Robert Grossman** . . **January** 2003, ***"1,'orcca.cting River Discharge into Bangladesh on Short***, *Medium and Lou, Time Scales* - ***lnrhli****shed* ***on 2(P.June 1998***

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"Indigenous technology in disaster mili ,ration Irom" hoii://w\v\vadpc.net/pclr-sea**/cbdrrm.htm** *(Accessed on 27th October 201 0)*

Wikipedia

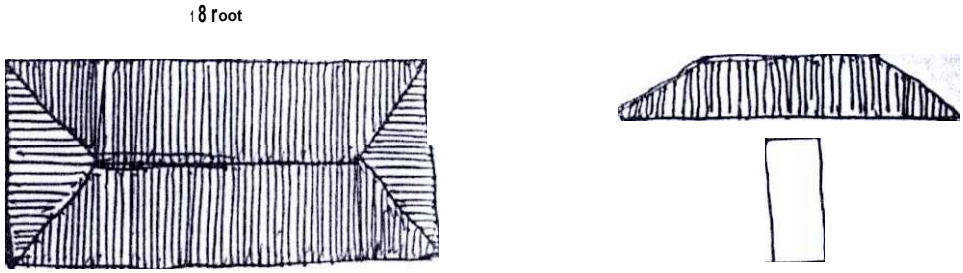
"Mythology on **Brahmaputra** River" (Ac c.^.ticd *on 1 2'i' ,hi/ ' 2010)*

"River Erosion in *Bungludcsh "* about *"Rrulrinaputru River "*

http /hvww. **google**, **com/ttsclicnt hs^**.<<|^| _cn&c a ş ocial **organization** +" **FRIENDSHIP"+w orkin^+on+strent thening homestead** + a t_ ' cha & ^q=f^Lncfi=& **agl=&oq=&^ s r**
(**Accessed on 4"' December 2010)**

Cost **analysis of** a typical house made by CI sheet

Cost of snaking houses in the char depends on materials. A cost analysis of a typical house of length 18 feet and width 9 feet using ('I sheet is given below.



Cost analysis ()J ',t tv pical house making by CI sheet

CI sheet - 2 bundles

(70 feet = I bundle) I bundle Cl sheet 8 Icet length = 9 pis = 4400 tk

Cost of 2 bundle = 2 X 4400 =i 8800 tk

Earth 15000 cft to 30000 cft

For earth filling work the daily wage is 200 tk per labor per day

For 1000 cft earth work it needs 5-6 labor per day

Labor work for earth tilling = 15 X 6 X 200 = 18000 tk

For making roof wood 4 cft

Eucalyptus wood per eft =350 tk

Cost for wood 4 X 350 tk = 1,100 tk

Nail =200 tk

Bamboo =250 tk per pis

I Bamboo = 4 pole

16 pole = 4 pis of Bamboo = 1000 tk

Labor bill for roof making complete by 2 person - 1000 tk

Total **cost for making**; **house** is = 30400 tk

wood and the labor bill of making the roof. It has been found that, about 40 **% cost is reduced** when Cl sheet, wood and labor hiIl is eycIuded lions the cost.

Many other components are to be considered fora good solution **of improving a single house. Through the findings, various** major components have been focused on **and analyzed providing a** tentative procedure ol- improve ing the homestead **in char areas in general.**

Questionnaire

Participant 1:

Name: Hazera

Age: 40 years

Sex: Female

Occupation: I louse wife

Q. Year of the settlement at the Char

Ans: About one and a half years ago

Q. Place of homestead owned/by lease

Ans: We are staying here for temporary basis. Still we did not have any permission from owner to settle here for some years.

Q. Relation with the house head?

Ans: Wife

Q. Source of family Income?

Ans: Daily labor work and agriculture

Q. Settlement of the temporary homestead?

Ans: On medium high land

Q. How much area you occupy?

Ans: 5 **Decimal**

Q. What are the uses of your spaces?

a. separate space for living, cooking, and storing of food

b. crop processing in the yard

c. there is a burner in one corner of the vard

d. space for little vegetation, as we did **not have lo** live Ior several **years so we do small scale vegetation**

e. space for ducks, **chickens**

f. **and for few other purposes**

Q. What types of vegetation you do?

Ans: In a small scale like some seasonal vegetation just only for gamily need

Disaster related question

Q. What are the hazards you faced bctorc?

Ans: We faced many flood events bctorc and also some erosion events. **In that time we** moved to another Char and took shelter. In one flood event we went to the flood shelter.

Q. Which on was the recent hood event:'

Ans Flood of 2009 was the recent event we faced. that's the reason we are here.

Q. What you did during that flood?

Ans: In that time my husband made a higher platlornr with the bed and hangs it with the support of the root. We have passed about 22 days in this situation.

Q. Frequency of Flood?

Ans: Almost once a year

Q. When flood occurs'?

Ans: from late of May to early of August

Q. How much area gets inundated during flood?

Ans: Almost all lower land gets inundated. We can see just the raising homestead. In that time all people travel by boat.

Q. On which capital it affects most?

Ans: During flooding we cannot do as regular time. So it effects on everything of us

Q. What was the maximum water level in that time'?

Ans: I cannot remember that

Q. What are the preparedness measures you have taken to mitigate flood?

Ans: as we are living in a temporary permission so we have not taken any steps yet but we will do some work when we get permission. Some of the works are, we will raise our homestead, we will settle a toilet, we will do vegetation surrounding of our homestead and so many work we will do.

Name: Hasern All

Age: 45 years

Sex: Male

Occupation: Daily labor work and Fiklung

Q. Year of the settlement at the Char

Ans: This year (2010) 4 month have passed

Q. Place of homestead owned/by lease

Ans: We are staying under temporary permission by the land owner

Q. Relation with the house head?

Ans: House head

Q. Source of family Income?

Ans: Daily labor work and agriculture

Q. Settlement of the temporary hommestead`?

Ans: On medium high land

Q. How much area you occupy?

Ans: Just space for a room

Q. What are the uses of your spaces?

a. living, cooking, and storing of food, all in one room

Q. What types of vegetation you do?

Ans: We share others land for doing vegetation

Disaster related question

Q. What are the hazards you faced before?

Ans: We faced many flood events be lore and also some erosion events.

Q. Which on was the recent flood event'!

Ans Flood of 2009 was the recent event.

Q. What you did during that flood?

Ans: In that time I moved to the flood shchcr to take shelter with nay family.

Q. Frequency of F lood?

Ans: Almost once a year

Q. When flood occurs?

Ans: During rainy season

Q. How much area gets inundated during flood'?

Q. On which capital it it`fccts most?

Ails: 1 any a very poor man, I have only my **life and I'amily to keep sale.**

Q. What was the maximum water level **in that time'?**

Ans: It was about] 2 -13 feet high troll) the lower land

Q. What are the preparedness measures you have taken **to mitigate flood?**

Ans: We are waiting to get help; if we `get any help then we **will do something for our homestead.**

Name: Md. Shekh Farid

Age: Around 40 years

Sex: Male

Occupation: Basically I am a vendor. I use to sell sweet compressed cake in the nearest villages and also I do cow rearing and boat rearing.

Q. Year of the settlement at this Char

Ans: Alter 2007 flood

Q. Place of homestead owned/by Icasc

Ans: I have taken this land by lease fl-om the owner.

Q. Relation with the house head?

Ans: House head

Q. Source of family Income?

Ans: Selling compressed sweet cake and cow and goat rearing.

Q. Settlement of the homestead?

Ans: On high land

Q. Flow much area you occupy?

Q. What are the uses ofyour spaces?

a. separate space for li ving, cooking. and storing of food

b. separate spaces for domestic animals

c. crop processing in the yard

d. there is a burner in one corner of the yard

e. space for little vegetation , as we did not have to live for several years **so we do small scale vegetation**

f. space for ducks, chickens

g. and for few other purposes

Q. What types of vegetation you do?

Ans: I and my wife do vegetation alone the year because these vegetables fulfill our daily need and we also sell it to the nearest market.

Disaster related question

Q. What are the hazards you faced heIOre?

Ans: We faced many flood and erosion events.

Q. Which on was the recent flood event?

Ans Flood of 2007 was the recent bii-i!^est even I can remember.

Q. What you did during that flood?

Ans: It was at night, I wake up and tic our bed up With the roof to rescue and find a boat to take my family to the Kondolpara Hood shelter.

Ans: Almost every year

Q. When flood occurs?

Ans: From late of'May to early ofJuly during full Monsoon

Q. How much area gets inundated during flood?

Ans: Almost all land gets inundated during flood.

Q. On which capital it affects most?

Ans: On all capitals

Q. What was the maximum water level in that time?

Ans: Above 10 feet from the lower land.

Q. What are the preparedness measures you have taken to mitigate flood?

Ans: We have raised our homestead with the help of"I RIENDSI III'". **We have done some vegetation surrounding our homestead**. We do cow **and goat rearing for better economic condition. Also we have a** sanitary latrine **to keep environment** healthy.

Name: Nuru Mia

Age: Around 42-43 years

Sex: Male

Occupation: Agriculture

Q. Year of the settlement at this Char

Ans: After 2007 flood

Q. Place of homestead owned/by lease

Ans: I have taken this land by lease lroin the owner.

Q. Relation with the house head?

Ans: House head

Q. Source of family Income?

Ans: Agriculture and have cows.

Q. Settlement of'the homestead?

Ails: On high land

Q. 1-low much area you occupy?

Ans: Around 5 Decimal

Q. What are **the uses ofyour** spaces'?

a. separate space for living, cooking, and storing, of food

b. separate spaces for domestic animals

c. crop processing in the yard

d. there is a burner in one corner of the yard

e. space for little vegetation, as we did not have to live for several years so we do small scale vegetation

f. and for few other purposes

Q. What types of vegetation you do?

Ans: We do all kind of vegetation along the year.

Disaster related question

Q. What are the hazards you faced before?

Ans: We faced many flood and erosion events.

Q. Which on was the recent flood event?

Ans Flood of 2007 was the recent biogcst even I can remember.

Q. What you did during that flood?

Ans: I made a higher platform to keep sate my family.

Q. Frequency of Flood'?

Ans: Almost every year

Ans: From late of May to early of July during full Monsoon

Q. How much area gets inundated during Hood?

Ans: Almost all land gets inundated during flood.

Q. On which capital it affects most?

Ans: On all capitals

Q. What was the maximum water level in that time?

Ans: Above 10-1 1 feet from the lower land.

Q. What are the preparedness measures VOL) have taken to mitigate flood?

Ans: I have raised our homestead. We have done some vegetation surrounding our homestead.

Name: Md. Khorshed

Age: Around 60 years

Sex: Male

Occupation: Agriculture

Q. Year of the settlement at this Char

Ans: After 2007 flood

Q. Place of homestead owned/by case

Ans: I have taken this land by lease from the owner.

Q. Relation with the house head?

Ans: I louse head

Q. Source of Family Income?

Ans: Agriculture and have son at the city.

Q. Settlement of the homestead?

Ans: On high land

Q. How much area you occupy?

Ans: Around 7 Decimal

Q. What are the uses ofyour spaces'?

a. separate space for living, cooking. and storing of food

b. separate spaces for domestic animals

c. crop processing in the yard

d. there is a burner in one corner of the yard

e. space for little vegetation, as we did not have to live Ibr several years so we do small scale vegetation

f. and for few other purposes

Q. What types of vegetation you do'?

Ans: We do all kind of vegetation alcui" the year.

Disaster related question

Q. What are the hazards you hbced hefore?

Ans: We faced many flood and erosion events.

Q. Which on was the recent flood event?

Ans Flood of 2007 was the recent even.

Q. What you did during that flood?

Ans: I went to the flood shelter with my family.

Q. Frequency of Flood'?

Ans: Almost every year

Ans: During rainy season

Q. How much area gets inundated dining hood?

Ans: Almost all land gets inundated during flood.

Q. On which capital it affects most?

Ans: On everything

Q. What was the maximum water level **in that time?**

Ans: Above 12 feet from the lower land.

Q. What are the preparedness measures you have taken to mitigate Flood?

Ans: We have raised our homestead. We have done some vegetation surrounding our homestead like banana trees vegetable shed etc.

Participant 6:

Name: Najimuddi

Age: Around 50 years

Sex: Male

Occupation: Daily labor work

Q. Year of the settlement at this Char

Ans: After 2007 flood

Q. Place of homestead owned /by leak

Ans: I have taken this land by lease from the owner.

Q. Relation with the house head?

Ans: House head

Q. Source of family Income?

Ans: Daily labor work.

Q. Settlement of the homestead?

Ans: On high land

Q. I-low much area you occupy?

Ans: Around 7 Decimal

Q. What are the uses of your spaces?

a. separate space for living, cooking. and storing of food
b. separate spaces for domestic animals
c. crop processing in the yard
d. there is a burner in one corner of the yard
e. space for little vegetation, as we did not have to live for several years so we do small scale vegetation
f. and for few other purposes

Ans: We do all kind of vegetation along the year.

Disaster related question

Q. What are the hazards you faced before?

Ans: We faced many flood and erosion events.

Q. Which on was the recent flood event?

Ans Flood of 2007 was the recent even.

Q. What you did during that flood?

Ans: I stayed here at that time I just made a platform and after sonic day I took shelter on of my neighbor's higher homestead.

Q. Frequency of Flood?

Ans: Almost every year

Q. When flood occurs?

Ans: During rainy season

Q. How much area gets inundated dui ing flood'?

Ans: Almost all land gets inundated during flood.

Q. On which capital it affects most'?

Q. What was the maximum water level in that time?

Ans: Above 12 feet from the lower land.

Q. What are the preparedness measures you have taken to mitigate flood?

Ans: We have raised our homestead. We have done some vegetation surrounding our homestead like banana trees vegetable shed etc.

Participant 7:

Name: Md. Shuja Mill

Age: Around 40 years

Sex: Male

Occupation: **Daily labor work and a" .riculture**

Q. Year of the settlement at this Char

Ans: After 2007 flood

Q. Place of homestead ownedlby, lease

Ans: I have taken this land by lease from the owner.

Q. Relation with the house head?

Ans: l-louse head

Q. Source of family Income?

Ans: Daily labor work and agriculture

Q. Settlement of the homestead?

Ans: On high land

Q. How much area you occupy'?

Ans: Around 7 Decimal

Q. What are the uses of your spaces'.'

a. separate space for living, cooking, and storing of food

b. separate spaces for domestic animals

c. crop processing in the yard

d. there is a burner in one corner of the yard

e. space for little vegetation, as we did not have to live for several years so we do small scale vegetation

f. and for few other purposes

Q. What types of vegetation you do`?

Ans: We do all kind of vegetation along the year.

Disaster related question

Q. What are the hazards you faced before?

Ans: We faced many flood and erosion events.

Ans Flood of 2007 was the recent even.

Q. What you did during that flood?

Ans: I stayed here at that time I just made a platform and after some day I took shelter on of my neighbor's higher homestead.

Q. Frequency of Flood?

Ans: Almost every year

Q. When flood occurs?

Ans: During rainy season

Q. How much area gets inundated during flood?

Ans: Almost all land gets inundated during flood.

Q. On which capital it affects most?

Ans: On everything

Q. What was the maximum water level in that time?

Ans: Above 12 feet from the lower land.

Q. What are the preparedness measures you have taken to mitigate flood?

Ans: We have raised our homestead. We have done some vegetation surrounding our homestead like banana trees vegetable shed etc.

Name: Kalam

Age: Around 45 years

Sex: Male

Occupation: Agriculture and fishing

Q. Year of the settlement at this Char

Ans: After 2007 flood

Q. Place of homestead owned/by lease

Ails: I have taken this land by lease Iron the owner.

Q. Relation with the house head'?

Ans: House head

Q. Source of family Income?

Ans: Agriculture and fishing

Q. Settlement of the homestead?

Ans: On high land

Q. How much area you occupy'?

Ans: Around 7 Decimal

Q. What are the uses ol'your spaces?

a. separate space for living, cooking, and storing of' food

b. separate spaces for domestic animals

c. crop processing in the yard

d. there is a burner in one corner of the yard

e. space for little vegetation, as we did not have to live Cor several years so we do small scale vegetation

c. and for few other purposes

Q. What types of vegetation you do?

Ans: We do all kind of, vegetation along the year.

Disaster related question

Q. What are the hazards you faced belore?

Ans: We Caced many flood and erosion events.

Q. Which on was the recent flood event?

Ans Flood of 2007 was the recent even.

Q. What you did during that flood'?

Ans: I stayed here at that time I just made a platform and after some day I took shelter on of my neighbor's higher homestead.

Q. Frequency of Flood?

Ans: Almost every year