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Research Report

on

**Disaster Management in Bangladesh: A Study of Structural Measures  
in Some Selected Disaster-prone Areas**



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Researchers



## *Executive Summary*

*A paradigm shift is now on the approach towards disaster management in all the countries especially in the South-Asian region— from post-disaster relief and rehabilitation to pre-disaster prevention and preparedness. This paradigm shift has also resulted in the realization that causes and consequences of the major disasters in this region are not limited within the political boundaries of the nations but are essentially regional and sometimes trans-regional in nature and therefore solution to these problems would lie in the increased regional understanding and cooperation in studying the problems, sharing information and best practices for dealing with the hazards and disasters in a comprehensive manner.*

*Bangladesh, in spite of being one of the most disaster-prone countries of the world its focus was limited in relief and rehabilitation activities in the early stages. But following the devastating floods of 1988, 1998 and the cyclone of 1991, which has created a massive destruction in the economy; the focus has been shifted towards adaptation of a holistic approach that embraces processes of hazard identification and mitigation, community preparedness and integrated response efforts. In the Delhi Declaration of the 14th SAARC Summit 2007, where Bangladesh urges immediate collective action and stronger regional cooperation for the conservation and utilization of our shared environment. The summit, accordingly, called for adaptation of initiatives and programmes; cooperation in early forecasting, warning and monitoring; and sharing of knowledge on consequences of climate change for pursuing a climate resilient development in South Asia; and agreed to commission a team of regional experts to identify collective actions in this regard. Against this backdrop, the researchers have visualized that there are scopes for carrying out research on this pressing reality.*

*This study as an attempt to analyse the implications of natural disaster in Bangladesh and its relationship to infrastructure development in particular, tried to – i) present a renewed perspective in infrastructure development for disaster mitigation; ii) to find out lapses in our disaster mitigation processes; and iii) to suggest some measures and initiatives for strengthening infrastructural growth relating to reduction of risks of disaster and its better management.*

*This study would rely on data and information collected from primary and secondary sources. Collection of data was facilitated through sets of questionnaire (annexes) as prepared according to the requisite conditions and requirements of the contents. Respondents were selected purposively from the following disaster prone areas – i) Patharghata of Barguna, and Kalapara of Patuakhali districts as cyclone and tidal surge-affected regions, and ii) Pansha of Rajbari and Sujanagar of Pabna districts as two severe flood-affected regions of the country. It is noted that while collecting information the smallest unit of local government (Union Parishad) was chosen as there were limitations for our accessibility to a broader sphere owing to spectrum of multitude problems. The respondents, who responded through questionnaires involved, i) the people severely affected in those regions; ii) the focal point of local administration i.e. the UNOs of the respective Upazilas; and iii) public representatives. Moreover, apart from the structured questionnaire interview along with telephonic communication were made with people, local elites, concerned people with disaster mitigation outside govt. administration, etc. with a view to grasp the gravity of the situation.*

*The study emerges with a bulk of findings, some important ones include the following:*

- *In Kalapara 26 cyclone shelters have become dysfunctional out of the total number (73) which reflects poor maintenance system over there. It is to be noted that these cyclone shelters were built in two phases- 1972-1973; 1994-1995. Within this short span of time, almost 19% have become dysfunctional. Which depicts that these cyclone shelter were designed and built just on the whimsical plans of building any infrastructure without justifying the purposes;*
- *capacity of existing cyclone shelters is not compatible rather imbalanced with the total strength of population of both the regions. Furthermore, the capacity of cyclone shelters of Pathargata is more inferior in comparison to Kalapara;*
- *the dams and embankments of the region are in wretched condition; those were built to protect the coastal regions and its people from joar-bhata (high and low tides), but unable to protect the people and soil from the severe calamities like AILA and SIDR; Moreover, those dams and embankments were not afforested properly and lacked nurturing;*
- *affected people suffers from a sense of negligence and positive awareness in responding to the traditional signaling and other forecasting systems;*
- *both the UNOs of Pathargata and Kalapara appear unable to furnish authentic statistics regarding the amount expended against construction of the specific cyclone shelters in their jurisdiction. It focuses further the idea that such types of accounts are not preserved at the Upazila levels;*
- *the cyclone shelters are not being maintained properly;*
- *owing to the lack of fund allocation proper maintenance of the cyclone shelters becomes difficult; and because of under-utilization during normal situation the shelters appear to be unsuitable for habitation;*
- *the cyclone shelters were built following onrush of some severe natural calamities which devastated the living existence of the hapless people of our coastal regions. This is but an absence of our proactive thinking in combating natural calamities;*
- *almost half of the affected people did not take refuge in the cyclone shelters in both the Upazilas because of adversaries not conducive to even subsistence living;*
- *it appears that the money sanctioned for construction of this cyclone shelter was not spent practically and lacking foresightedness;*
- *earthquake-resistant technology was not applied while constructing those cyclone shelters;*
- *an insignificant number of respondents (2.2% in Pathargata and 7.5% in Kalapara ) found interested to take refuge at nearby parjatan centre/hotel and safe houses.*
- *In Pangsha there are only 7 flood shelters (being used as school and madrasa) which could accommodate 1400 people at best and not enough in proportion to the population of the Upazila;*
- *In Sujanagar, being the most flood-prone regions of the country, there is no flood shelter constructed yet;*
- *no fund is reserved for these types of permanent disaster (flood) rather, allotted instantly when lives and properties of the respective region are threatened; and*
- *those flood shelters built so far specially in Pangsha region, just bearing the identity of flood shelters, are being used as madrasa and schools. The affected people responded in*

*anguish that for how long they could remain stranded waiting for those madrasa and schools to be vacated.*

*Based on the core findings the researchers propose scores of suggestions of which vital ones are-*

- *adequate fund should be kept reserved for cyclone and flood-prone areas, and there must be flexibility in disbursing the fund;*
- *the inhabitants of the affected regions should be motivated to build their houses on high altitudes that could protect themselves from the onrush of tidal surges like SIDR and AILA. In this regard, the government as well as the NGOs can facilitate constructing the houses based on unusually heightened vertical columns;*
- *the existing dams and embankments urgently need to be renovated with optimum structural heights that can surmount the catastrophic effects of tidal surges. Further, there should be extensive aforestation surrounding the dams and embankments with a commitment to nurturing both the forest and the embankments as well;*
- *with an aim to rehabilitate the affected people in safe and secured zones from risky and vulnerable regions;*
- *while building any dams, embankments or cyclone shelters in future earthquake and tidal surge-resistant technology must be applied;*
- *the stakeholders should be involved in maintaining the dams, embankments, shelters and the likes constructed for these very purposes;*
- *adequate numbers of cyclone shelters, should be built based on the proportional ratio of population of the areas;*
- *as flood and river erosion are perennial in nature, we must adopt necessary sustainable measures in advance;*
- *farmers of the flood prone and saline-intensive regions need to be motivated to cultivate rice resistant both to saline water and long duration of flood;*
- *climate change, as it clearly appears to be a threat to our very existence; though we are not to be blamed but victim to the grave circumstances- we should look forward for a pioneering role in cooperation with the global partners;*
- *Bangladesh needs detailed study to scientifically assess the Tsunami vulnerability. Besides, she needs to develop a Tsunami early warning system and mass awareness of Tsunami threat at the coastal areas;*
- *while combating disasters we have to think globally; we should open a windows through which we can exchange ideas and information on global climate change and its impacts.*

*Scores of lapses and lacks in the field have been found as findings of this research. Based on the core findings the researchers proposed a series of suggestions those, we hope, if taken into consideration, could help strengthening our disaster mitigation capabilities and ease the existing situation in combating natural disasters in the days to come.*

## *Abbreviations*

|                |                                                                         |
|----------------|-------------------------------------------------------------------------|
| <i>BMD</i>     | Bangladesh Meteorological Department                                    |
| <i>BPATC</i>   | Bangladesh Public Administration Training Centre                        |
| <i>CCA</i>     | United Nations Common Country Assessment                                |
| <i>CCDMC</i>   | City Corporation Disaster Management Committee                          |
| <i>CDMP</i>    | Comprehensive Disaster Management Programme                             |
| <i>CPP</i>     | Cyclone Preparedness Programme                                          |
| <i>CPPIB</i>   | Cyclone Preparedness Program Implementation Board                       |
| <i>CSDDWS</i>  | Committee for Speedy Dissemination of Disaster Related Warnings/Signals |
| <i>DDMC</i>    | District Disaster Management Committee                                  |
| <i>DFID</i>    | Department for International Development                                |
| <i>DMB</i>     | Disaster Management Bureau                                              |
| <i>DMIC</i>    | Disaster Management Information Centre                                  |
| <i>DMTATF</i>  | Disaster Management Training and Public Awareness Building Task Force   |
| <i>EDREMOS</i> | Environment, Disaster and Resources Monitoring System                   |
| <i>FPOCG</i>   | Focal Point Operation Coordination Group of Disaster Mgt.               |
| <i>GTS</i>     | Global Telecommunication System                                         |
| <i>IMDMCC</i>  | Inter-ministerial Management Coordination Committee                     |
| <i>ISDR</i>    | International Strategy for Disaster Reduction                           |
| <i>JICA</i>    | Japan International Cooperation Agency                                  |
| <i>LRP</i>     | Land Reclamation Programme                                              |
| <i>MCSP</i>    | Multipurpose Cyclone Shelter Programme                                  |
| <i>MES</i>     | Meghna Estuary Study                                                    |
| <i>NDMC</i>    | National Disaster Management Council                                    |
| <i>NDMAC</i>   | National Disaster Management Advisory Committee                         |
| <i>NGOCC</i>   | NGO Coordination Committee on Disaster Management                       |
| <i>NMCC</i>    | National Meteorological Communication Centre                            |
| <i>PDMC</i>    | Paurashava Disaster Management Committee                                |
| <i>SOB</i>     | Survey of Bangladesh                                                    |
| <i>SODM</i>    | Standing Orders for Disaster Management                                 |
| <i>SPARRSO</i> | Space Research and Remote Sensing Organization                          |
| <i>SWC</i>     | Storm Warning Centre                                                    |
| <i>UNDAF</i>   | United Nations Development Assistance Framework                         |
| <i>UDMC</i>    | Union Disaster Management Committee                                     |
| <i>UNEP</i>    | UN Environment Programme                                                |
| <i>UzDMC</i>   | Upazila Disaster Management Committee                                   |
| <i>WCDR</i>    | World Conference on Disaster Reduction                                  |
| <i>WSSD</i>    | World Summit for Sustainable Development                                |
| <i>WWW</i>     | World Weather Watch                                                     |

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# **Disaster Management in Bangladesh: A Study` of Structural Measures in Some Selected Disaster-prone Areas**

## ***Chapter - I***

### **1.0 Background**

A low-lying country with more than 230 waterways, Bangladesh is one of the most disaster-prone nations in the world. Fifteen per cent of its land floods annually on average. In 2004 that figure reached 34 per cent and in 2007 two floods and a cyclone together killed 4,000 people and caused economic losses of about \$3 billion. When such events occur water-borne diseases and mass internal displacements are inevitable consequences.

Natural disasters disrupt the nation's food supply and decimate the livelihoods of the many Bangladeshis who work in agriculture. Besides triggering flooding, severe weather frequently causes environmental damage by eroding riverbanks, directly affecting 100,000 people every year. Poor town planning, overcrowding and weak infrastructures amplify the threat of disasters to urban communities, particularly in cities vulnerable to earthquakes.

Dealing with these hazards is a major challenge for the national government. As well as the immediate cost to life and to the economy, large-scale disasters in such a small country can negate poverty-reduction efforts and divert development resources from more productive uses.



## **1.1 Rationale**

South Asia is one of the most critical global hotspots of natural hazards. Rapid depletion of ground water, erratic monsoons and recurring droughts are creating slow onset disasters in many parts of this region. South Asia has also a long coastline of 12000 kilometers, which face atmospheric depressions resulting in cyclones, storm surges, tsunami, erosion and flood. Moreover, sea level rise has threatened many coastal and deltaic regions from submergence. South Asia supports 23% of the global population, but it generates only 1.3% of the world's wealth. The combination of the natural hazards and social and human vulnerabilities have resulted in recurring disasters of severest magnitudes, some of them rapid fire like earthquake, flood, cyclone and landslide, which cause devastation in matter of minutes, hours or days, and some slow onset such as drought, epidemics, infant and maternal mortality, which are dispersed over a wide area and take a heavy toll of life and livelihood over a long time span. It is estimated that South Asian countries lose between 2 to 12% of the GDP annually on account of natural disasters (Chakrabarti, P.G. Dhar 2005).

The national governments of South Asia have rationally realized the gravity of the situation during the recent years and accordingly devising legal and institutional systems for dealing with disasters. Now a paradigm shift is in the approach towards disasters management in all the countries of this region– from post-disaster relief and rehabilitation to pre-disaster prevention and preparedness. This paradigm shift has also resulted in the realization that causes and consequences of the major disasters in this region are not limited within the political boundaries of the nations but are essentially regional and sometimes trans-regional in nature and therefore solution to these problems would lie in the increased regional understanding and cooperation in studying the problems, sharing information and best practices for dealing with the hazards and disasters in a comprehensive manner.

Bangladesh, in spite of being one of the most disaster-prone countries of the world its focus was limited in relief and rehabilitation activities in the early stages. But following the devastating floods of 1988, 1998 and the cyclone of 1991, which has created a

massive destruction in the economy; the focus has been shifted towards adaptation of a holistic approach that embraces processes of hazard identification and mitigation, community preparedness and integrated response efforts. Which was reflected in the Delhi Declaration of the 14th SAARC Summit 2007, where Bangladesh urges immediate collective action and stronger regional cooperation for the conservation and utilization of our shared environment. The summit, accordingly, called for adaptation of initiatives and programmes; cooperation in early forecasting, warning and monitoring; and sharing of knowledge on consequences of climate change for pursuing a climate resilient development in South Asia; and agreed to commission a team of regional experts to identify collective actions in this regard. However, in spite of our successful switchover from post-disaster relief and rehabilitation to pre-disaster prevention and preparedness there are many drawbacks and more to be done. Against this backdrop, the researchers have visualized that there are scopes for carrying out research on this pressing reality.

## **1.2 Objectives**

This study is an attempt to analyse the implications of natural disaster in Bangladesh and its relationship to infrastructure development in particular; and in general, it will address the following:

- to present a renewed perspective in infrastructure development for disaster mitigation;
- to find out lapses in our disaster mitigation processes; and
- to suggest some measures and initiatives for strengthening infrastructural growth relating to reduction of risks of disaster and its better management.

## **1.3 Methodology**

This study would rely on data and information collected from both primary and secondary sources. Collection of data was facilitated through sets of questionnaire (annexes) as prepared according to the requisite conditions and requirements of the contents. Considering the recurring trend, dimension and magnitude of disasters here we tried to get response from the people affected by two types of natural disasters – tidal surge and flood. Respondents were selected purposively from the following disaster prone areas – i) Patharghata of Barguna, and Kalapara of Patuakhali districts as cyclone

and tidal surge-affected regions, and ii) Pansha of Rajbari and Sujanagar of Pabna districts as two severe flood-affected regions of the country. It is noted that while collecting information the smallest unit of local government (Union Parishad) was chosen as there were limitations for our accessibility to a broader sphere owing to spectrum of multitude problems. The respondents, who responded through questionnaires involved, i) the people severely affected in those regions; ii) the focal point of local administration i.e. the UNOs of the respective Upazilas; and iii) public representatives. Moreover, apart from the structured questionnaire interview along with telephonic communication were made with people, local elites, concerned people with disaster mitigation outside govt. administration, etc. with a view to grasp the gravity of the situation.

**1.3.1 Data Analysis:** Collected data have been analyzed using necessary statistical tools. The data have been presented in the report in tabular forms, charts, and graphs (histogram and pie charts). In case of secondary data, access to related publications and online data and information have immensely benefited the researchers in conceptualizing and trimming the required materials as referred at the end.

**1.3.2 Study Areas:** Based on the principle of data collection the researchers have had selected two diversified regions such as, cyclone and tidal surge affected areas like i) Patharghata of Barguna, and Kalapara of Patuakhali districts and ii) Pansha of Rajbari and Sujanagar of Pabna districts as two common flood-affected regions of the country. Maps of the study areas have been annexed at the end of the report indicating the specific zones.

#### **1.4 Significance**

A little has been studied from the perspective of academic value on its key role in disaster risk management in Bangladesh. This research, which seeks to redress this lacking and loopholes, will be unique and pioneer work of its kind. About social values, this research would worth significance, as it would offer some useful research findings having some important policy implications for further betterment of involved communities of Bangladesh. Its findings, finally, would investigate the vulnerability of infrastructure to natural disasters in Bangladesh and recommend the areas that need to be prioritized.

### **1.5 Expected Results**

The researchers expect that the harvest of the research will be of use to the people—policymakers, academics, scholars, researchers as well as the professionals.

### **1.6. Plan of Presentation**

This paper consists of seven chapters. The introductory chapter embodies the conceptual framework, objectives, rationale, methodologies, highlights of the study areas, significance, and expected outcomes of the research. Chapter – II covers plethora of literature on the burning issues relating to disaster management. Chapter – III highlights on natural hazards affecting different nooks and corners of Bangladesh along with some statistics reflecting ravaging nature and the extent of damages in the recent past. The next chapter (IV) focuses on the overall disaster management system in Bangladesh. Chapter V accommodates various disaster management initiatives taken so far by different organs of the government entrusted with similar goals and objectives. Chapter VI, the vital segment of the paper analysed the data and information collected from different sources for exploring the realities of the disaster management scenarios of the country. And the final one enshrines the findings, recommendations along with a concluding note.

## *Chapter - II*

### **2.0 Literature Review**

A number of books are published in disaster management in Bangladesh perspective but publications relating to infrastructural development for disaster management in Bangladesh context are completely unusual. Despite this ground reality, few numbers of publications relating to this subject matter have been reviewed here.

Cuny, F. (1990) highlights that Asia and the Pacific is the world's most disaster-prone region, accounting for 91 per cent of deaths from natural disasters in the past century and 49 per cent of the resulting economic damage. Each year for the past 15 years, an average of 41,000 people have died in the region from natural disasters, which annually inflicted \$29 billion worth of damage. Of the world's 10 most severe natural disasters in 2004, five occurred in the Asian and Pacific region, causing damage amounting to \$55 billion, about 70 per cent of the total damage, estimated at \$80 billion.

The author also states that losses resulting from natural disasters are particularly damaging in the Asian and Pacific region, depriving countries of resources which could otherwise be used for economic and social development. The toll is most severe and tragic in the least developed and developing countries of the region, which have sometimes had their development goals, set back years, and even decades as a consequence of major disasters.

The objective of the chapter six is to analyze the impact of natural disasters in Bangladesh context and its relationship to infrastructure development with a view to identifying how regional cooperation could help address issues relating to disaster management. This chapter also provides brief analysis of the causes of natural disasters. The author stresses upon regional cooperation, for disaster management including infrastructure development, essential, not only to cope with the impacts but also to help ensure that the region sustains its economic growth.

Ahmed, K I (2006) describes that Bangladesh is one of the countries of the world most vulnerable to disasters, experiencing a wide variety of natural hazards that include floods, cyclones, earthquakes, drought, tornadoes, debris flows, hailstorms, storm surges, tsunamis and haze. Tropical cyclones occur more frequently in the Asian and Pacific region than in any other part of the world and are usually accompanied by severe flooding. Riverine flooding continues to be a common occurrence in Bangladesh that causes substantial damage every year. The impact of flash floods is also becoming increasingly important. Urban flooding has become a major potential hazard in terms of its economic and social impact as a result of the rapid urbanization process and uncoordinated infrastructure development. Coastal flooding and storm surges have the potential to cause substantial loss of life and property damage in large and heavily populated deltaic areas, such as those of Bangladesh and Viet Nam, and tsunamis generated by underwater earthquakes can also be very destructive, as experienced in December 2004 in the Indian Ocean and South-East Asia

The author highlights that the priority for enhanced regional cooperation in disaster management will be on rebuilding infrastructure and investing in infrastructure for disaster prevention and preparedness. Cooperation among different stakeholders in developing the physical infrastructure for disaster management has so far been limited, but there has been more significant cooperation in building an institutional infrastructure in Bangladesh.

Rahman, M. H. (2005) describes in the Disaster Management Handbook that the different natural events with focus on infrastructural development in Bangladesh which contributes towards reducing underlying risk of disaster happening in Bangladesh. He emphasizes on the disaster management frameworks with the incorporation of disaster preparedness measures for minimizing losses and damages of disasters in Bangladesh. Development of physical structure is given importance in recommendation part of this book.

Hossain, Hameeda *et. al.*, (1992) in their voluminous book '*From Crisis to Development: Coping with Disasters in Bangladesh*' exposed that with each disaster we have gained greater awareness of what we went wrong. In 1970 there was no warnings and no

shelters; disaster management was insufficient. In 1991 warnings were issued regularly since 24 April, but the messages designed for maritime use were not as meaningful as they could be to coastal inhabitants. Even if the people moved in larger numbers, they would have found the cyclone shelters grossly inadequate in number and facilities; although relief was provided in the first days after the storm. Victims were left largely to their own devices. How they managed to survive and how many survived depended very much on gender and age, but particularly on their own resources.

Stories of human fortitude abound at moments of crisis. But for a society to emerge from the frontiers of survival requires a combination of individual and societal resilience and institutional capacities. And to meet the challenges, the book went further, Bangladesh needs urgently to move away from its patronage culture to institutionalize popular participation and democratic forms of decision making at all levels, from the national to local village. Given the resource constraint, it concluded, distribution of relief and development inputs has become a means to buy support, to build power blocks and to maintain vote banks. This needs to be replaced with a faith in the people's capacity to decide, and this faith needs to penetrate through to all government, non-governmental and community institutions.

Rahman, Muhammad Saidur (2008) Indigenous Knowledge on Flood Risk Management in Bangladesh (*an article published through –Disaster Reduction Hyperbase (DRH-Asia)*)

The article, while giving importance on cooperation and collate practices on different areas, observes that due to geographical location Bangladesh is one of the most flood-prone countries in the world. Every year it is affected by flood of varying magnitude. Since the term “disaster management” is understood as post-disaster relief and rehabilitation operations by policy makers and the key actors, hardly any importance is given on pre-disaster preparedness. Early warning against flood is not disseminated in a way which is understandable by the people at risk. Since people in different areas use their indigenous knowledge to cope with flood disasters, there is a need to collect and collate good practices from different areas and promote them widely to the entire flood-prone areas through effective communication media.



Carlo del Ninno *et al.*, (2001) in their research report “The 1998 Floods in Bangladesh: Disaster Impacts, Household Coping Strategies, and Responses” examines in detail how the floods affected food security in Bangladesh at the national and household levels and draws lessons for the management of future natural disasters in developing countries. On focusing policy implications it finds that both short-term and long-term policies played major roles in preventing the 1998 floods from resulting into a major food security disaster in Bangladesh. Public sector investments in agricultural research and extension in the 1980s and 1990s, together with mainly private sector investments in small-scale irrigation, led to substantial increases in wheat and *boro* rice production. This made the country less vulnerable to floods by increasing total foodgrain production in the country, reducing the length of time between major crops from 12 months to only about 6 months, and leading to a shift away from highly flood-susceptible deepwater *aman* cultivation in the monsoon season to *boro* cultivation in the dry season. Continued investment in research and extension could further increase production efficiency and reduce the vulnerability of the food sector to floods. In addition, long-term public investments in infrastructure (roads, bridges, electricity, and telephones) contributed to efficient marketing systems that enabled the private sector grain trade to supply markets throughout the country following the floods.

Thus, the report goes further, the Bangladesh example illustrates the importance of coordinated actions at the sectoral and household levels, by both public and private sectors, in maintaining the availability of and access to food to ensure food security following major supply disruptions. Private trade alone might have provided sufficient availability of food, though this in itself would not have solved the problem of access to food for millions of households. Public sector actions enhanced access to food by flood-exposed households, though these interventions were too small to have a major direct effect on overall availability and market prices. Ultimately, food security in Bangladesh was largely maintained through an appropriate mix of public interventions, private market trade flows, and an extensive system of private borrowing. Continued investments in agricultural research, extension, roads, electricity, and other rural infrastructure, along

with policies promoting efficient markets and programs to provide targeted transfers and credit to poor households, could further enhance the food security of the poor.

Haq, AFM Sirajul *et. al.*, in a country profile on Bangladesh [*compiled by Bari, Fazlul et. al.*, ed. (1994)] hints that in line with the SAARC spirit of regional cooperation, close coordination among the SAARC members in disaster management information exchange activities which may affect environmental degradation leading to disaster and mutual supports at time of disasters can go a long way in disaster mitigation and thereby reduce sufferings of the people of the region from disasters and achieve sustainable development. The report offers some judicious recommendations which includes – i) exchange of information on weather; ii) exchange of information of movement of cyclones; iii) exchange of information on rainfall in catchment area of international rivers and water level in such rivers; iv) on request from member countries, emergency dispatch of salvage equipment, fire-fitting equipment and other materials required to tackle natural hazard/accident; v) on request from member countries dispatch of medical teams, relief materials etc.; vi) search and rescue of lost ships, aircraft, distressed personnel, identification/spotting and salvage of wrecked ships, aircraft or other vehicles; vii) fighting of swarm of locusts that cause large scale damage to crops; viii) cooperating in the field of information exchange and in activities that may adversely affect ecological balance in the region causing environmental disasters; ix) on request from a member country, dispatch of suitable technical manpower/expert service for fighting chemical or other accidents; and x) exchange of findings in research on tropical cyclones, floods, weather, cyclone resistant housing, flood/cyclone shelters and in other structural and non-structural mitigation measures.

A paper '*Development and Use of Geo-Information in Bangladesh*' prepared by Brigadier General Muhammad Shafiqul Islam, Surveyor General of Bangladesh, Survey of Bangladesh, presented at the Seventeenth United Nations Regional Cartographic Conference for Asia and the Pacific Bangkok, 18-22 September 2006 underscores, with many other aspects, the demands for geo information which is gradually increasing in Bangladesh for implementation of her improvement projects and to mitigate recurring natural calamities. Accurate geo information fulfills the followings: i) Proper utilization

of natural resources; ii) Land management system; iii) Controlling environment management; iv) Administrative managements; and v) Infrastructural development, etc.

The paper necessitates the establishment of national horizontal and vertical datum in Bangladesh and informs that in co-operation with Japan International cooperation agency in the year 1995, we established national horizontal and vertical datum at Gulshan, Dhaka, Bangladesh which was connected with nearest four IGS stations Tsukuba (Japan), Wettgell (Germany), Hartebeesthoek (South Africa), and Yarangadee (Australia). The paper informs further -we inherited vertical network which was linked in 1909 with nine tidal observatories around the coast of Indian sub continent. There were no tidal observatories in Bangladesh. These line traveled very long distance as well as old were used for crossing wide rivers and also due to passes time, natural disaster like earth quake significant relative error were found.

The paper documents the needs of development of our remote sensing and GIS activities in Bangladesh. We have Space Research and Remote Sensing Organization (SPARSO) dealing with remotely sensed data for Bangladesh. Meteorological department of the country forecasts weather information using different satellite data. We are using remote sensing data to mitigate natural calamities and disaster management using latest satellite images. In addition, hydrographic, forest, agricultural and educational institutes are using satellite data for implementation and research purposes. Moreover different organizations of the country are producing maps taking active help from satellite images time to time. In the field of GIS, various organization developed GIS for their own requirements. At the beginning coordination among the users and developers were less. In fact different platforms, codes, formats and primary data acquisition methods were used. As a result data standardizations, sharing problem became difficult. We are as National Mapping Organization (NMO), organizing to bring all related organizations including government and private bodies to be a common platform, the paper concluded.

Chakrabarti, P.G. Dhar (2005) in his paper "Regional Cooperation for Disaster Management in South Asia" focuses that rapid depletion of ground water, erratic monsoons and recurring droughts are creating slow onset disasters in many parts of the

region. South Asia has also a long coastline of 12000 kilometers, which face atmospheric depressions resulting in cyclones, storm surges, tsunami, erosion and flood. Seawater rise has threatened many coastal and deltaic regions from submergence. The paper highlights the natural hazards of South Asia are compounded by layers of human and social vulnerabilities. South Asia supports 23% of the global population, but it generates only 1.3% of the world's wealth. This mismatch had resulted some of the worst indicators of human deprivations- more than 40% of the world's poor live in South-Asia, half of the world's illiterates and malnourished belong to South Asia, which has also the most skewed sex ration, reflecting deeply rooted gender discrimination in societies.

The combination of the natural hazards and social and human vulnerabilities have resulted in recurring disasters of severest magnitudes, some of them- rapid fire like earthquake, flood, cyclone and landslide, which caused devastation in matter of minutes, hours or days, and some slow onset such as drought, epidemics, infant and maternal mortality, which are dispersed over a wide area and take a heavy toll of life and livelihood over a long time span. It is estimated that South Asian countries lose between 2 to 12% of the GDP annually on account of natural disasters. It is only during the recent years that the national governments of the region have realized the gravity of the situation and are accordingly devising legal and institutional systems for dealing with the disasters. There is now a paradigm shift in the approach towards disasters management in all the countries of South Asia- from one of post disaster relief and rehabilitation to pre-disaster prevention and preparedness.

This shift has also resulted in the realization that causes and consequences of the major disasters in South Asia are not limited within the political boundaries of the nations but are essentially regional and sometimes trans-regional in nature and therefore solution to these problems would lie in the increased regional understanding and cooperation in studying the problems, sharing information and best practices and developing agreed tools and methodologies for dealing with the hazards and disasters in a comprehensive manner. This realization, as the paper stressed, has crystallized into the following three recent initiatives. First, the Thirteenth Summit of Head of State or Governments held on 12-13 November, 2005 adopted the Dhaka Declaration which interalia underscored the

urgency to set up a 'permanent regional response mechanism on disaster preparedness, emergency relief and rehabilitation'.

Second, the *SAARC Comprehensive Disaster Management: A Framework for Action 2006-2015* was formulated by an Expert Group of the Member Countries which met in Dhaka on 7-9 February, 2006 in response to the Dhaka Declaration and earlier Declaration of the SAARC Environment Ministers which met at Male on 25 June 2005 after the devastating Indian Ocean Tsunami.

The third and probably the most important initiative were to set up the SAARC Disaster Management Centre in New Delhi. Considering the leadership role that India can play in the region particularly in harnessing scientific and technological capabilities for early warning of disasters and their dissemination, networking and capacity building, research and knowledge integration, quick response for search, rescue and evacuation, structural and nonstructural mitigation, early recovery and reconstruction.

An Expert Group of the SAARC countries drafted the vision, mission, structure, functions and strategies of the Centre, which was approved by the Council of Foreign Ministers and endorsed by the Summit. The Centre has the vision to be 'a vibrant centre of excellence for knowledge, research and capacity building on disaster management', its mission would be to 'serve the Member Countries by providing policy advice and facilitating capacity building services including strategic learning, research, training, system development, expertise promotion and exchange of information for effective disaster risk reduction and management' and its functions range from providing assistance to the countries in the formulation of policies, strategies, disaster management framework etc. conducting research, studies, training programmes, disseminating information, good practices etc. The Centre would also coordinate regional response in times of mega disasters affecting one or more countries.

As an operational strategy the Centre is developing a network of networking institutions to facilitate quick acquisition, storage, retrieval and dissemination of information, data and knowledge on disaster management including linkages with approved real-time data

providers. As a first step each country has designated its National Focal Point and a common format and protocol has been developed for networking. Institutions and organizations that would be part of the networking are being identified through the National Focal Points. When fully functional more than five hundred organizations in the eight countries- the ministries, departments, scientific, technical, academic, research and other organizations, civil society, media, private sector etc.- would be networked with the Centre, creating a virtual resource centre for disaster management in South Asia.

Bangladesh Climate Change Strategy and Action Plan-2008 summarises that Bangladesh is one of the most climate vulnerable countries in the world and will become even more so as a result of climate change. Floods, tropical cyclones, storm surges and droughts are likely to become more frequent and severe in the coming years. These changes will threaten the significant achievements Bangladesh has made over the last 20 years in increasing incomes and reducing poverty, and will make it more difficult to achieve the MDGs. Over the last 35 years, the Government of Bangladesh, with the support of development partners, has invested over \$10 billion to make the country less vulnerable to natural disasters. These investments include flood management schemes, coastal polders, cyclone and flood shelters, and the raising of roads and highways above flood level. In addition, the Government of Bangladesh has developed state-of-the-art warning systems for floods, cyclones and storm surges, and is expanding community-based disaster preparedness. Climate resilient varieties of rice and other crops have also been developed.

Sections I to V of the document provide the context, outline the implications and likely impacts of climate change in Bangladesh, provide an overview of different adaptation strategies and briefly outline mitigation issues. Sections VI to VII describe a ten-year programme to build the capacity and resilience of the country to meet the challenge of climate change over the next 20-25 years. The Climate Change Action Plan is built on six pillars; i) Food security, social protection and health to ensure that the poorest and most vulnerable in society, including women and children, are protected from climate change and that all programmes focus on the needs of this group for food security, safe housing, employment and access to basic services, including health; ii) **Comprehensive disaster**



**management** to further strengthen the country's already proven disaster management systems to deal with increasingly frequent and severe natural calamities; *iii*) **Infrastructure** to ensure that existing assets (e.g., coastal and river embankments) are well-maintained and fit-for-purpose and that urgently needed infrastructure (e.g. cyclone shelters and urban drainage) is put in place to deal with the likely impacts of climate change; *iv*) **Research and knowledge management** to predict the likely scale and timing of climate change impacts on different sectors of the economy and socioeconomic groups; to underpin future investment strategies; and to ensure that Bangladesh is networked into the latest global thinking on climate change; *v*) **Mitigation and low carbon development** to evolve low carbon development options and implement these as the country's economy grows over the coming decades; and *vi*) **Capacity building and institutional strengthening** to enhance the capacity of government ministries and agencies, civil society and the private sector to meet the challenge of climate change.

In the recent past, a vital step, the Comprehensive Disaster Management Programme(CDMP), has been taken by the government of Bangladesh in collaboration with the United Nations Development Programme (UNDP) and Department of International Development (DFID) which have proved to be very effective. The CDMP a strategic institutional and programming approach that is designed to optimise the reduction of long-term risk and to strengthen the operational capacities for responding to emergencies and disaster situations including actions to improve recovery from any kind of natural disasters.

The key benefits associated with this approach are that: *i*) the resources and expertise of government, NGO, private sector and the community are deployed according to national priorities and community risk reduction programming needs; *ii*) It provides a clear image of what needs to be done and as such, a mechanism for identifying gaps, monitoring and observing achievements; and *iii*) it provides the basis upon which formal collaborating partnerships are developed and nurtured.

Furthermore, the strategies correctly identified the drivers for changes – as national and global drivers. The national drivers include – a) Poverty Reduction Strategy Paper; b) Standing Orders for Disaster Management (SODM); c) Government of Bangladesh and



United Nations Common Country Assessment (CCA); and d) United Nations Development Assistance Framework (UNDAF). While, the global drivers comprises– Millennium Development Goals (MDGs); International Strategy for Disaster Reduction (ISDR); World Summit for Sustainable Development (WSSD); and World Conference on Disaster Reduction (WCDR).

In addition, the Comprehensive Disaster Management Programme Framework Document recognizes a sub-programme as a priority for the successful implementation of the CDMP process. The Policy, Programme and Partnership Development Unit (PPPDU) will undertake and promote coordination responsibilities among implementing agencies, consolidate the partnership among stakeholders and facilitate internalization of risk management issues into the core business of the Ministry of Disaster Management and Relief. The unit would support the Ministry in mainstreaming disaster risk management into the GoB development planning process.

Here it may be mentioned that the objective of the PPPDU is to drive the programme to lay the foundation for a paradigm shift from relief emphasis to comprehensive risk reduction culture involving all stakeholders. Moreover, the sub programme will provide the MoFDM with the necessary institutional support required for it to undertake both CDMP and MoFDM coordination functions.

Bangladesh has records of extreme climatic events claiming millions of lives and destroying past development gains. The people and social system have knowledge and experience of coping with their effects– to some degree and extent. Variability in rainfall pattern, combined with increased snowmelt from the Himalayas, and temperature extremes are resulting in crop damage and failure, preventing farmers and those dependent from meaningful earning opportunities. In a changing climate the pattern of impacts are eroding our assets, investment and future. This stands for families, communities and the state. Global warming and climate change threatens settlements and the number of people displaced from their land due to riverbank erosion, permanent inundation and sea level rise is increasing rapidly every year. Ms. Shormila Arefeen, in her unpublished article titled ‘Climate Refugees in Bangladesh: The Innocent Victims of Global Warming’ visualised that owing to climate change, a sea level rise of 0.5 meter

over the last 100 years has already eroded 65% landmass of 250 square kilometer Kutubdia, 227 square kilometers of Bhola and 180 square kilometer of Sandwip islands. Over the past 100 years, the once 1,000 square kilometer island into a small 21 square kilometer landmass. In case of any further sea level rise, she further added that islands like these and the entire coastal area would be hard-hit resulting in colossal losses worth billions of dollars in GDP, economic downturn, ecological damage and livelihood assets and options.

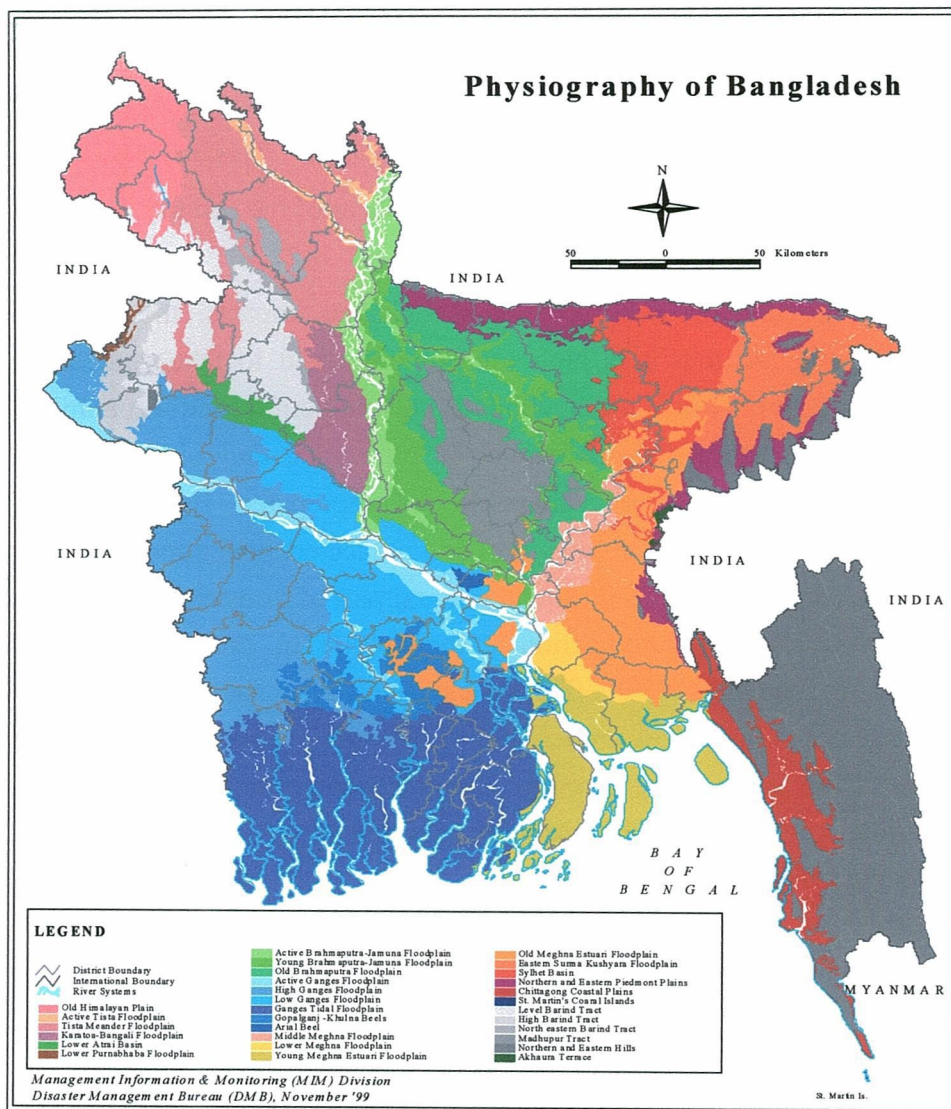
The article while reflecting 'first climate refugee' depicts that in 2005, half of Bhola Island in Bangladesh became permanently flooded, leaving 500,000 people homeless. The Bhola Islanders have been described as some of the world's first climate refugees. In 2007, citing a Bangladeshi scientist she stated: "We're already seeing hundreds of thousands of climate refugees moving into slums in Dhaka". These refugees were fleeing flooded coastal areas and many other river-eroded places of the country.

To curb increasing disaster risks and climate change impacts, the World Disasters Report-2009 highlighted that it is high time to unite and to take concrete concerted actions, for securing human life and livelihoods and protecting socio-economic gains and opportunities. While natural hazards cannot be prevented, they only become disasters because affected communities are vulnerable and unprepared. Early warning systems have been proved beyond doubt to save lives and reduce economic losses at all levels, as this report explains, but they are still not an integral part of disaster management and risk reduction globally. Nor is early action – the culture of prevention as the Hyogo Framework for Action called it– an effective and timely response to early warning, across different timescales. This report argues that early warning without early action is not enough; early action can do more to reduce loss of life and protect livelihoods than can be achieved through emergency response alone. National governments, donors and all stakeholders must take up this challenge.

## Chapter - III

### 3.0 Natural Hazards in Bangladesh

Bangladesh is exposed to natural hazards, such as, floods, river erosion, cyclones, droughts, tornadoes, cold waves, earthquakes, drainage congestion/ water logging, arsenic contamination, salinity intrusion etc. But the nature of occurrence, season and extent of effect of the hazards are not the same in all places. Figure 1 presents Bangladesh Topography.



### 3.1 Flood

Floods are annual phenomena with the most severe occurring during the months of July and August. Regular river floods affect 20% of the country increasing up to 68% in extreme years. The floods of 1988, 1998 and 2004 were particularly catastrophic, resulting in large-scale destruction and loss of lives. Approximately 37%, 43%, 52% and 68% of the country is inundated with floods of return periods of 10, 20, 50 and 100 years respectively (MPO, 1986). Four types of flooding occur in Bangladesh.

- Flash floods caused by overflowing of hilly rivers of eastern and northern Bangladesh (in April-May and September-November).
- Rain floods caused by drainage congestion and heavy rains.
- Monsoon floods caused by major rivers usually in the monsoon (during June-September).
- Coastal floods caused by storm surges.

Historical Flood damage lists in Bangladesh

| Loss                                  | 1988                                 | 1998                              | 2004                                |
|---------------------------------------|--------------------------------------|-----------------------------------|-------------------------------------|
| Number of livestock killed            | 172,000                              | 26,564                            | 8,318                               |
| Crop damage (mha)                     | 2.12                                 | 1.74                              | 1.30                                |
| People Death                          | 2300                                 | 1100                              | 747                                 |
| Rice production loss (m MT)           | 1.65                                 | 2.06                              | 1.00                                |
| Number of affected people             | 45 million                           | 31 million                        | 36 million                          |
| Road damaged (km)                     | 13,000                               | 15,927                            | 27,970                              |
| Land inundation (%)                   | 60                                   | 68                                | 38                                  |
| Number of damaged/<br>destroyed homes | 7.2 million                          | 980,000                           | 4 million                           |
| Total losses                          | TK: 82.6 billion<br>USD: 1.6 billion | TK: 118 billion<br>USD: 2 billion | TK: 134 billion<br>USD: 2.3 billion |
| Duration of flood                     | 23 days                              | 72 days                           | 21 days                             |

### 3.2 Cyclones and Storm Surges

Tropical cyclones from the Bay of Bengal accompanied by storm surges are one of the major disasters in Bangladesh. The country is one of the worst sufferers of all cyclonic casualties in the world. The high number of casualties is due to the fact that cyclones are always associated with storm surges. Storm surge height in excess of 9m is not uncommon in this region.

For example, the 1876 cyclone had a surge height of 13.6 m and in 1970 the height was 9.11 m (WARPO, 2005). In fact, the 1970 Cyclone is the deadliest Cyclone that has hit

Bangladesh coastline. With a wind-speed of about 224 km per hour and associated storm surge of 6.1 to 9.11 Metres, it was responsible for death of about 300,000 people. A list of devastating cyclones is given in Table 1.

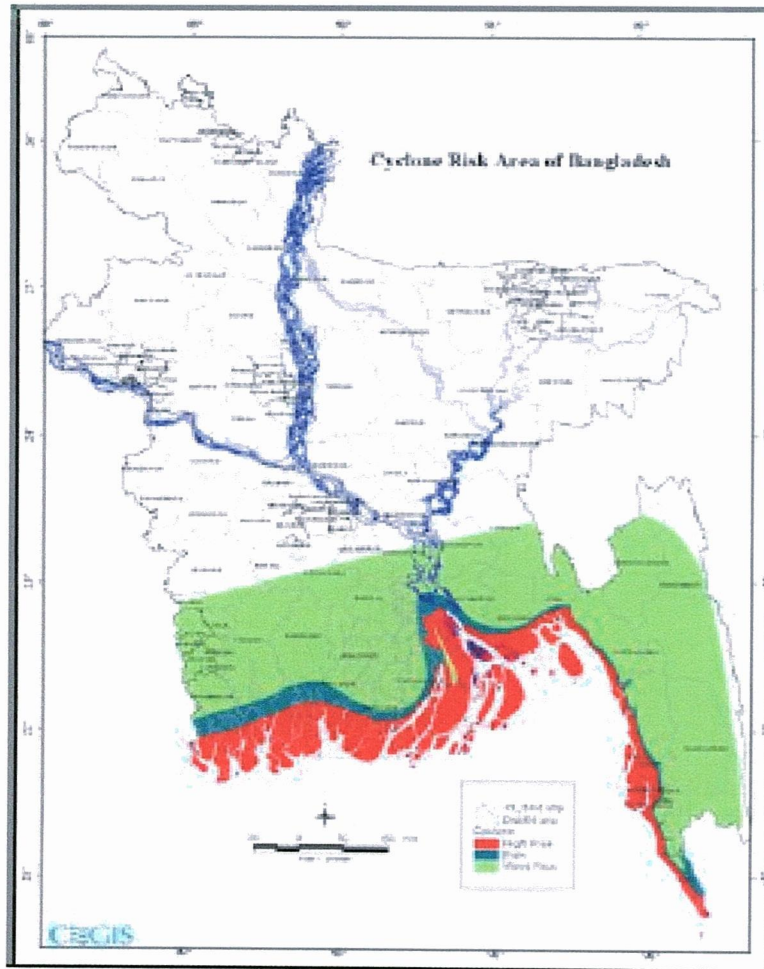
Table 1: Major Cyclones that hit the Bangladesh coast

| Date and Year |      | Maximum Wind speed (km/hr) | Storm Surge height (Meter) | 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   | 2007 | 223                        | 6.1-9.1                    | 3363       |

Source: Bangladesh Meteorological Department 2007



The Cyclone prone areas of Bangladesh are shown in the following map



Source: WARPO, 2005

### 3.2.1 The Super Cyclone Sidr-2007

The cyclone Sidr-2007 erupted from the Bay of Bengal packing winds of 240 kilometres per hour, swept through the south-western coastal areas within 155-miles radius of its eye with heavy rain and storm surges reached up to 15-20 feet high in some places on 15th November'07. According to Bangladesh Metrological Department, the Sidr's eye crossed the Khulna-Barisal coast near the Sunderbans mangrove forests around 9:30 pm, while it crossed over the Baleshwar River in Barguna district at mid night. The coastal districts of Barisal Patuakhali, Borguna, Pirojpur, Jhalkthi, Bhola, Bagerhat, Khulna, Satkhira, Shariatpur, Chittagong and Cox'sbazar and their offshore islands and chars received the major destructions by the Sidr. Out of 12 severely affected districts 4 are the worst affected, these are Bagerhat, Barguna, Perojpur and Patuakhali.

As on the reporting period it was observed that 3,363 peoples are dead, 55,282 are injured. Approximately 5,64,967 houses are totally destroyed and 9,57,110 houses are partly damaged. It is also reported that 7,43,321 acres of crop areas are fully and 17,30,316 acres area partly damaged by the Sidr'2007.

### **Damage and Loss caused by SIDR 2007 at a glance**

Bangladesh was struck by a category-4 cyclone (Sidr) on the evening of 15 November. The storm caused extensive damage to southern districts as it moved north into central Bangladesh. Cyclone SIDR has affected more than 8.9 million people of 2.0 million families in 30 districts.

|                                           |           |
|-------------------------------------------|-----------|
| Affected families                         | 2,064,026 |
| Affected persons                          | 8,923,259 |
| Dead                                      | 3,363     |
| Injured                                   | 55,282    |
| Missing                                   | 871       |
| Damaged Houses                            | 1,522,077 |
| Damage to crops in acres                  | 2,473,639 |
| Damage to trees                           | 4,065,316 |
| Total livestock dead                      | 1,778,507 |
| Damage to educational Institutions        | 16,954    |
| Damage to road (complete & partial) in km | 8,075     |
| Damage to bridges and culverts            | 1,687     |
| Damaged embankment (km)                   | 1,875     |
| Electricity: 33kv line & 11kv line (km)   | 416 & 287 |

*Source: DMB/DMIC (27Dec2007 at 0930 BST)*

### **3.2.2 Damage and Loss caused by Cyclone AILA 2009**

Cyclone Aila hit in the south west coastal region of Bangladesh on 25 May 2009. The coastal districts of Satkhira, Khulna, Bagerhat, Bhola, Barisal, Patuakhali, Barguna, Pirojpur, Jhalokathi and their offshore islands and chars were submerged and its signal number was seven. Under the influence of the cyclone the coastal districts mainly Satkhira and Khulna has been seriously affected through tidal surge. Offshore islands and chars of these districts are inundated by storm tidal surge of height 08-10 feet above normal astronomical tide. Coastal embankment was seriously damaged and overflowing

The information below, compiled by the Disaster Management Information Centre (DMIC) of the Bangladesh Ministry of Food and Disaster Management shows the extent of the devastation caused by Cyclone Aila:

- Affected districts 11
- Affected Upazilas (Sub-districts) 64
- Affected unions 195 (fully), 334 (partial)
- Affected households (families) 948,621



Affected population 3,928,238  
 Reported deaths 190  
 People injured 7,103  
 Houses damaged (Fully) 243,191  
 Houses damaged (Partially) 370,587  
 Crops damaged (Fully) 77,486 acres  
 Crops damaged (Partially) 245,968 acres  
 Livestock deaths 150,131  
 Roads damaged (Fully) 2,233 km  
 Roads damaged (Partially) 6,621 km  
 Educational institutions (Fully) 445  
 Educational institutions (Partially) 4,588  
 Embankment damaged 1742.53 km  
 Damaged Bridges/Culverts 157

### 3.3 Tornado

The two transitional periods between southwest and northeast monsoons over the Indian sub-continent are characterized by local severe storms. The transitional periods are usually referred to as pre-monsoon (March-May), and post-monsoon (October-November). It is the pre-monsoon period when most of the abnormal rainfall or drought conditions frequently occur in different parts of Bangladesh. Also there are severe local seasonal storms, popularly known as nor'westers (*kalbaishakhi*). Severe nor'westers are generally associated with tornadoes. Tornadoes are embedded within a mother thunder cloud, and moves along the direction of the squall of the mother storm. The frequency of devastating nor'westers usually reaches the maximum in April, while a few occur in May, and the minimum in March. Nor'westers and tornadoes are more frequent in the afternoon. Table 2 shows some of the devastating nor'westers and tornadoes that hit Bangladesh. Nor'westers may occur in late February due to early withdrawal of winter from Bangladesh, Bihar, West Bengal, Assam, and adjoining areas. The occasional occurrence of nor'westers in early June is due to delay in the onset of the southwest monsoon over the region (Karmakar, 1989).

Table 2: Some of the devastating nor'westers and tornadoes

|               |                     |
|---------------|---------------------|
| 14 April 1969 | Demra (Dhaka)       |
| 17 April 1973 | Manikganj (Dhaka)   |
| 10 April 1974 | Faridpur            |
| 11 April 1974 | Bogra               |
| 09 May 1976   | Narayanganj         |
| 01 April 1977 | Faridpur            |
| 26 April 1989 | Saturia (Manikganj) |
| 14 May 1993   | Southern Bangladesh |
| 13 May 1996   | Tangail             |
| 04 May 2003   | Brahmanbaria        |
| 21 March 2005 | Gaibandha           |

Source: Bangladesh: State of the Environment 2001 and web sources

Wind-speeds in nor'westers usually do not exceed 113-130 km/hr (70-80 miles/hr), though often their speeds exceed 162 km/hr (100 miles/hr). When the winds become whirling with funnel shaped clouds having a speed of several hundred kilometers or miles per hour, they are called tornados. Nor'westers bring the much needed premonsoon rain. They can also cause a lot of havoc and destruction. Tornados are suddenly formed and are extremely localized in nature and of brief duration. Thus, it is very difficult to locate them or forecast their occurrence with the techniques available at present. However, high-resolution satellite pictures, suitable radar, and a network of densely spaced meteorological observatories could be useful for the prediction or for issuing warnings of nor'westers and tornados.

### 3.4 River Bank Erosion

Rivers in Bangladesh are morphologically highly dynamic. The main rivers are braided, and form islands or chars between the braiding channels. These chars, of which many are inhabited, "move with the flow" and are extremely sensitive to changes in the river conditions. Erosion processes are highly unpredictable, and not compensated by accretion. These processes also have dramatic consequences in the lives of people living in those areas. A study concluded in 1991 reported that: out of the 462 administrative units in the country, 100 were subject to some form of riverbank erosion, of which 35 were serious, and affected about 1 million people on a yearly basis. Around 10,000 hectares land is eroded by river per year in Bangladesh (NWMP, 2001). The erosion prone zones of Bangladesh are shown in the Figure 6. Kurigram, Gaibandha, Jamalpur,

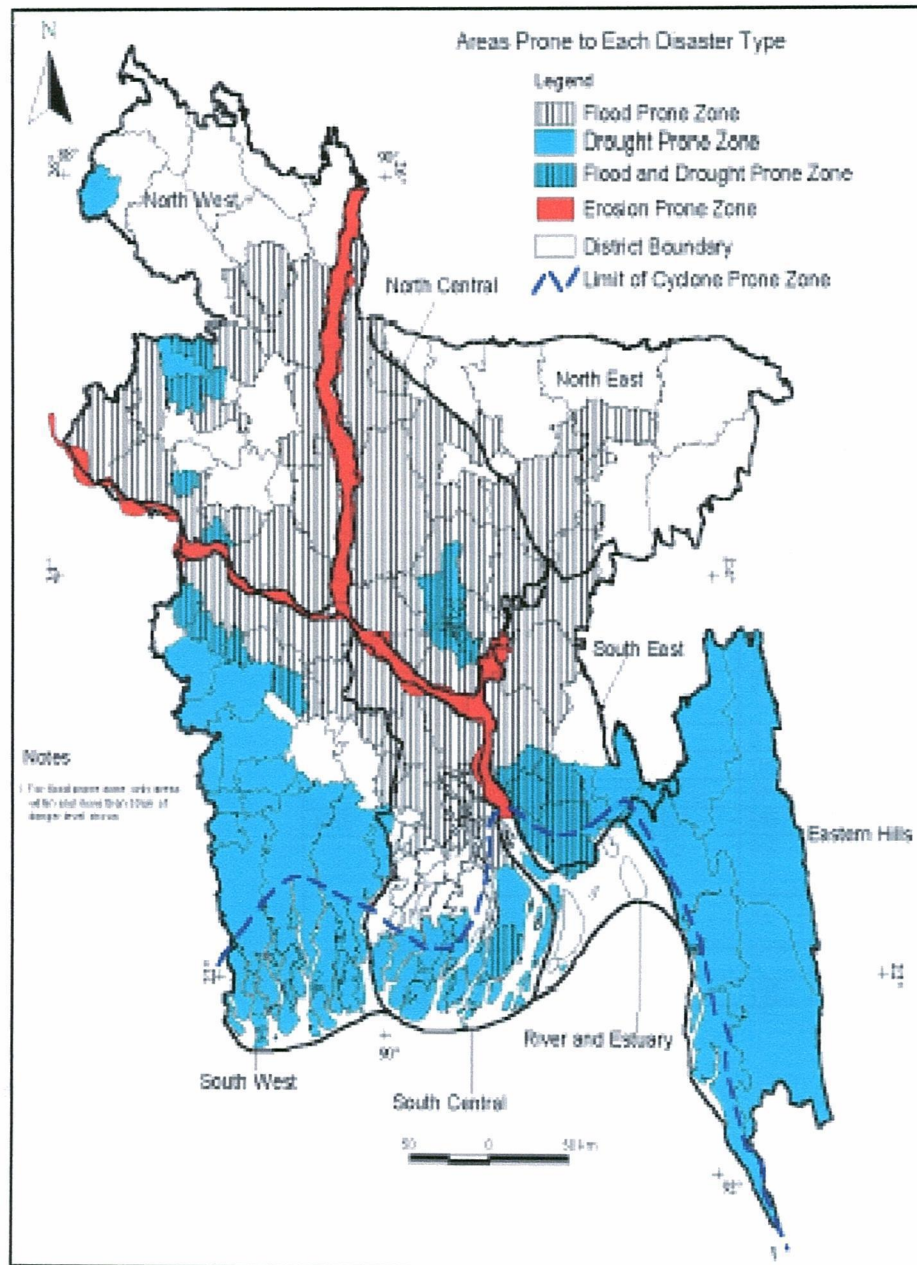
Bogra, Sirajganj, Tangail, Pabna and Manikganj districts lie in the erosion prone area along Jamuna River. Erosion of total area and settlement is higher along the left bank than that of the right bank. Along Padma River, there are the districts of Rajbari, Faridpur, Manikganj, Dhaka, Munshiganj, Shariatpur and Chandpur. A recent study of CEGIS (2005) shows that bank erosion along Padma River during 1973 – 2004 was 29,390 hectares and along Jamuna River during 1973 – 2004, it was 87,790 hectares. As relevant to this study, loss of land, settlements, roads and embankments due to erosion in 2004 in Sirajganj and Faridpur districts is shown in Table 3.

Table 3: Erosion of agricultural land, roads, embankments and settlements along the banks of the Jamuna and Padma in 2004 in Sirajganj and Faridpur districts

| District  | Upazila         | Total Land (ha) | Eroded Infrastructures |                   |                  |                |                |
|-----------|-----------------|-----------------|------------------------|-------------------|------------------|----------------|----------------|
|           |                 |                 | Settlement (ha)        | District Road (m) | Upazila Road (m) | Rural Road (m) | Embankment (m) |
| Sirajganj | Kazipur         | 177             | 50                     |                   | 176              | 84             | 1617           |
|           | Sirajganj Sadar | 170             | 13                     | 1                 |                  | 164            | 2107           |
|           | Belkuchi        | 0               | 0                      |                   |                  |                |                |
|           | Chauhali        | 207             | 45                     |                   | 395              |                |                |
|           | Shahjadpur      | 148             | 31                     | 159               |                  |                |                |
|           | Total           | 702             | 139                    | 160               | 571              | 248            | 3724           |
| Faridpur  | Faridpur Sadar  | 200             | 57                     |                   | 1175             | 370            |                |
|           | Char Bhadrasan  | 78              | 17                     | 320               |                  |                |                |
|           | Sadarpur        | 3               | 1                      |                   |                  |                |                |
|           | Total           | 281             | 75                     | 320               | 1175             | 370            |                |

Source: CEGIS, 2005

Figure 1: Areas Prone to Various Disasters including River Erosion



Source: NWRD 2001

### 3.5 Earthquake

Bangladesh and the northeastern Indian states have long been one of the seismically active regions of the world, and have experienced numerous large earthquakes during the past 200 years. The catastrophic earthquakes of 1762 and 1782 are believed to have been partially responsible for the diversion of the main flow of the Old Brahmaputra River

from the west to present Jamuna river and main flow of the Arial Khan river to the present Padma channel. Since 1860 over 20 shallow and intermediate earthquake epicenters have been recorded in Bangladesh and the surrounding areas.

Table 4. List of Major Earthquakes Affecting Bangladesh

| Date             | Name of Earthquake      | Magnitude (Richter) | Epicentral Distance from Dhaka (km) | Epicentral Distance from Sylhet City (km) | Epicentral Distance from Chittagong (km) |
|------------------|-------------------------|---------------------|-------------------------------------|-------------------------------------------|------------------------------------------|
| 10 January, 1869 | Cachar Earthquake       | 7.5                 | 250                                 | 70                                        | 280                                      |
| 14 July, 1885    | Bengal Earthquake       | 7.0                 | 170                                 | 220                                       | 350                                      |
| 12 June, 1897    | Great Indian Earthquake | 8.7                 | 230                                 | 80                                        | 340                                      |
| 8 July, 1918     | Srlmongal Earthquake    | 7.6                 | 150                                 | 60                                        | 200                                      |
| 2 July, 1930     | Dhubri Earthquake       | 7.1                 | 250                                 | 275                                       | 415                                      |
| 15 January, 1934 | Bi-har-Nepal Earthquake | 8.3                 | 510                                 | 530                                       | 580                                      |
| 15 August, 1950  | Assam Earthquake        | 8.5                 | 780                                 | 580                                       | 540                                      |

Source: Choudhury, 2005

The record of approximately 150 years shows that Bangladesh and the surrounding regions experienced seven major earthquakes (with  $M_b = 7$ ). In the recent past, a number of tremors of moderate to severe intensity had already taken place in and around Bangladesh. The Sylhet Earthquake ( $M_b = 5.6$ ) of May 8, 1997, the Bandarban Earthquake ( $M_b = 6.0$ ) of November 21, 1997, the Moheshkhali Earthquake ( $M_b = 5.1$ ) of July 22, 1999, and the Barkal (Rangamati) Earthquake ( $M_b=5.5$ ) of July 27, 2003 may be cited as examples (Source: Choudhury, 2005).

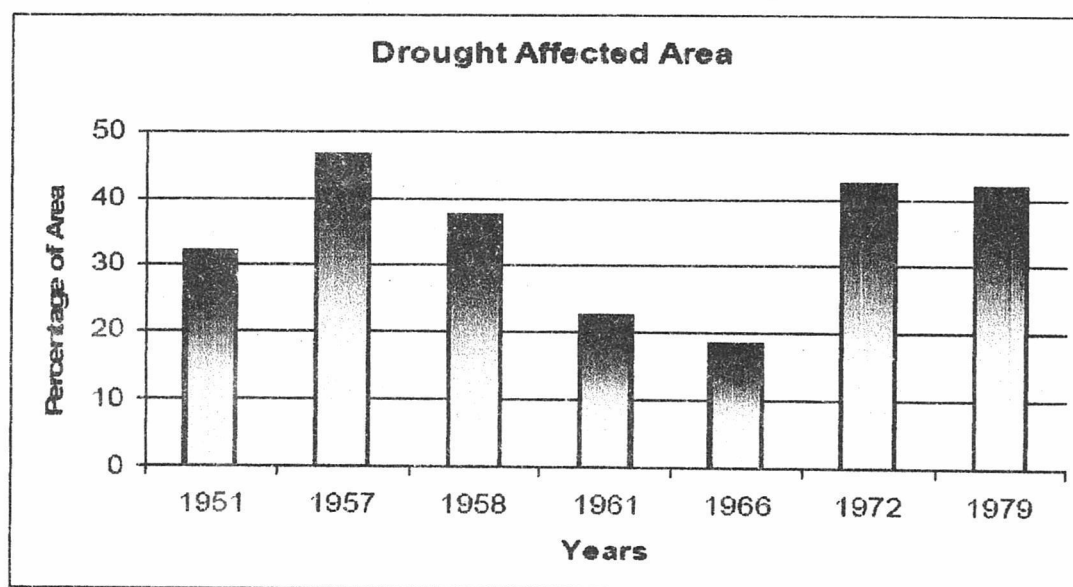
### 3.6 Drought

Drought is an abnormal condition where there is a lack of sufficient water to meet the normal needs of agriculture, livestock, industry, or for human use. While generally associated with semi-arid or desert climates, droughts can also occur in areas that normally enjoy adequate rainfall, and moisture levels (ADB, 1991). It is the result of

insufficient or no rainfall for an extended period, and causes a considerable hydrological (water) imbalance. The ensuing water shortage leads to stream flow reduction, depletion of ground water and soil moisture, and hence, crop damage. In drought conditions, evaporation and transpiration exceed normal levels. If it continues for a prolonged period, a serious threat is posed to agricultural production. In the agricultural context drought affects rice production the most. Based on drought severity, crop loss ranges between 20-60% for T. Aman and other rice varieties (Iqbal, 2000). It is one of the most insidious causes of human misery. Basically, there are three types of droughts in Bangladesh:

- Permanent drought characterizes regions with the driest climate, having sparse vegetation that is adapted to aridity. Agriculture cannot be practiced without irrigation.
- Seasonal drought occurs due to abnormal rainfall shortage in places where there are well-defined annual rainy and dry seasons.
- Unpredictable drought involves an abnormal rainfall failure, mostly in localized areas of humid and sub-humid climates.

**Figure 0: Drought affected areas of Bangladesh in different years**



Source: State of Environment 2001

### 3.7 Arsenic Contamination

At present, arsenic contamination is considered to be a dangerous environmental threat and a serious health risk. It is identified as a public health emergency in Bangladesh.



There is no specific treatment for chronic arsenicosis other than ceasing further intake of arsenic contaminated water and raising awareness of the population about the problem. The value (recommended limit) for arsenic in drinking water as per the guideline of the World Health Organization (WHO) is 10 mg/L while the national standard in most countries, including Bangladesh, is 50 mg/L. With varying levels of contamination from region to region, groundwater in 61 out of the 64 districts in Bangladesh is contaminated with arsenic. According to a study conducted by the British Geological Survey and DPHE, Bangladesh, arsenic concentrations in the country range from less than 0.25 mg/L to more than 1600 mg/L. This study report estimates that out of the Bangladesh population of 125.5 million, up to 57 million drinks water that has an arsenic concentration greater than the WHO guideline value and up to 35 million drinks water that has concentrations in excess of the Bangladesh standard. The waters in the southwest and southeast parts of Bangladesh are highly contaminated with arsenic (Figure 10). Important government initiatives to mitigate risk to arsenic contamination include development of the National Policy for Arsenic Mitigation 2003 and the Implementation Plan for Arsenic Mitigation in Bangladesh.

### 3.8 Salinity Intrusion

Saline water intrusion is mostly seasonal in Bangladesh; in winter months the saline front begins to penetrate inland, and the affected areas rise sharply from 10 percent in the monsoon to over 40 percent in the dry season. Coastal districts such as Satkhira, Khulna, Bagerhat, Barguna, Patuakhali, Barisal are the victims of salinity intrusion. Agricultural production, fisheries, livestock, and mangrove forests are affected by higher salinity in the dry season. It is observed that dry flow trend is being declined as a result of which sea flow (saline water) is travelling far inside the country resulting in contamination both in surface and ground water.

Salinity data from Land Reclamation Programme (LRP) and Meghna Estuary Study (MES) indicate an enormous seasonal effect due to the influence of huge fresh water discharge from the Lower Meghna River on the horizontal distribution of salinity in the estuary. This distribution is strongly influenced by the fresh water flow in the Lower Meghna River. Figures 11 and 12 present the movement of the 1 ppt salinity line during

6-4747

monsoon and dry season respectively. High salinity both in monsoon and dry season in the southwest corner and along the Pussur-Sibsa system of the area is associated with the decreasing upstream freshwater flow as well as silting of major channels (WARPO, 2005).

### 3.9 Tsunami

Before the Asia Tsunami 2004, a few Bangladeshis ever thought that Bangladesh was vulnerable to tsunami hazards. However, the 2004 Asia Tsunami raised the question why Bangladesh was not hit by the Tsunami. Bangladeshi scientists put together the following reasons: i) Long distance from the Epicenter; ii) 2. Long Continental Shelf (about 200 km) at the front of Ganges- Brahmaputra active Delta System; 3) Thick sedimentation in Bengal fan; 4) High density of sea-water in Bay of Bengal around / along the coast (suspended load); and 5) Anti-clockwise oceanic current at Bay of Bengal (winter time).

Considering the state of tsunami vulnerability and potential seismic sources, Geological Survey of Bangladesh has divided the Bangladesh coastal belt into three zones:

**Tsunami Vulnerable Zone- I** (Chittagong-Teknaf coastline) *Most vulnerable*. The intradeltaic coastline is very close to the tectonic interface of Indian and Burmese plates. The active Andaman-Nicobar fault system is often capable of generating tsunami waves.

**b. Tsunami Vulnerable Zone- II** (Sundarban-Barisal coastline)– *Moderately vulnerable*. This old deltaic belt is extremely vulnerable to local tsunamis due to presence of Swatch of No Ground.

**c. Tsunami Vulnerable Zone- III** (Barisal-Sandwip estuarine coastline)– *Low vulnerability*. The estuarine coastal belt considered to be less vulnerable due to presence of numerous islets and shoals in the upper regime of the continental shelf.

### 3.10 Fire

Fire hazards occur frequently in Bangladesh. Fire causes huge loss of lives and properties every year. Although termed as 'fire accident', most fire events are far from being accidental. Indeed, most fires are preventable. Industrial units, particularly garments industry, produce deadliest of the fires. For example, a fire broke out on 6 January 2005 on the fourth-floor of a building housing a factory in Narayanganj. It took fire-fighters four hours to extinguish the blaze. Dozens of workers were injured as they desperately tried to escape down the narrow smoke-engulfed stairs. About 23 people died because

they were unable to escape because many of the exits were blocked, and the fire extinguishers were not working.

Tragically, factory fires are all too common in Bangladesh. Whenever a fire occurs, the authorities are usually asked to investigate the fire, pay exemplary compensation to the survivors as well as to the families of those that died, take immediate steps to improve health and safety in the industry, as well as take legal action against those found responsible for criminal negligence in allowing the existence of such unsafe conditions. Fire incidents in the country are increasing at an alarming rate. In 2004 alone, a total of 7,140 fire incident occurred which caused damage to property worth more than Tk. 200 crore.

### **3.11 Climate Change Impact**

Global warming effects have already started showing up with increasing intensity, namely change in species habitats and habits, acidification of oceans, loss of wetlands and bleaching of coral reefs. Rapid and continued loss of biodiversity is taking place at an alarming rate, and the ecological footprint, which measures the extent of human demand on Earth's ecosystems, has tripled since 1961, showing that the planet's resources are being used at a rate 25% higher than their ability to regenerate. These disturbing effects will worsen as climate change accelerates and are likely to deprive hundreds of millions of people from access to water within just a couple of decades, while tens of millions will be displaced by floods from rising sea levels and tropical cyclones as well as wildfires will intensify; Food production may initially improve in some northern regions but starvation could affect hundreds of millions in near future.

**Fresh water resources and their management:** Droughts will spread to cover larger areas and rain will become more concentrated, implying more floods.

**Ecosystem:** The combination of climate change and associated disturbances like flooding, drought, wildfire, infestation and ocean acidification, in addition to other contributors to climate change such as land use change, pollution and overexploitation of resources, will exceed the resilience of many ecosystems.

Increasing ocean acidification due to higher CO<sub>2</sub> atmospheric concentrations will harm corals, shelled organisms and dependant species.

**Food production:** Although crops may increase in high and mid-latitudes, once local mean temperatures increase more than 1-3°C, they will decrease globally. Increased risk of hunger in lower latitudes, especially seasonally dry and tropical regions, where crop productivity may decrease for even small changes in local average temperature of 1-2°C. Adaptations through cultivation cycles may maintain cereal yields if warming remains modest. Regional adverse effects are predicted for aquaculture and fisheries.

**Coastal systems and low-lying areas:** Coasts will increasingly suffer from erosion and rising sea levels, exacerbated by human-induced pressures. Corals and coastal wetlands may be seriously affected by even small increases in sea surface temperatures and rising sea levels, respectively. Many people may be affected by continuous floods of coastal areas due to sea level rise may increase significantly, especially in the densely-populated and low-lying areas with low adaptive capacity and already prone to tropical storms and local coastal subsidence.

#### **Coastal infrastructure**

A 1m rise in sea level would inundate 18% of Bangladesh's total land, directly threatening 11% of the country's population with inundation (based on current population distribution). In addition, the backwater and increased river flow from sea level rise could affect 60% of the country's population (Karim and Rahman, 1995; Bijlsma, 1996). Nonetheless, such a rise in sea level is quite probable over many centuries (Church et al., 2001).

Inundation of such a large portion of the country could present major challenges in terms of loss of income and displaced populations. Huq et al. (1995) estimated that 11% of the country's population lives in the area threatened by a 1 m sea level rise. The area around Dhaka is quite dense, but there are also pockets of population density in the Khulna region, which is most vulnerable to sea level rise. More people would be at risk from flooding from coastal storms. In addition,

the major port of Mongla would be at risk, as would one-eighth of the country's agricultural land and 8,000 km of roads (Huq et al., 1995).

At present, Bangladesh is too poor to be able to adapt to such a rise in sea level. The costs of protection would be substantial. Huq et al. (1995) estimate that 4,800 km of existing coastal defences would need upgrading and an additional 4,000 km of new defences would be needed. These protection measures would cost up to 1 billion US\$. The most vulnerable part of Bangladesh, the Khulna region, lies along the country's southwestern coast. With the exception of the hilly Chittagong area and the northwestern part of the country, most of the country is less than 10 m above sea level. In the long run, sea level rise could displace tens of millions of people. To resettle 13 million people, Debove (2003) estimates it would cost US\$ 13 billion. However since this is a gradual and a long-run problem, it is less urgent than other risks that may become acute over coming decades rather than toward the end of the century.

A OECD/OCDE study entitled 'Development and Climate Change in Bangladesh: Focus on Coastal Flooding and the Sundarbans' by Shardul Agrawala & Tomoko Ota (2006) states, "Climate change poses significant risks for Bangladesh, yet the core elements of its vulnerability are primarily contextual. Between 30-70% of the country is normally flooded each year. The huge sediment loads brought by three Himalayan rivers, coupled with a negligible flow gradient add to drainage congestion problems and exacerbate the extent of flooding. The societal exposure to such risks is further enhanced by high population density in the country. Many projected climate change impacts including sea level rise, higher temperatures (mean temperature increases of 1.4°C and 2.4°C are projected by 2050 and 2100 respectively), evapo-transpiration losses, enhanced monsoon precipitation and run-off, potentially reduced dry season precipitation, and increase in cyclone intensity would in fact reinforce many of these baseline stresses that already pose a serious impediment to the economic development of Bangladesh".

The study while focusing on the same in touch with infrastructural changes states that it is difficult to determine Bangladesh's potential to adapt to climate change, but several key statistics give some insights as to the state of its infrastructure and social and human capital. In 2000, the World Bank estimated that only 9.5% of Bangladesh's 207,500 km network of roads was paved, putting it well below the average for low income countries of 16.5% (World Bank 2002), suggesting that its physical infrastructure in general might be less developed than that of low income countries.



## *Chapter - IV*

### **4.0 Disaster Management System in Bangladesh**

#### **4.1 Disaster Management Mechanism**

Government of Bangladesh has formulated a set of mechanisms to maintain proper co-ordination amongst the concerned Ministries, organizations and line agencies and also to ensure their effective functioning during emergency.

For the mechanisms to be operative, a guidebook named 'Standing Orders on Disaster' has been published as a basic tool. The Standing Orders outline the activities of each Ministry, major agencies / Departments so as to handle emergency situations efficiently.

In the efforts of making the mechanisms clear and comprehensive, National Policy on Disaster Management has been designed and under process for final approval. The initial operational direction and co-ordination for any disaster situation come from the highest level of institutional arrangement (I.e.; NDMC) through second highest authority IMDMCC for overall disaster management in the country. Committees from National to Grassroots levels (i.e. DDMC, UzDMC and UDMC) under the framework of disaster management guidebook i.e. Standing Orders on Disaster work on Disaster Management.

The Ministry of Food and Disaster Management (MoFDM) of the Government of Bangladesh has the responsibility for coordinating national disaster management efforts across all agencies. In January 1997 the Ministry issued the Standing Orders on Disaster (SOD) to guide and monitor disaster management activities in Bangladesh.

The Standing Orders have been prepared with the avowed objective of making the concerned persons understand their duties and responsibilities regarding disaster management at all levels, and accomplishing them. All Ministries, Divisions/Departments and Agencies shall prepare their own Action Plans in respect of their responsibilities under the Standing Orders for efficient implementation. The National Disaster Management Council (NDMC) and Inter-Ministerial Disaster Management Coordination Committee (IMDMCC) will ensure coordination of disaster related activities at the National level. Coordination at district, upazila and union levels will be done by the

respective District, Upazila and Union Disaster Management Committees. The Disaster Management Bureau will render all assistance to them by facilitating the process.

A series of inter-related institutions, at both national and sub-national levels (Figure 12) have been created to ensure effective planning and coordination of disaster risk reduction and emergency response management.

#### **4.1.1 *At the national level***

- i. National Disaster Management Council (NDMC) headed by the Hon'ble Prime Minister to formulate and review the disaster management policies and issue directives to all concerns.
- ii. Inter-Ministerial Disaster Management Co-ordination Committee (IMDMCC) headed by the Hon'ble Minister in charge of the Ministry of Food and Disaster Management (MoFDM) to implement disaster management policies and decisions of NDMC / Government.
- iii. National Disaster Management Advisory Committee (NDMAC) headed by an experienced person having been nominated by the Hon'ble Prime Minister.
- iv. Cyclone Preparedness Program Implementation Board (CPPIB) headed by the Secretary, Ministry of Food and Disaster Management to review the preparedness activities in the face of initial stage of an impending cyclone.
- v. Disaster Management Training and Public Awareness Building Task Force (DMTATF) headed by the Director General of Disaster Management Bureau (DMB) to co-ordinate the disaster related training and public awareness activities of the Government, NGOs and other organizations.
- vi. Focal Point Operation Coordination Group of Disaster Management (FPOCG) headed by the Director General of DMB to review and co-ordinate the activities of various departments/agencies related to disaster management and also to review the Contingency Plan prepared by concerned departments.

vii. NGO Coordination Committee on Disaster Management (NGOCC) headed by the Director General of DMB to review and co-ordinate the activities of concerned NGOs in the country.

viii. Committee for Speedy Dissemination of Disaster Related Warning/ Signals (CSDDWS) headed by the Director General of DMB to examine, ensure and find out the ways and means for the speedy dissemination of warning/ signals among the people.

#### **4.1.2 At sub-national levels**

i. District Disaster Management Committee (DDMC) headed by the Deputy Commissioner (DC) to co-ordinate and review the disaster management activities at the district level.

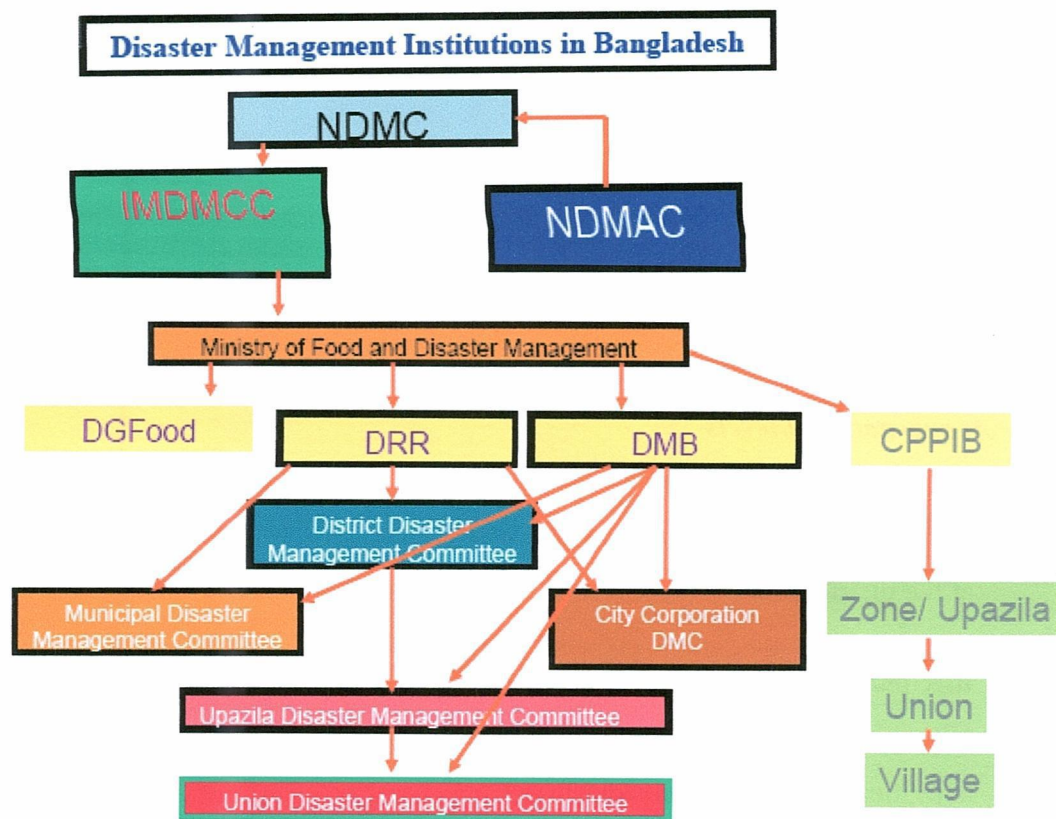
ii. Upazila Disaster Management Committee (UZDMC) headed by the Upazila Nirbahi Officer (UNO) to co-ordinate and review the disaster management activities at the Upazila level.

iii. Union Disaster Management Committee (UDMC) headed by the Chairman of the Union Parishad to co-ordinate, review and implement the disaster management activities of the concerned union.

iv. Pourashava Disaster Management Committee (PDMC) headed by Chairman of Pourashava (municipality) to co-ordinate, review and implement the disaster management activities within its area of jurisdiction.

v. City Corporation Disaster Management Committee (CCDMC) headed by the Mayor of City Corporations to co-ordinate, review and implement the disaster management activities within its area of jurisdiction.

## 4.2 Disaster Management Institutions



## 4.3 Disaster Management Regulative Framework

Bangladesh's regulative framework for disaster management provides for the relevant legislative, policy and best practice framework under which the activity of Disaster Risk Reduction and Emergency Management in Bangladesh is managed and implemented. The framework includes:

### 4.3.1 Disaster Management Act

A Disaster Management Act will be enacted with a view to create the legislative tool under which disaster risk and emergency management will be undertaken in Bangladesh, and the legal basis in which activities and actions will be managed. It will also create mandatory obligations and responsibilities on Ministries, committees and appointments. The objectives of the Act will be a) To help communities to mitigate the potential adverse effects of hazard events, prepare for managing the effects of a disaster event, effectively

respond to and recover from a disaster or an emergency situation, and adapt to adverse effects of climate change; b) To provide for effective disaster management for Bangladesh; c) To establish an institutional framework for disaster management; and d) To establish risk reduction as a core element of disaster management.

#### 4.3.2 National Disaster Management Policy

A National Disaster Management Policy will be formulated to define the national perspective on disaster risk reduction and emergency management, and to describe the strategic framework, and national principles of disaster management in Bangladesh. It will be of strategic in nature and will describe the broad national objectives, and strategies in disaster management.

#### 4.3.3 Disaster Management Plans

The Bangladesh National Plan for Disaster Management is a strategic document to be effective for a certain period of time. This is an umbrella plan which provides the overall guideline for the relevant sectors and the disaster management committees at all levels to prepare and implement their area of roles specific plans. The Ministry of Food and Disaster Management (MoFDM) being the focal ministry for disaster risk reduction and emergency management will take the lead role in disaster risk reduction and emergency management planning. Additionally, there will be a few hazard specific management plans, such as Flood Management Plan, Cyclone and Storm Surge and Tsunami Management Plan, Earthquake Management Plan, Drought Management Plan, River Erosion Management Plan, etc. Moreover, there will be a detailed Disaster Management Plan for each District, Upazila, Union and Paurashava and City Corporation of the country. A District Disaster Management Plan will be the compilation of the Upa-zila Disaster Management Plans of the district. Similarly a Upa-zila Disaster Management Plan will be the compilation of the union disaster management plans of that Upazila prepared by the Union DMCs. So DMCs at Union and Paurashava levels will be mainly responsible for conducting the risk assessments and prepare the ground level plans. Once developed those will be sent to the DMCs at one level higher – Upazila DMCs, whose role will be to verify and compile the union plans and identify the resource requirements for the Upazila.

#### 4.4 Standing Orders on Disaster

The Standing Orders on Disaster describes the detailed roles and responsibilities of committees, Ministries and other organizations in disaster risk reduction and emergency management, and establishes the necessary actions required in implementing Bangladesh's Disaster Management Model. The Standing Orders have been prepared with the avowed objective of making the concerned persons understand their duties and responsibilities regarding disaster management at all levels, and accomplishing them. All Ministries, Divisions/Departments and Agencies shall prepare their own Action Plans in respect of their responsibilities under the Standing Orders for efficient implementation. The National Disaster Management Council (NDMC) and Inter-Ministerial Disaster Management Coordination Committee (IMDMCC) will ensure coordination of disaster related activities at the National level. Coordination at district, Thana and union levels will be done by the respective District, Upazila and Union Disaster Management Committees. The Disaster Management Bureau will render all assistance to them by facilitating the process.

#### 4.5 Guidelines for Government at all Levels (Best Practice Models)

Guidelines for Government is to be implemented at all levels are developed as best practice models, and are used to assist Ministries, Directorate, Institutions and Divisions under the Ministry, NGOs, disaster management committees and civil society in implementing disaster risk management. Guidelines will include, among others:

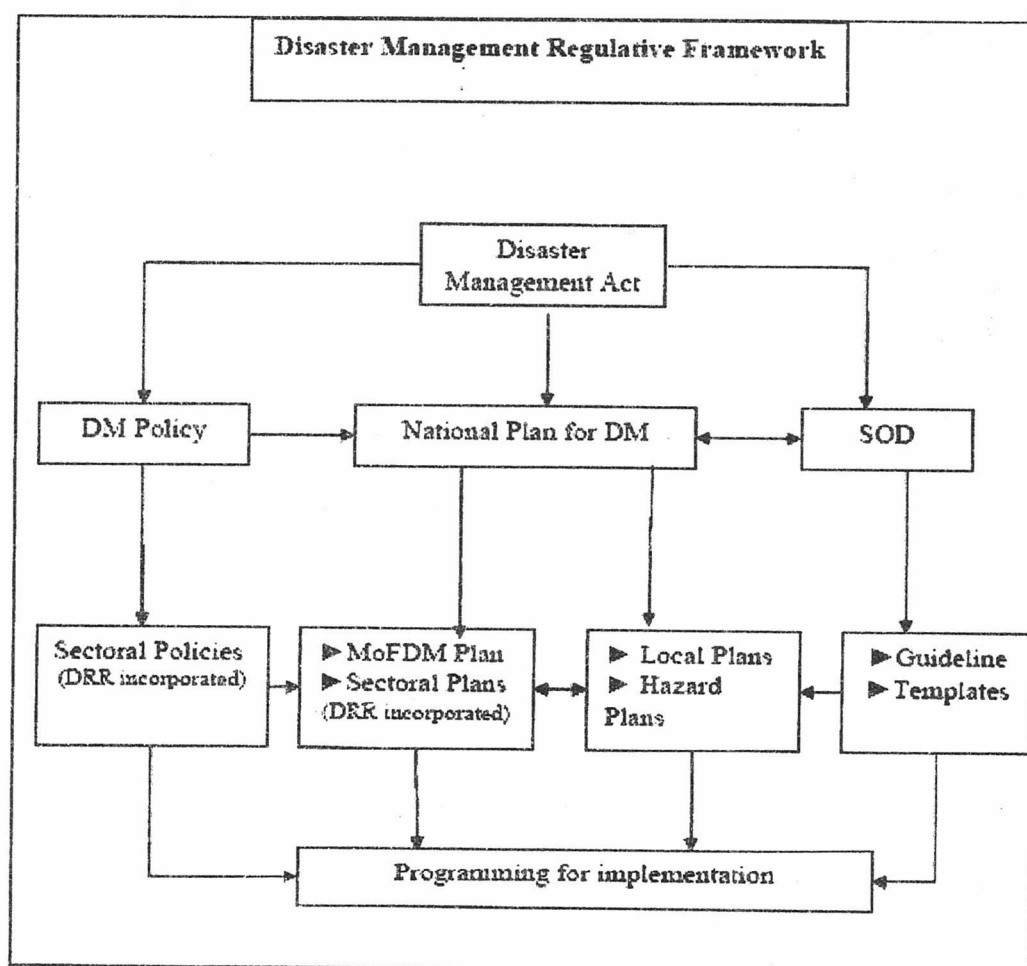
- Disaster Impact and Risk Assessment Guideline
- Local Disaster Risk Reduction Fund Management Guidelines
- Emergency Fund Management Guidelines
- Indigenous Coping Mechanism Guidebook
- Community Risk Assessment Guidelines
- Damage and Needs Assessment Methodology
- Hazard Specific Risk Assessment Guidelines
- Emergency Response and Information Management Guideline
- Contingency Planning Template
- Sectoral Disaster Risk Reduction Planning Template
- Local Level Planning Template
- National Risk Reduction Fund Management Guideline
- National Disaster Reduction and Emergency Fund Management Guideline
- Local Disaster Management Fund Guideline
- Guideline for road and water safety



- Guideline for industrial safety
- Guideline for Disaster Shelter Management
- Monitoring and Evaluation Guideline for the Implementation of the Plan
- Guideline for international Assistance in disaster emergency

#### 4.6 Disaster Management Regulative Framework

The following figure shows the inter-linkages between various regulative instruments and programming for implementation.



#### **4.7 Disaster Management Practice**

The existing system for disaster management in the country covers activities at normal times for important disaster management aspects like mitigation/prevention, preparedness, response and recovery. The Government as part of disaster management has been trying to develop its scientific networking in respect of disaster forecasting and early warning. With grant of Japan Government, replacement of radar at Agargaon, Dhaka, establishment of a new radar at Rangpur and a satellite ground receiving station at SWC, Dhaka have been completed last year to enhance the capability of SWC of Bangladesh Meteorological Department. Furthermore, substantial progress in the expansion of flood forecasting and warning services (FAP-10) in the country has been made with the help of Danish Hydraulic Institute.

#### **4.8 Disaster Mitigation**

GoB gives equal importance to both structural as well as non-structural mitigation measures.

##### **4.8.1 Structural mitigation**

As part of structural mitigation measures, GoB has so far constructed 2,023 cyclone shelters and 200 flood shelters. About 3,931 km. long coastal embankment to protect coastal land from inundation by tidal waves and storm-surges, and drainage channels of total length 4,774 km. have so far been constructed.

##### **4.8.2 Non-Structural mitigation**

For non-structural mitigation GoB has given emphasis on—

Legislation & Policy;  
Training and Public Awareness;

Disaster Management Draft Act has finalized with the purpose of providing for the formulation of disaster management policy relating to preparedness and emergency measures, and rehabilitation program to deal with disaster. As part of public awareness activities, booklets containing information about cyclone, flood etc. and calendar, posters depicting disaster points have been regularly printed and distributed up to the grass-root

levels. To raise awareness among the students on various hazards/disaster management, a chapter on disaster management has been included in the educational curricula from classes V to XII. Moreover, the Government has decided to make compulsory a session of at least 02 hours on disaster management in the training curricula of all types of Training Institutes to train officials and non-officials.

## *Chapter - V*

### **5.0 Disaster Management Initiatives**

To face the aforesaid challenges particularly cyclone, flood and tidal surge, different govt. & non govt. organizations have constructed about 2033 cyclone shelters in the coastal belts of 15 districts of the country. These shelters are insufficient in terms of necessity. So it would not be possible to provide shelter to all the affected people as well as their domestic animals. A survey team captioned as Multipurpose Cyclone Shelter Programme (MCSP) headed by Prof. Dr. Jamilur Reza Chowdhury recommended in its report of 1993 to construct 1250 new cyclone shelter as priority no.1 and 1250 as priority no.2 for providing shelters to the affected people during disasters. The report also mentioned that the total number of 2500 cyclone shelters including primary school, madrasa and secondary schools were proposed to be constructed.

These shelters will be constructed on the government khas land/institution's land/purchased lands. There is a provision of separate latrine facilities for women. One tubewell for each shelter will set-up for supplying pure drinking water. In normal period these shelters will be used as educational institution.

It was decided that Bangladesh's plan of action should be inclusive to multi-hazard, all risk, and all sector approach. Therefore, following technical options are considered as critical element of the plan of action.

- Comprehensive Risk assessment (Hazard Assessment and Vulnerability Assessment), including tsunami inundation modeling and evacuation mapping;
- Warning Guidance, including seismic and sea level monitoring, data evaluation, processing and interpretation, forecasting methods and warning dissemination (a detailed plan of action is prepared);
- Mitigation and Preparedness, including education and awareness programmes, structural and non-structural mitigations, and government policy and emergency management procedures;
- Development of Rescue, Relief and Rehabilitation Plan of Action based on Comprehensive Risk Assessment;
- Existing Cyclone Preparedness Programme (CPP) should be strengthened in a way that they can prepare the community for tsunami as well as cyclone.

### **5.1 Management Aspects of Shelter/Centre in Coastal Zones**

DMB proposes the facilitating role of local Disaster Management Committee in forming the Cyclone Center Management Committee for each center. The committee will have the following types of representation:

- A member of local Disaster Management Committee;
- Locally Elected Representative (UP Member);
- Head Master of local Primary School;
- Imam of Local Mashjid;
- NGO representative;
- Women representative

DMB also proposes for multipurpose use of the Cyclone Centers by local NGOs, Civil Society Groups and community people for public functions like marriage ceremony, meeting, training session and other social functions under the supervision of CC Management Committee. The users will pay a minimum fee for using CC as maintenance charge. The Management Committee will be responsible for keeping financial statement of CC.

### **5.2 Infrastructure**

#### **5.2.1 Cyclone Shelter and Killas**

To ensure the safer shelter of the coastal people and people living in the vulnerable flood prone areas, the Government has already constructed 2033 numbers of cyclone and flood shelters. But, it may pointed out that due to increase the number of population and the cattle heads, it has become essential to construct more 2000 numbers of disaster shelters in the coastal areas. Ministry of Primary & Mass Education has taken up a programme under the project titled "Primary Education Development Programme-2 (PEDP-2) " to construct 507 numbers of school-cum-shelter in the coastal areas. The others Ministries, Divisions, Organizations and NGOs will also construct about 300 shelters. Considering this the MoFDM has decided to construct the remaining 1200 numbers of disaster shelters and killas as per recommendations of the reports of the technical committee.

## 5.2.2 Statistics of existing Cyclone-shelters/Killas in the shore line of Bangladesh

### 5.2.2.1 Cyclone-shelters

| Name of the District | Total No. of Cyclone Shelter | No. Usable Cyclone-shelter | Capacity       |
|----------------------|------------------------------|----------------------------|----------------|
| Chittagong           | 484                          | 469                        | 375265         |
| Cox'sbazar           | 534                          | 528                        | 369600         |
| Feni                 | 57                           | 32                         | 6000           |
| Noakhali             | 275*                         | 31                         | 31000          |
| Laksmipur            | 107                          | 86                         | 34400          |
| Chandpur             | 33                           | 33                         | 15575          |
| Bhola                | 235                          | 211                        | 71300          |
| Patuakhali           | 243                          | 175                        | 98450          |
| Barguna              | 184                          | 166                        | 156750         |
| Jhalkathi            | 20                           | 20                         | 4650           |
| Barishal             | 139                          | 139                        | 97300          |
| Pirojpur             | 120                          | 120                        | 53100          |
| Satkshira            | 285                          | 285                        | 64000          |
| Bagerhat             | 185                          | 183                        | 69375          |
| Khulna               | 74                           | 74                         | 27150          |
| <b>Total</b>         | <b>2975</b>                  | <b>2552</b>                | <b>1473915</b> |

\* 145 cyclone shelters require to be repaired;

Source: DG, DMB, as furnished on 19.05.2009

### 5.2.2.2 Killas

| Name of the District | Total No. of Killas | No. Usable Killas | Capacity     |
|----------------------|---------------------|-------------------|--------------|
| Chittagong           | 04                  | 03                | 2150         |
| Cox'sbazar           | 25                  | 25                | 38890        |
| Feni                 | 01                  | 01                | 1000         |
| Noakhali             | -                   | -                 | -            |
| Laksmipur            | 19                  | 18                | 3200         |
| Chandpur             | -                   | -                 | -            |
| Bhola                | 42                  | 22                | 13500        |
| Patuakhali           | 32                  | 16                | 17100        |
| Barguna              | 04                  | 04                | 9200         |
| Jhalkathi            | -                   | -                 | -            |
| Barishal             | -                   | -                 | -            |
| Pirojpur             | -                   | -                 | -            |
| Satkshira            | -                   | -                 | -            |
| Bagerhat             | -                   | -                 | -            |
| Khulna               | -                   | -                 | -            |
| <b>Total</b>         | <b>137</b>          | <b>89</b>         | <b>85040</b> |

Source: DG, DMB, as furnished on 19.05.2009



### 5.3 Capacity Building for Disaster Management in Bangladesh

The Disaster Management Bureau (DMB), being the focal institution for managing and mitigating disasters in the country, has had been performing a myriad of multifarious responsibilities. Keeping that in view a variety of equipments have been purchased/indented to be purchased so far in lots as mentioned below:

Table – 1: Already Been Purchased:

| Lot No. | Name of the Equipment    | Qty. |
|---------|--------------------------|------|
| 2       | Pilot Transporter        | 04   |
| 4       | Crane (light)            | 04   |
| 6       | Personnel Locator System | 12   |
| 10      | Gas Cutter               | 16   |
|         | Rubble Removing Bag      | 4000 |
|         | Lock Cutter              | 12   |
|         | Stretcher                | 80   |
|         | Crow Bar                 | 360  |
|         | Spade                    | 360  |
|         | Panther Saw              | 12   |
|         | Pick                     | 360  |
|         | Tent (180 Pounder)       | 16   |
|         | Body bag                 | 400  |
|         | Chemical Light Sticks    | 900  |

Table – 2: Work order served for purchase

| Lot No. | Name of the Equipment    | Qty. |
|---------|--------------------------|------|
| 1       | Wheel Dozer (light)      | 04   |
| 3       | Excavator (heavy)        | 04   |
|         | Excavator (light)        | 04   |
| 5       | Fork Lifter (8 ton)      | 8    |
| 7       | Mobile Light Unit        | 12   |
| 9       | Generator                | 8    |
|         | Concrete Cutter          | 16   |
|         | Air Compressor           | 12   |
|         | Power Chain Saw          | 12   |
|         | Multi-purpose Cutter     | 12   |
|         | Ram Jack                 | 12   |
|         | Megaphone                | 40   |
|         | High Pressure Air Bag    | 72   |
|         | Breathing Apparatus      | 12   |
|         | Spreader                 | 12   |
|         | Knee Pad & Eye Protector | 360  |
|         | Gloves                   | 360  |

Table – 3: Equipments to be purchased for DMB with Financial Support of the World Bank

| Sl. No. | Name of the Equipment                                            | Qty.        |
|---------|------------------------------------------------------------------|-------------|
| 1       | Mobile Floating Hospitals (set up on a boat)                     | 06          |
| 2       | Rough Aquatic Sea Search & Rescue Boat                           | 04          |
| 3       | Small Marine Rescue Boat                                         | 12          |
| 4       | Hand-tool Set (Hammer, Plus, Screwdriver set, Splint, Pick etc.) | 64          |
| 5       | Handy Megaphone (for SIDR affected districts)                    | 144         |
| 6       | Harness, Orange vest & Identification card, caution tape (64x12) | 768         |
| 7       | Tent & Ground sheet                                              | 144         |
| 8       | Stretcher                                                        | 144         |
| 9       | First aid kit box                                                | 144         |
| 10      | Flashlight or Headlamp and Leather Gloves                        | 768         |
| 11      | VHF two-way radio for DMCs                                       | 36          |
| 12      | Plastic sheet                                                    | 50000 mtr   |
| 13      | Disruption-free Telecommunication Equipment                      | 13          |
| 14      | Portable Generator                                               | 24          |
| 15      | GPS set for field damage assessment team                         | 2           |
| 16      | Pole fitted Automatic System                                     | 1           |
| 17      | Emergency Jeep with Heavy duty VHF Communication                 | 4           |
| 18      | Pickup for Emergency Duty                                        | 5           |
| 19      | Computer and Printer                                             | 18 (each)   |
| 20      | Plotter and other office equipment                               | as required |

Apart from the DMB, the following organisations, namely, Bangladesh Meteorological Department (BMD); Bangladesh Space Research and Remote Sensing Organization (SPARRSO); and Survey of Bangladesh (SoB) – are contributing vital roles for Capacity building in mitigating disasters in different dimensions.

### 5.3.1 Projects of BMD (Ongoing)

- a. Up-gradation of Agro-meteorological Service: 7 new stations will be established.
- b. Establishment of Five 1st Class Meteorological Observatories
- c. Up-gradation of 17 Existing Meteorological Observatories and Establishment of 01 New Observatory along the Coastal Belt for Cyclone Monitoring.
- d. Establishment of Inland River Port Weather station: 14 new stations will be established.
- e. Establishment of Numerical Weather Prediction System.

### **5.3.2 Projects of BMD (ongoing)- JICA AID**

- a. Improvement of Meteorological Radar System at Cox's Bazar and Khepupara (completed): Doppler facility
- b. Establishment of Meteorological and hydrological Doppler Radar System at Moulvibazar, Bangladesh

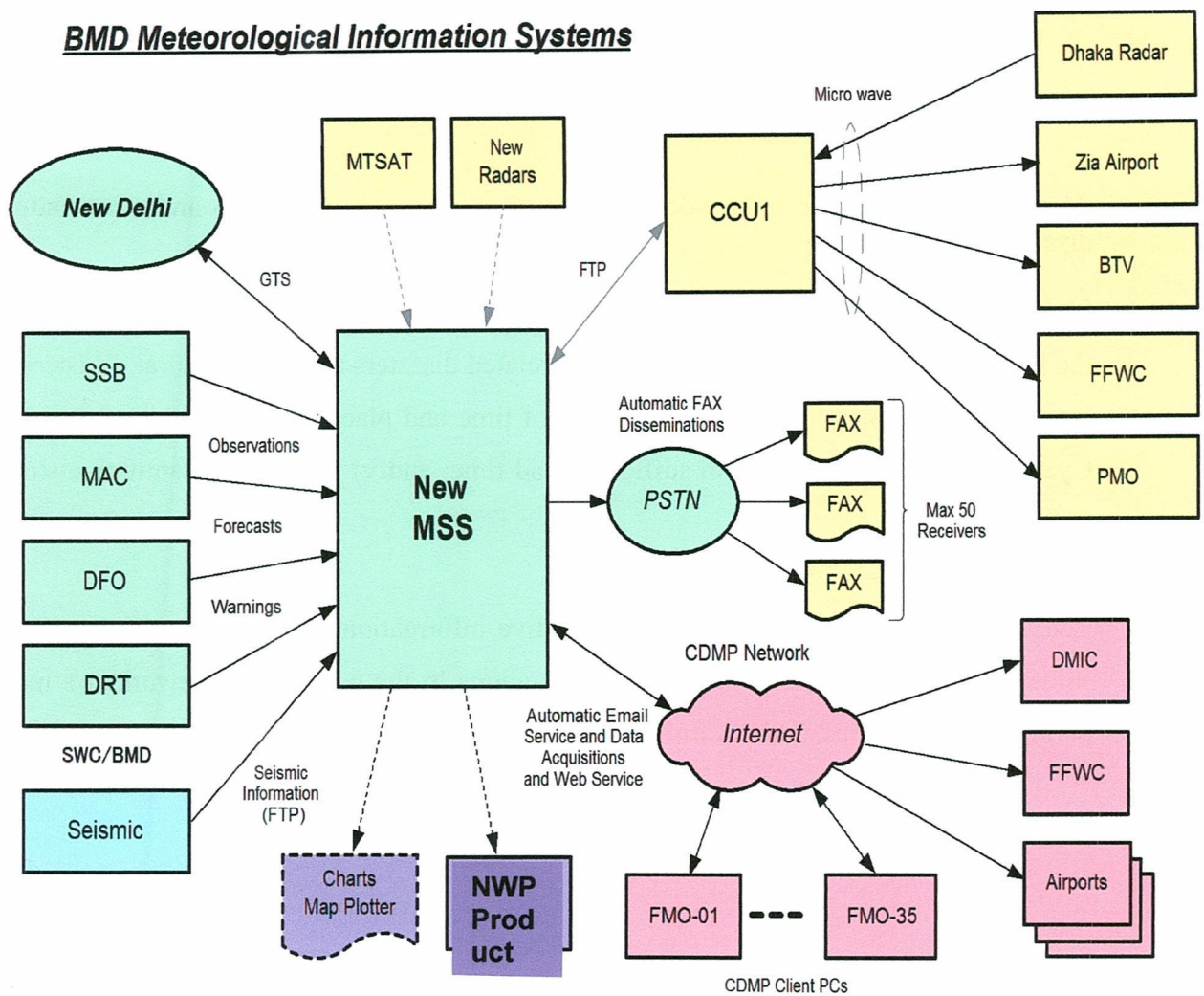
**Aim of the Project:** To reduce devastation caused by cyclones, floods and other natural disasters in Bangladesh

Scope of the project includes– i) to collect Radar data; ii) to monitor cyclones formed in the Bay of Bengal; iii) to monitor monsoon related disasters and other natural disasters in coastal areas of Bangladesh; iv) prediction of time and place of the landfall of Tropical Cyclones and storm Surge with sufficient lead time; and v) providing quantitative storm surge forecasts.

The BMD, furthermore, developed an effective information system network along with some observatories in some disaster-prone regions in the country; frameworked a main participatory agencies, and a warning message dissemination plan- as mentioned below:

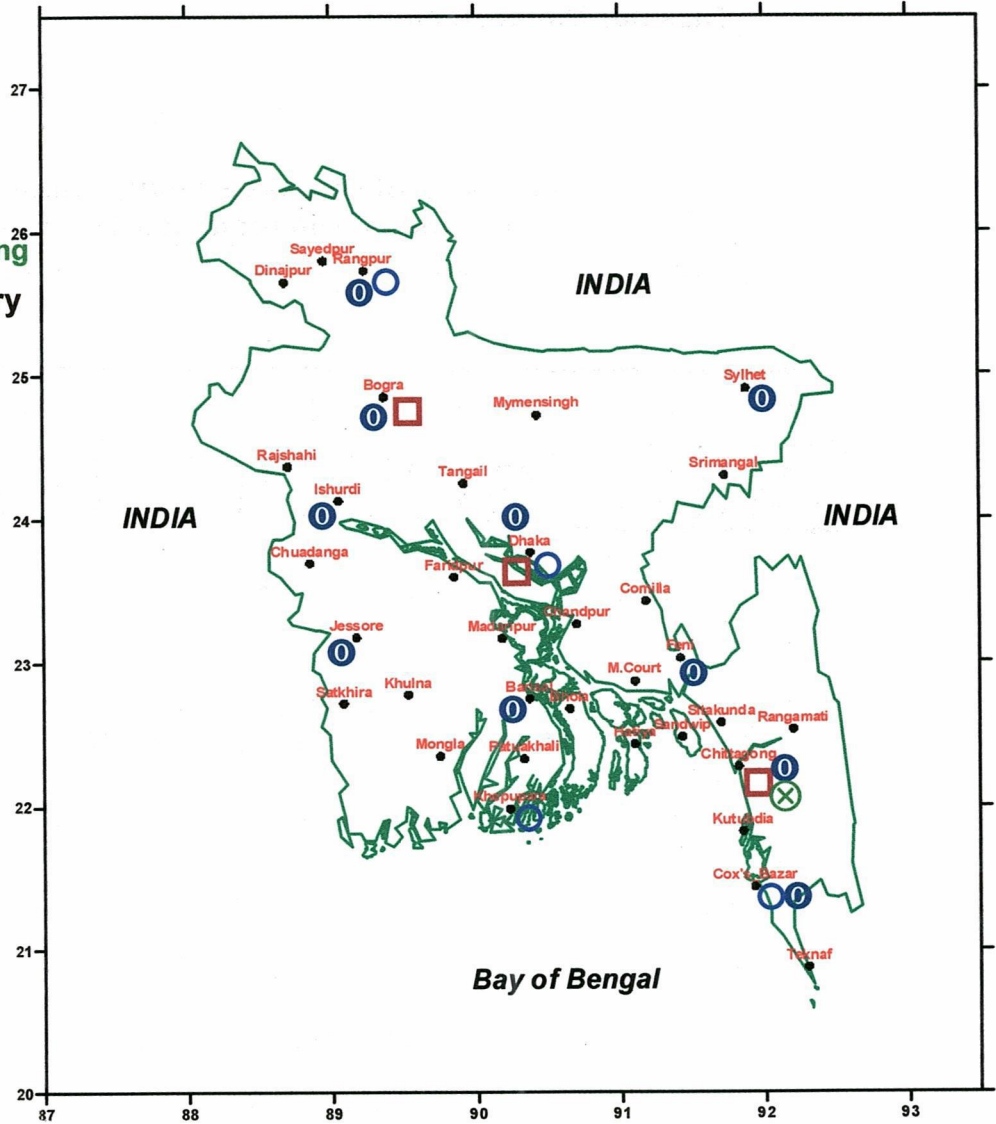
### 5.3.3 Meteorological Information Systems

#### BMD Meteorological Information Systems

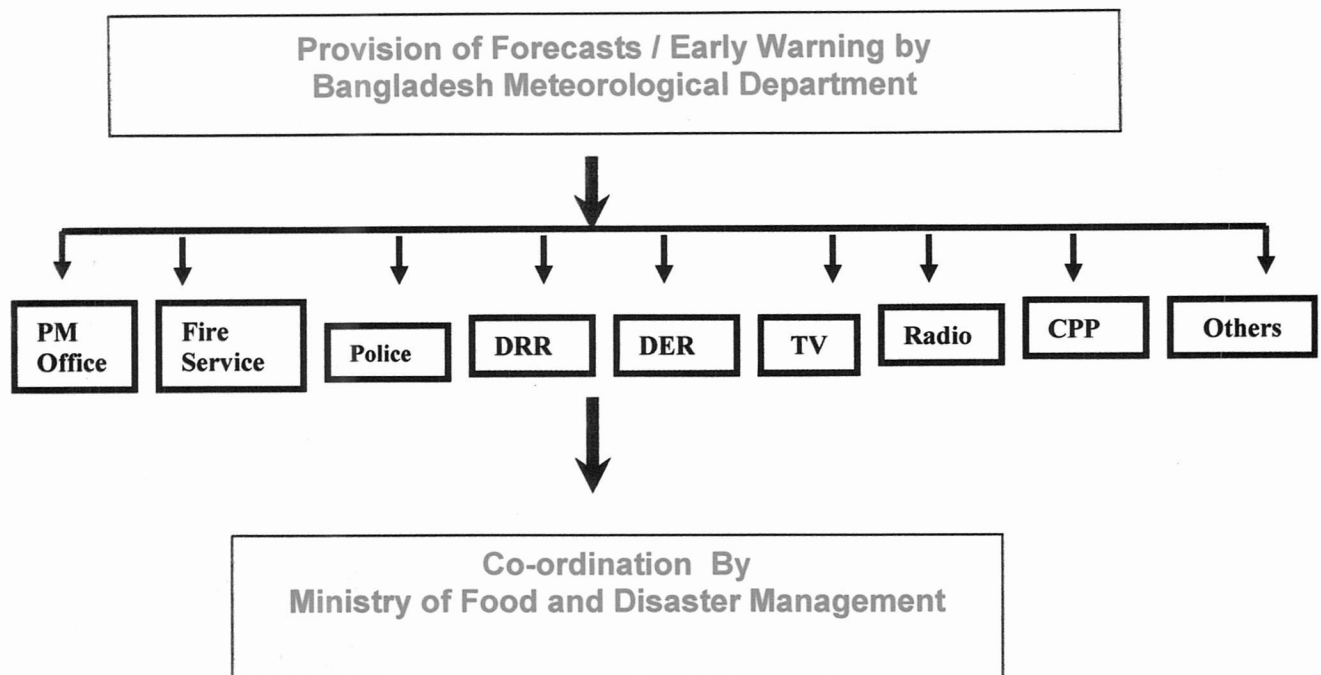


### 5.3.4 Observatories of BMD

- Radar Station
- Rawinsonde
- ① Pilot balloon
- ⊗ Earthquake Monitoring
- Synoptic Observatory

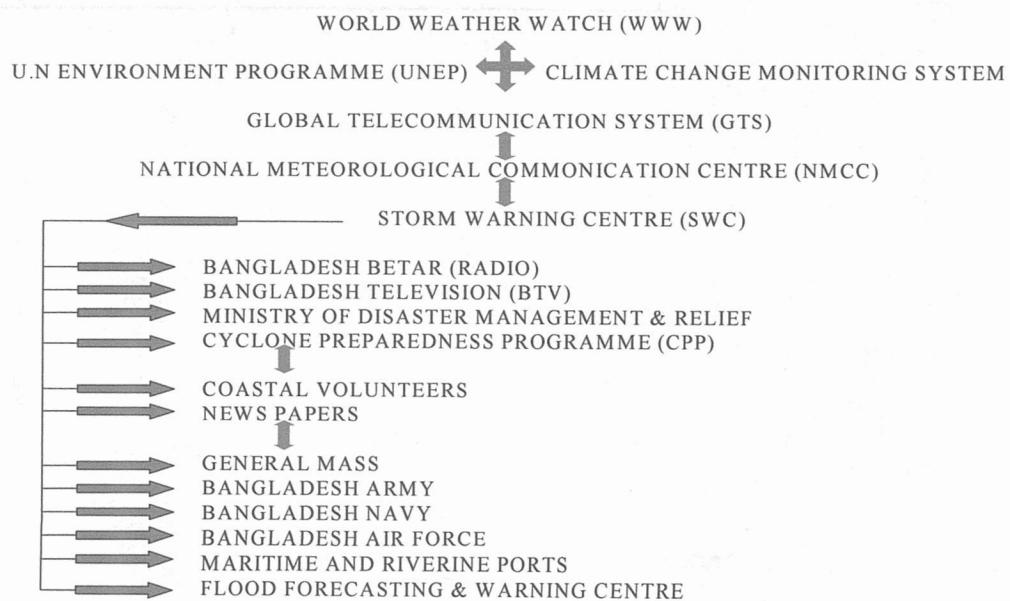


### 5.3.5 The Main Participatory Agencies for Cyclone and Storm Surge Disaster Management



### 5.3.6 Warning Message Dissemination Plan

#### WARNING MESSAGE DISSEMINATION PLAN



### **5.3.7 Projects of SoB (ongoing)**

**Project Name:** Improvement of Digital Mapping System of Survey of Bangladesh

**Aim of the Project:** To provide digital topographic maps with accurate and updated detail information and digital data to government and non-government organizations to undertake development works.

Scope of the project includes – i) to establish Digital Mapping Centre of SoB at Mirpur, Dhaka; ii) to produce 1:5000 scale digital topographic maps and data base; iii) produce 1:25,000 scale digital topographic maps and data base; and iv) to strengthen the capability of production of digital topographic maps of SoB.

### **5.3.8 Projects of SPARRSO (ongoing)**

**Project Name:** Environment, Disaster and Resources monitoring System (EDREMOS)

**Aim of the Project:** To Strengthen the analytical and qualitative research and development capabilities of SPARRSO.

Scope of the project includes – i) enhancement of the application of remote sensing and GIS technology in Forestry, Agriculture, Fisheries, Water Resources, Oceanography, Meteorology and Environment; ii) extension of infrastructure for processing, analysis and archival of satellite data; iii) conduct Research on the related fields.



## Chapter - VI

### 6.0 Data Analysis

Based on the principle of data collection the researchers have had selected two diversified regions such as, cyclone and tidal surge affected areas like i) Patharghata of Barguna, and Kalapara of Patuakhali districts and ii) Pansha of Rajbari and Sujanagar of Pabna districts as two common flood-affected regions of the country. The specific location of the areas are as follows:— a) Badurtala Union Parishad, existing at a distance of 5 km from Upazilla sadar, Patharghatta stands straight South of Barguna; b) Latachapli UP on the other hand, is approximately 6 km from Kalapara Upazila of Patuakhali district overlooking the Bay of Bengal; c) Bahadurpur UP is approximately 5 km North-West of Pangsha Upazila, under Rajbari district adjoining the mighty river Padma; iv) Besides, Satbaria UP lying on the Padma is straight West to Sujanagar Upazila of Pabna district. The maps, specifically marking the mentioned regions, are annexed at the end of the paper.

### 6.1 Information provided by the UNOs of respective Upazillas

Table -- 1: No. of Cyclone Shelters in the region

| Name of the Upazilla | Number of Cyclone Shelter |
|----------------------|---------------------------|
| Kalapara             | 73*                       |
| Pathargatta          | 31                        |

\* Out of those 26 are unusable

The above table highlights the existing cyclone shelters. Here we find that the number of cyclone shelter is more in Kalapara than that in Pathargatta. Both the UNOs of two Upazilas emphasized upon the enhancement of the number of cyclone shelters pinpointing their inadequacies in proportion to the size of inhabitants. More importantly, the UNO Kalapara informed, 26 cyclone shelters have become dysfunctional out of the total number (73) which reflects poor maintenance system over there. It is to be noted that these cyclone shelters were built in two phases- 1972-1973; 1994-1995. Within this short span of time, almost 19% have become dysfunctional. Which depicts that these

cyclone shelter were designed and built just on the whimsical plans of building any infrastructure without justifying the purposes.

Table – 2: Capacity of the Cyclone Shelters

| Name of the Upazilla | Capacity of Cyclone Shelter (person) | Total Population |
|----------------------|--------------------------------------|------------------|
| Kalapara             | 1,46,000<br>(approx.)                | 2,02,080         |
| Pathargatta          | 16,150                               | 181467           |

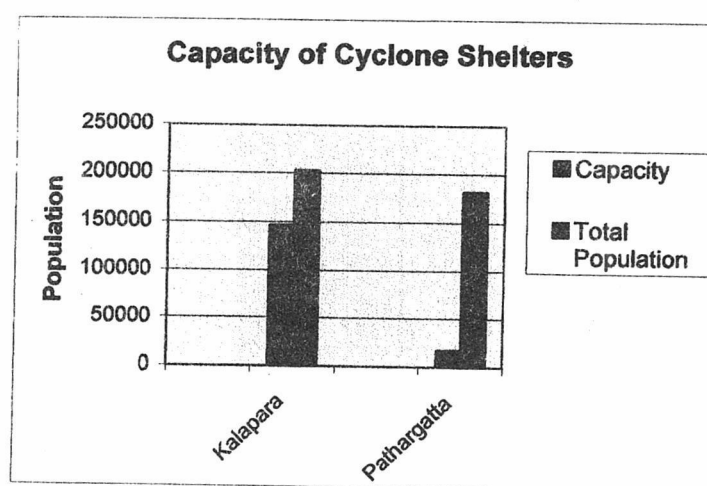


Chart -1

The table and chart above focus on the capacity of the cyclone shelters of the study area. Here it is found that the capacity of existing cyclone shelters is not compatible rather imbalanced with the total strength of population of the regions. Furthermore, the capacity of cyclone shelters of Pathargatta is more inferior in comparison to Kalapara.

Table -- 3: Information regarding the Population of respective Upazilla

| Name of the Upazilla | Population |        |          |
|----------------------|------------|--------|----------|
|                      | Male       | Female | Total    |
| Kalapara             | 1,02,700   | 99,380 | 2,02,080 |
| Pathargatta          | 92,609     | 88,858 | 181467   |

Table -- 4: Causes behind insufficient number of cyclone shelters

| <u>Causes</u>                          | <u>Number of Shelter</u> |                    |
|----------------------------------------|--------------------------|--------------------|
|                                        | <u>Kalapara</u>          | <u>Pathargatta</u> |
| Lack of initiative                     |                          |                    |
| Poor economic condition of the country | ✓                        | ✓                  |
| Others                                 |                          |                    |

Both the UNOs agreeably identified ‘poor economic condition of the country’ as a common cause behind the inadequate number of shelters ignoring other reasons mentioned in the questionnaire. But the fact gives a different impression from the contradictory expression of the same respondents who identified donor agencies or NGOs as major funding sources for the cyclone shelters built so far.

Table -- 5: Opinion of the UNOs about cyclone shelter requirements

| <u>Name of the Upazilla</u> | <u>Required number of cyclone shelter</u> |
|-----------------------------|-------------------------------------------|
| Kalapara                    | 45                                        |
| Pathargatta                 | 50                                        |

This self-explanatory table embodies the proposals of two respective UNOs about the requirement of cyclone shelters in the region. Considering the inadequacies of existing cyclone shelters, the UNO, Kalapara felt the necessity for construction of more 45 cyclone shelters against the felt requirement of UNO, Pathargatta for more 50.

*Which are the authorities entrusted with the responsibilities for maintenance/management of the existing cyclone shelters?* – In response to the question mentioned above– UNO, Kalapara mentioned that a managing committee comprising the Union Parishad Chairman and the local elite is responsible for maintenance/management; while LGED, Bangladesh Red-crescent Society, CARITUS, Grameen Bank are vested with the same in Pathargatta, the UNO informed.

Please highlight any problem encountered in discharging responsibilities regarding disaster management and maintaining the cyclone shelters.

In response to the above query– both the UNOs coincidentally mentioned that owing to the lack of fund allocation proper maintenance of the cyclone shelters becomes difficult; and because of under-utilisation during normal situation the shelters appear to be unsuitable for habitation. Moreover, UNO Patharghatta added other problems like ‘insecurity’ and ‘insufficient first-aid accessories’ during mitigation of natural calamities.

Table – 6: Period of construction of the Cyclone shelters

| Name of the Upazilla | Period of construction            |
|----------------------|-----------------------------------|
| Kalapara             | 1972-1973; 1994-1995              |
| Patharghatta         | 1991-1994 (estd. by Red Crescent) |

The above table focuses on the period of construction of the cyclone shelters. It appears from the construction period that the shelters were built following onrush of some severe natural calamities which devastated the living existence of the hapless people of our coastal regions. This is but an absence of our proactive thinking in combating natural calamities.

Table – 7: Amount expended in construction of the Cyclone Shelters

| Name of the Upazilla | Amount Expended                                                                                                  |
|----------------------|------------------------------------------------------------------------------------------------------------------|
| Kalapara             | 40,00,000/ ( <i>approx. per shelter</i> )                                                                        |
| Patharghatta         | Red-crescent Society – 1,00,00,000/<br>Grameen Bank - 1,25,00,000/<br>LGED - 50,00,000/<br>CARITAS -1,00,00,000/ |

This table highlights the amount spent in construction of the cyclone shelters in the respective localities. UNO, Kalapara disclosed an approximate amount (40,00,000/) spent per cyclone shelter. While UNO, Patharghatta furnished a gross amount of money individually spent by various funding sources. It reveals that both the UNOs appear to be unable to furnish authentic statistics regarding the amount expended against construction

of the specific cyclone shelters in their jurisdiction. It focuses further the idea that such types of accounts are not preserved at the Upazila levels.

Table -- 8: Sources of fund utilized to build the Cyclone Shelters

| Name of the Upazilla | Source                      |
|----------------------|-----------------------------|
| Kalapara             | Foreign Aid                 |
| Pathargatta          | Revenue Budget; Foreign Aid |

The above table focuses on sources of fund utilized to build the Cyclone Shelters. It spells out that in Kalapara, all the cyclone shelters were built with foreign aid. On the contrary, the shelters of Patherghatta were built with financial support from both revenue and foreign sources.

In response to the question as to whether the cyclone shelters are being maintained properly, both the UNOs replied negatively. The UNO Kalapara identified the reason –as i) management problems due to non-existence of any specific authority; ii) inadequate allocation of fund for maintenance. While, UNO Pathargatta informed, i) lack of proper maintenance, and ii) absence of any initiative for repairing since the construction of those shelters. They both suggested to form an effective management committee supported with sufficient fund in this head.

*Do you think that the existing profile of the local Disaster Management Committee is befitting to combat natural calamities?* – In response to this question both the UNOs opined positively that the existing structure of the local Disaster Management Committee is good enough.

*How can the present committee be more effective and pro-people?* – The UNOs concerned responded in this regard as – to make the existing Committee more effective and people-oriented, the UNO, Kalapara suggested sufficient fund and sanction of necessary communication equipment. While, the UNO, Pathargatta preferred training for the committee members which could enable and equip them to perform better in times of

necessity and motivate the people in a positive way. Their opinion gives clear impression that the local Disaster Management Committee is not supported with sufficient fund and necessary communication equipment, and lacks in proper training.

In response to the query – as to whether the local Disaster Management Committee function independently, interestingly, the two UNOs held different views. UNO, Kalapara replied positively, while UNO, Pathargatta remarked ‘no’. It smells that there is lack of operational flexibility in performing its respective functions independently.

In response to the query– as to whether if there are any impediments or adversities in performing the respective functions of the Disaster Management Committee- the two UNOs held different views. The UNO Kalapara mentioned ‘no problem’, while, UNO Pathargatta identified some reactions arising from amongst the people, specially when signal-4 is announced for making the people aware through miking.

Some problems identified by both the UNOs which they experienced previously on disaster management:

UNO Patharghatta identified problems in the light of his past experiences on disaster management as– the dams of the region are in wretched condition; people do not like to come to a secured position even after announcement of signal – 10; not only that they used to throw comments on those signaling as ‘bogus’ which they had seen many a times before without any effect. And UNO, Kalapara identified some different aspects– lack of quick evacuation transport; lack of megaphones to announce the news of upcoming disaster; lack of funds with the Upazilla Administration to handle the evacuation programme. Their remarks spelt out that in addition to scarcity of necessary equipments for combating natural calamities the affected people suffers from a sense of negligence and positive awareness in responding to the traditional signaling and other forecasting systems.

Moreover, both the UNOs shared negative viewpoints in response to the queries, as to whether administrative complicity coupled with prolonged process of decision making are impediments to combating natural disasters,

In replying the query as to whether the earthquake-resistant technology applied in construction of the cyclone shelters both the UNOs responded that no such technology was applied in construction of those cyclone shelters. It appears that the money sanctioned for construction of this cyclone shelter was not spent practically and lacking foresightedness. As we found earlier against another inquiry, the affected people are afraid of taking shelter in those cyclone shelters on the ground that such structures might befall on them. The earthquake-resistance technology is no more a rare mechanism which could easily be applied though it was not utilized possibly in all the sites which is a thought-provoking issue of the technocrats concerned with construction of those cyclone shelters. Why the affected people would take the risk of going to those cyclone shelters which might befall on them?

Generally, the affected people are not interested to take refuge in the cyclone shelter – what are reasons behind?

While responding the UNO, Kalapara informed the causes as– i) people feels insecure leaving behind their belongings; ii) distance of the cyclone shelters; and iii) insufficient space in the cyclone shelters. While UNO, Pathargatta identified those, as, i) *purda* (lack of privacy); ii) lack of WATSAN facilities; and iii) lack of medical facilities.



## 6.2 Opinions of the Affected People:

Table- 9 : Whether there is any cyclone shelter adjacent to the respondent's locality

n= 85

| Name of the Upazilla | Frequency |    |
|----------------------|-----------|----|
|                      | Yes       | No |
| Kalapara             | 33(82.5%) | 7  |
| Patharghata          | 42(93.3%) | 3  |

This table is the indicator of the existence of cyclone shelters as prevailing nearby the respondent's homestead. In Kalapara (82.5%) of the respondents are having closer attachment to cyclone shelters; while in Patharghata the ratio is (93.3%) reflecting proportionally a higher number of shelters nearby.

Table- 10: Distance of the cyclone shelter from the respondent's residence

n= 85

| Distance (km) | Patharghata (f) | Kalapara (f) |
|---------------|-----------------|--------------|
| > 0.5         | 05 (11.1%)      | 03 (7.5%)    |
| 0.5 – 1.0     | 27 (60%)        | 12 (30%)     |
| 1.0 – 1.5     | 10 (22.2%)      | 09 (22.5%)   |
| 1.5 – 2.0     | 02              | 07 (17.5%)   |
| 2.0 – 2.5     | -               | 06           |
| 2.5 – 3.0     | -               | 03           |

This table indicates the distances of the cyclone shelters from the respondents' homestead. In Patharghata those respondents staying within > 0.5 km of the cyclone shelters represents only 05 (11.1%) of the total which is a bit lesser (7.5%) in Kalapara. Similarly, the respondents staying within 0.5 – 1.0 km represents (60 %) in Patharghata; while in Kalapara the picture gives a lean figure with only 12 (30%). Again, the respondents staying within 1.0 – 1.5 km represents (22.2%) in Patharghata which is 09 (22.5%) in Kalapara. It is found that only two respondents staying 1.5 – 2.0 km in

Patharghata which is much bigger in comparison to that of Kalapara where the number is shown as 07 (17.5%). Lastly, it interestingly appears, respondents clustering within 2.0-2.5 km or 2.5-3.0 km of the cyclone shelters in Patharghata stands contrary to the number 06 and 03 respectively in Kalapara; which speaks of a favourable location in respect of distance of the cyclone shelters in Patharghata than that of Kalapara.

Table- 11 : Opinions about the respondent's taking shelter during 'SIDR'

n= 85

| Name of the Upazilla | Frequency  |    |
|----------------------|------------|----|
|                      | Yes        | No |
| Kalapara             | 20 (50%)   | 20 |
| Patharghata          | 25 (55.5%) | 20 |

This table focuses on the number of the respondents' taking refuge in the cyclone shelters. It appears that half of them did not take refuge in those shelters in Kalapara; while in Patharghata the proportion is more representing (55.5%) of the total respondents.

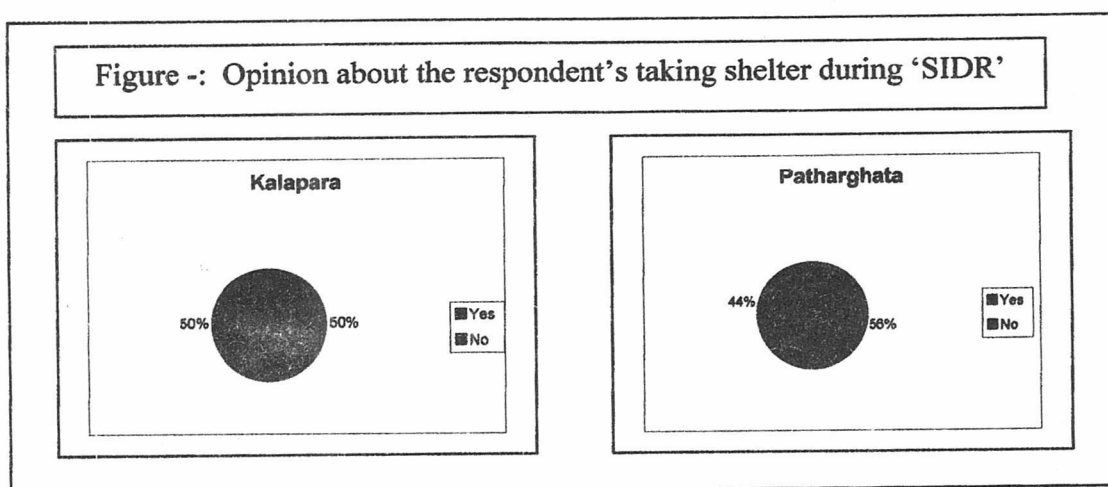


Chart - 2

The chart shows that almost half of the respondents did not take shelter during 'SIDR'

Table-12: Opinions about the facilities of the cyclone shelters

n= 85

| Opinion about facilities                                     | Patharghata (f) | Kalapara (f) |
|--------------------------------------------------------------|-----------------|--------------|
| Just for the sake of being sheltered                         | 12 (26.6%)      | 24 (60%)     |
| Insufficient space in proportion to the number of population | 10 (22.2%)      | 17 (42.5%)   |
| Sanitation is very bad                                       | 04 (8.8%)       | 04(10%)      |
| Lack of utility services                                     | 02 (4.4%)       | 04 (10%)     |
| Dry food is not available to everybody                       | -               | 02 (5%)      |

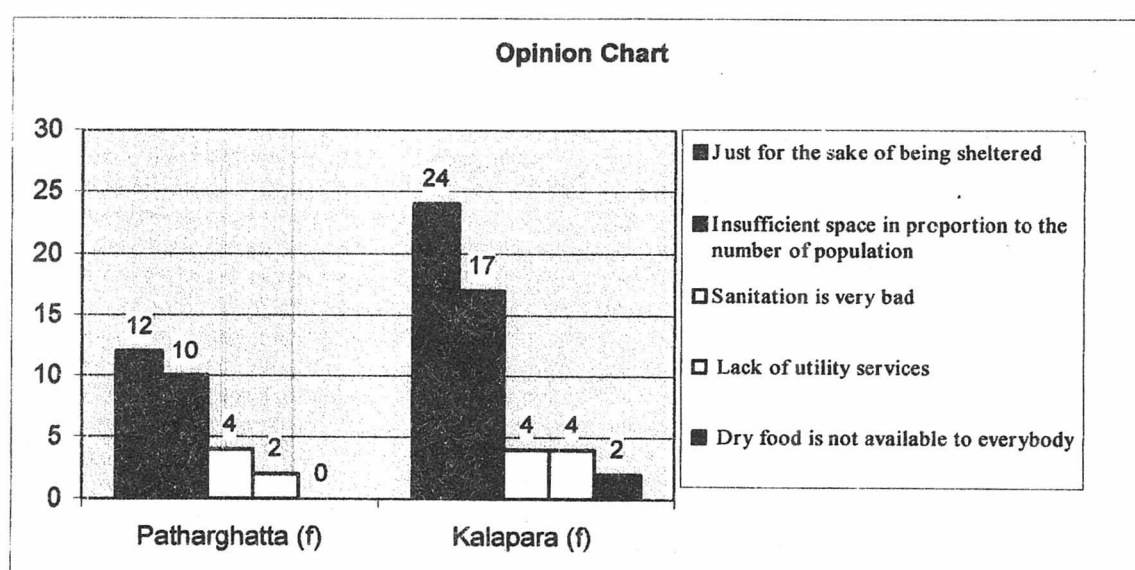


Chart - 3

The above chart focuses on the existing facilities of the cyclone shelters. Majority of the respondents of both the regions (60% in Kalapara and 26.6% in Patharghata) were compelled to take refuge in those shelters just for the sake of shelter. Another significant portion of the respondents – 10 (22.2%) in Patharghata and 17 (42.5%) in Kalapara respectively identified inadequate space in proportion to the number of population. Similar number of respondents (4) in Patharghata (8.8%) and Kalapara (10%) from both the regions found sanitation facilities ‘very bad’. Rather, a negative impression is found regarding utility services from (4.4%) and (10%) of the respondents of Patharghata and Kalapara respectively. Further, only 02 (5%) respondents from Kalapara mentioned the

scarcity of supply and uneven distribution of dry foods to everyone taking refuge in those cyclone shelters.

Table-13: Opinions of the respondents about the causes for not to take shelter in the cyclone shelter

| Causes                                                                | Patharghata (f) | Kalapara (f) |
|-----------------------------------------------------------------------|-----------------|--------------|
| Due to distance of cyclone shelter                                    | 04 (8.8%)       | 14 (35%)     |
| Ignoring of the signals                                               | 03              | 03           |
| Lack of preparation against sudden occurrence of disaster at midnight | 03              | 02           |
| Not hearing the signals in time                                       | 01              | -            |
| Water-logging                                                         | 02              | -            |
| Prefer to stay at home                                                | 01              | -            |
| Took shelter at nearest hotel/parjatan centre/pry. school             | -               | 02           |
| Poor communication                                                    | 02              | 01           |

The above table focuses on the causes as to why the respondents did not take shelter in the nearby cyclone shelters in times of necessity. It is found that a considerable number of respondents (35%) from Kalapara identified 'distance' as to why they did not take shelter which reveals the inadequacies of cyclone shelters in the vicinity of the affected people. On the contrary, the number of cyclone shelters is proportionately much more in Pathargatta considering their accessibilities. In both the regions it is found that there is a propensity to ignore the forecast of signals ahead of any natural disaster. Only one in two regions was left unnoticed about the ensuing disaster which reveals the loopholes of the forecasting system. Here we also found that in Kalapara only two respondents took shelter in nearby hotels/parjatan kendra avoiding the cyclone shelter which indicates that affected people seeks to find out comfortable resorts/places depending on circumstances and financial conditions. Moreover, poor communication also prevents someone from taking shelter in the nearby cyclone shelter.

Table-14: Opinion about the management of the cyclone shelter

n= 85

| Opinion          | Patharghata (f) | Kalapara (f) |
|------------------|-----------------|--------------|
| Satisfactory     | 03(6.6%)        | 07 (17.5%)   |
| Not satisfactory | 42 (93.3%)      | 30 (75%)     |
| No response      | -               | 03           |

The above table highlights the opinion of the respondents about the management of the cyclone shelters. It discloses the fact that almost all the respondents (93.3%) (75%) respectively, are unhappy with the existing management due to the underlying causes; i) lack of permanent staff; ii) lack of government initiatives and insufficient fund; iii) lack of accountability of the personnel employed, and other mismanagements.

Table-15: Respondents' view to improve the management of the cyclone shelter

n= 85

| Opinion                                                                                              | Patharghatta (f) | Kalapara (f) |
|------------------------------------------------------------------------------------------------------|------------------|--------------|
| Permanent staff to be appointed at the cyclone shelter                                               | 16               | 22           |
| Government initiatives and allocation of sufficient fund should be ensured                           | 10               | 16           |
| Accountability of the employed personnel to be ensured for proper functioning of the cyclone shelter | 10               | -            |
| Siren should be signaled at proper time; signal light and number of sirens should be adequate        | 07               | 08           |

This table compiles the opinions of the respondents as to how the management of the cyclone shelters to be improved. Majority of the respondents in Kalapra (55%) and Pathargata (35%), proposed for permanent staff at the cyclone shelter. (22.2%) and (40%) respondents respectively suggested for allocation of adequate fund for proper and wholesome management of the cyclone shelters. A considerable number of respondents (22.2%) from Pathargata suggested to make the employed personnel accountable to the respective controlling authority, which is lacking at the moment. Furthermore, almost the same number of respondents (15.5% & 20%) opined for adequate number of signal lights and sirens at the cyclone shelter.

Table-16: Opinions of the respondents on development of facilities of cyclone shelter  
(To your viewpoint what additional facilities should be provided in the cyclone shelter?)

| Opinion                                                                                                    | Patharghata (f) | Kalapara (f) |
|------------------------------------------------------------------------------------------------------------|-----------------|--------------|
| Supply of safe drinking water to be ensured                                                                | 10              | 27           |
| Employment of doctors and necessary medicinal supports to be ensured                                       | 24              | 30           |
| Adequate supply of food/dry food to be ensured                                                             | 19              | 28           |
| Sewerage system should be provided                                                                         | 17              | 20           |
| Supply of electricity/solar power should be ensured                                                        | 11              | 22           |
| Separate living accommodation should be provided for both males and females                                | 07              | 27           |
| There should be arrangement for treatment of the pregnant women                                            | 03              | 07           |
| Area of cyclone shelters should be expanded, and those to be strengthened as well                          | 06              | 06           |
| There should be separate space for livestock and poultry                                                   | 10              | 22           |
| Supply of clothes to be properly ensured                                                                   | 03              | 07           |
| Miscellaneous: a) Rain coat;<br>b) Lifejacket, and iii) Dam to be constructed outside the cyclone shelter; | 03              | 13           |

The above table depicts what more facilities to be provided in cyclone shelters in accordance with the suggestions of the respondents. It is evident that a significant number of respondents both in Patharghata (22.2)% and Kalapara (67.5%) identified the scarcity of safe drinking water in the shelters and suggested for ensuring the facility. Majority of the respondents from Kalapara (75%) and Patharghata (53.3%) pinpointed the necessity of Doctors and insufficient medicare facilities and urges for employment of doctors in the cyclone shelters along with sufficient medical facilities. They also suggested for ensuring adequate supply of foodstuff including dry foods. Almost half of the respondents favour installation of sewerage system in the cyclone shelters. Nearly half of them proposed for supply of electricity or solar power alternatively. Notably, majority of the respondents (67.5%) of Kalapara region opined for separate accommodation for females; while the number is only (15.5%) on this suggestion, appears very negligible in Patharghata. There

was also suggestion for arrangement of treatment for pregnant women. The table also embodies some other important suggestions like – expansion of the cyclone shelters; separate accommodative space for livestock and poultry; adequate supply of clothes as such, raincoat, lifejacket; including dams outside the cyclone shelters.

Table-17: Scope for forecasting natural disaster besides the government ones

| Sources                        | Patharghata (f) | Kalapara (f) |
|--------------------------------|-----------------|--------------|
| Radio                          | 30              | 30           |
| Mobile phone                   | 24              | 30           |
| Television                     | 02              | -            |
| Newspaper                      | 09              | 06           |
| NGOs like Red-crescent Society | 07              | 10           |

The table appears that most of the respondents (66.6% in Patharghata and 75% Kalapara) received signals of disaster through radio which amply testifies to the fact that radio is still the most accessible informative media at those remote villages of Pathargata and Kalapara, notably the two cyclone and tidal surge-prone areas of our coastal region. Besides, the table depicts that mobile phone is emerging as the vital source/carrier of information. In Kalapara, the number appears to be equal to that of the radio; while, in Pathargata it is gaining momentum with a ratio of (53.3%). The role being played by newspapers appears quite significant in the regions as 20% (Patharghata) and 15% (Kalapara) respondents are being benefited there. NGOs like Red-crescent Society is also playing important role in these remote areas in disseminating disaster forecast. On the contrary, the figure responded against 'Television' is meagre (% in Patharghata and 0 in Kalapara) which indicates lack of visual-communication system in the region.



Table-18: Respondent's suggestion on the forecasting system

| Opinion                                                                                             | Patharghata (f) | Kalapara (f) |
|-----------------------------------------------------------------------------------------------------|-----------------|--------------|
| Sirens to be signaled from the cyclone shelters so that the affected people can take shelter timely | 05              | -            |
| Signal lights are to be posted at higher places on the river banks and sea shore                    | 21              | 20           |
| Prevailing forecasting system is alright                                                            | 09              | 01           |
| Publicity of forecasting to be strengthened                                                         | 03              | 05           |
| Supply of adequate hand-mike and radio to be ensured                                                | 04              | 06           |
| The prevailing forecasting systems to be made effective                                             | 02              | 02           |
| To be careful so that the forecast of disaster to reach at remotest part of the locality            | -               | 04           |
| Teams to be formed to make forecasting available to everybody                                       | -               | 01           |

The table focuses that most of the respondents suggested for Signal lights to be posted at higher altitudes on the riverbank and seashores. It apprehends that the signal lights are either not posted at all in necessary places or not functioning in time if exists. The suggestions for supply of adequate hand-mikes and radio sets though are few (8.8% in Patharghata and 15% in Kalapara) in number, it appears there is lacking. Moreover, a fewer number of respondents (6.6% in Patharghata and 12.5% in Kalapara) opined for strengthening the prevailing forecasting system which hints that they are not happy with the existing system and awaiting optimum output. There are also suggestions for making the prevailing forecasting systems more effective; and to be careful so that the forecast of disaster to reach at remotest part of the locality

Table-19: The purposes of cyclone shelters are being used other than its specific purposes

| <b>Utilization of the cyclone shelters other than the specific purposes</b> | <b>Patharghata (f)</b> | <b>Kalapara (f)</b> |
|-----------------------------------------------------------------------------|------------------------|---------------------|
| School                                                                      | 36                     | 37                  |
| knitting and repairing of net                                               | 32                     | -                   |
| Centre for arbitration                                                      | 10                     | 18                  |
| Community centre                                                            | 09                     | 01                  |
| Vote Centre                                                                 | 07                     | 03                  |
| NGO Office                                                                  | -                      | 07                  |
| Hotel/Community Clinic                                                      | 01                     | 01                  |
| Election campaigning                                                        | -                      | 03                  |

This table highlights the nature of utilisation of the cyclone shelters other than its specific purposes. It reveals that majority of them are being used as schools. Knitting and repairing of fishing nets are also vital activities for which those cyclone shelters are being used by almost half of the respondents. The cyclone shelters are also used as arbitration centres; community centres; vote centres; NGO office; community clinic; and for the purpose of election campaign as well.

Table- 20: Flexibility to take shelter in the nearest cyclone shelter during necessity

| <i>Opinion</i> | <b>Patharghata (f)</b> | <b>Kalapara (f)</b> |
|----------------|------------------------|---------------------|
| Yes            | 25                     | 23                  |
| No             | 15                     | 17                  |

Table-21: Reasons behind as to why the respondents unwillingness to take refuge in nearby shelters in times of necessity

| Causes                                                                    | Patharghata (f) | Kalapara (f) |
|---------------------------------------------------------------------------|-----------------|--------------|
| distance                                                                  | 12              | 16           |
| poor communication                                                        | 06              | 08           |
| lack of preparation/lack of enough space in the cyclone shelter           | 01              | 05           |
| lack of arrangement to live together with the family                      | 01              | 03           |
| concern about insecurity of livestock/poultry                             | 01              | 01           |
| having scopes for shelter at nearby parjatan centre/hotel and safe houses | 01              | 03           |

The above table depicts the rationale behind their unwillingness to have shelter in the nearest cyclone shelters. It focuses that 'distance' from their residence is an obstacle to availing the opportunity. Poor communication also contributes to such inconveniences as expressed by a considerable number of respondents. Among other causes, lack of preparation/lack of enough space in the cyclone shelter; lack of arrangement to live together with the family; concern about insecurity of livestock/poultry. What is noteworthy, an insignificant number of respondents (2.2% in Patharghata and 7.5% in Kalapara %) found interested to take refuge at nearby parjatan centre/hotel and safe houses. It testifies that the local people are impoverished and unable to bear the expenses in sheltering themselves on payment basis. Therefore, any initiative, at this moment, by the non-state actors does not appear to be feasible apart from charity.

Table- 22 : Reasons behind as to why the cyclone shelters were built at the current places

| Causes                                                  | Patharghata (f) | Kalapara (f) |
|---------------------------------------------------------|-----------------|--------------|
| Being in the region of the then public representative   | 0               | 0            |
| Willingness of the majority people                      | 42 (93.3%)      | 38 (95%)     |
| Availability of land at a cheaper rate                  | 01(2.2%)        | 10 (25%)     |
| Following the survey of the Red Crescent Society        | 08 (17.7%)      | 0            |
| Considering the advantage of the people at the vicinity | 02 (4.4)        | 0            |
| Availability of land at free of cost                    | 01(2.2)         | 0            |

Table- 23: Experiences of the respondents' stay at the cyclone shelters

| Experiences                                                  | Patharghata<br>(n=45) | Kalapara<br>(n=40) |
|--------------------------------------------------------------|-----------------------|--------------------|
| Lack of space in proportion to the number of affected people | 23 (51.1)             | 15 (37.5)          |
| Very painful, subsistence living                             | 18 (40)               | 13 (32.5)          |
| Sewerage system is very bad                                  | 10 (22.2)             | 08 (20)            |
| Inadequate food supply                                       | 09 (20)               | 08 (20)            |
| Lack of pure drinking water                                  | 19 (42.2)             | 12 (30)            |
| To live in darkness/lack of electricity                      | 02 (4.4)              | 04 (10)            |
| Fear; whether it breaks down over the head                   | -                     | 08 (20)            |
| Insufficient Medicare                                        | -                     | 04 (10)            |
| Lack of winter clothes                                       | 03 (6.6)              | 06 (15)            |

*Figures in parenthesis indicate percentage.*

This table embodies the bitter experiences while staying at those cyclone shelters during natural calamities. It is found that 'lack of space in proportion to the number of affected people; mattered severely to the majority respondents. Almost half of them regarded their stay as-- quite agonizing on the verge of subsistence living. Another significant portion of the respondents (Patharghata- 22.22%, Kalapara 20%) regarded existing sewerage system as very deplorable. A considerable number of respondents identified inadequacy in food supply (Patharghata- 20%, Kalapara 20%) accompanied by scarcity of pure drinking water (Patharghata- 42.22%, Kalapara 30%). To live in darkness/lack of electricity; fear for the cyclone shelters for getting broken down; insufficient Medicare and lack of winter clothes among others are also accounted for their pangs and hardships inflicted upon them.

### 6.3 Experiences Gathered from the Flood-prone Regions

The questionnaires designed for the affected people and the respective local authorities were almost the same other than the questions for the flood-affected people of the study area. The data and information gathered in response to those specific questions has been analysed as below. Firstly, we would highlight the information furnished by the UNOs of the respective regions i.e. Pansha and Sujanagar. Secondly, the information collected from the flood-affected people would be scrutinized.

*Note- the questions left aside which are found not applicable and already been scrutinized in places of tidal surge and cyclone-prone regions.*

#### 6.3.1 Opinions of the Respective UNOs

Table – 24: Capacity of the Flood Shelters in Proportion to the Population

| Name of the Upazilla | No. of Flood Shelters | Capacity of Flood Shelter (person) | Total Population |
|----------------------|-----------------------|------------------------------------|------------------|
| Pangsha              | 7                     | 1400 (approx.)                     | 3,52,620         |
| Sujanagar            | 0                     | 0                                  | 2,51,136         |

The above table highlights the number and capacity of the flood shelters in proportion to the population of the locality. It appears that in Pangsha there are only 7 flood shelters (being used as school and *madrasha*) which could accommodate 1400 people and not need to mention that these are in no way enough in proportion to the population of the Upazila. However, in Sujanagar, being the most flood-prone regions of the country, there is no flood shelter constructed yet.

As flood and river erosion are a common phenomena of these locality, both the UNOs were asked to put tick mark on the options as– a) special fund is kept reserved; or b) fund and required resources are allotted instantly; in combating these problems. Both of them opted for ‘b’ and urges for reservation of special funds for these types of permanent disasters; and furthermore, they reminded for early sanction of that allocation so that could be utilized in times of necessity.

Both the UNOs, interestingly, contrary to the UNOs of cyclone-prone regions, shared positive viewpoints in response to the queries, as to whether administrative complicity coupled with prolonged process of decision making are impediments to combating natural disasters,

In replying the query as to whether the earthquake-resistant technology applied in construction of the cyclone shelters UNO Pangsha responded that no such technology was applied in construction of those cyclone shelters.

### 6.3.2 Opinions of the affected people of flood-prone regions

Table- 25: Opinion about the respondent's taking shelter during the recent floods

n= 40

| Name of the Upazilla | Yes | No |
|----------------------|-----|----|
| Pansha               | 20  | 0  |
| Sujanagar            | 0   | 20 |

This table focuses on the opinion about the respondent's taking shelter during the floods of recent years. As we informed earlier that in Sujanagar there is no flood shelter at all. And in case of Pangsha, the respondents replied that they didn't need to take refuge in the nearby shelters in the recent years as no severe flood was occurred; but in 1998 they were in a helpless situation as no shelter was built till that period. From the above experiences it appears that following the devastating flood of 1998 some flood shelters were built; before that no measures were undertaken to provide shelter to the permanently affected people of these flood-prone localities. Even, just bearing the identity of flood shelters, those shelters built so far are being used as madrasha and schools. But for how long the affected people would remain stranded waiting for those madrasha and schools to be vacated.

Table- 26: Distance of the cyclone shelter from the respondent's residence

n= 40

| Distance (km) | Pansha (f) | Sujanagar (f) |
|---------------|------------|---------------|
| > 0.5         | 07         | 0             |
| 0.5 – 1.0     | 09         | 0             |
| 1.0 – 1.5     | 03         | 0             |
| 1.5 – 2.0     | 01         | 0             |
| 2.0 – 2.5     | 0          | 0             |
| 2.5 – 3.0     | 0          | 0             |

The UNO Pansha opined that there should be as many as 50 more flood shelters to be constructed in this locality as the density of population demands.

Table- 27: Opinions of the respondents on development of facilities of cyclone shelter

n= 40

| Opinion                                                                                                            | Pansha (f) | Sujanagar (f) |
|--------------------------------------------------------------------------------------------------------------------|------------|---------------|
| Adequate supply of food/dry food to be ensured                                                                     | 19         | 19            |
| Supply of safe drinking water to be ensured                                                                        | 14         | 04            |
| Employment of doctors and necessary medicinal supports to be ensured                                               | 17         | 18            |
| Supply of electricity                                                                                              | 07         | 07            |
| Proper Sanitation                                                                                                  | 11         | 07            |
| Number of shelters should be in proportion to the population of the locality                                       | 03         | 0             |
| Separate living accommodation should be provided for both males and females                                        | 03         | 04            |
| There should be separate space for livestock and poultry                                                           | 14         | 17            |
| As flood is a longer disaster there should be provision of separate arrangement for each and every affected family | 08         | 04            |
| There should be special arrangement for the pregnant women                                                         | 0          | 10            |

The respondents in response to the query as to whether the trend of flood is on the rise informed the following:



Table -28: Feasible causes of rising trend of floods according to the respondents.

n= 40

| Causes                                                                 | Pansha (f) | Sujanagar (f) |
|------------------------------------------------------------------------|------------|---------------|
| siltation of river/                                                    | 20         | 19            |
| construction of embankment                                             | 11         | 12            |
| sedimentation of khals/beel                                            | 16         | 11            |
| effect of Farrakka barrage                                             | 11         | 14            |
| ice-melting/defrostation at the Himalayan region at a increasing ratio | 07         | 06            |
| accumulation of new chars                                              | 06         | 05            |
| rise of the sea-level                                                  | 2          | 0             |
| rise of temperature                                                    | 04         | 09            |
| lack of dredging                                                       | 06         | 05            |
| diminishing of plants                                                  | 03         | 04            |
| untimely and increase in rainfall                                      | 04         | 04            |

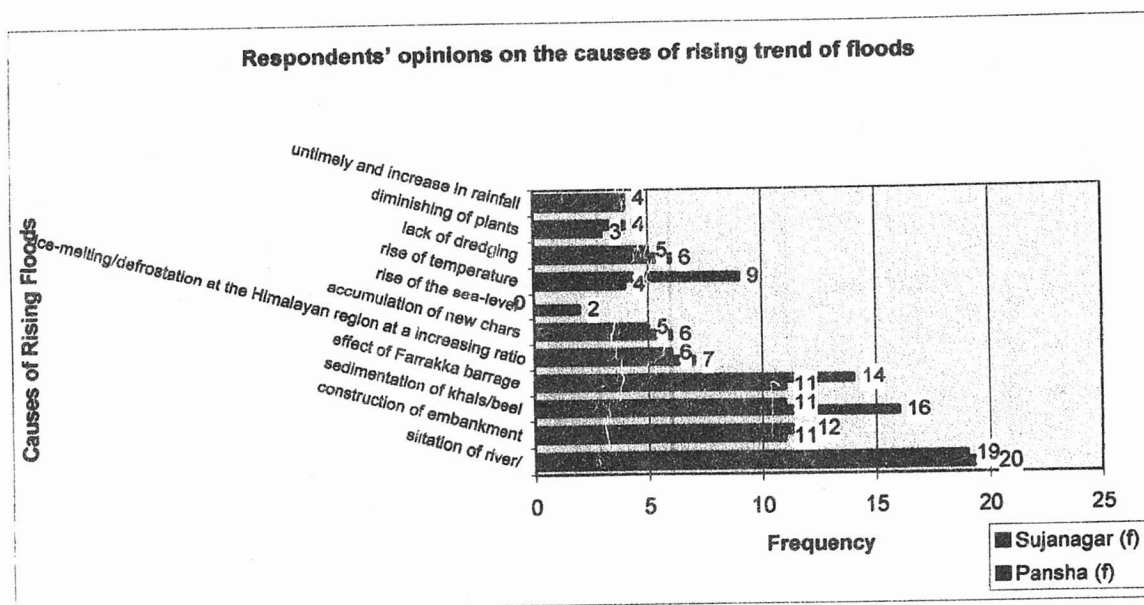


Chart-4

Have you ever been victim of river erosion? If yes, please mention the number.

a) Once      b) Twice      c) Thrice      d) Four times      e) More

Table-29: Respondents' opinions on being victim of river erosion

n= 40

| Times      | Pansha   | Sujanagar |
|------------|----------|-----------|
| None       | 0        | 0         |
| Once       | 4        | 7 (35%)   |
| Twice      | 12 (60%) | 5 (25%)   |
| Thrice     | 2        | 4 (20%)   |
| Four times | 0        | 3 (15%)   |
| Five times | 0        | 1 (5%)    |
| More       | 2        | 0         |

The above table shows the disastrous conditions of the respondents due to river erosion. It highlights that 60% respondents in Pangsha Upazila have become victim of river erosion twice in their lifetime; 20% victimized once; 10% affected thrice, and another 10% victimized more than five times. But what is striking that none of them in this region got rid of such calamities. On the other hand, in Sujanagar Upazila also, none of the respondents was escaped; 35% of the respondents victimized once, 25% twice, 20% affected thrice, and the most vulnerable one affected five times so far.

And it is evident from their responses that they had to build new houses due to river erosion.

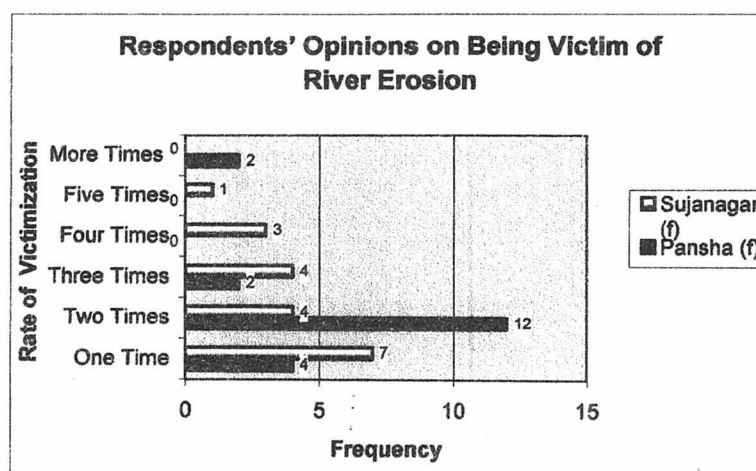


Chart-5

For how many times you had to build new houses due to river erosion?

a) Once      b) Twice      c) Thrice      d) Four times      e) more

Table-30: Respondents' opinions regarding for how many times they had to build new houses due to river erosion

n= 40

| Times      | Pansha   | Sujanagar |
|------------|----------|-----------|
| None       | 0        | 0         |
| Once       | 4        | 7 (35%)   |
| Twice      | 12 (60%) | 5 (25%)   |
| Thrice     | 2        | 4 (20%)   |
| Four times | 0        | 3 (15%)   |
| Five times | 0        | 1 (5%)    |
| More       | 2        | 0         |

The information of the above table depicting the same facts and figures like the previous one as the victims had to build new houses as frequently as they fell victim to river erosion.

Table-31: Ownership status of homesteads/land of the respondents

n= 40

| Name of the Upazilla | Frequency |          |
|----------------------|-----------|----------|
|                      | Own       | Others   |
| Pansha               | 09        | 11 (55%) |
| Sujanagar            | 17 (85%)  | 03       |

This table focuses on the ownership pattern of the respondents. It appears that in Pansha 55% of them have lost their homestead and living in other's accommodation. The situation in Sujanagar, is comparatively better as 85% of the respondents are living in their own homesteads.

Table-32: Changes in profession due to river erosion

n= 40

| Name of the Upazilla | Frequency |    |
|----------------------|-----------|----|
|                      | Yes       | No |
| Pansha               | 19 (95%)  | 01 |
| Sujanagar            | 11 (55%)  | 09 |

This table discloses the deadly effect of river erosion as 95% of the respondents in Pansha, so far, eventually had to change their profession. They have become rootless, destitute and ultimately the unbearable burden of the society. While in Sujanagar, it appears a little better as 55% of the respondents had to change their profession.

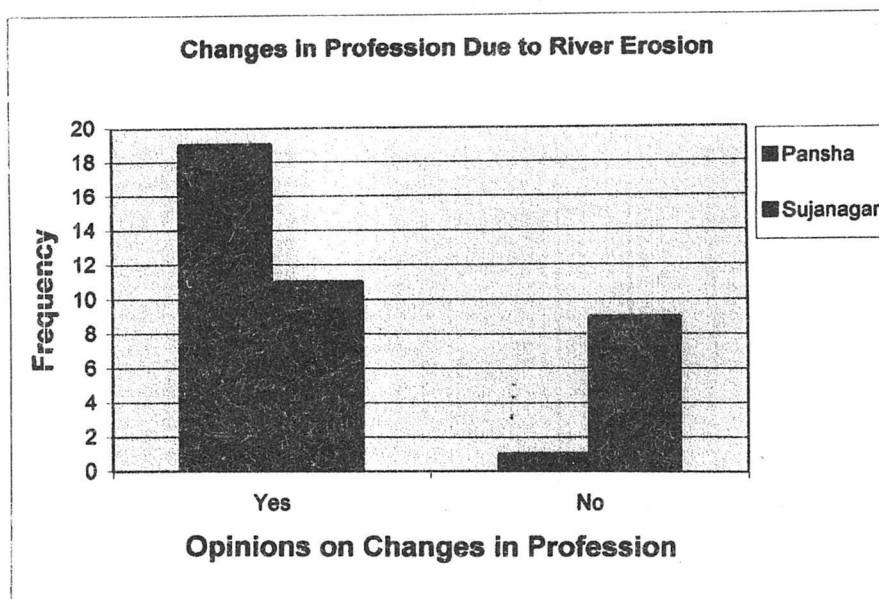


Chart -6

Table-33: Changed profession of the respondents

n= 40

| Profession                        | Pansha (f) | Sujanagar (f) |
|-----------------------------------|------------|---------------|
| unemployed                        | 5          | 3             |
| share cropper/landless cultivator | 7          | 7             |
| fisherman                         | 3          | 0             |
| street grocer                     | 1          | 0             |
| daily labourer                    | 2          | 1             |
| van puller                        | 1          | 0             |
| did not change profession         | 1          | 9             |

Here we can refer some cases emerging from the devastating impacts of natural calamities:

#### Case – 1

Md. Jabber Sheikh hails from Sujanagar PS of village Shyamnagar under Pabna district. Originally he does not belong to this village rather, he was an inhabitant of Harirampur which has been devoured by the mighty river Padma.

He narrates his own plight by saying – “My forefathers were living besides Jamuna. After the devastation of their homestead they migrated to Harirampur during the twenties of the last century. We are now here following consecutive demolition of our homesteads for more than five times. Now we don't have any longings for land and care for permanent homesteads. There is no dearth of land in the chars for the hapless like Jabbaer Sheikh who can switch over to any charlands at any time against any adversaries.”

He added, further, “Once we were affluent farmers being possessors of so many lands and cattle. But the river betrayed us by snatching away all our properties leaving us in a miserable state. With the erosion of our riverside we compelled to move to the other side. Against such a horrifying situation I couldn't do anything productive in my life. Owing to financial crisis I had to sacrifice one of my beloved child. I have forgotten farming; my wife is now a labourer in the neighbouring houses. Some of my children are now engaged as rickshapuller and daylabourer, one of which is working in a garment factory at Dhaka.”

Have you ever had received ‘old-age-pension’? Jabbar Sheikh replied in a tone of dejection, “No, I have hadn't. Once, someone of this locality collected my photo for this very purpose, but aftermath everything appeared to be missing to me till to date. Perhaps, I have to wait further to be a model one.”

## Case - 2

*(as referred by - Roger Harrabin Environment Analyst, BBC News, Bangladesh, Climate fears for Bangladesh's future)*

Masuma's home is a bamboo and polythene shack in one of the hundreds of slums colonising every square metre of unbuilt land in Dhaka, the capital of Bangladesh. Masuma is an environmental refugee, fleeing from the floods which have always beset her homeland but which are predicted to strike more severely with climate change. She has found her way to the city from the rural district of Bogra - a low-lying area originally formed from Himalayan silt where the landscape is still being shaped by the mighty Brahmaputra river as it snakes and carves through the soft sandy soil.

"In Bogra we had a straw-made house that was nice. When the flood came there was a big sucking of water and everything went down," Masuma says.

"Water was rising in the house and my sister left her baby upon the bed. When she came back in, the baby was gone. The baby had been washed away and later on we found the body," she recalls.

### 'Climate refugees'

Masuma's story is already commonplace in Dhaka, the fastest-growing city in the world. Its infrastructure is creaking under the weight of the new arrivals. Climate change is likely to increase the risks to people like her. Climate modellers forecast that as the world warms, the monsoon rains in the region will concentrate into a shorter period, causing a cruel combination of more extreme floods and longer periods of drought. They also forecast that as sea level rises by up to a metre this century (the very top of the forecast range), as many as 30 million Bangladeshis could become climate refugees.

"The problem is hidden at the moment but it will inevitably come to the fore as climate change forces more and more people out of their homes.



### *Case-3*

*Mr. A. Kashem was born in Bridashuria of Chauhali under Sirajganj district. His parents were compelled to leave that village for nearby Bakulia following severe river erosion when he was two years old. Here they stayed for four years. Afterwards, their family had to quit this village facing another sweep of flood for further settlement in Panchsimulia. No sooner than three years have had passed; they had to return again to the alluvial charland of Bakulia. Lamenting his fate, poor Kashem remarked, "We couldn't stay there even for one year rather had to leave for another destination, Paila, a village around two miles away where at last we could settle down for consecutive twelve years, but we became victim again, our homestead swept away." He further expressed, "I passed my unforgettable youthful days there which appears just a vanished dream to me, into the river . . ."*

*Against such a doldrums, we had to leave for Bridashuria again, the reemerged charland where our family settled down for another seven years. But the miserable story, the fellow added in a choked voiced, doesn't end here, "After spending three years in Hatail, Sirajganj, our homesteads swept away again. Thus, our family became victim of river erosion for seven times so far. . . ."*

*This time, finding no other ways, their family left Sirajganj for Tebaria, Nagarpur of Tangail district where they are living at present. They don't have any land in their possession now. Their profession got diversified. Some of them are in petty services, others are- day labourers, fishermen etc. Their family tree has completely been scattered; they hardly keep in touch with each other; some are living on the East of Yamuna while the others are on the West or elsewhere.*

*"Bridashuria-Bakulia-Panchsimulia-Bakulia-Paila-Bridashuria and finally Hatail; thus we have had been floating like water-hyacinth from one char to another till to date" disheartened Kashem's heavy sigh could express his sorrows a little . . .*

## Chapter - VII

### 7.0 Findings and Recommendations

7.1 The research study analysing the collected data and information ensues the following findings which are presented below.

#### 7.1.1 Findings from the tidal surge-prone regions

- the number of cyclone shelter is more in Kalapara than that in Pathargata. Though both the UNOs emphasized upon the enhancement of the number of cyclone shelters pinpointing their inadequacies in proportion to the size of inhabitants;
- In Kalapara 26 cyclone shelters have become dysfunctional out of the total number (73) which reflects poor maintenance system over there. It is to be noted that these cyclone shelters were built in two phases- 1972-1973; 1994-1995. Within this short span of time, almost 19% have become dysfunctional. Which depicts that these cyclone shelter were designed and built just on the whimsical plans of building any infrastructure without justifying the purposes;
- capacity of existing cyclone shelters is not compatible rather imbalanced with the total strength of population of both the regions. Furthermore, the capacity of cyclone shelters of Pathargata is more inferior in comparison to Kalapara;
- the dams and embankments of the region are in wretched condition; those were built to protect the coastal regions and its people from *joar-bhata* (high and low tides), but unable to protect the people and soil from the severe calamities like AILA and SIDR; Moreover, those dams and embankments were not afforested properly and lacked nurturing;
- as being depicted from literature review as well as the opinion of the respondents it appears that natural calamities like flood and tidal surges are on the rise;
- affected people suffers from a sense of negligence and positive awareness in responding to the traditional signaling and other forecasting systems;
- it spells out that in Kalapara, all the cyclone shelters were built with foreign aid. On the contrary, the shelters of Patherghata were built with financial support from both revenue and foreign sources;

- both the UNOs of Patharghata and Kalapara appear unable to furnish authentic statistics regarding the amount expended against construction of the specific cyclone shelters in their jurisdiction. It focuses further the idea that such types of accounts are not preserved at the Upazila levels;
- the cyclone shelters are not being maintained properly;
- owing to the lack of fund allocation proper maintenance of the cyclone shelters becomes difficult; and because of under-utilisation during normal situation the shelters appear to be unsuitable for habitation;
- there are 'insecurity' and 'insufficient first-aid accessories' during mitigation of natural calamities;
- local Disaster Management Committees are not supported with sufficient fund and necessary communication equipment, and lacks in proper training;
- the cyclone shelters were built following onrush of some severe natural calamities which devastated the living existence of the hapless people of our coastal regions. This is but an absence of our proactive thinking in combating natural calamities;
- donor agencies or NGOs are virtually the major funding sources of the cyclone shelters built so far;
- UNO, Kalapara felt the necessity for construction of more 45 cyclone shelters in his jurisdiction; while UNO, Pathargata indented for 50 more;
- almost half of the affected people did not take refuge in the cyclone shelters in both the Upazilas because of adversaries not conducive to even subsistence living;
- it appears that the money sanctioned for construction of this cyclone shelter was not spent practically and lacking foresightedness;
- there is lack of operational flexibility on the part of local Disaster Management Committees in performing respective functions independently;
- earthquake-resistant technology was not applied while constructing those cyclone shelters;
- the affected people are afraid of taking shelter in those cyclone shelters on the ground that such structures might befall on them;
- an insignificant number of respondents (2.2% in Patharghata and 7.5% in Kalapara ) found interested to take refuge at nearby *parjatan* centre/hotel and safe

houses (Table-21). The local people are impoverished and unable to bear the expenses in sheltering themselves on payment basis. Therefore, any initiative by the non-state actors does not appear to be feasible apart from charity.

#### 7.1.2 Findings from the flood-prone regions

- In Pangsha there are only 7 flood shelters (being used as school and *madrasha*) which could accommodate 1400 people at best and not enough in proportion to the population of the Upazila;
- Earthquake-resistant technology was not applied in construction of these cyclone shelters;
- In Sujanagar, being the most flood-prone regions of the country, there is no flood shelter constructed yet;
- No fund is reserved for these types of permanent disaster (flood) rather, allotted instantly when lives and properties of the respective regions are threatened. Both the UNOs of Pangsha and Sujanagar informed that there is no provision for allocation of recurring budget to mitigate the flood and river erosion. Rather, they informed further, only during such disasters and aftermath necessary money and materials are supplied;
- 60% respondents in Pangsha Upazila have become victim of river erosion twice in their lifetime; 20% victimized once; 10% affected thrice, and another 10% victimized more than five times. But what is striking that none of them in this region got rid of such calamities. On the other hand, in Sujanagar Upazila also, none of the respondents left unaffected; 35% of the respondents victimized once, 25% twice, 20% affected thrice, and the most vulnerable one affected five times so far;
- those flood shelters built so far specially in Pangsha region, just bearing the identity of flood shelters, are being used as *madrasha* and schools. The affected people responded in anguish that for how long they could remain stranded waiting for those *madrasha* and schools to be vacated.

## 7.2 Recommendations

Based on the above core findings the researchers proposing the suggestions earmarked below:

- adequate fund should be kept reserved for cyclone and flood-prone areas, and there must be flexibility in disbursing the fund;
- the inhabitants of the affected regions should be motivated to build their houses on high altitudes that could protect themselves from the onrush of tidal surges like SIDR and AILA. In this regard, the government as well as the NGOs can facilitate constructing the houses based on unusually heightened vertical columns;
- the existing dams and embankments urgently need to be renovated with optimum structural heights that can surmount the catastrophic effects of tidal surges. Further, there should be extensive aforestation surrounding the dams and embankments with a commitment to nurturing both the forest and the embankments as well;
- with an aim to rehabilitate the affected people in safe and secured zones from risky and vulnerable regions;
- dams and embankments should be densely forested and there should not any scope for agricultural venture or building homesteads;
- while building any dams, embankments or cyclone shelters in future earthquake and tidal surge-resistant technology must be applied;
- the stakeholders should be involved in maintaining the dams, embankments, shelters and the likes constructed for these very purposes;
- adequate numbers of cyclone shelters, should be built based on the proportional ratio of population of the areas;
- operational flexibility should be ensured to the local Disaster Management Committees in performing their respective functions;
- the disaster forecasting (cautionary) signals should be simplified;
- as flood and river erosion are perennial in nature, we must adopt necessary sustainable measures in advance;
- as natural calamities like flood and tidal surges are on the rise so we should adopt preparatory measures proactively instead of traditional approaches;

- long-term planning should be adopted specially for those areas prone to recurring flood;
- as flood persists for long duration in recent past which thereby necessitates the facilities for food and shelter for the affected people along with temporary employment;
- farmers of the flood prone and saline-intensive regions need to be motivated to cultivate rice resistant both to saline water and long duration of flood;
- investment for disaster mitigation should be on massive scale because the losses and damages incurred in natural disasters always outweighs the investment;
- climate change, as it clearly appears to be a threat to our very existence; though we are not to be blamed but victim to the grave circumstances- we should look forward for a pioneering role in cooperation with the global partners;
- strong commitment to be injected within the SAARC framework so these countries could combat natural calamities themselves; which could strengthen their bondage and self-sufficiency as well;
- rehabilitation programmes should be chalked out for the climate refugees;
- Bangladesh needs detailed study to scientifically assess the Tsunami vulnerability. Besides, she needs to develop a Tsunami early warning system and mass awareness of Tsunami threat at the coastal areas;
- while combating disasters we have to think globally; we should open a windows through which we can exchange ideas and information on global climate change and its impacts.

### **7.3 Conclusion**

A paradigm shift is now on the approach towards disasters management in all the countries of the South-Asian region– from post-disaster relief and rehabilitation to pre-disaster prevention and preparedness. This paradigm shift has also resulted in the realization that causes and consequences of the major disasters in this region are not limited within the political boundaries of the nations but are essentially regional and sometimes trans-regional in nature and therefore solution to these problems would lie in the increased regional understanding and cooperation in studying the problems, sharing

information and best practices for dealing with the hazards and disasters in a comprehensive manner.

Bangladesh, in spite of being one of the most disaster-prone countries of the world its focus was limited in relief and rehabilitation activities in the early stages. But following the devastating floods of 1988, 1998 and the cyclone of 1991, which has created a massive destruction in the economy; the focus has been shifted towards adaptation of a holistic approach that embraces processes of hazard identification and mitigation, community preparedness and integrated response efforts.

It is to be mentioned here that though there appears similarity in the nature and magnitude of the tidal surges of 1970 and 1991 but the rate of fatality is, remarkably, on the decrease— *which bears the testimony towards our successful switchover from post-disaster relief and rehabilitation to pre-disaster prevention and preparedness*. However, there are many a drawbacks and more to be done. This study as an attempt to analyse the implications of natural disaster in Bangladesh and its relationship to infrastructure development in particular, tried to – i) present a renewed perspective in infrastructure development for disaster mitigation; ii) to find out lapses in our disaster mitigation processes; and iii) to suggest some measures and initiatives for strengthening infrastructural growth relating to reduction of risks of disaster and its better management.

Apart from the structured questionnaire we posed some queries to the inhabitants of the respective localities, people's representatives and the administrative focal points regarding many aspects concerned. Scores of lapses and lacks in the field have been found as findings of this research. Based on the core findings, the researchers proposed a series of suggestions those, we hope, if taken into consideration, could help strengthening our disaster mitigation capabilities and ease the existing situation in combating natural disasters in the days to come.



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ANNEX-1

for the affected people

Questionnaire designed to collect data for implementation of the project titled 'Infrastructural Development for Disaster Management: The Case of Bangladesh' financed by Bangladesh Public Administration Trg. Centre (BPATC)

Name : (Optional)

Address:

1. Is there any cyclone/flood shelter nearby your homestead? Yes/No
2. If the reply is 'yes' please mention the distance. (please tick mark)  
a) > 0.5 km.    b) 0.5 – 1.0 km.    c) 1.0 – 1.5 km.    d) 1.5 – 2.0 km.  
e) 2.0 – 2.5 km.    f) 2.5 – 3.0 km.
3. Did you take refuge there during the recent 'SIDR'/Flood? Yes/No
4. If the reply is 'yes' please give your opinion about the prevailing facilities of the cyclone/flood shelter.
5. If the reply is 'no' please mention the causes.
6. What sort of facilities should be there according to your opinion?
7. Is the management system of the cyclone shelters satisfactory? Yes/No
8. If the reply is negative, what are the ways and mean to upgrade the quality of mangement of the cyclone shelters.
9. To your viewpoint what additional facilities should be provided in the cyclone shelter?
10. Is the number and capacity of the cyclone shelters adequate in proportion to local inhabitants?
11. Do you think, the traditional system of forecasting disaster by the government is adequate enough?
12. Is there any scope for forecasting natural disaster besides the government ones?
13. If the answer is 'yes' please mention the sources.
14. Do you have any suggestion on the forecasting system?
15. For which purposes the cyclone/flood shelters are being used other than its specific purposes?
16. Could you take shelter in the nearest cyclone/flood shelter during necessity?
17. If the answer is 'no' please mention the reasons behind.
18. Is there any political biasness or influence in facilitating the affected people?
19. Are the cyclone shelters conducive to living with the family?

20. Are there any facilities for providing shelter to poultry, livestock and other domestic animal?
21. What are the reasons behind construction of cyclone shelters at these very places?
22. Please mention your experiences while staying at the cyclone/flood shelters.
23. Was there any instance that you couldn't take shelter due to lack of space at the cyclone/flood shelter?  
Yes/No
24. Do you think that the trend of flood is on the rise?  
Yes/No
25. If the answer is 'yes' please mention the feasible causes of the trend.
26. What are the other purposes of utilization of the cyclone/flood shelter other than accommodating the affected people?
27. Please mention the distances in between the cyclone/flood shelters of the locality.  
a) 1.0 km.      b) 2.0 km.      c) 3.0 km.      d) 4.0 km.      e) 5.0 km.
28. Have you ever been victim of river erosion? If yes, please mention the number.  
a) Once      b) Twice      c) Thrice      d) Four times      e) more
29. For how many times you had to build new houses due to river erosion?  
a) Once      b) Twice      c) Thrice      d) Four times      e) more
30. For how long you have been living in your present homestead?  
a) One year      b) Two years      c) Three years      d) Four years      e) More
31. Does the homestead belong to you?  
Yes/No
32. Did you have to change/leave your homesteads due to natural disaster? If yes, mention the previous addresses:  
1.      2.      3.
33. Did you have to change your profession due to the erosion of agricultural lands/homesteads?  
Yes/No
34. Mention your opinions about staying in private secured shelters on payment basis specially during prolonged disasters.