

RECOVERY OF HOUSEHOLD-LEVEL ASSETS: TOWARDS A CYCLONE RESILIENT COMMUNITY



A Dissertation for the Degree of Master in Disaster Management

By
Shawly Samira
Student ID: 11268009

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Postgraduate Programs in Disaster Management (PPDM)
BRAC University, Dhaka, Bangladesh

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Abstract

During and in the undermath of a cyclone, the major concern in disaster management becomes to saving human life. In this regard, a good number of shelters has been built in the coastal belt of Bangladesh by Government of Bangladesh (GoB) and different humanitarian organizations. The country has been successful in reducing human casualty rate at a satisfactory level. But, there is another sector disaster management needs to focus on, which has become another priority parallel to saving human lives: securing assets of affected people. In post-disaster period, people need their assets to be taken care of to get back to their normal life. Hence, recovery of household-level assets can be dealt as a secondary priority in disaster management strategy just next to the primary priority of saving human life. Any asset which is related to a household is regarded as household-level asset, where securing it to the cause of obtaining resilience by a community, is the focus of this dissertation. An effort has been given here to ensure a required state of living, an affected community can expect to have after a cyclone. The assets that had been considered here were limited to livestock, food grains and safe drinking water. The primary goal of the study is to understand the necessity of recovering the assets as a measure in cyclone preparedness program. The recovery of household level assets interventions are in accordance with two major strategies: structural and non-structural measures. The structural measures include two interventions: strengthening of existing structures housing the assets and alternative options to survive in severe cyclones. Alternative options are proposed here to secure a cyclone prone community's household assets and to provide options to allow them to recover assets after a severe cyclone, while these assets become very important to them in terms of economic support and safe health. In this dissertation, a conceptual idea of "Asset Hub" is proposed to house the food grains and rain water harvesting system. The idea of this structure is provided to act as a community asset storage area throughout the year. The non structural measures encompasses the implementation strategies of recovery and strengthening of household level assets to gain community resilience. After determining some strategic options, a case study needs to be done in order to check that those options work in reality or not. This dissertation ends up examining the strategic options in a village of a coastal area of Bangladesh. Different measures such as, improving the infrastructure of the community, proposing greenbelt to protect the community from the cyclonic wind, strengthening of existing houses by providing some guidelines were undertaken to ensure a cyclone resilient community.

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List of Acronyms

BDRCS	Bangladesh Red Crescent Society
BMD	Bangladesh Meteorological Department
CDMP	Comprehensive Disaster Management Program
CPP	Cyclone Preparedness Programme
DDM	Department of Disaster Management
DMB	Disaster Management Bureau
FAO	Food and Agriculture Organization
GoB	Government of Bangladesh
ICZMP	Integrated Coastal Zone Management Plan
IFRC	International Federation of Red Cross and Red Crescent Societies
IUCN	International Union for Conservation of Nature
HRA	High Risk Areas
JDNLA	Joint Damage, Loss and Needs Assessment
NGO	Non-Governmental Organization
PEDP	Primary Education Development Programme
PWRI	Public Works Research Institute
PSF	Pond Sand Filter
RCC	Reinforced Cement Concrete
RZ	Risk Zone
WARPO	Water Resources Planning Organization
WB	World Bank
WFP	World Food Programme
WASH	Water Sanitation and Hygiene
UN	United Nations
UNDP	United Nations Development Program
UNEP	United Nations Environment Programme
UNICEF	United Nations International Children's Emergency Fund
UNISDR	United Nations International Strategy for Disaster Reduction

Chapter 01: Introduction

1.1 Background

Bangladesh is sometimes considered a land of natural disasters because it is very vulnerable when it comes to floods, river erosion and cyclones. Between 1980 and 2008, it experienced 219 natural disasters, causing over US\$16 billion in total damage (UNDP). This country is vulnerable in face of earth's forces. That is why the country is in a permanent state of danger. The natural elements have caused the death of millions of people and are threatening the 140 million populations that are currently living in Bangladesh.

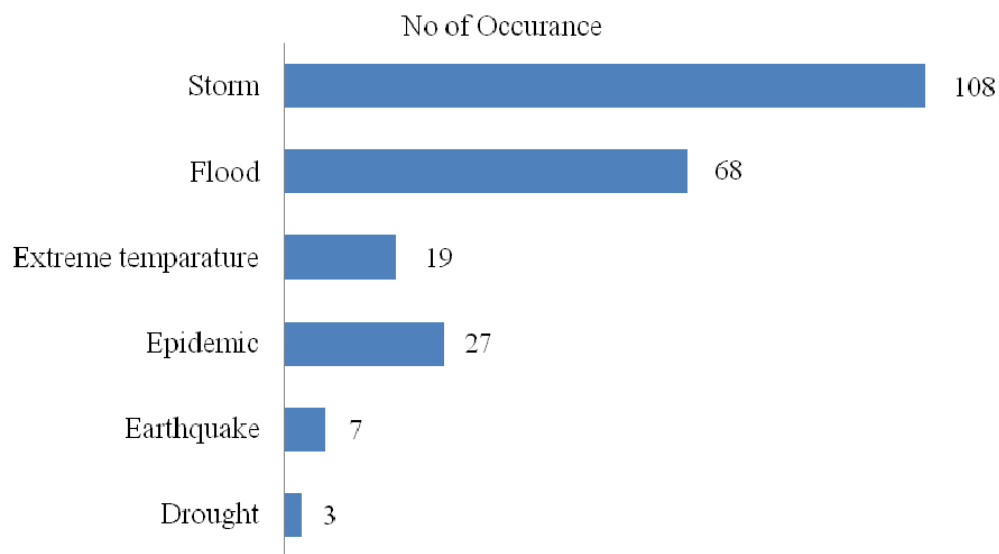


Fig 1.1: Number of Natural Disaster Occurrence in Bangladesh between 1980-2010,
(Source <http://www.preventionweb.net> accessed on 24.12.2013)

According to United Nations International Strategy for Disaster Reduction (UNISDR) 2013 between 1980 to 2010, Bangladesh experienced 234 natural disasters, where the highest number of disaster was cyclonic storms (Fig 1.1.1). Because of the funnel shaped coast, Bangladesh very often becomes the landing ground of cyclones formed in Bay of Bengal. These cyclonic storms cause maximum damage to this country. This is because of the low flat terrain, high density of population and poorly built houses (Choudhury M A, 2001).

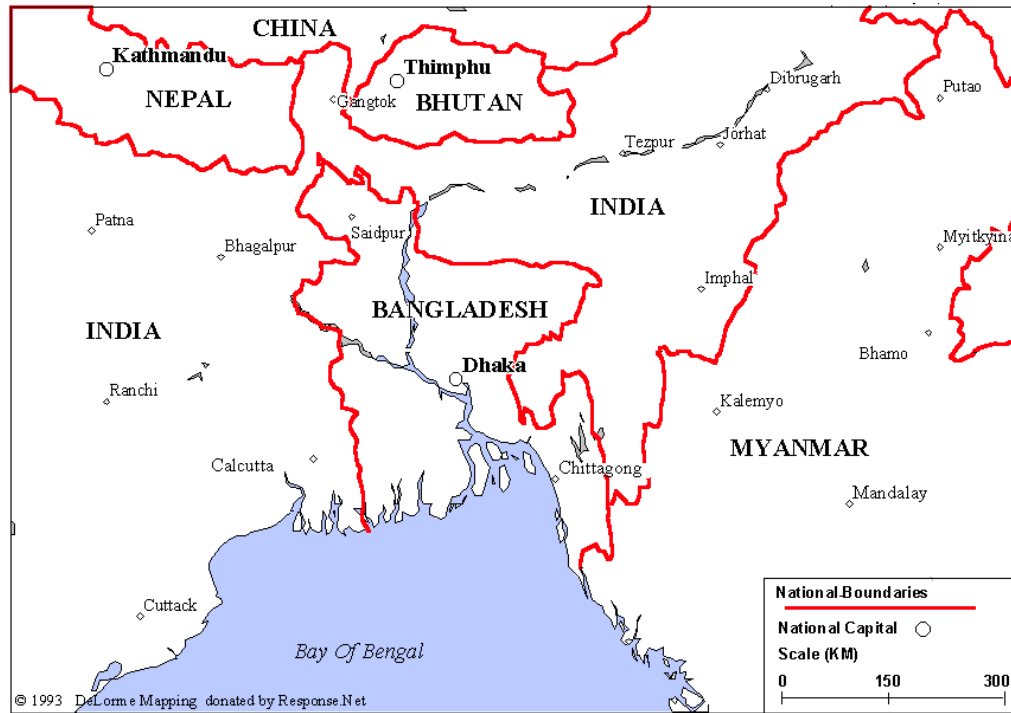


Fig 1.2: Map showing funnel shaped coast of Bangladesh
(Source: www.users.physics.harvard.edu accessed on 03.01.2014)

Abrupt surge of water known as storm surge are associated with cyclones in addition to the waves associated with winds. Most of the damages during a cyclone storm are done by the storm surges which sometimes wash away whole islands and coastal areas. The geography of Bangladesh brings not only the life giving monsoon but also the life threatening cyclones.

In Bangladesh, the severe cyclones occur mostly during pre (April-May) and post (September-December) monsoon and they are the ones which cause the most destruction (Choudhury M A, 2001).

Table 1.1: Average Disaster per year

Disaster	No. of Occurrence/Year
Drought	0.10
Earthquake	0.23
Epidemic	0.87
Extreme temp	0.61
Flood	2.19
Insect infestation	...
Mass mov. dry	...
Mass mov. wet	0.06
Volcano	
Storm	3.48
Wildfire	...

(Source <http://www.preventionweb.net> accessed on 24.12.2013)

From 1970–98, there was devastation due to 38 severe cyclones. The April 1991 cyclone inflicted a material damage was about USD 2.4 billion and human casualties numbered around 140,000. In 1970, a similar catastrophe claimed some 500,000 lives. In addition, storm surge, an unusual rise in seawater associated with a tropical cyclone originating in the Bay of Bengal, has also caused major devastation in the coastal region. In November 2007, Cyclone Sidr struck the coastal region, the worst of its type since 1991, with winds of 250 km/h—155 miles per hour (mph)—and a five meter sea surge, killing more than 3,300 people. Millions of people were affected, approximately one million tones of rice crop were lost, and by January 2008 nearly 500,000 people were estimated still to be living in temporary accommodation. In Bangladesh nearly 4,641,060 people are exposed in areas under the threat of cyclones; ranking it 6th among the 89 countries analyzed (Banglapedia).

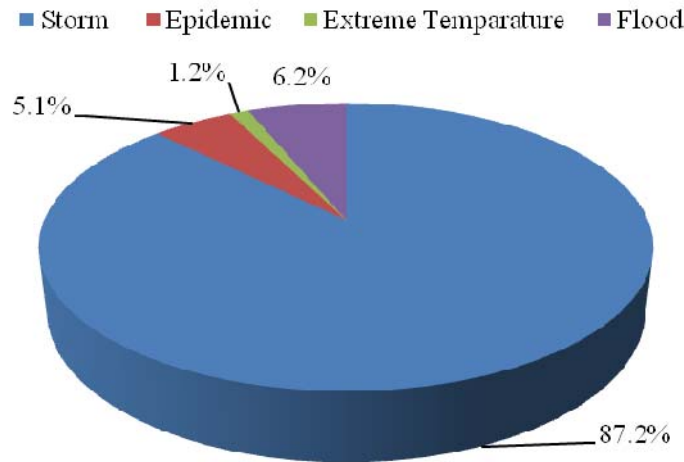


Fig1.3: Percentage of reported people killed by disaster type
(Source <http://www.preventionweb.net> accessed on 24.12.2013)

Table1.2 Economical damages in Natural Disasters of Bangladesh

Diaster	Economic Damage(in taka)
Drought:	...
Earthquake	71,428.57
Epidemic	...
Extreme temp	...
Flood	165,129.41
Storm	49,478.70

(Source <http://www.preventionweb.net> d onaccesse 24.12.20)

Bangladesh government and various organizations and NGOs took up an extensive program of building a good number of cyclone shelters in the affected areas. There are some 2000 cyclone shelters in the coastal areas of the country. Considering the increasing number of population and the cattle heads, it has become essential to construct another 2000 nos. of disaster shelters & killas in the coastal areas to ensure the safety of the coastal population (Mallick and Rahman, 2008).

Improved disaster prevention measures, including an improved forecasting system, coastal afforestation projects, cyclone shelters and embankments are credited with lower casualty rate than expected.

After super cyclone Sidr (2007), it was estimated that about two million people lost vast number of their household assets (livestock, crops, fishing boats, house gardens etc) in the affected districts. These districts also have some of the highest poverty rates in the country (Bagerhat, Barguna, Patuakhali, Pirojpur and Barisal) where according to data from the 2005 household survey, poverty level range between 35 to more than 50 percent of the population (Damage, Loss and Needs Assessment for Disaster Recovery and Reconstruction, GoB, 2008). Thus, the brunt of the disaster was borne by some of the poorest population groups of the country and will significantly further degrade their living conditions. Here the poor people become poorer. Their livelihood assets get affected by damage to income generating assets. According to World Food programme (WFP) study, the percentage of vulnerable and ultra poor households in the coastal areas of Bangladesh is above the national average. The vulnerable and ultra poor groups, according to that study have very meager assets (worth less than 5000 BDT). Moreover, drinking water sources (tube wells and ponds) in many cyclone affected communities get contaminated by saline water and debris and ground water get contaminated by arsenic and salinity in shallow aquifers resulting to a great deal water scarcity.

This paper attempts to ensure the protection of the household assets as these can support the vulnerable members of society during and in the aftermath of a cyclone as well as throughout a year and to resume socio-economic development in the affected regions.

1.2 Objectives

The primary goal of the study is to understand the necessity of recovering the assets (Livestock, food grains and safe drinking water) as a measure in cyclone preparedness program.

- To understand the significance of securing the assets (Livestock, food grains and safe drinking water) parallel to save human life.
- To study three recent major cyclones in Bangladesh.
- To develop a set of comparisons amongst the three cyclones in terms of damage.
- To establish the importance of securing the three assets.
- To provide solutions to make the assets safe and secured in normal time throughout the year as well as to withstand the severity of a cyclone.
- To strengthen the existing state of keeping assets.
- To provide alternative option which will be kept before the occupants to take the options or not.

1.3 Significance of the Research

Bangladesh is a disaster prone country, where cyclone is a major calamity which is experienced by the people of coastal belt of the country very frequently. The sectors that get affected by cyclone storms are:

- Human life
- Infrastructure: Housing, Transport, Power, Telecommunications, Water Supply and Sanitation, Urban and Municipal Infrastructure, Embankments and Water Control Structures
- Social Sectors: Education, Health and Nutrition
- Productive Sectors: Agriculture (Crops, Livestock and Fisheries), Industry, Commerce and Tourism
- Environment

The management interventions of Bangladesh government and various other organizations managed to taken down the number of human fatality to a satisfactory level. But, there are these other sectors which get affected in cyclones which are neglected in comparison to saving human life. After surviving a cyclone, the next important factor is needed is economical and social recovery to sustain a normal life. It takes a long time and sometimes it is impossible to get back to the previous standard of living one used to have prior to the disaster. But it is very important to sustain a minimum level of economically and socially a satisfactory life.

This dissertation gave an effort to ensure a required state of living an affected community can expect to have in the aftermath of a cyclone. The assets that will be considered in this study would be limited to be: Livestock, Grains and Safe Drinking Water.

Livestock are one of the precious assets a household can have. Livestock is a very important asset for the rural landless and for marginal and small farmers. Raising livestock is not only labor intensive, providing many employment opportunities, but also generates regular monthly income from selling milk, eggs, poultry and goats. Most of the damage in the livestock sector was caused the tidal surge that drowned animals and birds and by falling trees. The construction of livestock shelter (Killa), had started in 1970 (source: Comprehensive Disaster Management Program 2013) but till now there is no official data of the total number of killas on the coastal belt of the country. There is insufficient number of shelters for the livestock which should be considered with importance. The recovery of livestock in the aftermath of cyclone is needed.

Rice grains are one of the major components of household assets which get damaged during cyclones. The farmers lose a great deal of these assets due to the absence of considering them. Recovery of rice grains is important.

Safe drinking water in the aftermath of cyclone becomes scarce. People cannot access to the pure drinking water because of the contamination of saline and debris's. They rely on the relief water to meet their need. But not always they get the benefit and they end up using the contaminated water, resulting into affected in water borne diseases. Hence, recovery of pure drinking water will be the consideration of this study.

1.4 Hypothesis

“Recovery of household level assets is needed and important parallel to secure human life in order to make a cyclone resilient community.”

1.5 Methodology

The study is undertaken through some phases, they are- Preparation of Research Problem, Contextual Analysis and Recommendation.

Each phase is important to formulate the research paper. Many data collection methods have been used.

The preliminary stage is to prepare the research problem. A practical problem leads to a research problem. In order to do so an extensive literature review has been done.

Literature review on three major recent cyclones in Bangladesh (Sidr, Aila and Mahasen) has been undertaken to establish a research problem. Report on super cyclone Sidr in Bangladesh, on the topic of damage, loss and need assessment for disaster recovery and reconstruction prepared by the Government of Bangladesh and assisted by the International Development Community with financial support from the European Commission was a guideline to study the effects of cyclone Sidr on the different sectors. A report on cyclone Aila, prepared by UN was a reference to study on the severe cyclone which added to the disastrous effects of cyclone sidr within two years. To study cyclone Mahasen, a report on early recovery detailed assessment of Mahasen, prepared by Government of Bangladesh has been studied.

In order to derive a research problem, after studying the reports, some factors have become important to consider: poverty rate, livelihood pattern and comparison of the human death toll and loss of household assets of the affected areas. Under these factors it became clear that in the affected areas poor people becomes poorer and the socio-economical situation gets disrupted because of the disastrous effects of cyclone.

After considering the above mentioned factors, there came the practical problem which is followed by a research problem. The practical problem is the loss of household assets is bigger than the human death toll in cyclones because of the cyclone shelters which are acting as safe havens and the sector of loss of household assets is being neglected.

Economic recovery as recovery of household assets is needed to protect the most vulnerable members of the society living in the coastal belt of the country and to resume the socio-economic development. In order to ensure a cyclone resilient community, recovery of household assets is required and as important as saving human life. And this consideration needs to be included in our disaster management strategy of cyclones.

After deriving a research problem, a contextual analysis has been done. Concept of recovery of assets in respect of Bangladesh has been analyzed in this part of study.

Different terms related to recovery assets have been explored through various literature reviews. The second phase of contextual study is on Bangladesh, concept of recovery and cyclone mitigation measures. The source of information collection is books, scholarly articles, journals and related websites. In this section all of the data collection is from secondary sources.

A major part of data of this section has been collected through Key Informant Information (KII) from resource persons of Comprehensive Disaster Management Programme (CDMP). They supported this research with various necessary information regarding the cyclone management measures and shelter inventory.

Recommendation is the final section of this research. It includes two parts: analysis and recommendation.

The analysis part is undertaken studying different standards of securing assets. By analyzing them, some recommendations have been derived. The standards of preserving assets have been gathered from books, journals and some other secondary sources.

To verify whether the standards work in real life asset preservation, a case study has been done. The site is chosen from a cyclone prone area of the coastal belt of Bangladesh, Khulna. The selected villages are Botbonia, Dacope, and Khulna. All the site related information is from secondary source. Primary data collection could not be possible due to political unrest throughout the country. To elaborate the study, various drawings and

layouts have been prepared supported by Google Earth. Some hand drawn drawings are there in the recommendation section.

1.6 Research Scopes and Limitations

The study aims to figure out the damages in the sectors of livestock, food grain and safe drinking water. It also finds out the necessity to recover these assets. As Bangladesh constantly improving the mitigating measures of cyclones, it is believed that the study will help to progress one step ahead in cyclone preparedness program.

The limitation of the study is lack of information and inaccessibility to necessary information. Due to the political unrest throughout the country it was not possible to get into the sites and also to access required information.

Most of the part of the whole paper is based on secondary data. Studying the relevant sites would be a great benefit to complete the paper. Interviews, surveys could not be possible.

Chapter 02: The Research Context: Bangladesh

2.1 Introduction

The Context of the research is Bangladesh, which has an approximate area of 147,570 sq.km, bounded between 20°34' to 26°38' N latitude and 88°01' to 92° 41' E longitude. Bangladesh is a low-lying alluvial delta, criss-crossed by many rivers and their tributaries. It is bounded by India and Myanmar on three sides, with the Himalayas in the North and in the South; the funnel shaped coast touching the Bay of Bengal, resulting to experience catastrophic effects of tropical cyclones, norwesters and floods (Choudhury,2001).



Fig 2.1: Location of Bangladesh

(Source: www.physicalmapofasia.com, accessed on 24.12.2013)

The present population size of Bangladesh is estimated at over 158 millions. The rate of population growth has been estimated in 2011 according to which the population growth rate has been 1.566%. Four principal sources of household in 2001 were agriculture/forestry/livestock (29.2%), agricultural labour (20.6%), business (14.7%) and salary/wage (10.9%) (Banglapedia).



Fig 2.2: Map of Bangladesh
(Source: www.banglapedia.org, accessed on 15.11.2013)

2.2 Livelihood Pattern

Rural livelihood of Bangladesh is highly dependent on the natural resources and governed by the climate very much. It includes agriculture, agricultural related activities, fishing and some other activities such as cottage industries and business, etc. (Saadat and Islam, 2011).

Manual labor, including agricultural labor, non agricultural labor and pulling rickshaw or rickshaw-van, is the most important source of income in rural areas. This sector employs nearly 40 percent of all adults and 45 percent of household heads. Many individuals involved in casual labor migrate to nearby cities in search of work for several months of the year. The largest proportion (25 percent) of households dependent on manual labor are engaged in agricultural labor during key phases of the agricultural production cycle. Agriculture, including farming one's own land, sharecropping, and horticulture nurseries constitute the second most important income strategy, involving 26 percent of household heads and 30 percent of all adults. Fifty-five percent of working-age individuals depend on agriculture as their point of income, either through production or labor. Vulnerable households disproportionately (57 percent) depend on manual labor jobs for their income. (WFP 2013)

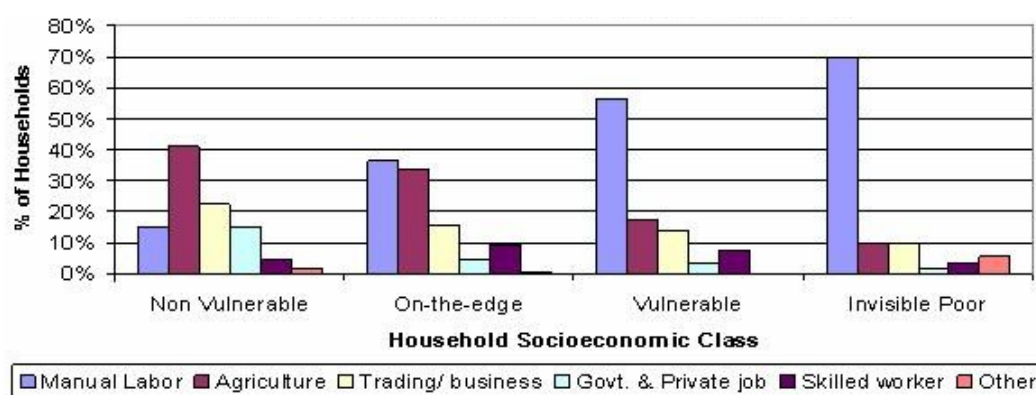


Fig 2.3: Primary Income Strategy of the Households of Bangladesh
(source: WFP)

Manual labor is the most important livelihood strategy in coastal, drought, and northwest zones. A significantly larger proportion of Chittagong Hills Tribe (54 percent) continue to depend on agriculture, which has declined in importance in other regions, particularly in the Char and Coastal zones; in these areas landownership inequalities have dramatically increased in recent decades. Trading and business opportunities are prominent in the coastal zone. Coastal and Char households have the lowest per-capita income (WFP 2013).

2.3 Settlement Pattern

In the word of urban design, settlement pattern is defined as objects and spacing among objects to perform desired functions (Nahiduzzaman and Haas, 2008). Settlement patterns of Bangladesh are determined by the different physiographic regions of the country with their various characteristics. The settlement patterns of the country can be classified into the following groups (Rahman, Tahmina, 2008) :

- a. Nucleated settlements in the high flat land
- b. Settlements scattered and built on artificially raised land
- c. Linear settlements along the river levees
- d. Scattered and isolated settlements on offshore islands
- e. Highly dense clusters on artificially built mounds
- f. Separately built homesteads in hilly areas

The settlement pattern of the coastal regions of Bangladesh is dense clusters. In fact, people have learnt such clustering technique to get more protection from cyclone and through a learning paradigm- experiential learning. The clustering technique could be regarded as a prominent feature of vernacular architecture and mass in urban design that has been evolved from the beginning of human settlement to cope and survive in the harsh climate. The coastal areas are prone to nor-western storm and cyclone and therefore settlement pattern is highly influenced by such hostile weather (Nahiduzzaman and Haas, 2008).



Fig 2.4: Bhola, Barisal
(Source: Googleearth 2013)

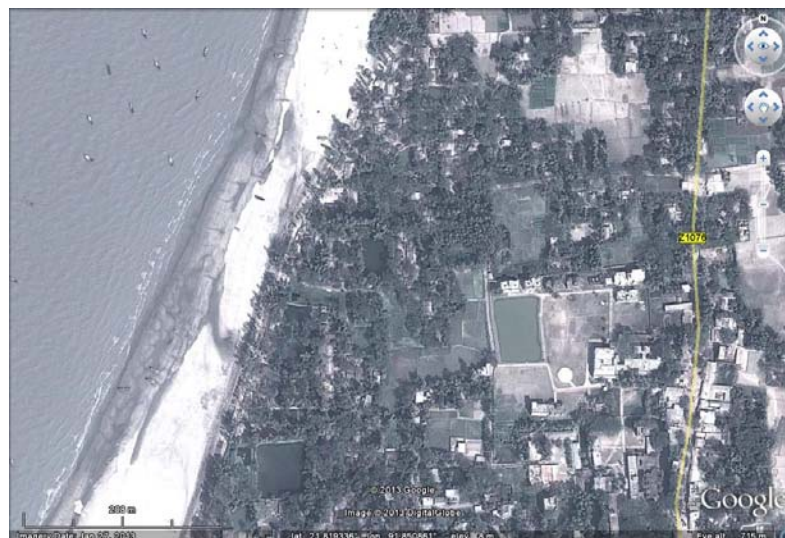


Fig 2.5: Kutubdia, Chittagong
(Source: Google earth 2013)

2.4 Features of a Typical Rural Household of Bangladesh

The traditional rural house form of Bangladesh has been evolved through some factors, such as available land and its characteristics socio economic status of the dweller, culture, religion, climate and available resources. Usually these are built of locally available materials with local construction methods and techniques.

The general character of the rural homesteads is introvert in layout creating spaces for domestic use. The layout comprises of a central courtyard around which tree plantation

and functional spaces are being made. This layout ensures privacy of the women from the passersby and letting them done their household chores.

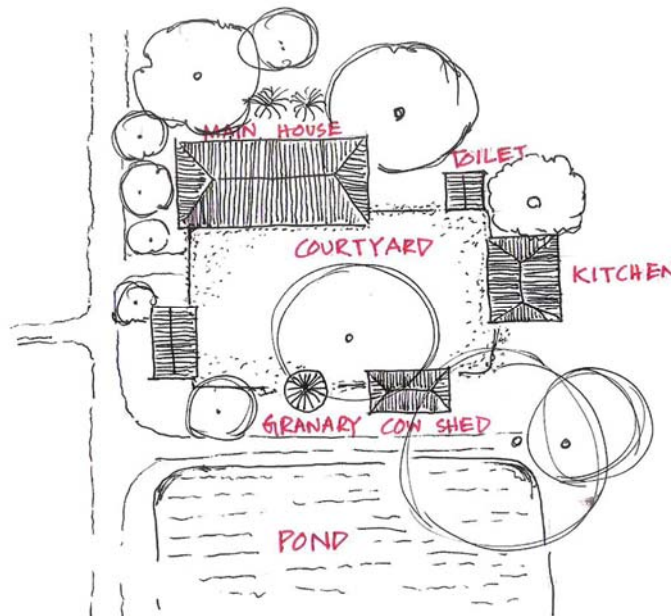


Fig 2.6: Figure showing a layout of a typical household of rural Bangladesh
(Source: Author 2013)

The rural houses have evolved without being influenced by industrialization. The traditional rural homesteads are being changed gradually its' character and form due to the change in family structure and smaller nuclear size. "Changes in different livelihood, livelihood practice, scarcity of available resources and energy sources, cost and availability of land, better communications with the towns, exposures with luxury amenities etc are changing the quality of life and thus the homestead spaces. The use and purpose of different domestic spaces and their associated values are changing with it. Nevertheless, the distinct quality of homesteads is still prominent in the rural Bangladesh" (Rahman, Tahmina, 2008).

2.5 Household Level Assets

Household assets are the important assets of rural Bangladesh households including land, livestock, productive assets, appliances, and non-productive assets.

The poor and vulnerable do not have the assets necessary to generate stable income and maintain a healthy quality of life. Only a little more than four of every ten rural households own agricultural land. Vulnerable and highly vulnerable households are overwhelmingly landless. More than nine out of every ten highly vulnerable households do not own any agricultural land; more than one-fourth of the households do not own any homestead land; and virtually no highly vulnerable households own a pond.

2.6 Disasters in Bangladesh

The land is frequently visited by natural hazards of which floods, cyclones with accompanying storm surges, droughts, tornadoes, river-bank erosions and earthquake are the most disastrous. The losses of lives and properties caused by natural disasters with repeated frequency in short intervals make Bangladesh one of the most disaster prone countries in the world. Since the 90s due to global climate change the occurrence of natural disasters have become irregular and their intensity and frequency have become very high.

One of the strongest named cyclones in the Bay of Bengal was cyclone Sidr. The Joint Damage, Loss and Needs Assessment (JDLNA) estimated the total damage and losses caused by the cyclone to be 1.7 billion USD. Loss on housing due to cyclone Sidr was 893 million USD (GoB, 2008). The impact is primarily felt by the poor people who hardly have any affordability to build cyclone resistant house and thereby to save their lives. In the flood history, flood in 2004 were likely to be as devastating as the 1998 floods in many ways. The joint mission's preliminary estimates show that total damage to assets and output losses are approximately about 2.2 billion USD or 3.9% of GDP, most of which correspond to lost assets (houses). (Nahiduzzaman and Haas, 2008)

2.7 Cyclones in Bangladesh

Geographically, Bangladesh belongs to tropical zone. Tropical cyclones generate near the entrance of the Bay of Bengal and gradually grow while propagating first toward the North-West, then after a turning point to the north-East (Choudhury, 2001). But this pattern is not uniformly followed. The cyclones usually decay after crossing land, causing colossal losses to life and damages to property in the coastal region.

During cyclone propagation, storm surges (resulting from pressure depression, strong wind and heavy rain) are generated and amplified often affecting the coast of the country. Due to the placement of Bangladesh, at the bottom of the funnel shaped Bay of Bengal, storm surges are easily amplified because of the concentration of energy (Choudhury,2001).

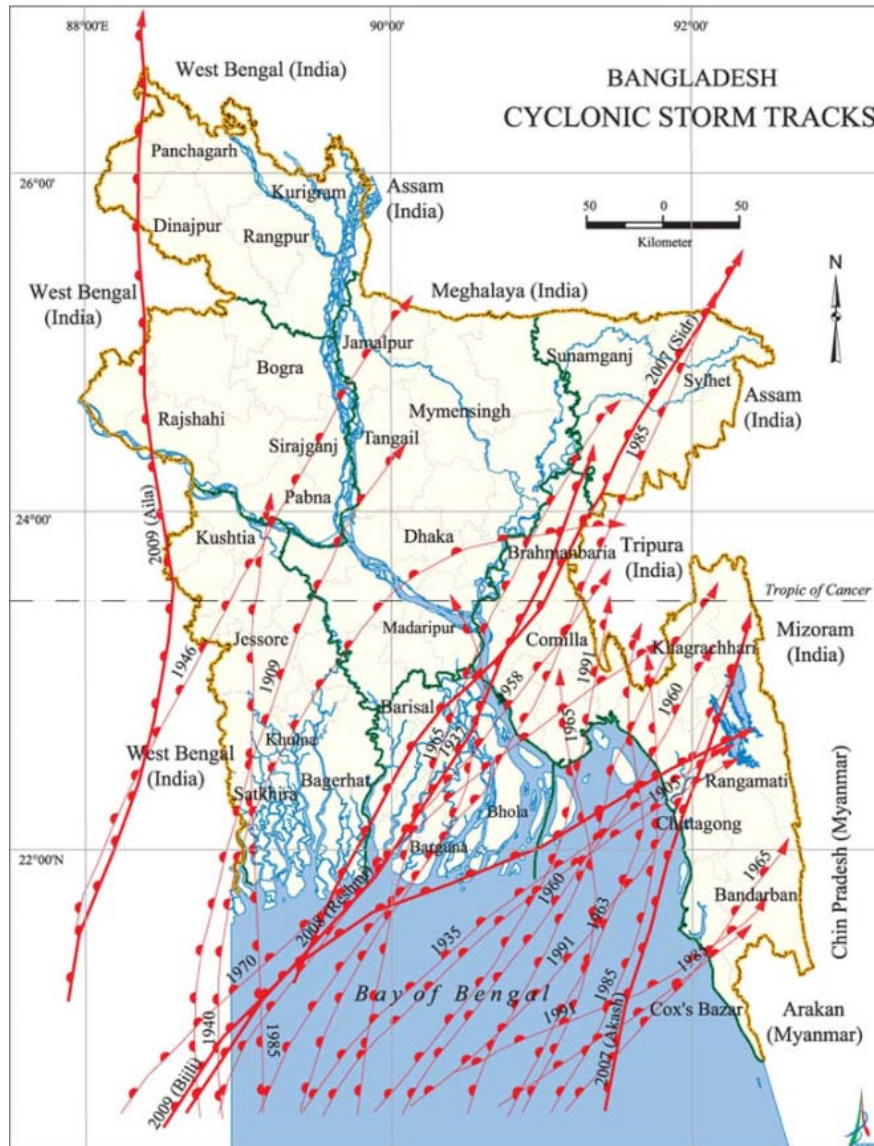


Fig 2.7: Tracks of cyclonic storms.

(Source: www.banglapedia.org, accessed on 22.12.2013)

These cyclones also move towards the coasts of India, Myanmar and occasionally Sri Lanka. But because of the low flat terrain, highly dense population and poorly built houses of Bangladesh, the cyclones cause maximum damage to the country (Choudhury, 2001). Tracks of cyclones in the Bay of Bengal show that normally cyclones at their

initial stages move at a rate of 8-16 km/hour, and in their final stages at 24-32 km/hour, or even up to 48 km/hour.

Records of last 200 years (1795-2010) show that at least 70 major cyclones hit coastal Bangladesh.

Table 2.1: A Comparison of intensity, casualties and loss of economy of the major cyclones experienced by Bangladesh

Date	Maximum Wind speed	Storm Surge	Death Toll
11 May 1965	161	3.7-7.6	19,279
15 December 1965	217	2.4-3.6	873
01 October 1966	139	6.0-6.7	850
12 November 1970	224	6.0-10.0	300,000
25 May 1985	154	3.0-4.6	11,069
29 April 1991	225	6.0-7.6	138,882
19 May 1997	232	3.1-4.6	155
15 November (SIDR)	223	6	3363
25 May (AILA) 2009	92	6.5	190

(Source: Bangladesh Meteorological Department)

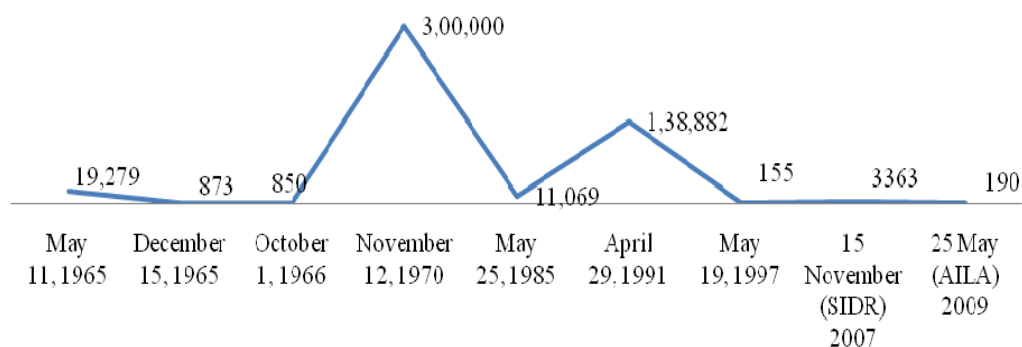


Fig 2.8: Human Death Toll in Cyclones of Bangladesh
(Source: Author 2013)

An average of 1-3 severe to moderate cyclonic storms hit Bangladesh each year, with associated storm surges as much as 13 meters higher than normal in extreme cases, which can reach as far as 200 km inland (Milliman et al. 1989). Approximately 12000km² of coastal area is prone to cyclonic storm surge flood where there is intrusion coastal in south-west zone is 55km and Chittagong 15km.

Cyclone and storm surges occur frequently and cause significant destruction in the coastal areas of the country. The impacts of cyclones can be described through the following table:

Table 2.2: Impacts of Cyclones on Bangladesh

Impacts on Social Structure	Impacts on Physical assets	Impacts on Environment	Impacts on Economy
Loss of human lives, injury, health problems of people, childhood malnutrition, large scale of migration and landlessness, increased suicide and crime rates, and adverse pregnancy outcomes.	Damage and destruction of houses and immobile infrastructure , disruption of communication , damage to port facilities and coastal embankments and structures ,effects on cyclone and storm surge protection measures in the coastal areas .	Damage to mangroves, fisheries and bird habitats ,lack of fresh drinking water ,increase in soil salinity , change in cropping pattern.	Loss of agricultural production, and livelihood system, livestock and property, loss of recreational beaches , coastal cultivable lands are not being utilized for crop production, mostly due to soil salinity which is an impact of tropical cyclones leaving serious and adverse effects on the nationaleconomy as well as on the whole environment..

Cyclones annually hit three to five times during pre-monsoon (April-May) and post monsoon (September- November) period. Cyclones occur before Monsoon season (June-September is Monsoon season in Bangladesh), tend to move along the South-Eastern coastal area. Whereas, cyclones after the Monsoon, tend to move along the West side of the Bay of Bengal (PWRI 2007).

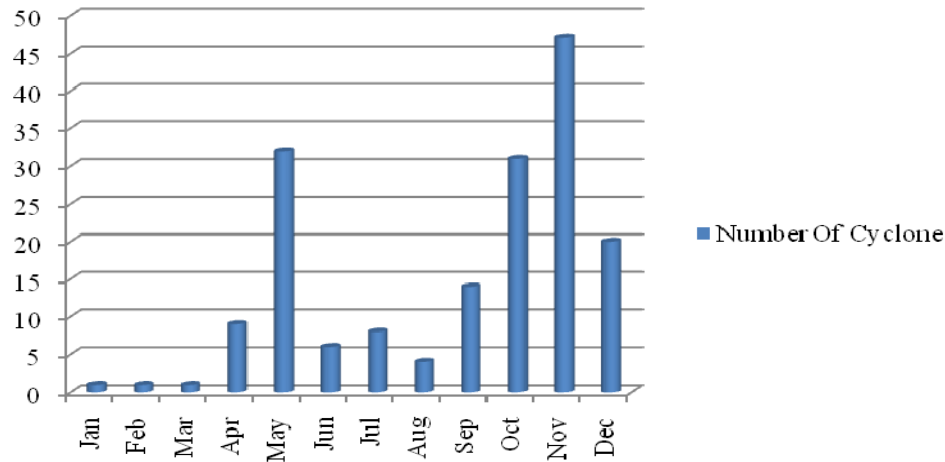


Fig 2.9: Frequency of cyclones in Bangladesh
(Source: www.banglapedia.org, accessed on 22.12.2013)

The coastal area of Bangladesh as defined by Integrated Coastal Zone Management Plan (ICZMP) of Water Resources Planning Organization (WARPO), comprises of 19 districts located in the southern part of Bangladesh (Report by CDMP,2009).The 580km long coastline of Bangladesh is situated at the top of the Bay of Bengal (Mallick and Rahman, 2008) Areas on this coastline and offshore islands are the cyclone prone areas. The areas in which there is a risk of damage to properties are called “Risk Zone” (RZ) and the areas where is a possibility of loss of lives due to appreciable inundation by storm surges are called “High Risk Area”(HRA) (Nishat,1998).It was estimated that about five million people live in “High Risk Areas” (HRA) along the western, central and south-eastern coasts of Bangladesh. Of these, four million people live in “Very High Risk Areas” (Karim,2000).

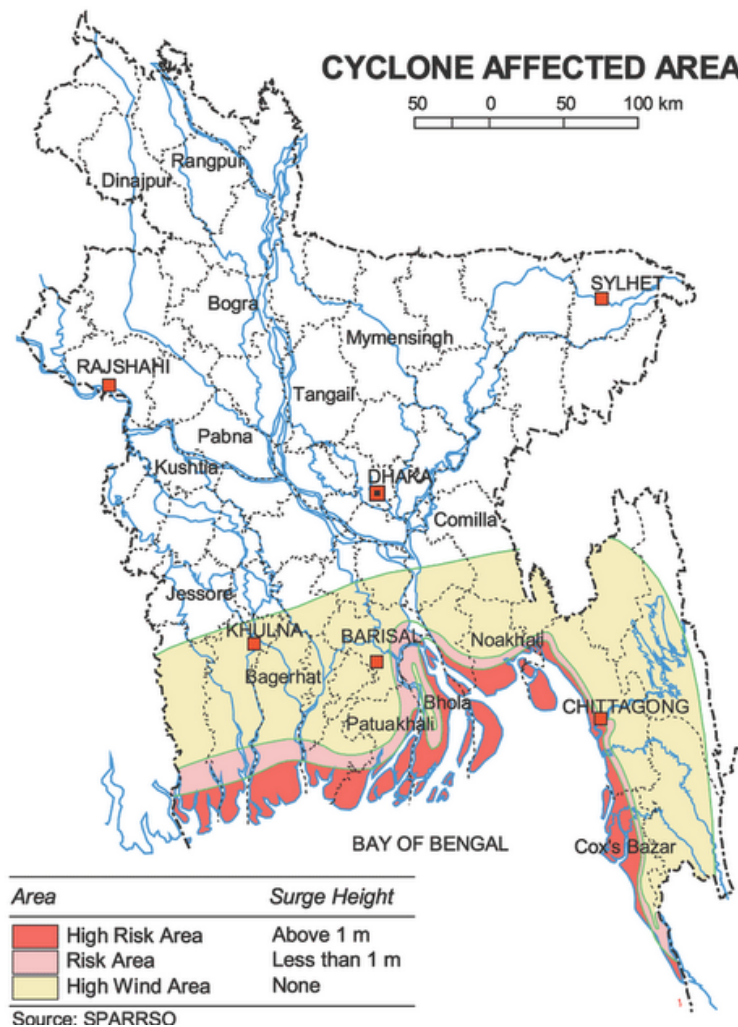


Fig 2.10: Cyclone affected areas of Bangladesh
(Source: www.mapofbangladesh.blogspot.com)

2.8 Institutional Support in Cyclone Mitigation

The impact of natural disasters not only varies with their type and magnitude, but also critically depends on institutional strength and response to disasters by different branches of the government, as well as community-based organizations.

For example, the intensities of the 1991 and 1997 cyclones were of the same magnitudes. Loss minimization was only possible due to accurate and timely forecasting, adequate proper warning dissemination, social mobilization, proper coordination by the government, and other institutional backup.

In the past 50 years, Bangladesh has learnt how to adapt to recurrent cyclones and has succeeded in significantly reducing cyclone-related deaths. Both structural and non-structural approaches are followed in cyclone disaster management since 1961.

Disaster Management Bureau (DMB): DMB established in 1993 under the Ministry of Disaster Management and Relief of the Government of Bangladesh. The revenue budget of Bangladesh government and the financial assistance of UNDP and UNICEF meet the expenditure of the Bureau (Banglapedia).

The Government of the People's Republic of Bangladesh is reducing the risk of people, especially the poor and the disadvantaged, from the effects of cyclones to a manageable and acceptable humanitarian level and having in place an efficient emergency response management system.

Department of Disaster Management (DDM) : DDM, under the Ministry of Disaster Management and Relief was set up in November 2012 following enactment of the Disaster Management Act 2012(Department of Disaster Management).

It pointed out due to increase the number of population and the cattle heads, it has become essential to construct at least 2000 nos. of disaster shelters & killas in the coastal areas. Ministry of Primary & Mass Education has taken-up a programme under the project title "Primary Education Development Programme-2 (PEDP-2) " to construct 507 nos. of school-cum-shelter in the coastal areas. It is expected that about 300 shelters will also be constructed by the others Ministries, Divisions, Organizations and NGOs. Considering this the DM&RD has decided to construct the remaining 1200 Nos. of disaster shelters and killas as per recommendations of the reports of the technical committee (Department of Disaster Management).

Structural Measures of Government of Bangladesh

- As a part of structural mitigation measures the GoB with its own and external resources built about 4000 km coastal embankments during 1961-1978 made to protect coastal land from inundation by tidal waves and storm surges, created mangrove forest (in 1966) along the coast line to protect the embankments.
- GoB also took a Green Belt Project in the coastal areas. This is a participatory reforestation program aimed at reducing the adverse impacts of natural disasters, particularly cyclones and storm surges in the coastal regions. Reforestation of

approximately 1200 km² of mangrove forests in Bangladesh has been carried out to mitigate cyclone risk.

- Since 1960, an extensive program of constructing cyclone shelters had been undertaken by the Government and private sectors of Bangladesh.
- Construction of Multipurpose Cyclone Shelters in the Coastal belt of Bangladesh: Objective of the Project was to provide shelter to the poor people in the coastal areas during emergencies through constructing multipurpose cyclone shelters and thereby help them in reducing disaster risks for their lives and properties and also to increase institutional facilities for community people to use these shelters for multipurpose such as, School/College/Madrasha/Community Centre during normal time (DMRD).

Non-Structural Measures of Government of Bangladesh

- As part of the non-structural measures to cope with cyclones, the GoB is committed to improve its cyclone warning and dissemination system in all parts of the country.
- A very effective cyclone warning system has been established in the country. BMD announces forecasts and warning by wired telegraphy, telefax, telephone, teleprinter, radio and television. Among these, radio broadcasting is the most effective warning communication.
- There are 11 warning level for sea and four for land so that people can know the estimated track/path of the cyclone and degree of risk and necessity of evacuation.
- Under the Cyclone Preparedness Program, Bangladesh has implemented awareness campaigns to disseminate information about cyclone warning signals and preparedness measures, using meetings, discussions, posters, leaflets, film shows and demonstration performances. The Cyclone Preparedness Program (CPP) of BDRCS operates prevention measures including early warning transmission and evacuation, training on preventive measures.
- Other than the CPP, the whole government machinery – Civil administration, Army, Navy, Air force, Ansar, VDP and the line of departments discharge duties in cyclone disaster management.

CDMP:

In mid 1999 the GoB, together with UNDP and other development partners, agreed to address the issue of risk reduction in a more comprehensive programmatic approach. As agreed, the Comprehensive Disaster Management Program (CDMP) is being formulated and nearly in its final stage.

Structural Mitigation:

CDMP constructed a good number of shelters in the coastal belt of Bangladesh.

Non-Structural Mitigation

CDMP has undertaken different strategies to mitigate cyclones:

- Legislation, Policy and Planning
- Training and Public Awareness
- Institutional Arrangements
- Warning Systems
- Local Disaster Action Plans

NGOs :

United Nations (UN) Agencies (such as the World Food Programme (WFP), the UN Children's Fund (UNICEF)), non-governmental agencies such as OXFAM and CARE International, and the International Federation of Red Cross and Red Crescent Societies (IFRC) are working wholeheartedly in mitigating the effects of cyclones in Bangladesh.

Various NGOs are providing great assistances to mitigate the effects of cyclones.

Chapter 03: Reasons Behind Recovery of Household Level Assets

3.1 Introduction

During a cyclone, the first thing we need is to save human lives. Cyclone shelters in coastal areas are acting as safe havens for millions of people since construction of shelters was initiated in the 1960s. Bangladesh Government and various organizations are working wholeheartedly to construct a good number of cyclone shelters on different locations of the country as an effective structural measure as management interventions in cyclone disaster management.

There are a total of 2,583 cyclone shelters located in the coastal districts (CDMP).

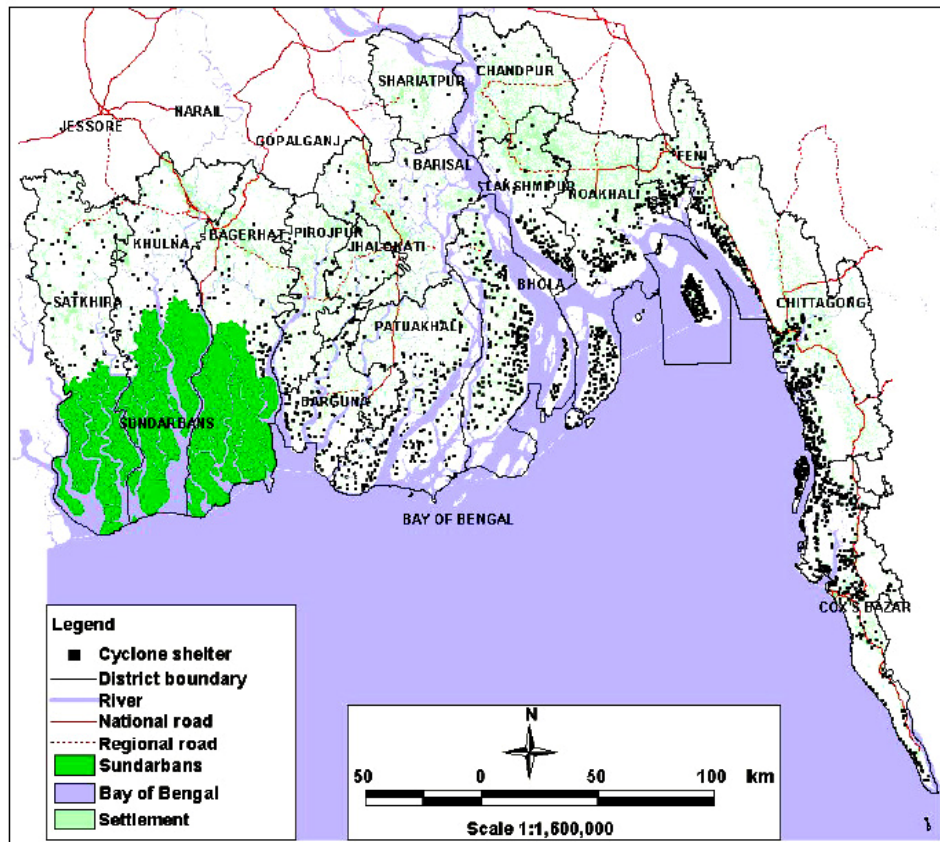


Fig 3.1: Location of cyclone shelters on the coastal areas of Bangladesh
(source: report CDMP,2009)

From the above figure it can be seen that concentration of shelters is higher in eastern coast (in Noakhali, Chittagong, Cox's Bazar and Feni) than in the western coast. The number of shelters is less in the districts of western coast.

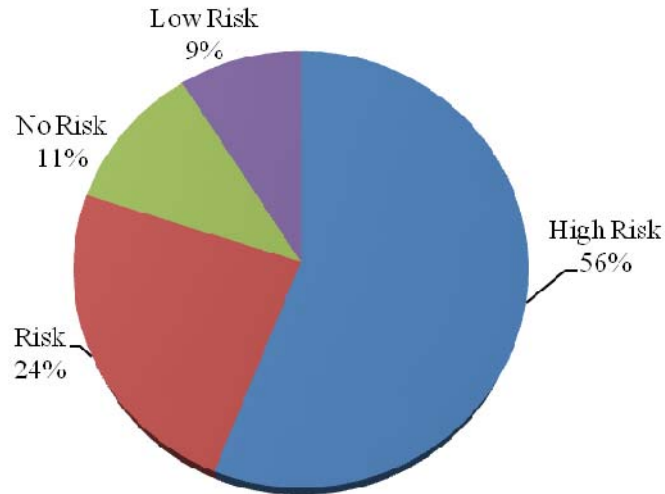


Fig 3.2: Distribution of Shelters in Different Risk Area.
(Source: Report CDMP,2009)

Public shelters were built since 1970, hence the death toll was less in 1991 than the cyclone in 1970.

In a Cyclone, the primary affected sector is human death tolls which are held with great care by providing shelter, which cyclone shelters in Bangladesh are doing at their best. By doing need assessment in post disaster phase of cyclones, it was found that the secondary affected sectors should be taken with great importance, which are- livelihood assets, food and safe drinking water. After a cyclone, the normal standard of life of people becomes threatened in loss of these assets, which make them feel insecure. These assets play an important role in recovery of an affected community. These assets shape up the economical situation or status of a community, which should be preserved to get supports during and after cyclones. This chapter attempts to examine what are the other sectors which become threatened and where the normal standard of living decreases in a cyclone affected community (Report CDMP,2009).

3.2 Three Cases of Cyclones in Bangladesh

a. Cyclone Sidr

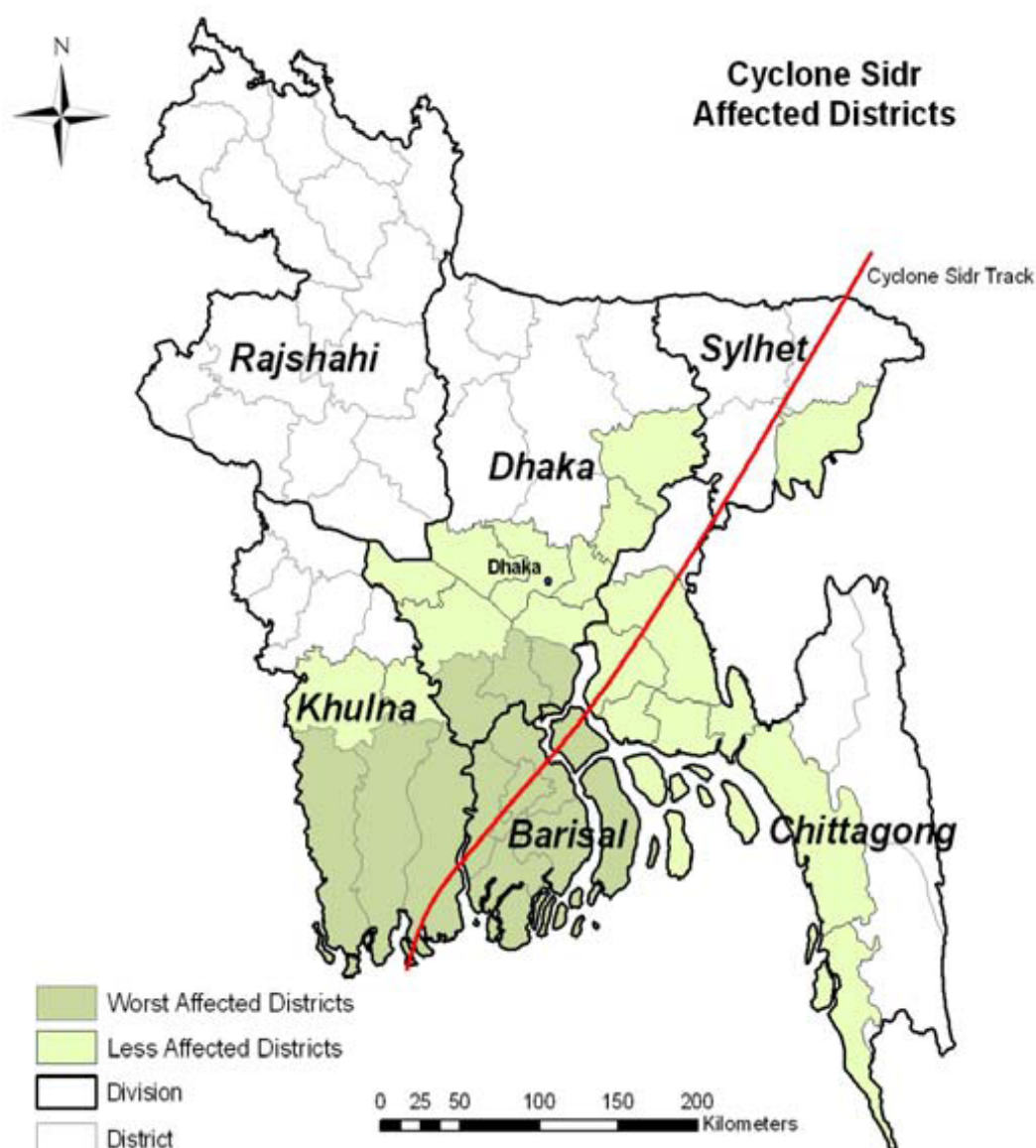


Fig 3.3: Map showing track of Cyclone Sidr.
(Source: Report GoB, 2008)

Super cyclone sidr occurred on the 15th November 2007. The four worst affected districts were Bagerhat, Barguna, Patuakhali and Pirojpur. The eight moderately affected districts were Khulna, Madaripur, Shariatpur, Barishal, Bhola, Satkhira, Jhalakthi, and Gopalgani.

In the affected 12 districts total population is 18,742,733 (18.7 million) where population density per square kilometer is 800 (report GoB, 2008).

Bangladesh is a poor country with a national poverty rate of 40 percent (2005) (Upper Poverty Line) (report GoB, 2008). The two most affected divisions, Barisal and Khulna, have poverty rates that are higher than the national average. Barisal, the worst affected division, has the highest poverty rate in the country at 52 percent and Khulna has a rate of 45.7 percent (2005) [Cyclone Sidr in Bangladesh: Damage, Loss and Needs Assessment for Disaster Recovery and Reconstruction, April 2008].

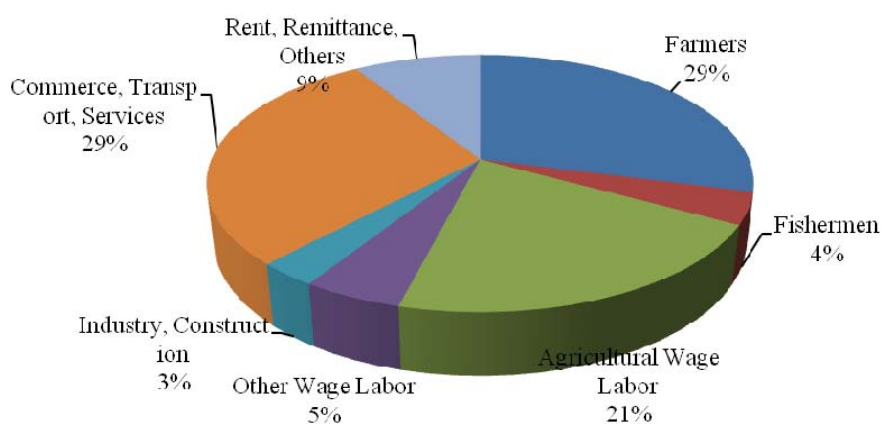


Fig 3.4: Livelihood Pattern

(Source: Cyclone Sidr in Bangladesh: Damage, Loss and Needs Assessment for Disaster Recovery and Reconstruction, April 2008)

The number of death in the Sidr was estimated 3,406 with 55,000 had physical injuries. The preliminary damage and loss assessment for crops, livestock, and fisheries was estimated to be BDT 30.2 billion (US\$ 437.6 million). The estimated value of damage to the livestock subsector was BDT 1.3 billion (US\$ 19.33 million). Around 2,680,942 livestock were killed in Sidr. One million people were seriously affected in their livelihood. This includes two million people affected on their farms, though only 0.58 million of them depended mainly on their farm incomes. Destruction of standing crops and gardens, household food stocks and assets, and livelihoods were done on which the poor households depend on to purchase food. Moreover 11,612 tube wells and 7,155 ponds were completely destroyed (Cyclone Sidr in Bangladesh: Damage, Loss and Needs Assessment for Disaster Recovery and Reconstruction, April 2008).

b. Cyclone Aila

Cyclone Aila occurred on the 25th May 2009. Khulna and Satkhira District of southwest coastal zone of Bangladesh were hit the hardest by the cyclone Aila although other coastal districts Barisal, Bhola, Pirojpur, Patuakhali, Barguna, Jhalokathi, Bagerhat, Chittagong, Cox's Bazar, Feni, Laxmipur and Noakhali were also affected.

More than two thirds of the population (67%) in four upazilas of Shatkhira and Khulna districts (the worst affected areas by Aila) are originally poor. More than half (55%) are extremely poor and food insecure [Cyclone Aila: Joint Un Multi-Sector Assessment & Response Framework, June 2010].

The recent Poverty Estimates, calculated by the Bangladesh Bureau of Statistics, WFP and World Bank, indicates that 65 percent and 58 percent of the population of Shyamnagar and Assasuni upazilas respectively of Satkhira district are extreme poor (below the lower poverty line), and that for Koira and Dacop upazilas of Khulna district are 35 percent and 60 percent [Cyclone Aila: Joint Un Multi-Sector Assessment & Response Framework, June 2010].

The two major livelihoods in the affected areas are farming and fishing. Shrimp farming constitutes 40% of the total occupation. Rests of the employed people are engaged with small holding agriculture (30%) and wage labour activities (30%) [Cyclone Aila: Joint Un Multi-Sector Assessment & Response Framework, June 2010].



Fig 3.5: Livelihood Pattern
(Source: Joint UN Multi-Sector Assessment and Response Framework, 2010)

Total number of death was 190 and approximately 7,100 injuries were counted and over 3.9 million people were affected. Some 1000,000 livestock were killed which is more than 80% of the total number of livestock of the affected areas. Nearly 350,000 acres of cropland were destroyed. More than 70% of the homestead gardens were flooded and 70% of the green vegetation was damaged. All local markets were severely damaged and communities faced difficulties in buying food. Physical access to markets had been disrupted in some of the worst affected areas due to breaches of roads and embankments. Saline intrusion over the surface water resources making them unfit for drinking .4,000 protected ponds, 1,000 pond-sand filters, and 13,000 tube-wells were damaged. This damage has adversely affected water supply coverage by 50 percent (Cyclone Aila: Joint Un Multi-Sector Assessment & Response Framework, June 2010).

c. Cyclone Mahasen

Cyclone Mahasen occurred on the 16 May 2013. Areas of Barisal Division of Southern Bangladesh were mostly affected by the cyclone. In all three affected districts, agriculture, fishing ponds and sea fishing represent the main livelihood activities.

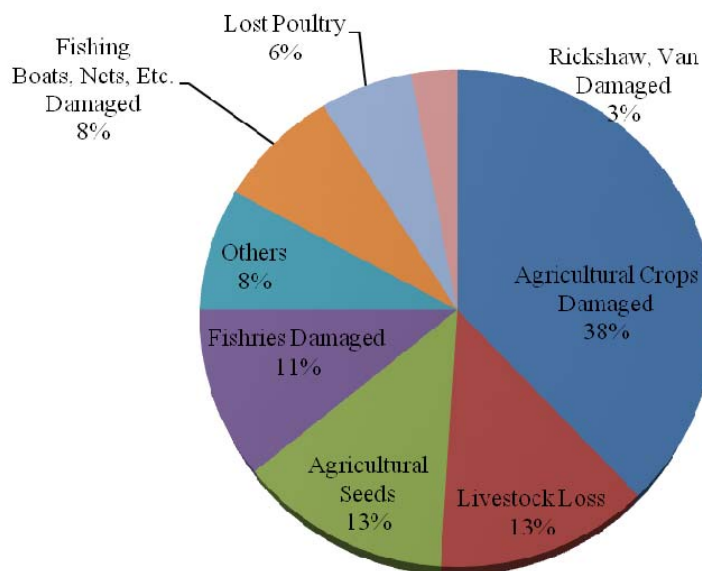


Fig 3.6: Livelihood Loss
(Source: Early Recovery Detailed Assessment, June 2013)

17 casualties were reported with 4,63, 303 people directly affected. Overall estimated damages for the three districts was 34,544,950 taka, with a total of 19,998 livestock and poultry farmers affected. 13% of the affected households assessed lost their livestock and 6% lost their poultry resources. Most fishermen struggled to repair or buy fishing nets while marginal farmers struggled to acquire vegetable seeds, Aman seedling and tools. Some damage to household foodstock had been reported then. No significant effect was reported water source options (Early Recovery Detailed Assessment: Bangladesh-Tropical Storm Mahasen, Final Assessment Report, June 2013).

Priorities reported at Upazila level

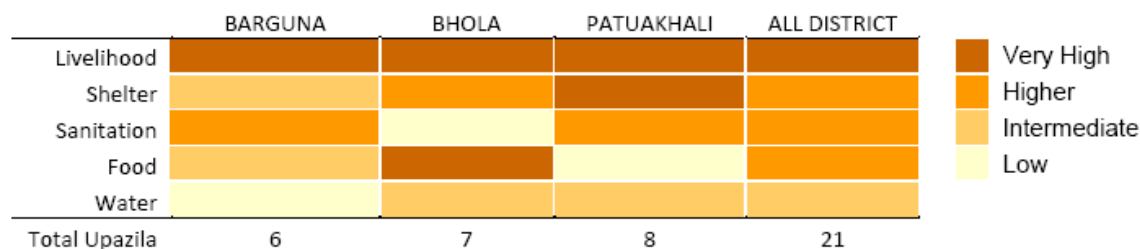
Livelihoods, Shelter and WASH are reported as the main priority sectors across the districts. Food is a significant priority in Bhola.

Table 3.1 : Priorities in District level

	BARGUNA	BHOLA	PATUAKHALI	All DISTRICT
Priority 1	Livelihood	Food	Shelter	Livelihood
Priority 2	Sanitation	Livelihood	Livelihood	Shelter
Priority 3	Food	Shelter	Sanitation	Sanitation

(Source: Phase 3 Shelter, WASH, Early Recovery Detailed Assessment, June 2013)

Table 3.2: Priorities in Upazila level



(Source: Phase 3 Shelter, WASH, Early Recovery Detailed Assessment, June 2013)

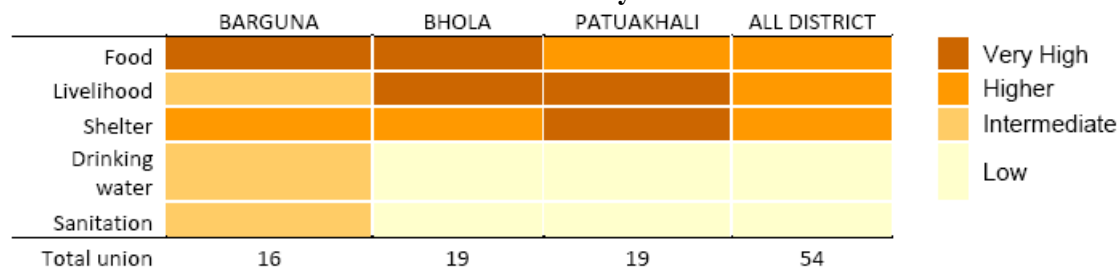
Priorities reported in the most affected unions

Table 3.3: Priorities in Union level

	BARGUNA	BHOLA	PATUAKHALI	All DISTRICT
Priority 1	Food	Livelihood	Shelter	Food
Priority 2	Shelter Livelihood	Food	Livelihood	Livelihood
Priority 3	Water Sanitation	Shelter	Food	Shelter

(Source: Phase 3 Shelter, WASH, Early Recovery Detailed Assessment, June 2013)

Table 3.4: Level of Priority in Unions



(Source: Phase 3 Shelter, WASH, Early Recovery Detailed Assessment, June 2013)

3.3 Analysis of situations for three recent major cyclones

- Focusing only on the destructions cyclones did in the household sector:
- Livelihood Pattern: The cyclone affected areas are mainly agriculture and shrimp farm based livelihood.
- Livestock based livelihood
- Decreasing human casualties and increasing death of livestock.

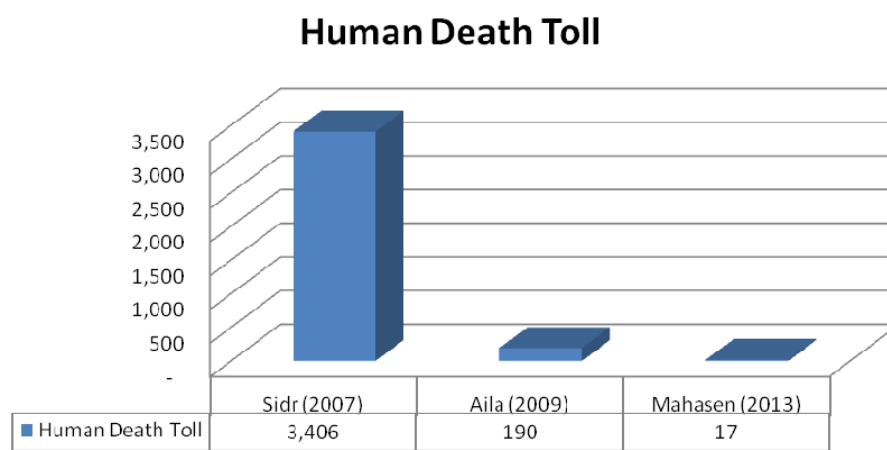


Fig 3.7: Comparison of death toll in recent major cyclones
(Source: Author 2013)

- Destruction of livestock is huge in comparison with human death toll.

Table 3.5: Chart showing human and livestock casualty ratio

Casulty Ratio	Human : LiveStock
Category 4 (Sidr)	1:787
Category 1 (Aila)	1:526

(Source: Author 2013)

- Destruction of livestock not only represents a major loss of assets, and loss of purchasing power for the affected families, but it also leads to an expected and protracted decline in the consumption of meat, milk, and eggs in the diets of affected people, plus further loss of income from the use or sale of such products.
- Destruction of Household assets: Livestock (source of livelihood and protein), household food stock, vegetation, source of drinking water.

- The cyclones eroded the household capacity to access adequate food supplies due to the destruction of standing crops and gardens, household food stocks and assets, and livelihoods that poor households depend on to purchase food.
- Drinking water sources (tube wells and ponds) in many communities were contaminated by saline water and debris and power outages affected water supplies in areas with piped water. In addition, in many areas groundwater sources were contaminated by arsenic and salinity in shallow aquifers.
- Households using surface water for drinking purposes got affected of water borne diseases like almost two times more than those using ground water. This suggests that surface water was being used without any treatment and has the potential to further increase the presence of water borne diseases.

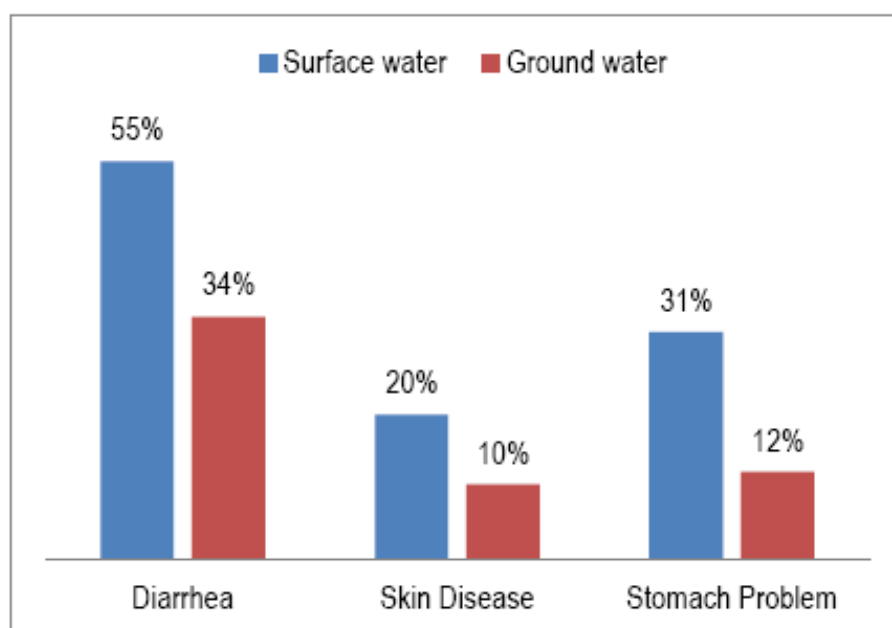


Fig 3.8: Water borne Diseases by Water Source in Mahasen
 (Source: Phase 3 Shelter, WASH, Early Recovery Detailed Assessment, June 2013)

Chapter 04: Theoretical Framework

4.1 Household Assets and Livelihoods

Assets can be defined as “A resource with economic value that an individual, corporation or country owns or controls with the expectation that it will provide future benefit” (Investopedia). Also it can be said that “Something valuable that an entity owns, benefits from, or has use of, in generating income” (Business dictionary).

Assets, also known as “resources, or capitals, include investments for the future (including surpluses, or retained earnings from previous periods, as well as training, education, networks etc.), stores or stocks of physical capital, and claims which can be exercised on others. Most of the anomalies between the lists of different researchers can be resolved through the classification as Natural, Physical, Social, Human and Financial” (Ellis, Frank 2000).

“Livelihood” does not just mean the activities that people carry out to earn a living. It means all the different elements that contribute to, or affect, their ability to ensure a living for themselves and their households. This includes:

- The assets that the household owns or is able to gain access to- human, natural, social, financial and physical;
- The activities that allow the household to use those assets to satisfy basic needs;
- The different factors that the household itself may not be able to control directly, like the seasons, natural disasters or economic trends, that affect its vulnerability;
- Policies, institutions and processes that may help them, or make it more difficult for them, to achieve an adequate livelihood.

The livelihood strategies that households develop to ensure their livelihoods will depend on how they can combine their livelihood assets, take into account the vulnerability context in which they live, and the policies, institutions and processes that affect them. The livelihood outcomes that households achieve with their strategies can depend on any or all of these elements.(Local institutions and livelihoods Guidelines for analysis, FAO).

Livelihoods are based on income derived from jobs, but also on incomes derived from assets and entitlements. According to Chambers and Conway (1992),

“A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its

capabilities and assets both now and in the future, while not undermining the natural resource base”.

"A livelihood comprises the assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household"(Ellis, Frank 2000) where the dynamic nature is also to be emphasized - livelihoods adapt and adjust, and hence evolve through time in response to changing conditions and circumstances. Asset stocks change, as do availability and access.

The members of a household combine their capabilities, skills and knowledge with the different resources at their disposal to create activities that will enable them to achieve the best possible livelihood for themselves and the household as a whole. Everything that goes towards creating that livelihood can be thought of as a livelihood asset. These assets can be divided into the five different “types” showing in the following figure. This division into five types of livelihood assets is not definitive. It is just one way of dividing up livelihood assets. Other ways may be developed depending on local circumstances. What is important here is that these are all elements of livelihoods that influence households directly or are potentially controlled by them.

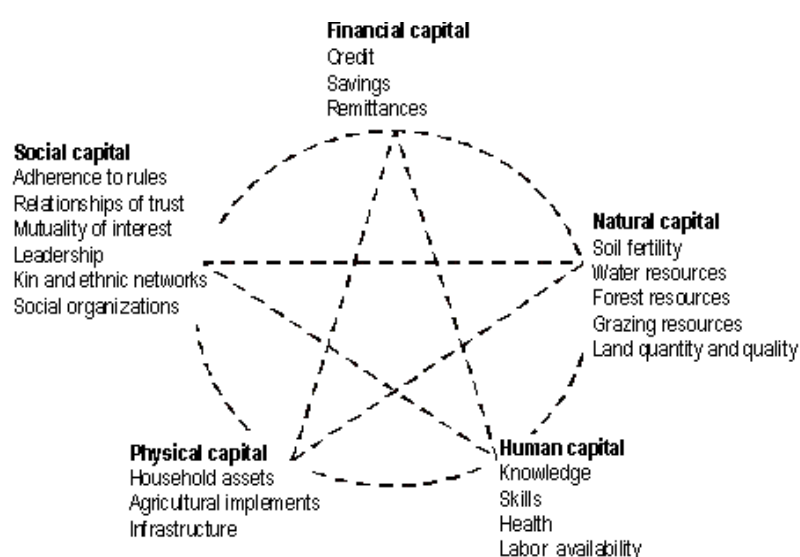


Fig 4.1: Livelihood Assets
(source: <http://www.ecologyandsociety.org>)

Household level asset comes under the physical capital of livelihood assets. Household assets can be regarded as the stock of wealth in a household, representing its' gross wealth (World Bank Institute Distance Learning). A household must have a minimum level of assets to cope with disaster risks. If the household does not have the bare essential assets, it slips to situation where it cannot cope with risks and reaches a breakdown point. The asset-level of a household corresponds to its poverty level. Extremely poor households have lower level of assets. Due to better ownership of assets, these households manage their risks with minimum welfare loss (World Bank Institute Distance Learning).

Households reallocate their assets in response to risks. They use their savings and insurance, draw down their physical stocks, borrow, sell or pawn assets, reduce expenditures, modify their consumption or seek help from friends and relatives. A popular strategy is to make claims upon governments, NGOs and international organizations, though such claims have their own limits (World Bank Institute Distance Learning).

The interaction of assets with risk is always complex. It is not just a level of assets that influences the capacity to manage risks. While the importance of financial and physical assets is obvious, human and social assets have also emerged as important variables in risk management. Education, skills and information equip households in dealing with risks in a more balanced way. Similarly, social cohesion, community networks, gender relations and participation in social organizations, which are intangible social assets, play important roles in responding to risks and crisis situations (World Bank Institute Distance Learning).

4.2 Thoughts and Ideas on Community

A community is an entity that has geographical boundary and shared fate. Communities are composed of built, natural, social and economic environments that influence one another in complex ways.

Communities have the potential to function effectively and adapt successfully in the aftermath of disasters (Norris, Steves, Pfefferbaum, Wyche and Pfefferbaum, 2007).

A community asset (or community resource, a very similar term) is anything that can be used to improve the quality of community life (Community Tool Box). And this means:

It can be a person -- The stay-at-home mom or dad who organizes a playgroup. The church member who starts a discussion group on spirituality. The firefighter who's willing to risk his life to keep the community safe. These are all community assets.

It can be a physical structure or place -- a school, hospital, church, library, recreation center, social club. It could be a town landmark or symbol. It might also be an unused building that could house a community hospice, or a second floor room ideal for community meetings. Or it might be a public place that already belongs to the community -- a park, a wetland, or other open space.

It can be a community service that makes life better for some or all community members - good public transportation, early childhood education center, community recycling facilities.

It can be a business that provides jobs and supports the local economy.

It has some skills or talents, and everyone can provide knowledge about the community, connections to the people they know, and the kind of support that every effort needs - making phone calls, stuffing envelopes, giving people information, moving equipment or supplies - whatever needs doing. This suggests that everyone in the community can be a force for community improvement if only we knew what their assets were, and could put them to use.

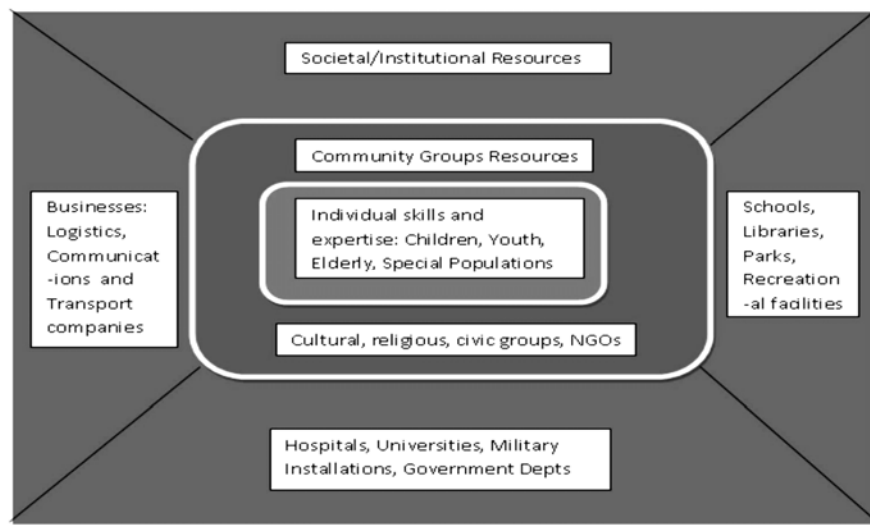


Fig 4.2: Community Asset
(source: Tan, 2009)

The importance of community networks in mobilizing human, social and financial assets has been demonstrated in recent disasters. A generous international assistance for the Gujarat earthquake in 2001 could be attributed to the political and commercial strength of the non-resident Gujarati community in a number of developed countries.

Community-based interventions help people to get access to resources and information from trusted sources and reduce their vulnerabilities. It also helps them in reinforcing trust cooperation in community level.

An important component of community program is to support women with special programs. In Honduras, women coped with hurricane Mitch by mobilizing formal and informal social networks and organizing women's groups to meet needs, organize temporary shelters, and coordinate relief efforts. They also used kin networks to take in affected family members. In Maharashtra, India, after the Latur earthquake of 1993, women's participation in the seismic repairs and strengthening program facilitated successful completion of owner-driven earthquake reconstruction program. SEWA's micro insurance program for women working in informal sector in Gujarat (India) provided them protection against natural disasters as well as everyday life risks (World Bank Institute Distance Learning).

4.3 Social Capital and Community

“Social capital, in general, refers to trust, social norms, and networks which affect social and economic activities. Although it is not a new idea that trusts and networks help reduce transaction costs and make things easier, the recent argument concerning trust is quite sensational. Supporters of this new concept believe that the level of trust, social norms and networks can be measured and a high accumulation of such capital contributes significantly to social, political and even economic performance, for better or worse. The term “social capital” has become quite popular both in the field of social science disciplines and international development”(Nakagawa and Shaw, 2004).

Coleman (1988), one of the founders of the term used in the current manner sees that, “social capital is defined by its function. It is not a single entity but a variety of different entities, with two elements in common: they all consist of some aspect of social structures, and they facilitate certain actions of actors- whether persons or corporate actors- within the structure”.

In 2003, the World Bank has listed eleven topics in social capital: crime and violence; economics and trade; education; environment; finance; health, nutrition, and population;

information technology; poverty and economic development; rural development, urban development; water supply and sanitation (Nakagawa and Shaw, 2004). On the other hand, Woolcock (1998) attempted categorize social capital into seven areas: social theory and economic development; families and youth behavior; schooling and education; community life; work and organization; democracy/governance; and more general collective action problems (Nakagawa and Shaw, 2004).

Incorporation of social capital in disaster management has been rare. Until in Japan, earthquake disaster management has been considered as an engineering issue and solutions were sought in a technical direction. However, the Great Hanshin-Awaji Earthquake (popularly known as the Kobe Earthquake) of 1995 has indicated that solutions should be multi-disciplinary, and there should be clear links between technological solutions and social solutions. In this regard, the challenge for the developed and developing countries is shared: how to incorporate people and communities in the process of pre-disaster mitigation and/or post-disaster recovery initiatives (Nakagawa and Shaw, 2004).

As witnessed in Kobe, the government has limited capacity during times of crisis like an earthquake. It was individuals and their neighbors, who saved most of the victims right after the earthquake. And it was the community which was determined whether each member was satisfied by the rehabilitation. But in order to meet such community needs, individual effort is essential. Disaster recovery is not only about building houses but the reconstruction of the whole community was a safer place. To mobilize each member of the community in this collective action, social capital is a crucial need (Nakagawa and Shaw, 2004).

Nakagawa and Shaw in their *Social Capital: Missing Link to Disaster* (2004) showed with two case studies of Kobe and Gujarat Earthquake that although the local socio-economic and cultural backgrounds are different in those two areas, the recovery process of urban areas is quite similar. At every stage of the disaster cycle (rescue, relief and rehabilitation), the communities played the most important roles among other concerned stakeholders. In both cases, the communities with social capital are found to be efficient in rescue and relief.

Community resilience is a process linking a network of adaptive capacities (resources with dynamic attributes) to adaptation after a disturbance or an adversity. Community resilience emerges from four primary sets of adaptive capacities- Economic

Development, Social Capital, Information and Communication, and Community Competence- that together provide a strategy for disaster readiness. To build collective resilience, communities must reduce risks and resource inequities, engage local people in mitigation, create organizational linkages, boost and protect social supports, and plan for not having a plan, which requires flexibility, decision-making skills and trusted sources of information that function in the face of unknowns (Norris, Steves, Pfefferbaum, Wyche and Pfefferbaum, 2007).

Chapter 05: Recommendation and Conclusion

5.1 Characteristics of Existing Household Assets in Rural Areas of Bangladesh

In this section of the chapter, there is a discussion on the general characteristics considering three household assets- livestock, food grains and safe drinking water.

i. Livestock Shed

In many cases livestock as cows and goats are kept under trees. There are at least one livestock shed and chicken coop in every household. The structure, livestock's shed, stands on bamboo poles having straw roof over it.

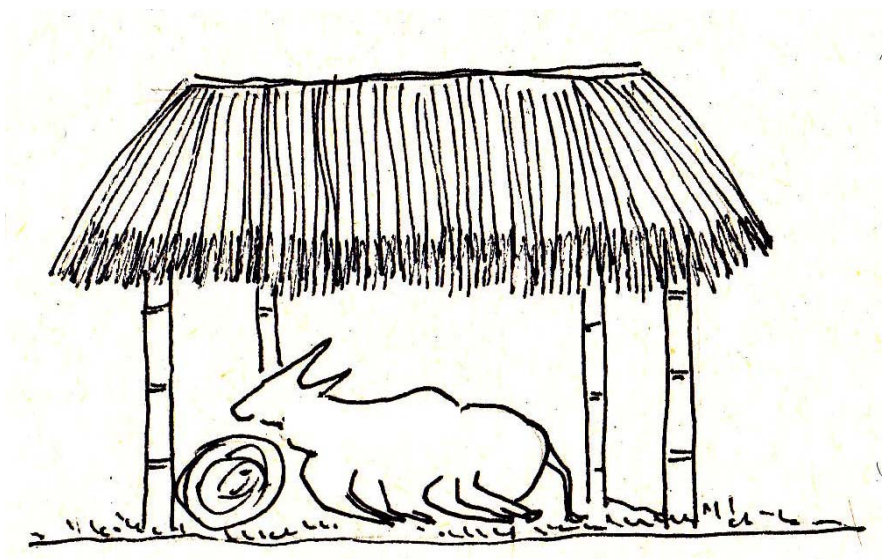


Fig5.1 .A Cow Shed
(Source: Author 2013)

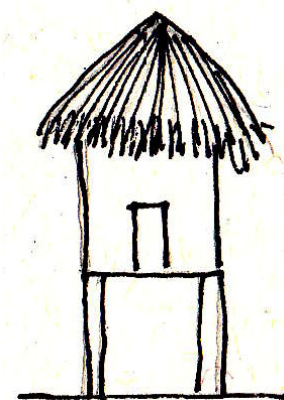


Fig 5.2: A traditional chicken coop
(Source: Author 2013)

Chicken coop is comparatively small structure built in courtyard of a household. It is made of wood roofed with rice straw. This structure is given height with bamboo posts or layers of bricks to safe guard the chickens.

Livestock sheds such as cow shed or chicken coop, are made with local material using local construction techniques. These structures are very susceptible to withstand cyclonic wind and water surge. So it is needed to make strong enough to survive in normal storms and serve the community throughout the year.

Killa

Killa is an earthen mound over which livestock are kept during cyclones. The starting time of construction of killa is in 1970. The NGOs, who built killas are: World Vision, CCDP, IFRC(sajid), BDRC and Caritas.

About 20% killas in coastal belt are within 1km of shelters. Rests of them are upto 4km within the cyclone shelter premise (CDMP). People prefer to keep their livestock with them or at least at a place from where they can look after their last assets. So in recent time shelters are built keeping the killas nearer to it as the owners can look after their livestock.

People keep their livestock on the earth mound before taking shelter. People can look after their livestock if they are kept close to shelters. Livestock do not panic as they are open to sky.

Accessibility of the livestock is not properly designed in a typical killa. It lacks fodder and pasture for the livestock. There is no provision for security. It needs a lot of earth to construct it which makes it costly to build a Killa. It needs a huge area for construction.

ii. Granary/ Rice Holder (*Dhaner Gola*)

A granary is a storehouse or room for threshed grain or animal feed. Granaries are often built above the ground to keep the stored food away from mice and other animals.

In villages, every two or three households share one granary or rice holder. This granary is uplifted on brick columns to safe guard the grains from rodents and rain water. The whole structure is made of bamboo mat roofed with rice straw and sometimes with C.I. sheet. This structure is not strong enough to withstand cyclonic wind or water surge.

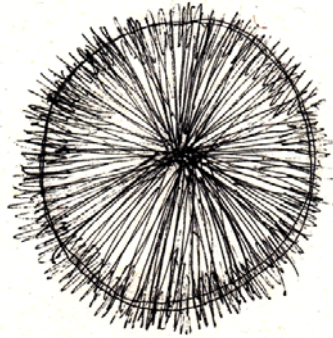


Fig 5.3: Roof plan of a Granary (*Dhaner Gola*)
(Source: Author 2013)

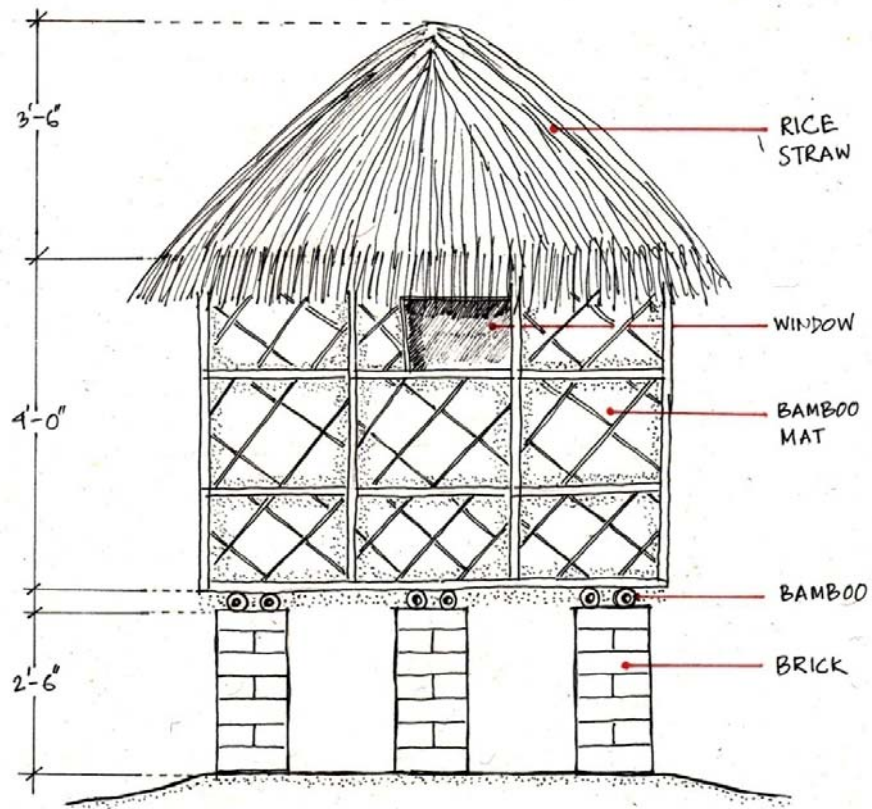


Fig 5.4: Elevation of a Granary (*Dhaner Gola*)
(Source: Author 2013)

iii. Source of Safe Drinking Water

There are some areas like the coastal belt in the south part of Bangladesh, where the conventional shallow and deep tube wells technologies are not successful due to the high salinity. Alternative water supply options are needed for those areas. The important alternative water supply technologies include:

- Shallow Shrouded Tube well (SST)
- Very Shallow Shrouded Tube well (VSST)
- Pond Sand Filter (PSF)
- Household Filter
- Infiltration Galley
- Solar Desalination
- Rainwater Harvesting (Ahmed & Rahman,2000)

The sources of drinking water in coastal areas of Bangladesh are PSF and Rain Water Harvesting System as these areas have saline contamination in ground and surface water.

Pond Sand Filter (PSF)

An alternative and popular option of potable water supply in coastal problem areas is the pond sand filter (PSF). It is a package type slow sand filter unit developed to treat surface water, usually low-saline pond water, for domestic water supply in the coastal areas. Slow sand filters are installed near or on the bank of a pond, which does not dry up in the dry season. The water from the pond is pumped by a manually operated hand tube well to feed the filter bed, which is raised from the ground, and the treated water is collected through tap(s). It has been tested and found that the treated from a PSF is normally bacteriologic ally safe or within tolerable limits. On average the operating period of a PSF between cleaning is usually two months, after which the sand in the bed needs to be cleaned and replaced.

The PSF is a low-cost technology with very high efficiency in turbidity and bacterial removal. It has received preference as an alternative water supply for medium size water settlements in arsenic affected areas and areas where low salinity ground water is not available. Although PSF has very high bacterial removal efficiency, it may not remove 100% of pathogens from heavily contaminated surface water. In such cases, the treated water may require chlorination to meet drinking water standards (Ahmed & Rahman,2000). A PSF can serve to 50-60 households (United Nations Environmental Program: UNEP).

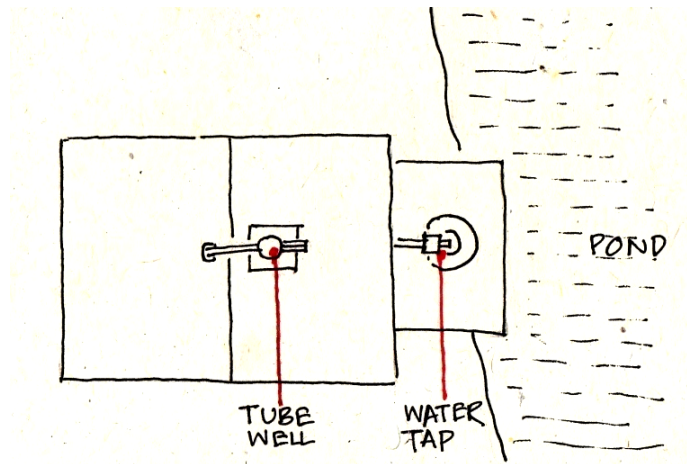


Fig5.5 :Layout of a PSF
(Source: Author 2013)

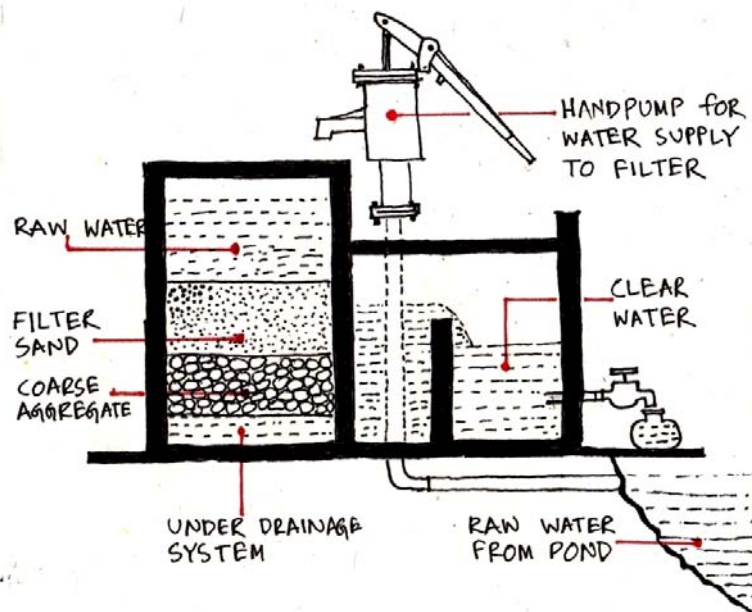


Fig5.6 :Section through a PSF
(Source: Author 2013)

Rain Water Harvesting System:

In the coastal belt and hilly regions of Bangladesh, suitable water sources are scarce. The coastal belt suffers from high salinity in surface and ground water and the hilly areas suffer from absence of surface and ground water sources for the development of a dependable water supply system.

The average annual rainfall in the coastal and hilly regions is more than 3000mm, against an average rainfall of about 2400mm in Bangladesh. The collection and storage of rainwater is an alternate option of water supply areas in these areas. Rainwater harvesting is a potential water supply option in the acute arsenic affected areas of Bangladesh. Rainwater collection in Bangladesh has been practiced for a long time on a limited scale. There are two main constraints in development of a completely rainwater based water supply system: Availability of suitable catchment area and the need for larger storage tank.

A large catchment for rainwater collection is needed if the total water supply is based on rainwater. Again a larger storage reservoir is required for unequal distribution of rainfall throughout the year (Ahmed & Rahman,2000).

The coastal belt suffers from high salinity in surface and ground water, As, the average rainfall in the coastal area is more than 3000mm (Ahmed and Rahman, 2000), catching and storing rain water is a convenient option to get safe drinking water in coastal areas of Bangladesh. The initial cost may prevent a family from installing a rainwater harvesting system. Also, a large catchment area is needed. The poorer segment of the population may not have a roof suitable for rainwater harvesting.

The advantages and disadvantages of rainwater collection systems over the other water supply schemes are presented in the following table.

Table 5.1: Advantages and disadvantages of rainwater collection system

Advantages	Disadvantages
<ul style="list-style-type: none"> • The quality of rainwater is comparatively good. • The system is independent and therefore suitable for scattered settlements. • Local materials and craftsmanship can be used in construction of rainwater system. • No energy costs are incurred in running the system. • Ease in maintenance by the owner/user. • system can be located very close to the consumption points. 	<ul style="list-style-type: none"> • The initial cost may prevent a family from installing a rainwater harvesting system. • The water availability is limited by the rainfall intensity and available roof area. • Mineral-free rainwater has a flat taste, which may not be liked by many. • Mineral-free water may cause nutrition deficiencies in people who are on mineral deficient diets. • The poorer segment of the population may not have roof suitable for rainwater harvesting.

(Source: Ahmed & Rahman, 2000)

Though the structures holding assets like livestock, food grains and drinking water for a long time in the rural areas of Bangladesh, these structures necessarily are strong enough to safeguard the assets from cyclones.

5.2 Recommendation to Recover Assets

The recovery of household assets interventions are in accordance with the two major strategies.

- Structural Measures
- Non-Structural Measures

Following are the strategies under structural measures:

- Strengthening of Existing structures holding the three household assets
- Alternative Option to survive in severe cyclones

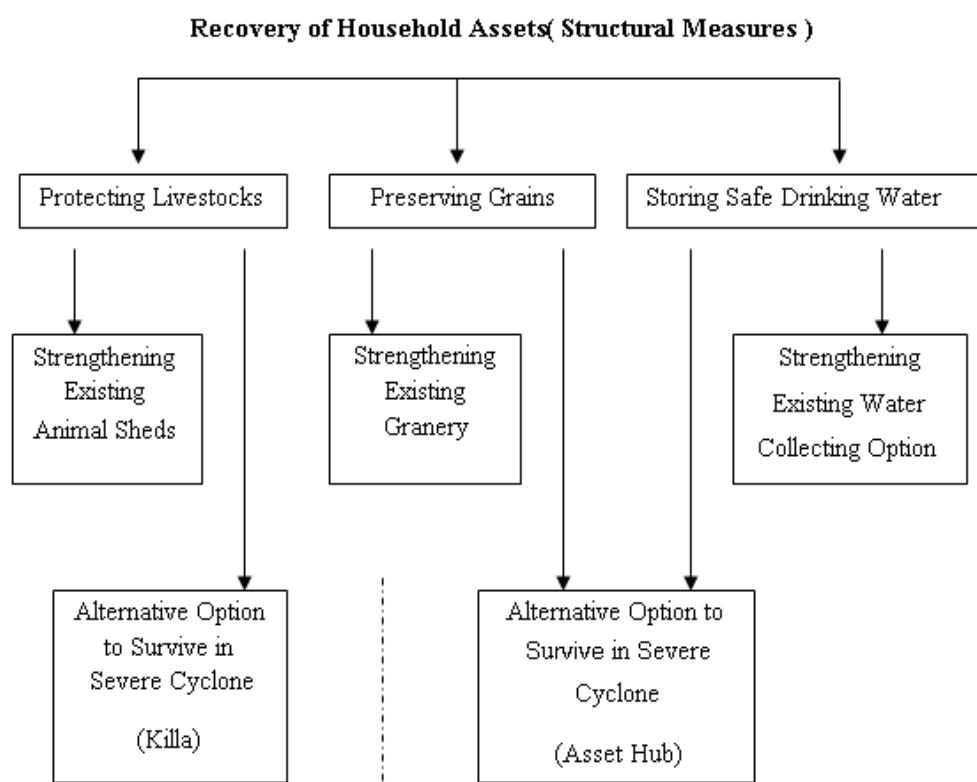


Fig 5.7: Flow chart showing structural measures to recover household assets
(Source: Author 2013)

5.2.1 Structural Measures

a. Strengthening Existing Structures

The existing structuring systems, which are built by the people over generations, have substantial scope to sustain throughout the year and in storms which are less severe. So it is essential to strengthen these structures in the community rather than introducing any new options that would take time for people to cope.

i. Livestock Shed

Sheds keeping cows and goats can be strengthened by cross bracing of the bamboo poles standing on the corners. The roof can be having cross bracing. These cross bracings will make them work as a rigid structure to withstand storms.

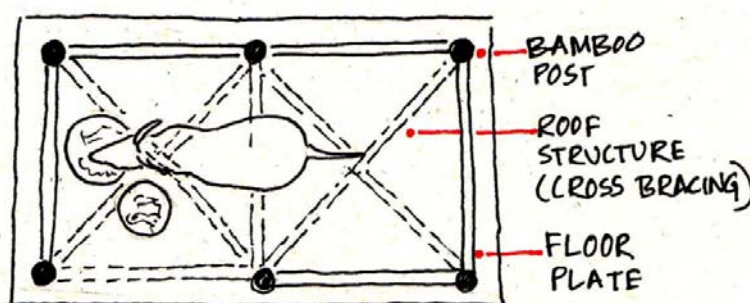


Fig 5.8: Plan of a cow and goat shed showing cross bracing on roof (Source: Author 2013)

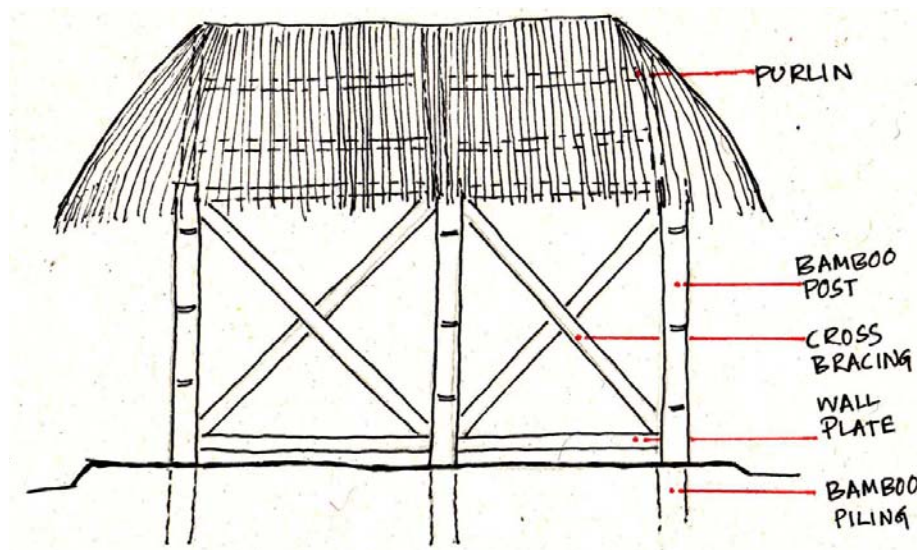


Fig 5.9: Elevation of a cow and goat shed showing cross bracing (Source: Author 2013)

ii. Granary (*Dhaner Gola*)

Granaries can be made stronger by making brick footings. These footings will provide a base plate underneath the ground. This structure can be uplifted on brick columns upto 7-8 feet to make it safe from water inundation. The space measuring 7-8 feet can be provided to keep chickens and ducks. The structure to grains can be strengthened by cross bracing to act as a rigid structure. The roof can be strengthened by cross bracing roofed with C.I. sheet.

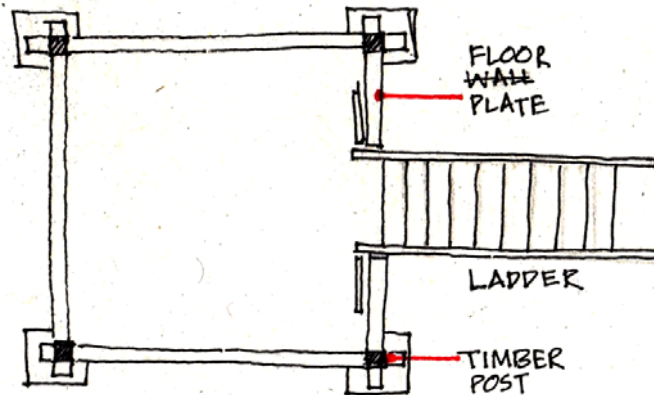


Fig 5.10: Plan of a granary
(Source: Author 2013)

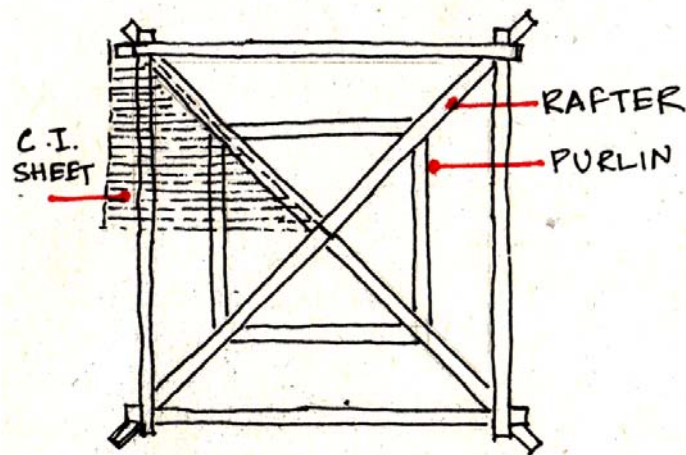


Fig 5.11: Roof plan
(Source: Author 2013)

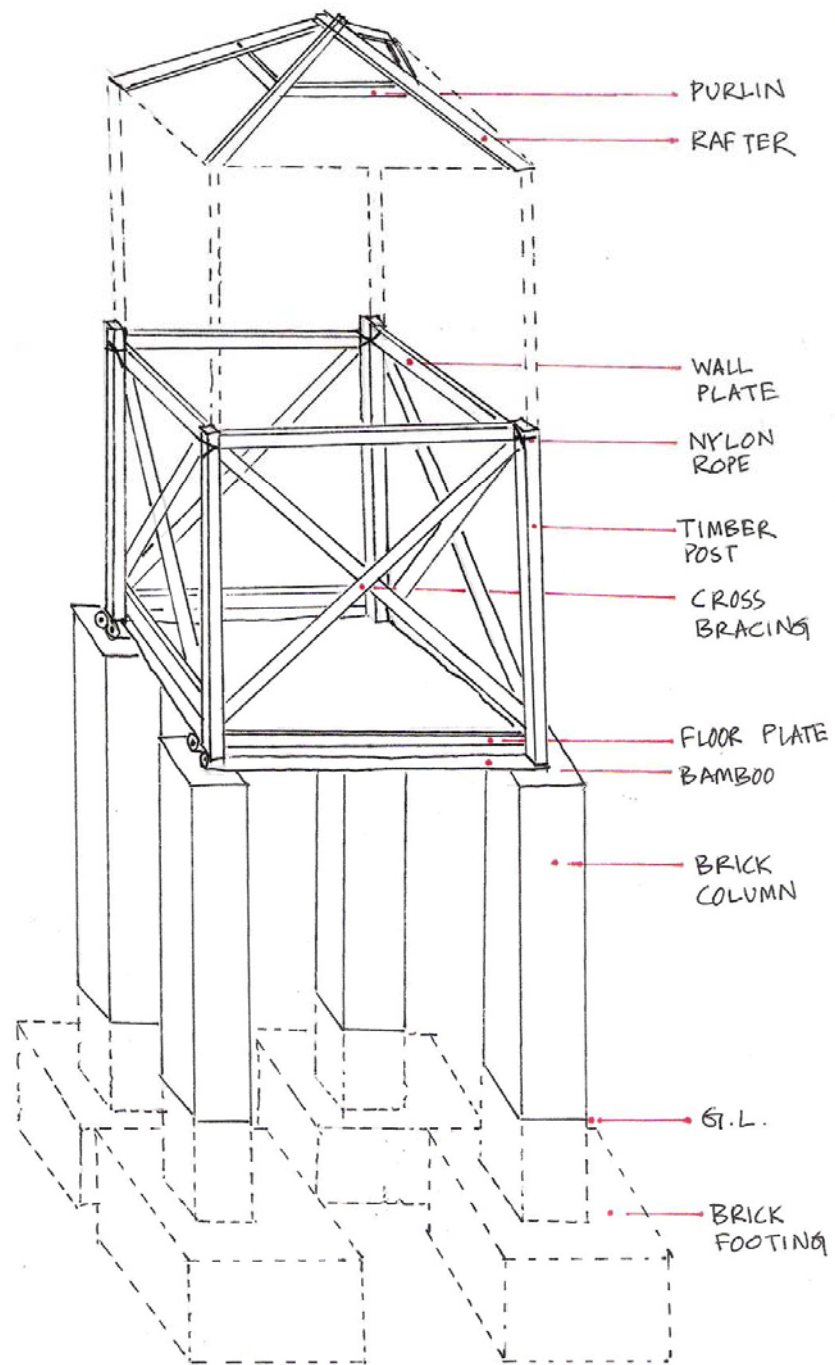


Fig 5.12 :Figure showing structural system of a Granary
 (Source: Author 2013)

iii Safe Drinking Water:

Pond Sand Filter (PSF)

As, a PSF can serve 50-60 households according to UNEP, in my opinion there should be more PSFs serving less than 50 households. Distance of the communities from the available water sources should be considered. The PSF can be given height to avoid inundation after a cyclone. The layout of a PSF is convenient. The filters beds need to clean very often. Since these are small units, community involvement in operation and maintenance is absolutely essential to keep the system operational. After a cyclone, ponds get a great amount of saline contamination. To deal with it, pond re-excavation work can be done to get sweet water and it needs to be completed during dry season.

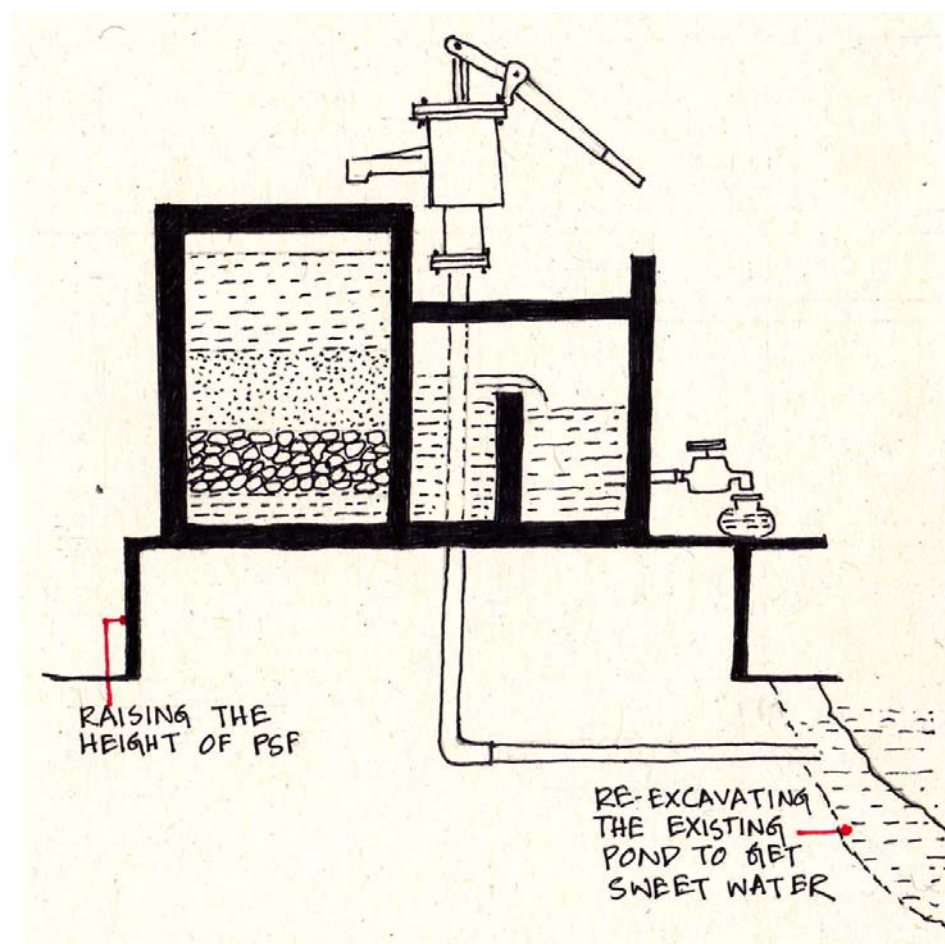


Fig 5.13: PSF showing some alterations
(Source: Author 2013)

Rain Water Harvesting:

After a cyclone, since a large number of catchment area is needed in a rainwater harvesting system and poorer segment of the population may not have a suitable roof to do this, local organizations and NGOs can provide plastic sheet and a water tank to each family to reduce the cost.

b. Alternative Options to Survive in Severe cyclones:

Alternative option can be taken to secure a cyclone prone community's household assets and to provide an option to allow them to recover assets in the aftermath of a severe cyclone, while these assets become very important to them in terms of economic supports and safe health.

i. Killa for Livestock:

A killa can be square or circle in shape and made of earth. It requires a huge space (around 3 bighas). It should be kept open to sky. A killa should be placed in a close proximity of a cyclone shelter so that the owners can look after their livestock. Proper accessibility should be incorporated in killas to reduce the struggle of livestock as well as of the owners of the livestock. In order to do that ramp can be introduced. Fodder and pasture should be provided for the livestock. Proper security can be incorporated. The height of the earth mound should be kept considering additional 7'-8' than the height water reaches during full moon.

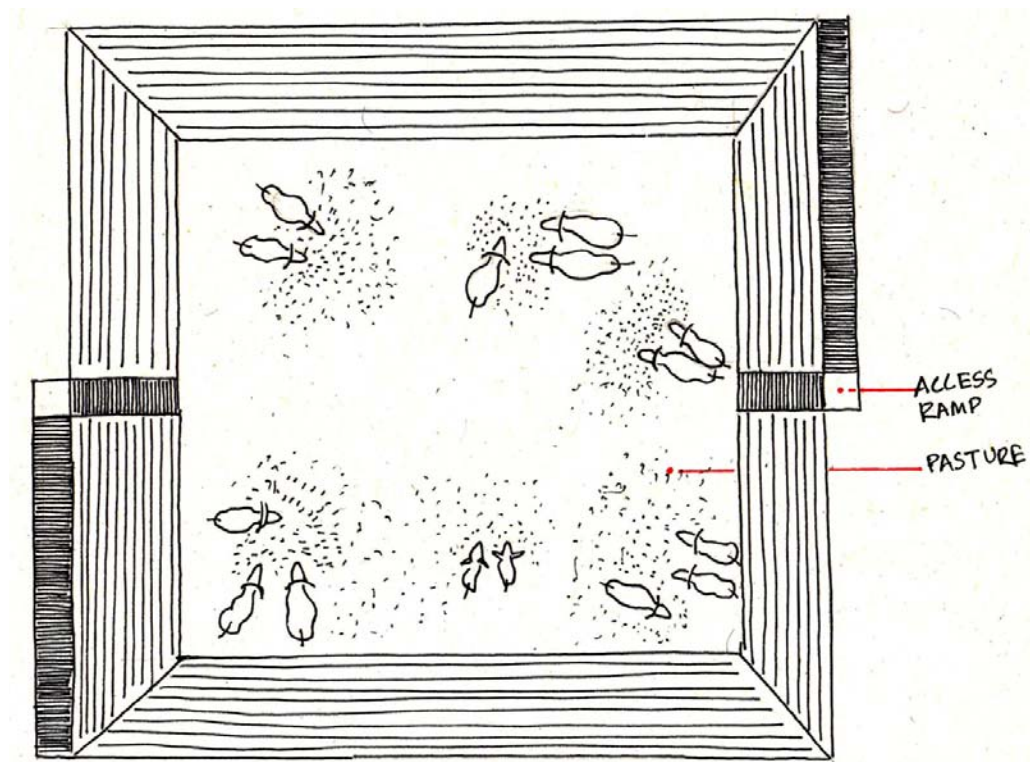
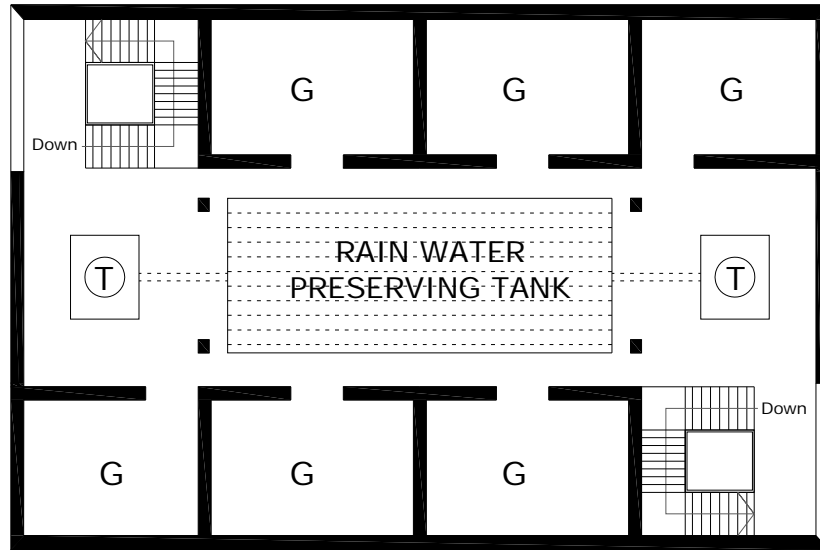


Fig5.14 :Plan of a Killa
(Source: Author 2013)

ii Asset Hub:

Asset Hub is a conceptual idea of a structure made to secure the assets from severe cyclones. The idea was to house the food grains and rain water harvesting system. This is a RCC structure, uplifting it upto 15 feet to avoid the inundation. In normal time the ground floor can be used as a community space. The roof is a large catchment area storing water in a central rainwater preserving tank. The water is collected by the community people through a water tap placing at the two ends of the building. The other spaces are let to store grains. This asset hub is provided to act as a community asset storage area throughout the year. The community people can preserve a portion of their assets in this hub. An Asset may serve to 15 families. This hub can create an option to recover their assets just after a cyclone.



G: Granary T: Water Tap

Fig5.15 :Plan of an Asset Hub
(Source: Author 2013)

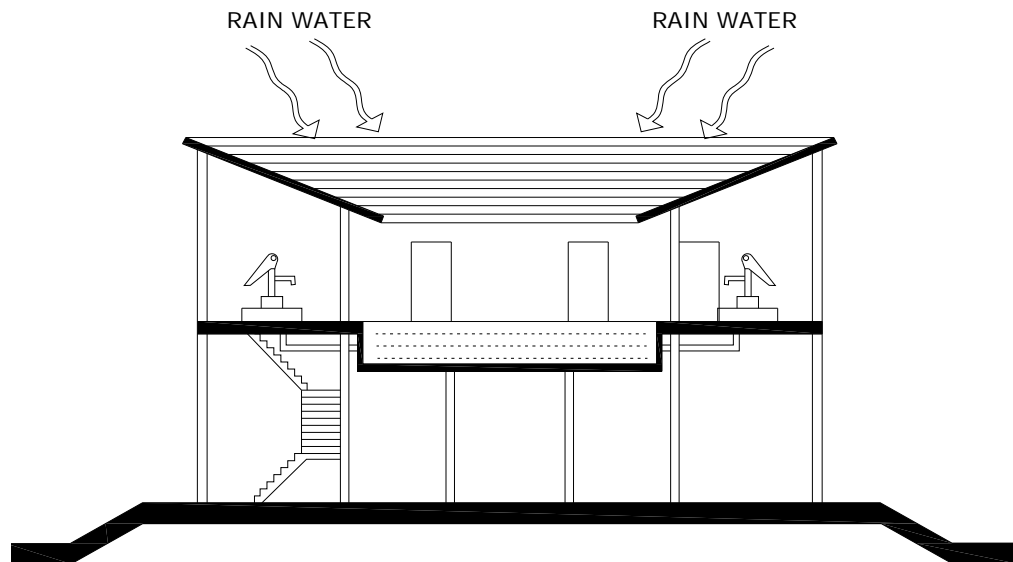


Fig 5.16: Section through an Asset Hub
(Source: Author 2013)

5.2.2 Non-structural Measures

This section of the chapter encompasses the implementation strategies of recovery and strengthening of household level assets to gain community resilience. This process involves two crucial dimensions: the user community and the institutional involvement.

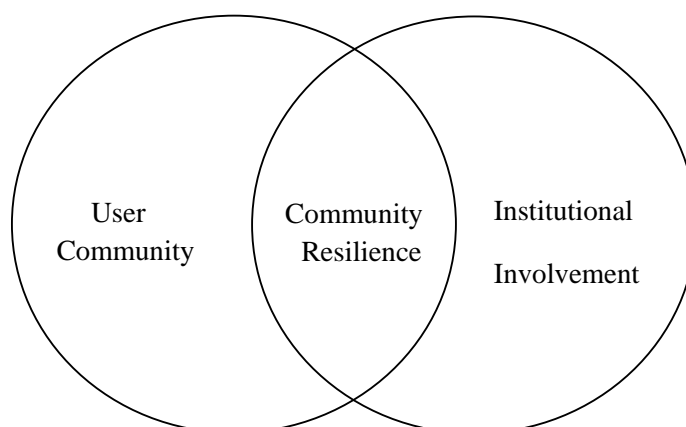


Fig 5.17: Key elements to gain community resilience
(Source: Author 2013)

The user community is composed of different groups of people with common but also conflicting interests and ideas. The community dimension includes issues such as the capacity and willingness to participate in different levels of implementation program.

The institutional involvement needs to be taken into account in recovering the household level assets. It requires from the institutions that the financial aspects are properly addressed. It is important that the community trusts the administration and the supporting agencies in technical, managerial and financial matters. Special efforts may be needed to gradually build this trust.

a. Community Participation:

The principle of user participation in disaster management sector has widespread acceptance. The international Glossary on Poverty (Gordon and Spicker, 1999) defines participation as referring primarily to the process of involvement in decision-making. It is seen as both an empowering and an educative process. Gordon and Spicker believe, for example, that the only way poor can overcome their difficulties is by directly participating in the process of development, including participating in the formulation of social policy and development, program implementation and sharing in their benefits. In

other words, one can define, participatory approach has the dual goal of promoting growth and equity while also ensuring the development of democratic process in the grassroots (Huq, 2001).

It is often assumed that a community consists of a group of people with common values and interests, living in one geographic area. Furthermore, they are often seen as beneficiaries and not as clients with a right to decision making. But, community can also be defined as groups of people with common but also conflicting interests and ideas, and different socio-economic and cultural backgrounds. The identity of the people in communities is shaped by their history and their socio-economic and environmental conditions. Women may have interests different from those of men and may not have been heard in the past, or their position makes it difficult to achieve changes on their own (Ahmed and Rahman, 2000).

Men, women and children have different needs, different access to resources and different areas in which they can take decisions. Yet all have the right to contribute and benefit from development activities, thus making it necessary to strike a gender balance in program activities, problem identification, conflict resolution and joint management of common interests (Ahmed and Rahman, 2000).

Thus participation of users in planning, development, operation and maintenance through local government and community based organizations of the stakeholders is important

b. Gender Approach:

A gender approach means that the different knowledge, responsibilities , roles, resources, needs and attitudes of men and women are taken into account. A gender approach requires and opens mildness and aims at the fullest possible participation of both women and men. It takes account of a gender approach is that it focuses on men and women and reviews the needs and possibilities to fully involve both groups in asset recovery projects.

A gender approach helps to predict and take action to improve how different members of a society or household will be affected by development efforts and to what degree they will be able to participate and benefit from efforts. It looks not only at roles and activities but also at relationships.

It is important to note, that if gender is completely disregarded in program then many opportunities are lost and new problems are created. For example, water points are not effectively used when they do not meet women's requirements because they were not consulted on their design and location. Thus, men and women should be involved in

decision making on those issues which affect them directly and for which they have some responsibility (Ahmed and Rahman, 2000).

c. Public-Private Partnership

The current trend is to develop management options tailored to local needs and capacity, with an equation between local authorities, private sector and communities. Many programs in disaster management around the world are public-private partnerships. These range from government agencies that use private contractors for construction through to government agencies which act in regulatory roles with all services being provided, usually on a contract basis, by private groups. Responsibilities for investment and operation can be transferred to private firms under a concession without transferring the ownership of the assets from the government agency (Ahmed and Rahman, 2000).

d. Project Cycle

All projects go through certain stages. The nature of stages and the activities within depend, of course, on the goals, objectives, strategy, location and populations involved in the project. There are, however, common elements and problems that appear frequently in different projects. Therefore, this section describes the major stages and activities of non-structural measures, taken to implement the structural interventions. There should be coherence amongst the user community, local government and the private sector.

Four stages are being identified. These stages are components of a process that must include learning, and feedback of the lessons learned to improve activities and the outputs at each stage. Each of this stage must ensure institutional involvement and participation of user community. The four main stages are:

- Introduction and Planning
- Community mobilization and pre-construction activities
- Construction
- Management and Operation

At the beginning, the institution (government or private sector) may start work in the community by:

- Learning about needs of community members, their idea of household assets, problems they face in the aftermath of a cyclone.
- Identification of field workers of the community, key informal leaders, relevant experiences and projects in the past, divisions and groups in the community.
- Decisions about community demand, including women users.
- Formation of groups within the community.

Some simple strategies can be useful, including participatory activities such as a transect walk, mapping, focus discussions. The participatory activities can provide a useful overview of problems, demands and needs which can be used to plan implementation. They can also provide information that can be checked at the end. It is often very useful to do part of the participatory activities separately with men and women so that the women can participate fully.

The members of the community should be representative of all groups of the community. Even children should not be excluded. They have their own needs and demands. Gender issues are also important. It is often most effective for women to identify their own representatives outside a general community meeting. Too often certain tasks are automatically assumed to be women's or men's tasks.

- At this stage of the project it is useful to check:
- Whether at least one person in each household, particularly women, know about the project.
- If the community members are representative of all groups in the community or all user households.

Community mobilization and pre-construction activities:

Sufficient time is needed before construction. During this time communities can be made highly motivated waiting for the repair works and strengthening of the structures to secure assets. This is a good time to emphasize education on how to secure their assets in the period of cyclones and also throughout the year. Thus, this period could include:

- Mobilization: Organizing key leaders and working with the community. Simple activities could be undertaken which have a visible result and motivate the community.
- Committee formation and training. It is important that the training is organized in a participatory manner, with perhaps some lectures but with a lot of practice.
- Design Workshop: An initial design team of technical persons and representatives of donor groups can organize a day long design workshop with community people (consisting carpenters, masons, bamboo workers, user groups). Through this workshop, some ideas can be rejected some ideas can be taken in terms of durability, design quality, cost and availability. A new design and construction team can be formed consisting of initial design team of technical persons, representatives of donor institutions, local builders and user groups. It is important during the workshop to let everyone in the team understand their responsibilities (Improved Design and Construction of Rural Housing in Noakhali, IUCN, 2008).
- It is important to plan community meetings carefully where women and men can participate freely.
- Using social capital to enhance the quality of the project. Building trust with the builders, community representatives and user groups.

In Bangladesh, the severe cyclones occur mostly during pre (April-May) and post (September-December) monsoon and they are the ones which cause the most destruction (Choudhury M A, 2001). Hence, construction should start and end in dry seasons. Construction can be monitored by the community representatives and also the local government. The community members should be oriented and have a good method to report problems when they occur.

After the strengthening of structures housing the assets and construction of alternative options are done, their operation and maintenance needs to be managed to keep them in good order and ensure optimal use. Activities during this stage are:

- Ensuring adequate operation and maintenance of the structures and systems.
- Keeping track of system performance through an adequate but simple monitoring system that leads to remedial action if required.
- Ensuring that financial procedures are being implemented and reviewed. This includes proper monitoring and honest auditing of accounts.

- Ensuring that the voice, ideas and complaints of users are heard through a community reporting system.
- Fine tuning of the back up support system that needs to take care of the operation, maintenance and management requirements.

Just ensuring of the proper functioning of the structures and systems is very important but not sufficient. Efficient and effective uses are to be encouraged. Also it needs to be explored whether the structures and systems indeed meet their purpose and provide benefits to men and women, rich and poor.

5.3 Potential Application of Recommendations: A Case Study

After determining some strategic options, a case study needs to be done in order to check that those options work in reality or not. In order to do so, a village in a coastal area of Bangladesh has been taken. This portion of the chapter studies the village to examine all the above mentioned strategies.

5.3.1 Botbonia Village, Dacope, Khulna

Village: *Botbonia*

Union: *Tildanga*

Sub-district: Dacope

District: Khulna

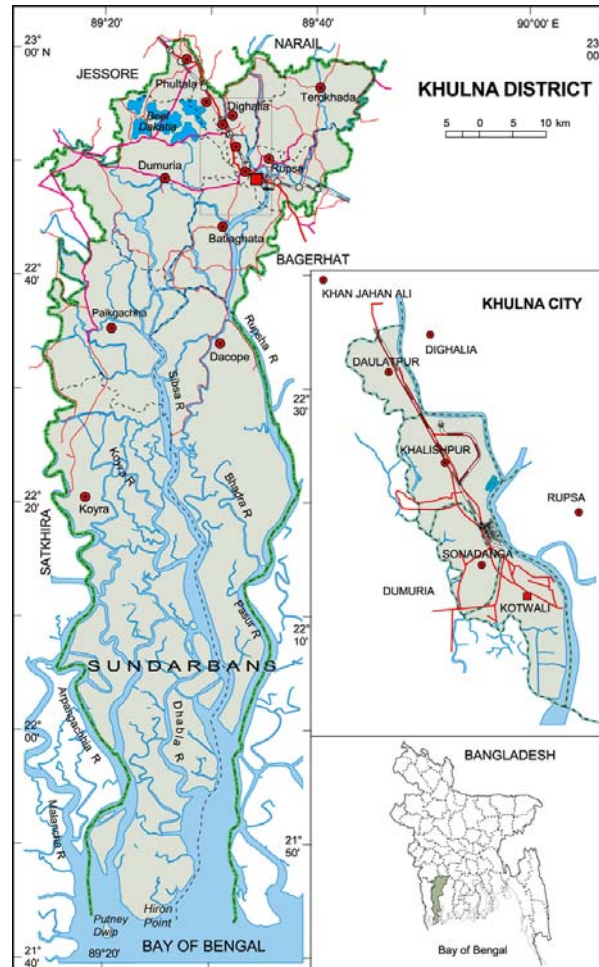


Fig 5.18: Map showing Dacope.
(Source: www.banglapedia.org. Accessed 25.12.2013)

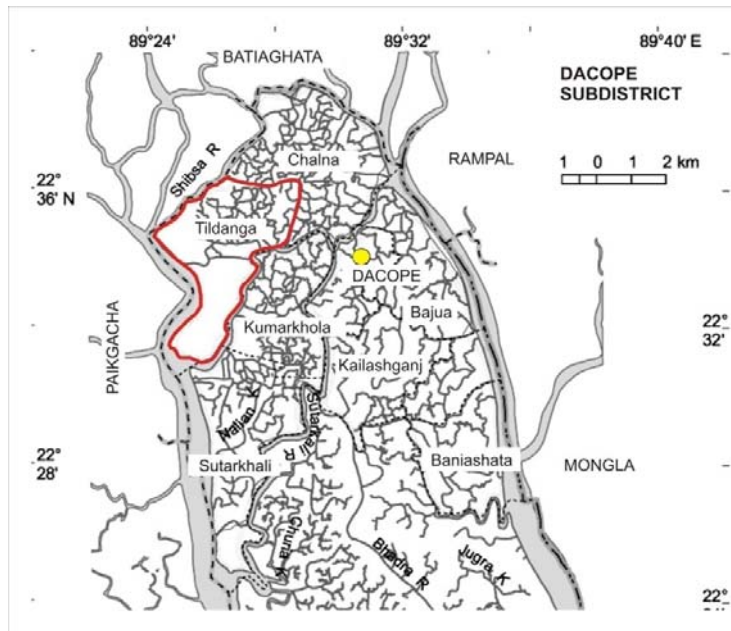


Fig 5.19: Map showing Tildanga union.
(Source: www.banglapedia.org. Accessed 25.12.2013)

Population: 1400 families.

Livelihood: Mostly farming. Also fishing and wage labor. Shibsha River is their major source of income.

Religion: Majority Hindu. Then Islam.

Educational status: 70%

No of cyclone shelter: 01

Infrastructure: Embankment parallel to Shibsha river.

Important structures: Primary school, union council. These structures also been used as shelters during cyclone Sidr and Aila.

Source of drinking water: PSF (which needs maintenance) and rain water harvesting.

Household assets: Livestock, ponds, home garden, food grains.



Fig 5.20: Site map of *Botbonia* Village (Source: Author 2013)



Fig 5.21: Land Use Pattern (Source: Author 2013)



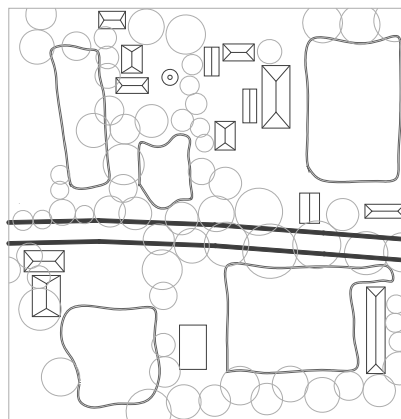
Fig 5.22: Layout of Household Assets (Source: Author 2013)



⊖ River Bank Homesteads



⊖ Homesteads Surrounded by Farmland



⊖ Road Side Homesteads

Fig 5.23: Different patterns of households in the village (Source: Author 2013)

Existing situation of the household assets of the community:

This community faced a huge loss of household assets in Sidr and Aila. They realized the need of securing household assets in order to survive in the aftermath of cyclone. Here is the situation of the household assets they got:

i Livestock shed

There are livestock shed in every two or three households consisting of cows and goats which are the owner's livelihood assets. These structures are made of bamboo posts roofed with rice straw. Here, livestock sheds are susceptible to cyclones. During sidr and aila, these structures were been washed away. Later they were built again.



Fig 5.24 :A Cow Shed in village iaBotbon (Source: Author 2013)

ii Granary (*Dhaner Gola*)

This village has got agriculture based livelihood. A major portion of the villagers are farmer. Here, every two or three household consisting a joint family, share one granary. These granaries are made of bamboo mat standing on brick columns and roofed with straw. These structures are very vulnerable to cyclone and make the owners poor to poorer.



Fig 5.25: A granary in a homestead of the community (Source: Author 2013)

iii Source of Safe Drinking Water

Here, in this village, the sources of drinking water are PSF and rainwater harvesting system.

PSF

There are two PSFs in this area which are located in the adjacent areas of cyclone shelter and primary school. These two PSF have got poor maintenance. After Aila, ponds got saline contamination. These systems need repair work. Moreover, though each PSF is serving an optimum number of people, the distance of some houses from the water source must be considered. Women have to travel a long distance to get water.



Fig5.26 :People of the village are collecting water from a PSF (Source: Author 2013)

Rain Water Harvesting System

People of *Botbonia* use traditional techniques of storing water through the principles of rain water harvesting system as source of drinking water parallel to PSF. But they face problem of catchment area as these poor segment of the villagers do not have suitable roof for rainwater harvesting.

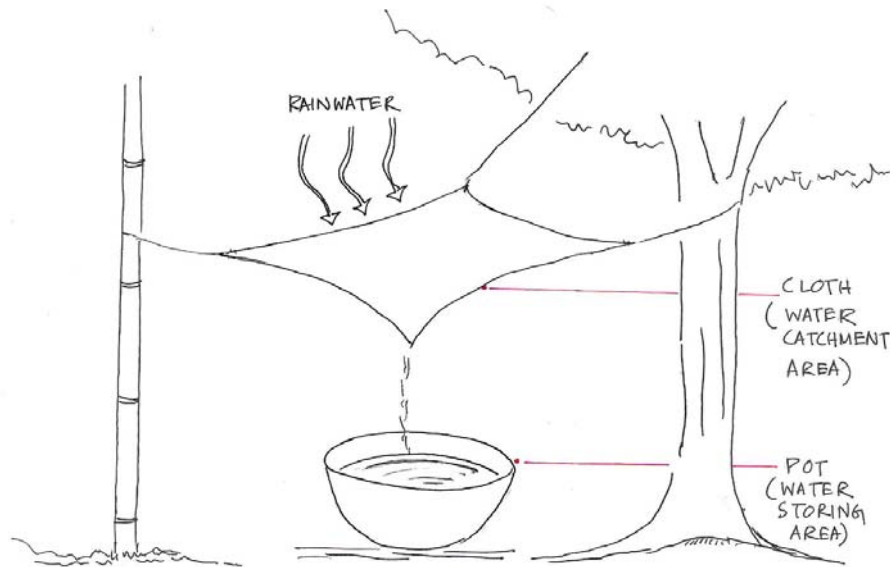


Fig 5.27: A technique of storing water by the community people
(Source: Author 2013)

5.3.2 Implementing Interventions: A Cyclone Resilient Community

In order to implement interventions from section 5.2.2, let us divide the village into five clusters: Cluster 01, Cluster 02, Cluster 03, Cluster 04 and Cluster 05.



Fig 5.28: Layout showing clusters (Source: Author 2013)

Table 5.2 :No of Families Under Each Cluster

	Cluster01	Cluster02	Cluster03	Cluster04	Cluster05
Total no of Family	15	15	08	15	15

(Source: Author 2013)

a. Recovery of Assets

Strengthening existing structures and taking alternative options.

i. Livestock shed

Strengthening the existing livestock sheds with cross bracing to make a rigid structure.

ii. Granary

Building brick footings over which there will be brick columns. The main structure where the grains will be stored, may be made with wooden cross bracing upon which bamboo mat will make walls.

iii. Source of Safe Drinking Water

Both the sources of drinking water will be sustained and repaired.

The number of PSF may be increased. Cluster 01 and 02 may have one PSF placed on the adjacent area of cyclone shelter. The PSF on the adjacent area of school may provide water for Cluster 03 and Cluster 04. People of Cluster 05 need to walk a long way to get water from PSF placed on the school adjacent area. There is needed another PSF to serve Cluster 05 and may be positioned on the Cluster 05.

Both the previous PSFs need repair work. The re-excavation of those two ponds is required to get sweet water within the dry season. The filter beds required to be cleaned by the community people under the strategy of section **5.2.2- Non Structural Measures: Management and Operation.**

To meet the need of large catchment area of this village, the donor agencies may provide each family or two a piece of plastic sheet and GAZI water storing tank to catch and store rain water. This is a cost effective solution and the villagers will be benefited.

iv. Killa

Killa is proposed on the nearer site of the cyclone shelter. It is positioned as such the owners can look after their livestock.

v. Asset Hub:

As an asset hub is proposed for 15 families, each cluster can be provided with a hub. It is placed on the central area of a cluster. The maintenance and management of the hub is essential and should be dealt by the community people.

b. Green Belt:

A belt of greenery may be proposed along the embankment parallel to Shibsha River to protect the embankment as well as the community.

c. Infrastructure:

The roads need to be repaired. The embankment parallel to the Shibsha river needs repair work which can be done by the community people under the supervision of a technical team and governed by private sector.

d. Strengthening of Existing Houses:

Because of the coastal location, houses of this village need to be built to withstand strong wind. The nature of the existing rural housing may not permit it to withstand a severe cyclone, but strengthening the house structure would at least provide resistance to the frequent strong winds and storms. According to a book of “Improved Design and Construction of Rural Housing in Noakhali, IUCN, 2008)”, some of the basic design principles for cyclone-resistant homestead planning and construction are outlined here:

- Using of landscape and topography to minimize inundation risk and modify wind speed direction.
- Giving the building a uniform shape presenting minimum obstruction to the wind.
- Keeping the roof pitch between 25 degree and 35 degree to minimize suction caused by negative pressure.

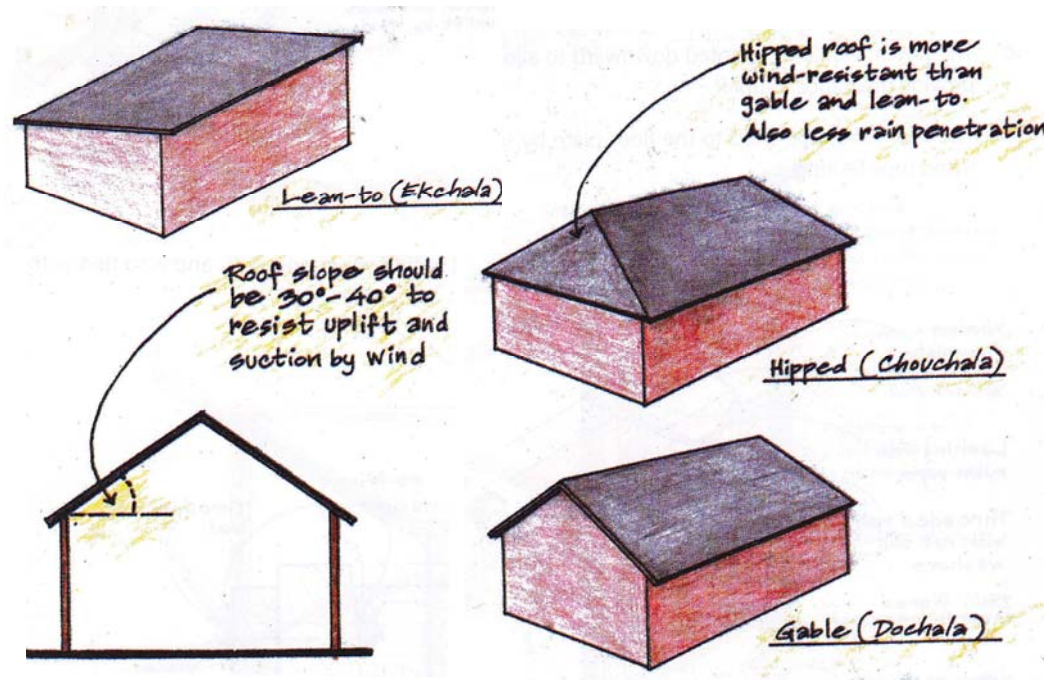


Fig 5.29: Roof form criteria for wind-resistance

(Source: Improved Design and Construction of Rural Housing in Noakhali, IUCN, 2008)

- Avoiding large overhangs, separate verandah covering and frame from the main roof.
- Making sure of strong fixings and joints between all elements: foundations and walls, walls and claddings, walls and roof frame, roof frame and covering.

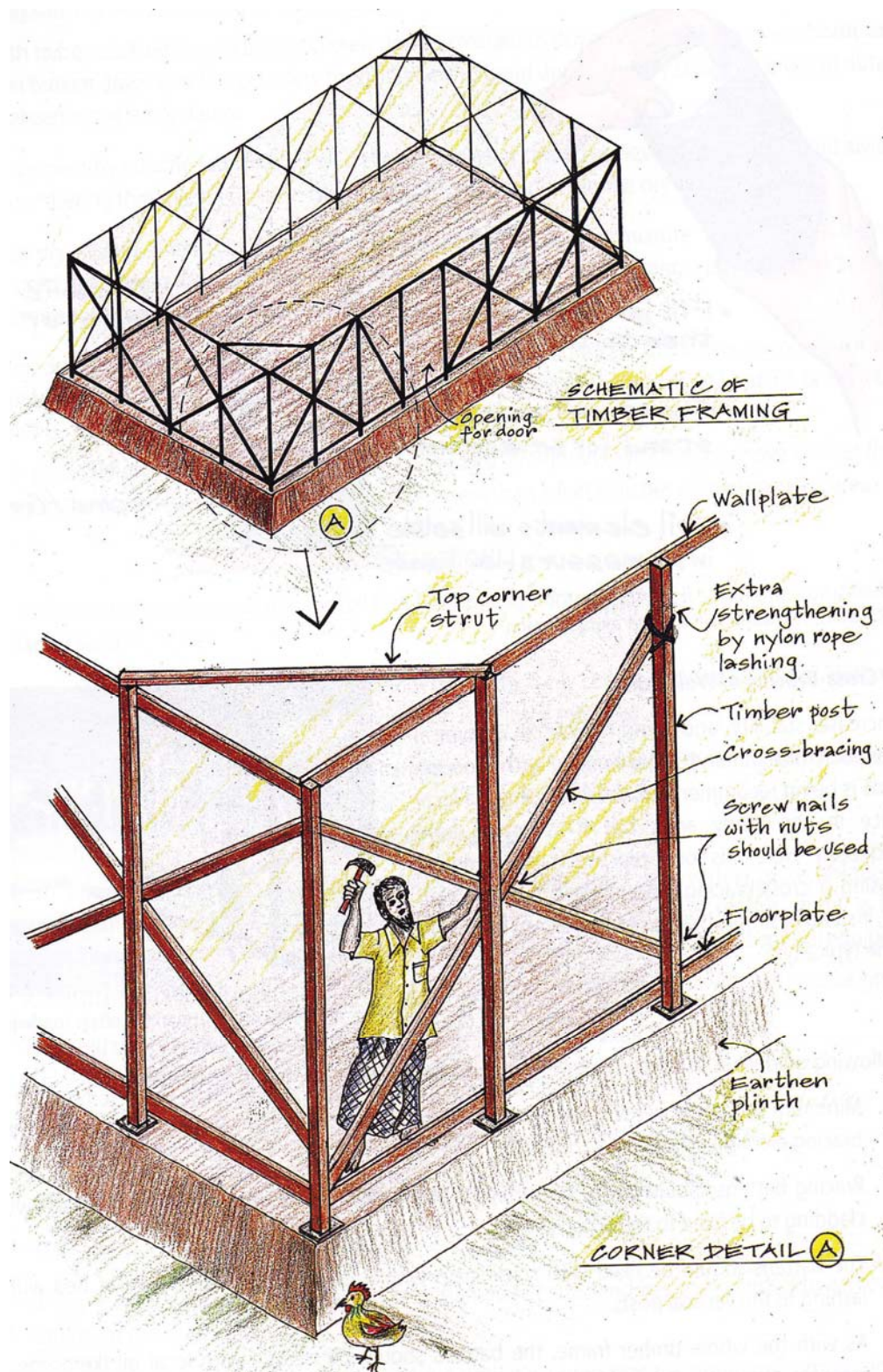


Fig5.30: Techniques of cross-bracing of wall frame

Source: Improved Design and Construction of Rural Housing in Noakhali ,IUCN,2008

- Fixings between elements must be good enough and frequent enough to stop the structure from breaking into separate and vulnerable elements.
- Making sure that the roof covering elements cannot be lifted off by wind.

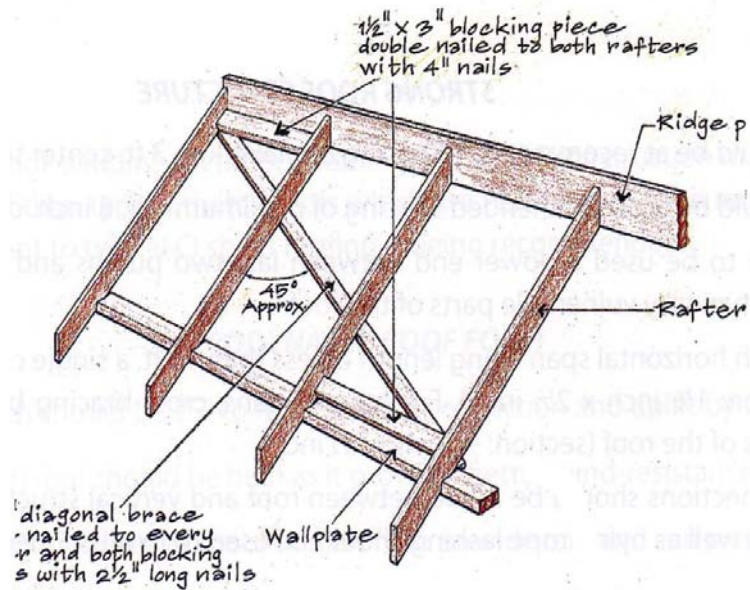


Fig 5.31 :Techniques of cross-bracing the roof structure

Source: Improved Design and Construction of Rural Housing in Noakhali, IUCN, 2008

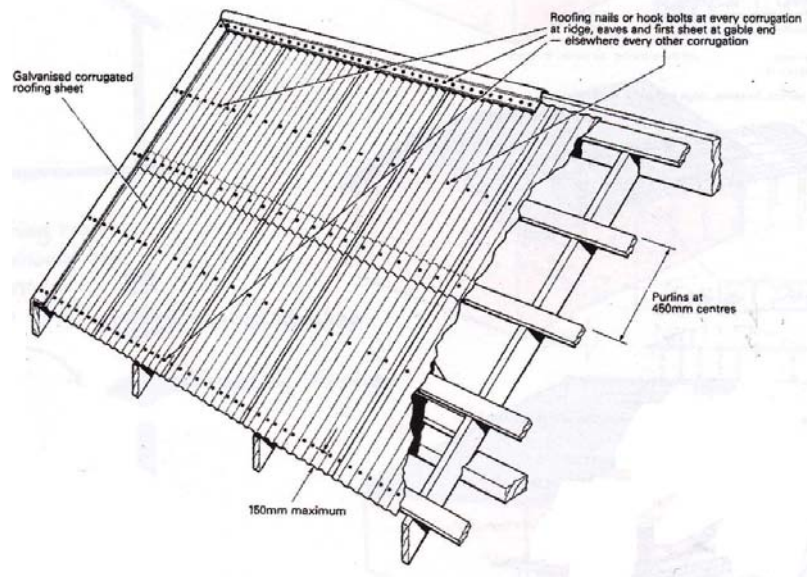


Fig5.32: Techniques of fixing CI sheet roof Cladding

Source: Improved Design and Construction of Rural Housing in Noakhali, IUCN, 2008



Fig 5.33: Layout of after implementing intervention (Source: Author 2013)

5.4 Conclusion

Cyclone is a frequent disaster in Bangladesh. Various cyclone disaster management programs have been initiated and successfully completed. Though the main focus of this management intervention is saving human lives, the other sectors regarding disastrous cyclonic effects are being taken into consideration. The aspect of recovering assets can be a major concern in order to reduce the effects of cyclone. This issue should be included in cyclone awareness programs in rural areas to make the community be concerned. The more the community becomes aware of securing their assets to get a support from these in the cases of livelihood and safe health, the more it would become successful taking the initiatives. Community and institutional involvement collectively would make a complete scenario of cyclone resilient community.

This study is an initiation to direct the attention of relevant resource persons and organizations to assets and health issues parallel to saving lives. More in depth studies and researches are needed to get a complete picture and establish proper measures. In order to make a cyclone resilient community many other relevant issues are required to be understood and explored. There is an immense scope of further study to explore other issues, sectors and interventions to deal with the disastrous effects of cyclone to protect the vulnerable community of our coastal belt.

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