

# CLIMATE CHANGE AND EDUCATION BANGLADESH



P. K. Das



# Climate Change and Education

**Bangladesh**

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# ABBREVIATIONS

AAB	ActionAid Bangladesh
APIT	Advancing Public Interest Trust
BBS	Bangladesh Bureau of Statistics
BCCSAP	Bangladesh Climate Change Strategy and Action Plan
BGS	British Geological Survey
BMD	Bangladesh Meteorological Department
BNBC	Bangladesh National Building Code
BRAC	Bangladesh Rural Advancement Committee
CAC	Centre for Analysis and Choice
CAMPE	Campaign for Popular Education
CC	Climate Change
CCC	Climate Change Cell
CCD	Climate Change Database
CCIA	Climate Change Impact Assessment
CDMP	Comprehensive Disaster Management Programme
CEGIS	Centre for Environmental and Geographic Information Services
COP	Conference of the Parties
CPP	Cyclone Preparedness Programmes
CW	Concern Worldwide
DFID	Department for International Development
DFIDB	Department for International Development Bangladesh
DMA	Disaster Management Action
DMB	Disaster Management Bureau
DoE	Directorate of Education
DPE	Disaster and Primary Education
DPHE	Department of Public Health Engineering
DRRE	Disaster Risk Reduction through Education
DRRS	Disaster Risk Reduction through Schools
EDG	Esho Desh Gori
EEC	European Economic Community
EMIS	Education Management Information Systems
FAO	Food and Agriculture Organisation
FGD	Focused Group Discussion

FIVDB	Friends in Village Development Bangladesh
GDP	Gross Domestic Product
GHG	Green House Gas
GIS	Geographic Information System
GoB	Government of Bangladesh
GPS	Government Primary School
GRID	Global Resource Information Database
GSB	Geological Survey of Bangladesh
HFA	Hyogo Framework for Action
ICT	Information and Communication Technology
IPCC	Intergovernmental Panel on Climate Change
LGED	Local Government Engineering Department
LIO	Local Implementing Organisations
MDG	Millennium Development Goals
MoEF	Ministry of Environment and Forest
MoFDM	Ministry of Food and Disaster Management
MPO	Master Plan Organisation
NAPA	National Adaptation Plan of Action
NFPE	Non Formal Primary Education
NGO	Non Governmental Organisation
NPDM	National Plan for Disaster Management
NRNGPS	Non Registered Non Government Primary School
NWMP	National Water Management Plan
NWRD	National Water Resources Database
PARSES	Participatory Actions towards Resilient Schools & Education Systems
PEDP	Primary Education Development Programme
PVA	Participatory Vulnerability Analysis
PVCA	Participatory Vulnerability Capacity Assessment
R & R	Review and Reflection
RNGPS	Registered Non Government Primary School
RRMCP	Risk and Resource Map and Contingency Plan
RWD	Power Works Department
SAP	South Asia Partnership

SDEJ	Social Development and Economic Justice
SIRD	State Institute of Rural Development
SLR	Sea Level Rise
SMC	School Management Committee
SMRC	SAARC Meteorological Research Centre
SPARRSO	Space Research and Remote Sensing Organisation
TOR	Terms of Reference
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
VCA	Vulnerability and Capacity Assessment
WAPRO	Water Resources Planning Organisation
WFP	World Food Programme
WHO	World Health Organisation
WS	Workshop



## EXECUTIVE SUMMARY

1. 63 million children in Bangladesh may become physically and socially vulnerable due to increased frequency and enormity of hazards like floods, cyclones and storm surges, tornadoes, riverbank erosion, drought and sea level rise. Physical vulnerability may include death, injury, diseases, physical abuse, chronic malnutrition and forced labour. Social vulnerability may include loss of parents and family, internal displacement, risk of being trafficked, loss of property and assets, and lack of educational opportunities.
2. Four different geo-climatic zones are vulnerable to different kinds of hazards in Bangladesh. Drought and floods in the north, cyclone and tidal surges in the south and river erosion and flood in the middle of the country are the major climate change hazards for Bangladesh.
3. River floods affect from 20% to 65% of the country every year. The frequency and height of floods will increase due to rising sea levels and extended monsoon. Along with regular floods, occurrences of irregular flash flood, tidal flood and rain flood will increase hampering schooling of children.
4. In 2008 approximately 49 schools were washed away and 700 schools were seriously damaged causing severe disruption in access to education for around 50,000 children. The total rehabilitation cost to the damages was approximately USD 8 million.
5. Tropical cyclones from the Bay of Bengal accompanied by storm surges are another climate change hazard that will have serious negative impact on Bangladesh. The cyclone SIDR affected education of more than 100,000 children in 589 schools in 12 districts of the country. The total cost of reconstructing of the schools, supply of textbooks and other materials was approximately USD 85 million. This is almost 30 times higher than the average USD 35 per pupil expenditure.

6. Adaptation measures could include hazard specific school design and construction, retrofitting the existing schools to withstand further hazards, flexible school calendar and test schedule, provision of emergency pool of teachers and educational materials, boat schools, food, water and medicine storage for children in schools, include climate change in curriculum for both teachers and students, community awareness about continuing education during hazards.
7. National architecture for climate change response is quite robust. The National Disaster Management Bureau along with several national and international NGOs has developed a mechanism for early warning, crisis management and post-crisis rehabilitation, which include provision for education.
8. However, a shift is necessary from a response mode to an adaptation and mitigation mode. Bangladesh Climate Change Strategy and Action Plan points towards that direction. Future education programmes should be screened from the adaptation and mitigation point of views. A detail cost analysis could also be carried out for adaptation and mitigation in the education sector.

# Chapter 1

## INTRODUCTION

### 1.0 CLIMATE CHANGE

The IPCC scientists have provided tangible evidences on climate change due to increased human activities and development. According to the United Nations Framework Convention on Climate Change (UNFCCC) there are two types of responses to climate change; a) mitigation of climate change by reducing greenhouse-gas emissions and enhancing sinks and b) adaptation to the impacts of climate change. Instead of viewing them separately, recently policy-makers have started showing their interest in exploring interrelationships between adaptation and mitigation. However, this is a complex domain and depends upon the countries' economic status, emission level, their commitments to the international forum, etc. The major issues are a) determining the optimum level of adaptation and mitigation, b) time frame and the right combination of adaptation and mitigation, c) who should decide these and based on what criteria should they be decided?

Generally, the mitigation research community has been found to emphasise primarily on technological and economic issues, and has traditionally relied on 'top-down' approach for studying trade-offs inherent in mitigation (IPCC, 2007). In contrast, the adaptation research community has put its emphasis on local and place-based analysis.

In countries such as Bangladesh, Maldives, Nepal, etc., it has been observed that, if adaptation is treated as a top-down, the local communities tend to view them as external impositions by government authorities. Field visits to these countries revealed that the local communities are not comfortable with such approach. It

becomes less acceptable to the communities if the adaptation measures for a particular location are explained to them by outside experts. The bottom up approach brings the lab knowledge of climate change in a simple and understandable format to the community which they do not and cannot be expected to know. Together with this, the local knowledge/wisdom and understanding will help to figure out the best mode of adaptation at a particular location.

If the adaptation, mitigation and the interconnected interventions are monetized, one could draw the above diagram to a scale. In that case, the bubbles would represent the quantum of mitigation, adaptation and interconnected actions of a particular country and would depend upon its life style, emission, nature of production industries, etc. Each country will have a unique pattern of these two bubbles and their overlap. This will change over time depending upon the country's speed of approach towards its set target.

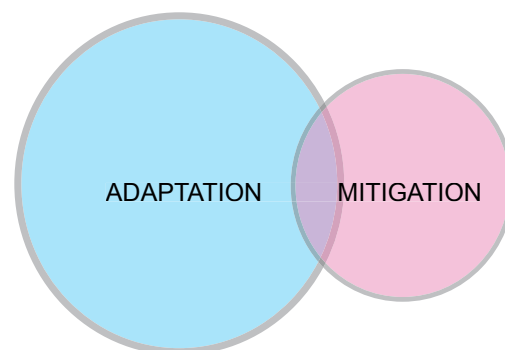


Figure 1.1: The relative sizes of the bubbles representing adaptation and mitigation and the overlap- will differ from country to country depending upon their socio-economic conditions, life style, emission status, etc.



These two bubbles are interconnected since one action will regulate the other. For example, to reduce emission of GHG, a country may use clean development mechanism (mitigation); however, changing the life style (adaptation) will reduce the mitigation actions at the root level. Awareness of the people, investment on projects and programmes on adaptation and mitigation actions, political stability, regional co-operation, etc. will determine the diagram.

While NAPA and similar documents are participatory, they are heavily supported by research based knowledge, which is predominantly

analytic. However, there is a need for synthetic knowledge (Gorsky, 1987) which is based on direct experience such as community wisdom in the context of climate change. The above Figure shows the process of top down and bottom approach.

In summary, it may be said that Climate Change is a reality and there is a need for combating it through planned mitigation and adaptation interventions in a time frame. Climate change has been an issue since long. However, it got the due political importance after Al Gore and the U.N.'s Intergovernmental Panel on Climate Change won the 2007 Nobel Peace Prize.

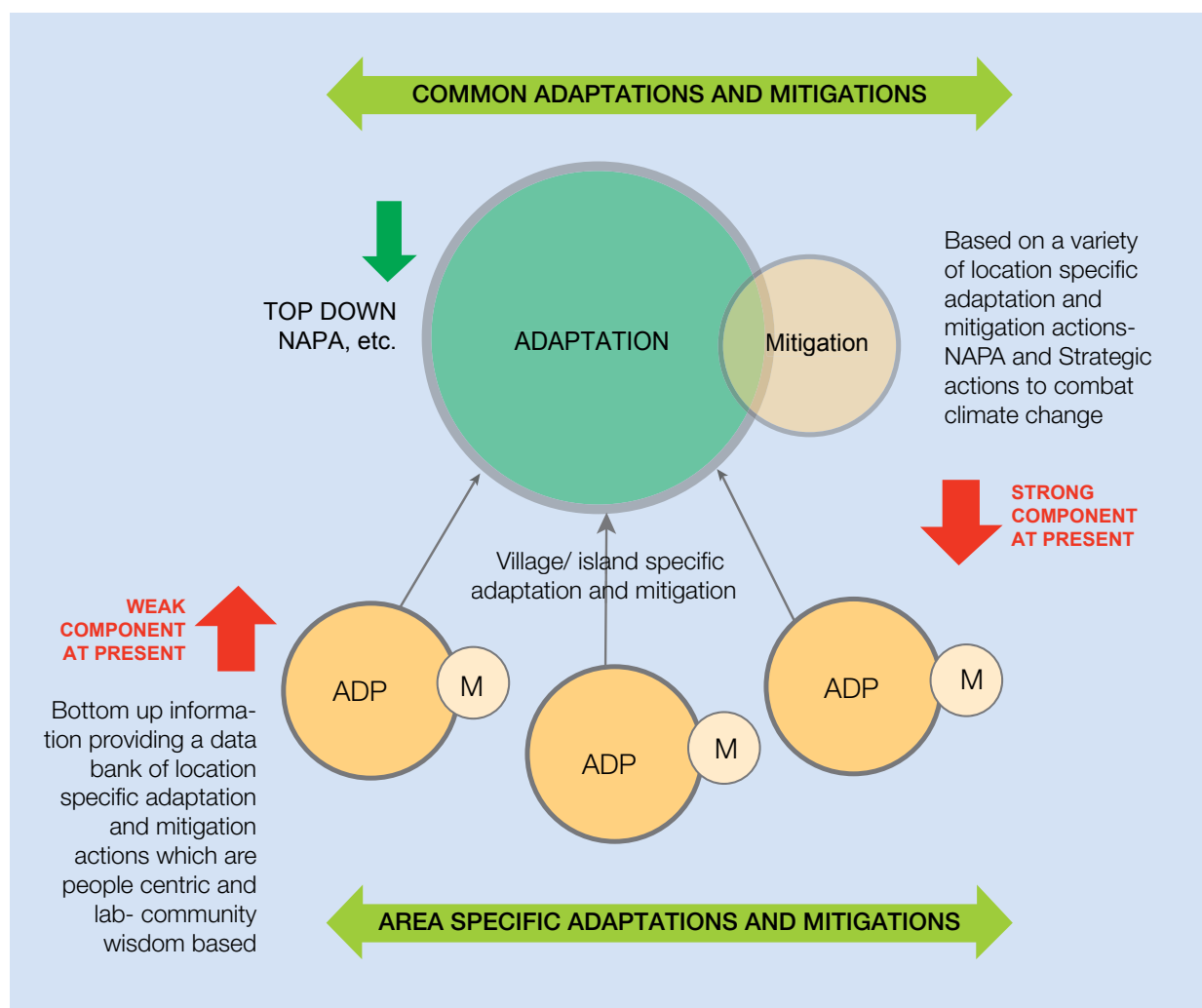


Figure 1.2 : Balanced system of bottom-up and top down

## 2.0 IMPACT OF CLIMATE CHANGE ON MDG

According to IPCC (2001a), countries such as Bangladesh, Maldives, etc. will be adversely affected by climate change because of their vulnerability due to different categories of disasters. One metre rise in sea level would flood 17.5 per cent of Bangladesh. Rising sea levels could force Pacific islanders to become nations of environmental refugees (Collins, 2006). Developing countries are particularly vulnerable since they are often located in high-risk natural settings and their adaptive capacity is reduced by poor socio-economic development. In many small islands such as Maldives, Coral bleaching, caused by warmer waters, kills coral reefs and puts the tourism industry at risk.

These will pose additional pressure on these countries' efforts towards achieving the MDGs. It may be noted that, there are many ongoing programmes by many institutions across the globe towards preparing for the climate change. For example Adaptation Policy Framework (APF) prepared by the UNDP/GEF (Global Environment Facility) emphasises on Capacity Development and Adaptation Cluster as the Cornerstone of their (UNDP's) Strategy in Adaptation. APF will assist in the process of incorporating adaptation concerns

into national strategies and guide formulation and implementation of projects. UNDP has its focus on MDG in the context of Climate Change. The following table shows the probable impacts of Climate Change on the MDGs.

The Adaptation Principles of UNDP-GEF considers that the adaptation activities should be supportive to the achievement of the MDGs and they must have development-focus. According to UNDP-GEF, the starting point for developing national responses is strengthening adaptive capacity and ensuring the stakeholders' involvement and public participation. One of the key activities is changing existing policies and practices and adopting new policies and practices so as to secure MDGs in the face of climate change and its associated impacts (UNDP 2006). The attempt should be to develop strategies to moderate, cope with and take advantage of the consequences of climatic events are enhanced, developed, and implemented (UNDP 2005).

The target of MDG 2 is interlinked with the other MDGs. Universal primary education is a key issue for the development and enhancement of living standard of the world population. Therefore, there is an urgent need for mitigation and adaptation to climate change in these countries in order to make their primary education systems sustainable.

Table1: Table showing the different MDGs at climate risks

MDGs	CLIMATE RISKS
MDG 1: Eradicate extreme poverty and hunger	Depleted livelihood assets, reduced economic growth, and undermined food security.
MDG 2: Achieve universal primary education	Reduced ability of children to participate in full-time education by loss of infrastructure, loss of livelihoods (forcing children to work), and displaced families.
MDG 3: Promote gender equality and empower women	Additional burdens on women's health and limited time to participate in decision making and income-generating activities.
MDGs 4, 5 and 6: Reduce child mortality; improve maternal health; combat HIV/AIDS, malaria and other diseases availability of potable water.	Greater prevalence of vector- and waterborne diseases, and heat-related mortality, declining food security, maternal health, and availability of potable water
MDG 7: Ensure environmental sustainability	Negatively impacted natural resources and productive ecosystems

### 3.0 COST OF THE RESPONSE

One of the most important issues in the context of response towards climate change is the probable preparedness costs. The Figure below shows (qualitatively) the interrelation among adaptation, mitigation and impact costs. If there is a low level of preparedness in terms of mitigation and adaptation, the impact-cost due to climate change will obviously be considerable as evident in the Figure below. Further to that, the less preparedness will result in time consuming post-disaster interventions making the distressed people suffer for prolonged periods, which is not acceptable on humanitarian ground. While it is desirable to invest on mitigation and adaptation, this will largely depend upon a country's financial ability, political will and level of awareness. It is important to study the implications of  $C_a$ ,  $C_m$  and  $C_i$  (Figure below) in a particular country vulnerable to climate change. This will help in planning for its target towards climate change which is a trade off (adaptation, mitigation, socio-economy, etc.). In the planning stage, it is utmost important to thoroughly examine whether the mitigation and adaptation actions in a context are the right ones. This, along with a method of prioritising the mitigation and adaptation actions will lay the foundation stone for sustainable development. In order to achieve these, there is a need for greater level of regional co-operation and political stability within and around a country.

While the above paragraph covers the basic issues of costs related to combating climate change, most of the literatures state that there is a lack of data on cost of mitigation and adaptation making it difficult to estimate the required funding for disaster response. Personal interviews with the climate change specialists, NGOs, government departments, etc. under this research also confirmed that, relatively little research has been conducted to accurately calculate the costs of climate change for education systems. It may be noted that there are existing data on these issues, mostly based on reactive interventions. At present in countries such as Bangladesh, Nepal, India, etc., there are data on proactive measures as

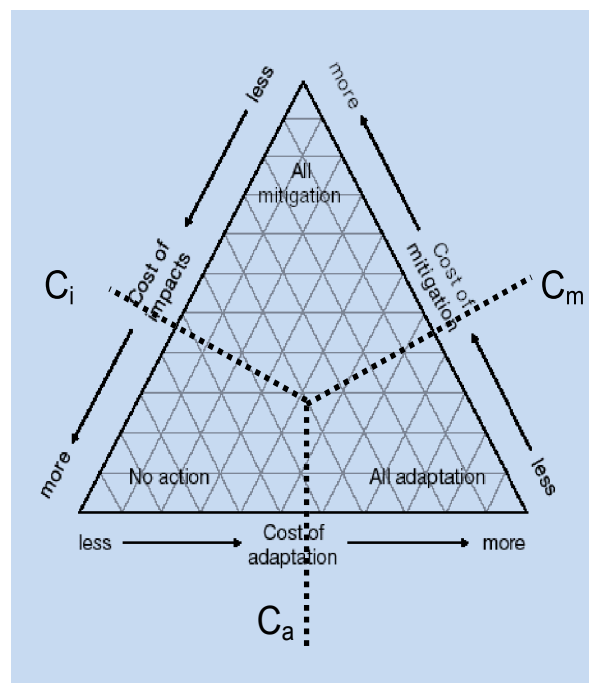


Figure 1.3: Inter-relationships between adaptation, mitigation and impacts, based on Holdridge's life-zone classification scheme (Holdridge, 1947, 1967): as cited by Klein et al (2007)

well. These data could be collated, reframed and analysed to obtain the mitigating and adapting cost towards climate change related increased disasters. The people living in the disaster prone areas have resilience. Their knowledge of combating disasters could be recognised as good source of knowledge that could be used for identifying the right parameters of adaptation and the right way of spending money on proactive measures against climate change related disasters.

It may be noted that the mitigation and adaptation have moving targets. Therefore, the intervention (mitigation+ adaptation) to have a sustainable society is a time bound effort. Therefore, there is a need for regular assessment of the situation in each country at suitable intervals acceptable to the people. This will enable one to assess the gaps and set new targets and carry out revised costing.

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#### 4.0 IMPACT OF CLIMATE CHANGE ON EDUCATION

According to Save the Children's 'Legacy of Disasters' and UNICEF's 'Our Climate, Our Children, Our Responsibility' (Back & Catherine, 2008), the children will be the hardest hit by the increasingly frequent and severe weather events, desertification and flooding brought by climate change. Supply side consequences of extreme weather events include: damage to education infrastructure and the resultant rehabilitation costs which drain constrained education budgets, and disruptions to schooling which have a significant impact on learning attainment. On the demand side, the impact of deteriorating livelihoods is likely to have widespread and long-term consequences including: the ability of families to send their children to school, increased levels of malnutrition and increased likelihood for conflict. Previous experiences suggest that these impacts are likely to disproportionately affect girls, raising serious concerns about gender equity.

In countries such as Bangladesh, there are already instances of very negative impact on educational infrastructure due to severe cyclone and flood that had destroyed school infrastructure, disrupting transport, and interrupting teaching and learning. The increased risk of diseases such as malaria, dengue fever and water-borne infections for both students and teachers due to these events further disrupts educational programmes.

Another issue is forced migration due to disasters which can also disrupt education systems (which puts pressure on schools and parents in both sending and receiving communities), civil conflict, and the increased necessity for children's participation in agricultural labour. The resulting social and economic costs therefore include a wide range of development concerns, from malnutrition and ill health to an increased risk of child labour and child trafficking. This seriously undermines existing efforts to increase education provision and to improve both economic and human development.

While much of the existing literature on climate change focuses on efforts at mitigation (e.g. carbon

trading, reduced consumption, etc.), adaptation to climate change is also a key concern. Education plays a key role in both areas. Communities affected by either slow environmental change or more frequent and severe natural disasters will require new sets of skills and knowledge in order to either adapt their livelihoods or to move to new locations. Existing educational infrastructure (including schools, transportation, texts and other learning materials) in these areas is also likely to be heavily affected – making it imperative to consider potential climate change impacts as part of planning processes. Where these issues are not taken into account, investment in education provision will be highly inefficient. The situation is worse in the countries affected by war, civil war, political unrest and instability, etc.

#### 5.0 CONTEXT OF THE PRESENT RESEARCH

The Super cyclone SIDR hit Bangladesh on 15th November, 2007. During SIDR, 596 Government Primary Schools (GPS), 209 Registered Non Government Primary Schools (RNGPS) and 44 community schools (total 849 schools) were reported as completely destroyed in the twelve coastal districts. There was no official data on the extent of damage in the remaining seven types of schools in Bangladesh. SIDR had also partially damaged 2,396 GPS, 1,189 RNGPS and 190 community schools (total 3,775 schools). Apart from that, there was massive infrastructure damage, loss of human and animal lives, loss of fertility of land, spread of diseases and massive food shortage due to SIDR. An on-site damage assessment was carried out in the twelve SIDR affected districts by a team of representatives from DPE, Project Liaison Unit, Local Government Engineering Department (LGED) and DFID. According to the site data, about 1,46,000 students were severely affected in the completely damaged 849 schools (GPS+ RNGPS+ Community).

It may be noted that, prior to the super cyclone 74 schools got completely washed off, 131 schools were severely damaged and 8,686 schools were partially damaged due to flood. This type of disaster is frequent in Bangladesh.



The Department of Education, Government of Bangladesh, undertook the following important activities immediately after SIDR.

1. Making all the schools operational/functional in the 12 affected districts
2. Transition (temporary) arrangement for all the GPS, RINGPS and Community Schools to resume the classes
3. Reconstruction of the completely destroyed GPS by designing them as cyclone and flood shelter as well
4. Repair and upgrading of the partially damaged GPS, RINGPS and Community Schools
5. Supply of books, education aids, play items, post cyclone trauma counselling etc.

About 81 million USD was allocated for replacing damaged buildings in 589 GPS in the 12 SIDR-damaged districts of Bangladesh. The entire process of intervention was fully and intensely participated by Directorate of Primary Education (DPE) and there is a good possibility of continuance of institutional memory to combat future disasters. Right now, a computerised response system comprising human resources with EMIS and GIS data is in place in Bangladesh.

While the main objective of post SIDR intervention was originally aimed at “responding to the past”, the process developed appeared to have adequate merit to facilitate “preparing for the future”. During the course of discussing various issues on disaster and

primary education the experience of “responding” had gradually transformed into “preparing for the future”. The entire work was documented and published by DFID which is a major funding institute towards Bangladesh’s target of EFA.

The 2007 Nobel Prize to IPCC and Al Gore, Stern Review (Stern, 2007), “Save Our Children” (Legacy of disasters, no date)- Bangladesh report and above all the findings of post SIDR interventions had motivated DFID Bangladesh to conduct a study on climate change and its impact on the children (Figure below). DFID Headquarters had decided to fund this and thus the present research “Education and Climate Change in South Asia: Impact and Response” was initiated. The present research aims to learn from the other sectors of responses to climate change and to influence them as well. It will attempt to span between the grassroots and the policy focussing on “the right kind of adaptation and mitigation” and their corresponding “costs” of interventions to enable the government and the development partners to plan for the funding in a sustainable manner.

This work does not attempt to say what is to be done. It is based on what is available as hard data on good examples of communities’ wisdom towards combating disasters. While this is basically a bottom up approach, the scientific knowledge will be integrated with the traditional wisdom to make mitigation and adaptation the right way.

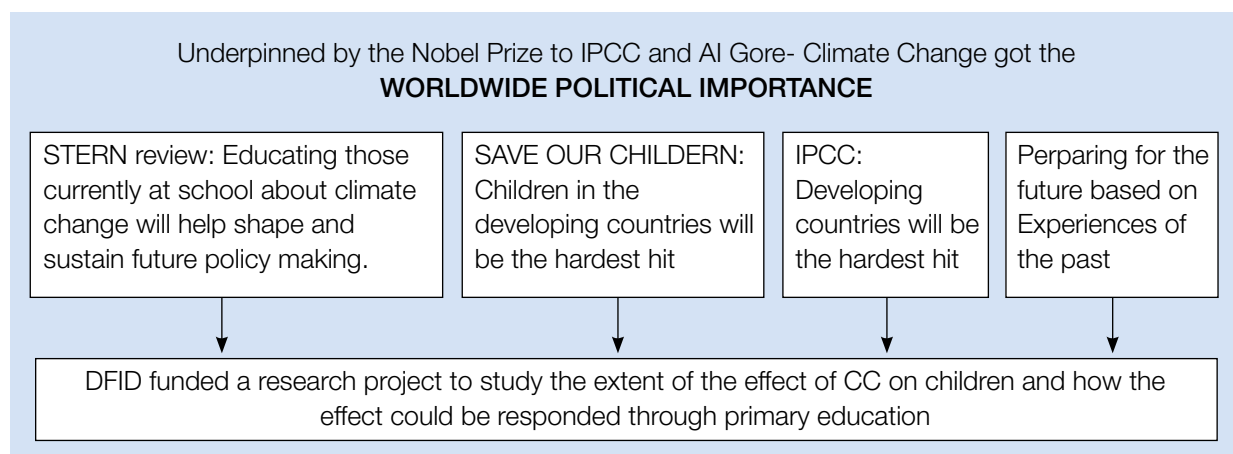


Figure 1.4: Background of the present research



## 6.0 DOMAIN OF THE PRESENT RESEARCH

In the present study, it has been assumed that the governments cannot be expected to take on the task of adaptation alone. There could be a need for enhancing awareness, willingness and capacity in the government system. The government's all encompassing presence in a country should preferably be together with local knowledge and understanding to figure out the best mode of adaptation and mitigation at grass root level. Primary education network in any country is an appropriate and perhaps the most influencing system to deal with the negative impacts of climate change, especially in the developing countries.

### Children and Climate Change

Stern review (2007) proposes that Policy to reduce emissions should be based on three essential elements a) carbon pricing, b) technology policy, and c) removal of barriers to behavioural change. All these could be initiated and propagated through the primary education system in a cost effective manner. Apart from that, propagating adaptation through primary education system to cope with the changed environment will need the least intervention and could help in transforming the young minds towards a climate resilient life style. There are several advantages of this approach since it is;

- easy to teach the children
- established that the children have tremendous capacity to assimilate knowledge
- possible with minimum intervention through teachers' training, text book revision, appropriate pedagogy and examination system through the education and hence, Cost effective

The focus of the present research is the children and their education. Awareness and capacity building on climate change related preparedness could be instilled in the students by adequately

trained and motivated teachers in the classroom as well as by demonstrating the various aspects of this issue through the school building and its campus. Each primary school is situated in a settlement and hence, the teachers could be the protagonists for disseminating awareness on this issue to the communities. This research is based on the following assumptions.

- teachers are the champions who will disseminate knowledge on adaptation and mitigation to the students and the communities
- children are the disseminators at home and in the neighbourhood
- community is a source of knowledge to combat disasters and there are good examples of their abilities to combat different types of disasters, which could be combined with the scientific knowledge
- school building and its campus are the media for campaign on adaptation and mitigation in the context of climate change.

Cost of Preparedness through Primary Education Cost has been the pivotal element in the present research. The effort has been to identify the activities in the context of adaptation and mitigation at grass root level that are feasible and practical for the communities. This has been determined through a consultative process. The emphasis has been on the right way and on right types of activities on a prioritised set of activities.

The objectives of the study are to demonstrate a) impacts of climate change on education and b) responses through education to the impacts of climate change in Maldives and Bangladesh. These two countries have been selected based on the following reasons. The number of countries had to be restricted to two due to time and fund constraint.



Figure 1.5: Background of the present research

## 7.0 METHODOLOGY

The research is based on the following

- Existing literature reviewed
- Gaps in knowledge and practice identified
- Gaps in knowledge addressed
- Good practice identified
- Making sure that the following have been considered in the present research
- the problem due to climate change: Impacts due to climate change,
- linked to National Priorities, Action Plans, Programmes
- learning component clear
- clearly outline Goal, Objective, and Outcomes
- outcomes explicit
- examining whether the mitigation and adaptation activities are the right way towards the goal and the funding spent the way they should be
- The following Figure shows the assumed pathways of impacts at school and its children due to climate change related disasters.
- Identification and understanding the mitigation and adaptation activities and their interrelations/ interdependencies and priorities in the context of education system starting from the Ministry level down to the school at community level

Participatory vulnerability assessment has been used to identify the mitigation, adaptation and interconnected activities which are primarily bottom up. This has been combined with the top down interventions through NAPA and similar recommendations.

- Participatory Vulnerability assessment/analysis to identify adaptation and mitigation

The following Table is a summary of the different methods used by the development agencies/ NGOs for community-based vulnerability analysis in Bangladesh.

All these tools are similar in terms of utility and efficacy towards community-based vulnerability assessment and action plans. While any one of the above could have been suitable in the present research, PVA by ActionAid was adopted in the present research because of its easy access, the quality and quantity of data and the ease of logistic arrangements with the NGOs for field verifications. ActionAid Bangladesh

has already launched a massive programme on Resilient Schools & Education Systems to combat Climate Change. The following Figure shows the overall process of the present research on Education and Climate Change in South Asia: impact and response through the Primary Education.

After carrying out the desktop research with support from the concerned agencies such as Disaster Management Bureau (DMB), Directorate of Education (DoE), Centre for Environmental and Geographic Information Services (CEGIS), Bangladesh Rural Advancement Committee (BRAC), ACTIONAID, Bangladesh, etc., a national level workshop was convened at Dhaka by involving the different Ministries, Development Agencies, NGOs and researchers.

Bangladesh had existing data on Participatory Vulnerability Analysis (PVA) carried out in 28 schools by ActionAid under a programme named “Disaster

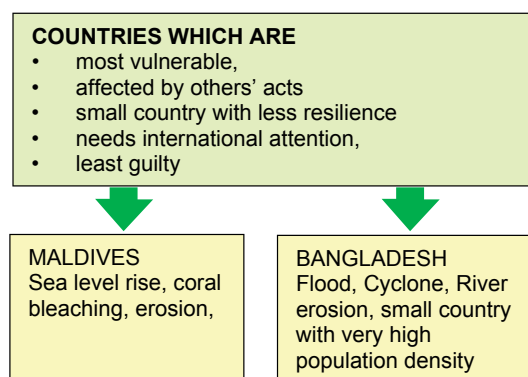


Figure 1.6 : The basis of selecting the countries under the present research

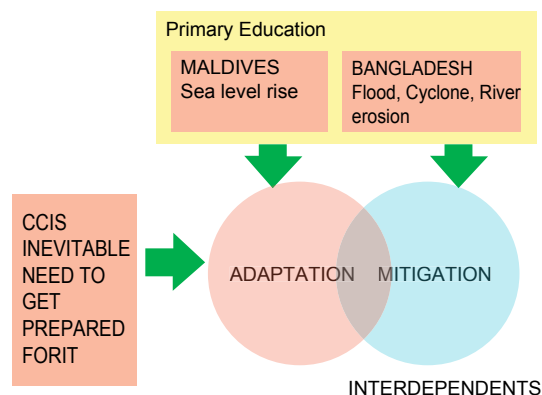
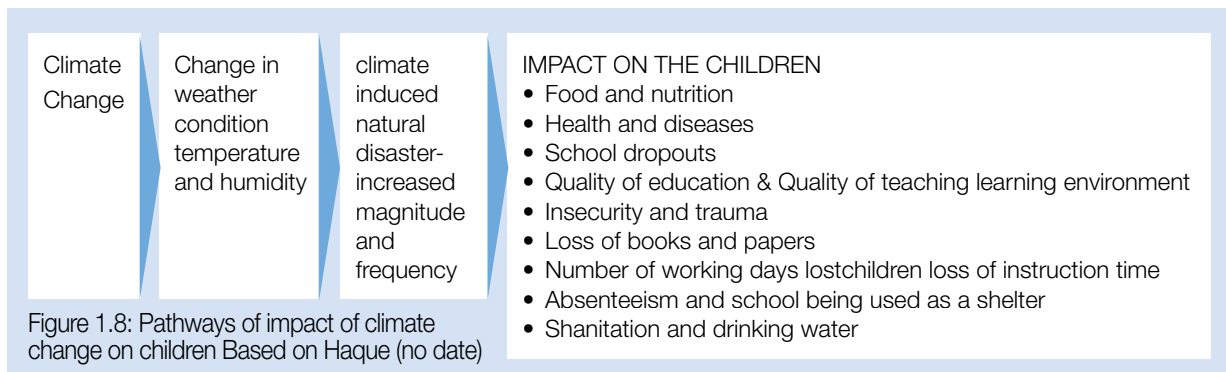


Figure 1.7: The position of school-based adaptation and mitigation in general context



Risk Reduction through Schools” (DRRS). PVA is process oriented and it is designed to induce ownership of the process, making people aware of their rights, etc. The lead consultant had visited a number of schools to verify the process and product of PVA. In all the schools visited, rapid PVA exercises were carried out for an in-depth understanding of the process. Similar methods (Annexure IX) in use were examined and the main reason for adopting PVA was quality and access to the data. One important aspect of the research is costing the interventions. While the report does not provide a final cost of interventions, it shows the different components of costing. Based on this, Bangladesh can carry out the costing at a later date after conducting a country wide survey.

There are nine Chapters in this report. Chapter 2 describes the context by introducing the geology, climate, culture, etc. Chapter 3 is on the hazard profile of Bangladesh, which is based on the available research papers. Chapter 4 carries out Situation Analysis by examining Bangladesh Climate Change Strategy and Action Plan (BCCSAP), NAPA, Millennium Development Goals and Disaster Management Action. This Chapter describes the present level of preparedness to combat the impacts of climate change in Bangladesh. Chapter 5 is on the primary education profile along with a discussion on the types of vulnerability of the children.

Chapter 6, on PVA, describes the process and types of outputs leading to community level adaptation and mitigation actions. Chapter 7 is on the Adaptation and Mitigation actions/programmes and activities that can be implemented/ promoted through

the primary education system of Bangladesh. Chapter 8 shows the different components of cost of interventions to cope with CC in Bangladesh. Chapter 9 summarises the present study.

The report is supported by nine Annexure. The PVA exercise reports by the three NGOs on 28 schools were voluminous. These contained PVA carried out by the teachers and the SMC, the guardians and by the students of each school. First of all a consolidated report was prepared for each school, which was followed by all school level consolidated report under one NGO. Finally a consolidated report for all NGOs was prepared. Therefore, the adaptation and mitigation actions put forward in this report are based on the consolidated report and not necessarily applicable to a specific school. The Annexure II provides school specific PVA reports which have the area specific adaptation and mitigation actions. It is envisaged that a computerised system will be developed in future that will link the school specific PVA with the EMIS data. This will provide a practical tool for the DoE to plan for sustainable primary education system in Bangladesh. The following Figure shows the methodology adopted in this research.

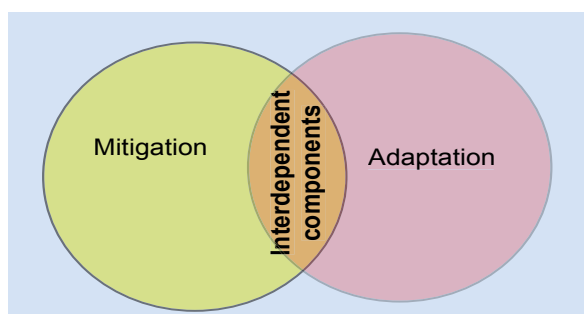
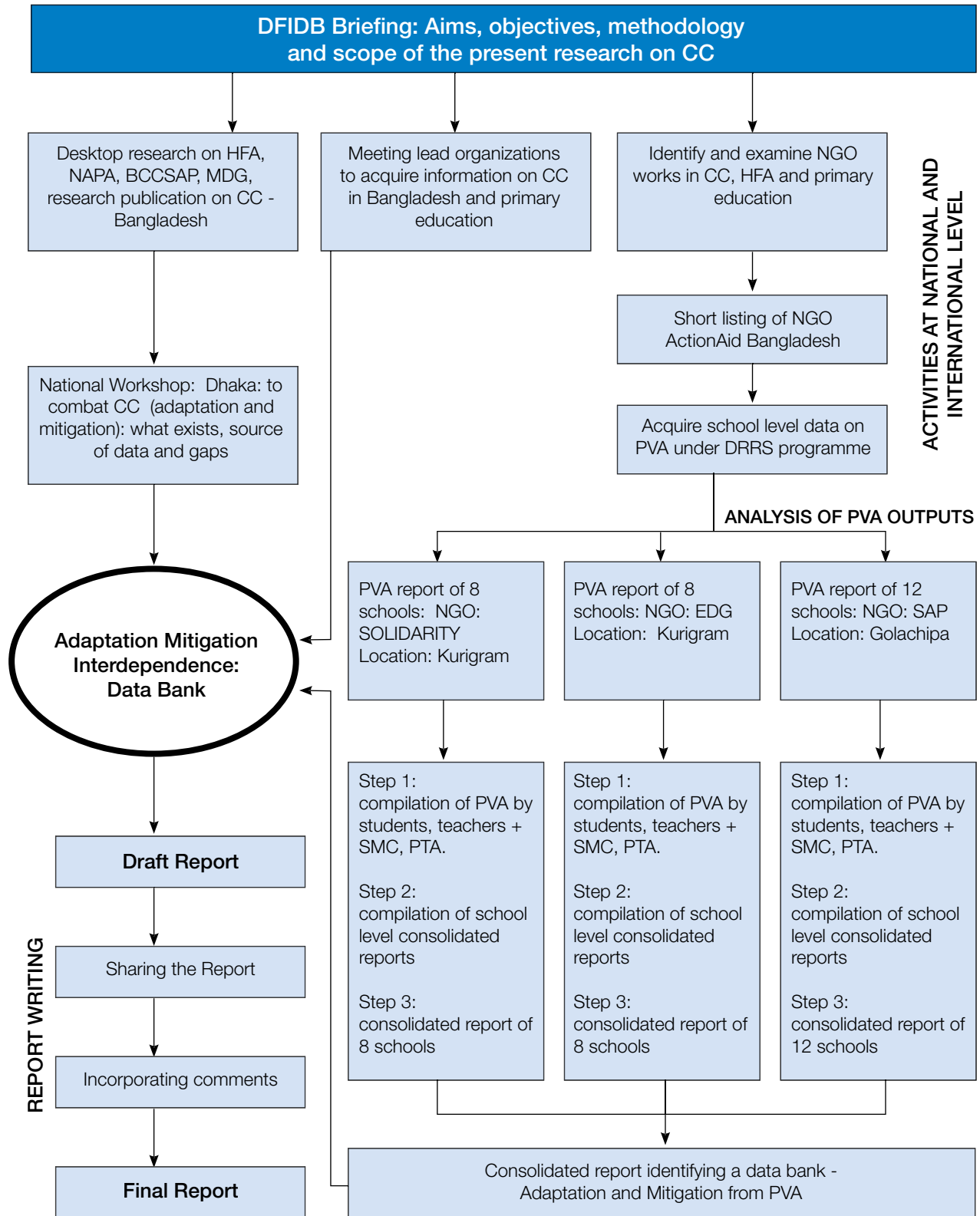


Figure 1.9: Diagram showing the mitigation and adaptation activities and the zone of interdependency



# Chapter 2

## THE CONTEXT

The main objective of this Chapter is to understand the context of Bangladesh in order to prepare for climate change. The context of the present research (in Bangladesh) has been briefly covered in this Chapter by describing the geography, geology, climate, cultural and socio-economy of the country. This Chapter ends with a very brief description of the environmental risk profile in the context of Bangladesh.

### 2.1 Geography

- Lies in the south of Asian subcontinent, the country share its boundaries with India and Myanmar.
- Its coastline runs along the Bay of Bengal.

### 2.2 Geology

Bangladesh is essentially formed by the sedimentation in the Bengal Basin within a series of isolated basins that contained alluvial to fluvio-deltaic deposits. Break-up of these basins along the northeast and southwest lines led to the separation of India from Australia/Antarctica.

Following the separation, India moved towards the north-east. The rapid northward movement of the Indian Plate resulted in the beginning of collision with the Asian Plate to the north. In the eastern part, the subduction of the oceanic unit below the Asian Plate led to the formation of the

Indo-Burma Ranges. On the other side there was rapid subsidence of the Bengal Basin. This led to increased sedimentation on the basins. With time, the growing collisions of the land plates along with frequent fall in the sea level led to the sedimentation of rocks on the deltaic and shallow marine systems. This led to the formation of the Ganges – Brahmaputra Delta system.



Figure 2.1: The geography of Bangladesh



## 2.3 Climate

- Tropical monsoon climate with wide seasonal variations.
- April is the hottest month, January is the coolest month.
- **HIGHEST TEMPERATURES recorded:**  
max. 41deg C min. 8deg C
- **ANNUAL RAINFALL recorded:**
  - Most parts of the country = 2300mm
  - Western regions (Rajshahi) = 1600mm
  - Greatest average rainfall is received by north-eastern regions (Sylhet) – location at foothills of Himalayas.
  - Annual rainfall in north-eastern regions = 3280 – 4780mm (1977 – 1986)

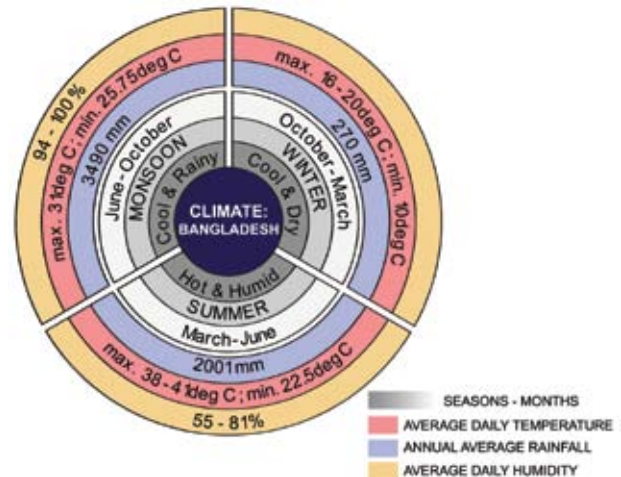


Figure 2.2: The climate of Bangladesh

## 2.4 Culture

- Language spoken: Bengali by about 98% (the National Language)
- Residents: 88% Muslims, 11% Hindus, 1% Buddhists, Christians, Animists.
- Rich historical and cultural past – Dravidian, Indo-Aryan, Mongol / Mughal, Arab, Persian, Turkic, and West European cultures.
- Rich in music, dance and drama; art and craft; folklore and folktales; languages and literature, philosophy and religion, festivals and celebrations and culinary traditions.



Figure 2.3: Culture of Bangladesh (religion, language, art, music, dance, drama, etc.)

## 2.5 Socio-Economy

Development of the infrastructure is mainly dependent on the agriculture. The supporting systems aiding the development of economy are industry and investment.

### Agriculture



- Account for 30% GDP.
- There is an increase in commercial farming and use of irrigation.
- Highly dependent on monsoon rainfall.
- Crops generated – rice, jute, sugar, wheat.

Figure 2.4: Agriculture – predominantly rice producing



## Industry



- Account for 20% GDP
- Country's domestic steel is generated from ship breaking
- Other industries – sugar, tea, leather goods, jute, newsprint, pharmaceutical, fertilizer

Figure 2.5: Industry in Bangladesh (ship breaking, jute industry, etc.)

## Fishing

There are hundreds of varieties of fish in Bangladesh. One of the delicacies is dried fish. About 1,004,164 tons of fish (67% from inland waters) were produced in 2000. Fish is a staple food of Bangladesh and the main source of protein and majority of its catch is consumed domestically. However, Bangladesh exports freshwater fish to India and its other neighbouring countries exports of fish products in 2000 had earned \$371.5 million. It is also a major source of frog-legs, which are “farmed” commercially. Fishermen’s cooperatives foster the use of modern fish-catching trawlers in the Bay of Bengal, and the government has established a fisheries corporation to stimulate production of freshwater fish for export.

## Tourism

While tourism is a slowly developing foreign currency earner, much of this industry remains unexplored. In the northern part (Rajshahi division) there is an exquisite temple city Puthia. Bangladesh has many archaeological sites. Mahasthangarh in Bogra district is the single largest Buddhist monastery. Apart from that, Paharpur in Naogaon; the richly ornamental terracota Hindu temple Kantaji, and many palaces of old zamindars (landlords) are potential tourist destinations in Bangladesh.

Sundarbans, the largest mangrove forest of the world, is distinguished for its Royal Bengal Tiger and spotted deer. It is situated in the south-



western part (Khulna Division) of Bangladesh. The historically and architecturally important sixty domed mosque in Bagerhat is a notable site. In the south-eastern part, (Chittagong division), popular tourist destinations range from natural beauty and scenic hilly terrain down to sandy sea beaches. The most notable one is the longest unbroken sandy sea beach in Cox's Bazar. In the north-eastern part, (Sylhet division), there is a green carpet of tea plants on small hillocks. Natural and reserved forests are great attractions.

Migratory birds in winter, particularly in the haor areas (physically a bowl/saucer shaped shallow depression) are also an attraction of this area.

### Foreign Investments

Foreign investment made by the Bangladesh Government has been successful in sectors such as private power generation, gas exploration and production, cellular telephony, textiles and pharmaceuticals.



Figure 2.6 : Tourism sites in Bangladesh

Source: <http://www.dhakaholidays.com/tour-operator-bangladesh-tourism-map.html>



Figure 2.7: Natural Disasters affecting Bangladesh

## 2.6 Environmental (risk profile)

Bangladesh with a high population density is spread over a relatively small area. It is prone to disasters such as flood, cyclone, tidal wave, inundation, salinity, earthquake, river erosion, drought, etc. According to NAPA (2005), it is well recognized that Bangladesh would be one of the most adversely affected countries to climate change. Low economic strength, inadequate infrastructure, low level of social development, lack of institutional capacity, and a higher dependency on the natural resource base make the country vulnerable to climate stimuli (including both variability as well as extreme events).

The socio-economy and the rich cultural heritage of Bangladesh have grown over a long time primarily in the context of its geography, geology and climate. Out of this, climate is going to change significantly in future affecting one of the most important ingredients of the socio-cultural existence- the livelihood of the people of Bangladesh. According to IPCC, UNICEF and many others, the worst affected due to climate change will be the small children. Therefore, there has to be a way out to save the children.

Worldwide campaign for reducing green house gas emission is talk of the day and negotiations are

- Annual disasters: floods, tropical cyclones, tornadoes, tidal bores.
- 1947 – 1988: 13 severe cyclone hit Bangladesh
- The country is affected by cyclones 16 times a decade (on average).
- Consequence – loss of life and property.
- Problems – CC, Population Density, Poverty, etc.
- Actions required
  - Serious consideration of CC
  - Strong political will and stability, regional and international level cooperation etc.
  - Check on interventions and their impacts to restrict situations leading to deterioration of present state.

going to reach a consensus about every country's commitment on emission control. However, even if a consensus on emission is reached, the climate is going to change to some extent and hence, there is a need for appropriate adaptation. To identify and accept the adaptations one must have a clear and accurate estimate of the degree of vulnerability that varies from place to place in Bangladesh. The following Chapter focuses on the hazard profile of Bangladesh.

## HAZARD PROFILE

### 3.1 HAZARDS IN BANGLADESH

Ahmed (2006) reported that, according to the Third Assessment Report of IPCC, South Asia is the most vulnerable region of the world to climate change impacts. It has been mentioned in the last Chapter that Bangladesh is in a high risk zone due to its exposure to a number of hazards. Bangladesh ranks high in the list of most vulnerable countries on earth due to a number of factors that include its:

- geological condition
- flat deltaic topography with very low elevation with respect to the sea level
- extreme climate variability that is governed by monsoon
- high population density and poverty
- majority of population is dependent on crop agriculture which is highly influenced by climate variability and change.

Despite its emphasis on achieving MDG, Bangladesh's potential to sustain its development is faced with significant challenges posed by climate change. Therefore, it is very important for the country to examine its vulnerability in terms of population and sectors at risk and its potential for adaptation to climate change.

As mentioned before, Bangladesh is exposed to a long list of natural hazards, such as, floods, river erosion, cyclones, droughts, tornadoes, cold waves, earthquakes, drainage congestion/ water logging, arsenic contamination, salinity intrusion etc. It has already been mentioned earlier that poverty, dependence on nature for food and livelihood have resulted in low level of resilience of Bangladesh. The problem has been compounded by high population density. The following is a description of the different types of hazards which are likely to increase in magnitude and frequency due to CC. While earthquake and tsunami have also been included in the description, so far there is no established relation between earthquake and CC. The reason for including this issue is that the buildings and infrastructure could be made safe while addressing other climate change related disasters.

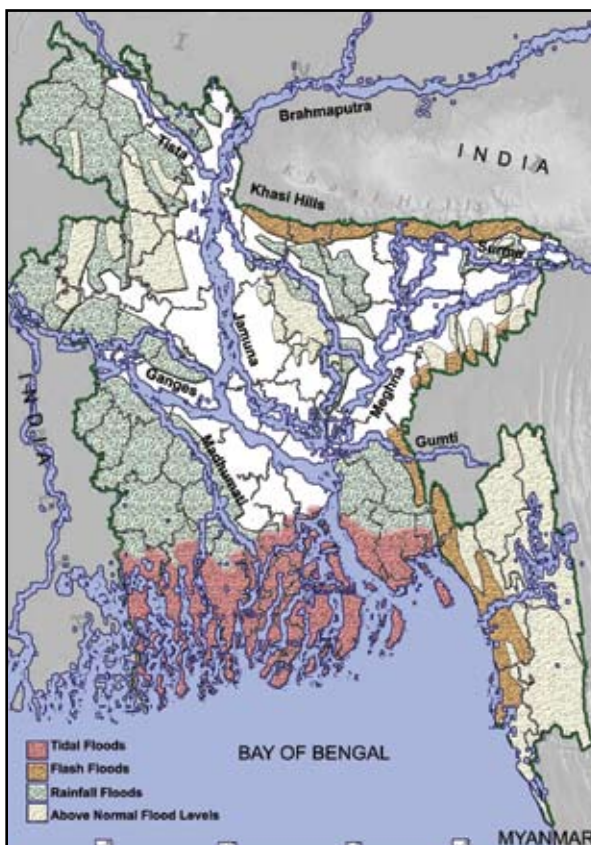


Figure 3.1: Flood types in Bangladesh  
(Based on: NPDM, 2008-2015)



### 3.1.1 Flood

Flood is almost an annual event in Bangladesh. It is the most severe during July and August. Regular river floods affect 20% of the country. There are past incidences of its increase up to 68%. Approximately 37%, 43%, 52% and 68% of the country is inundated with floods with of return periods of 10, 20, 50 and 100 years respectively (MPO, 1986). Flood in Bangladesh is categorized as (i) monsoon flood, increases slowly and decreases slowly, inundate vast areas and causes huge loss to the life and property; (ii) flash flood-from sudden torrential flows, following a brief intense rainstorm and (iii) tidal flood - short duration, height is generally 3-6m iv) rain floods caused by drainage congestion and heavy rain. The following map shows the zones of different categories of floods in Bangladesh.

The map in Figure 3.1 (NPDM, 2008-15) shows different categories of flood situation in Bangladesh. According to NAPA (2005), all land types except highlands are exposed to monsoon flooding for part or whole of the year. Figure 3.2 (based on NAPA, 2005:2), shows that 34% of land area experiences flood-water depth between 1.8m to 3m which is very high for the safety of the people especially the primary school children. About 60% of the total land area of the country experiences flood-water depth between 0.4m and 0.9m. It may be noted that 6% of the total land area of Bangladesh is permanently flooded.

During flood people are constrained to take shelter in nearby safe buildings since many live in weak buildings. Any building placed on highland is a possible flood shelter. In general, primary schools are easily available shelters for the flood affected people. They stay in the refuge for a while and get back to their homes as soon as flood water recedes. It may be noted that the use of school as flood shelter is not unique to Bangladesh. The neighbouring countries such as India, Pakistan, etc. also face the same problem. It will be morally indefensible to deny the flood affected people from using the school as a shelter during disaster. Having said that it is also important to state

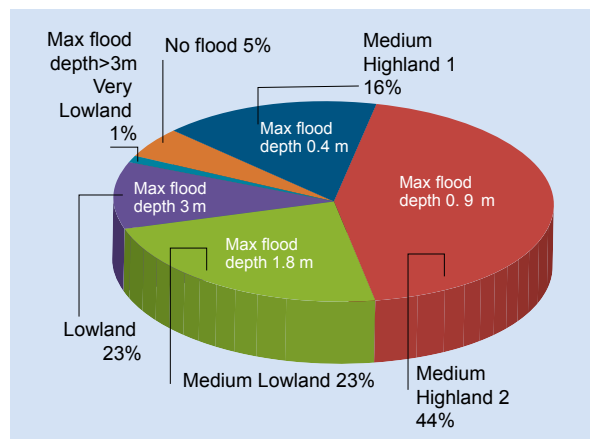


Figure 3.2: Distribution of land vulnerable to different flood-water depths (Based on: NPDM, 2008-2015)

that flood has a very highly negative impact on primary education, its infrastructure and facilities. The classrooms are damaged, vandalised and sometimes timber furniture is used as fuel for cooking. This is a major area of concern for Bangladesh and there is a need for cost effective solution to this perennial problem.

From Figure 3.2, it is apparent that the country faces a great challenge of flood which is likely to increase in magnitude and frequency due to climate change. The majority of the population in Bangladesh will be severely affected if flood is intensified in future. The normal functioning of the schools located in these areas will also be affected severely resulting in dropouts and lowering the quality of education. Each time there is a flood, the children stop coming to the school for a while till the families restore their livelihood loss and building damage.

Therefore, in order to cope with the changed situation there is a need for appropriate adaptations at community level. It will be cost effective to promote and disseminate the knowledge to cope with the problem through the primary school system which has presence in almost every corner of the country. Apart from that it will be cost effective to include climate change in the primary education through its curricula and extracurricular activities to inculcate a lifestyle change to cope with the changed situation. It is suggested that the department of education will emphasise creating sustainable flood resilient school environment.

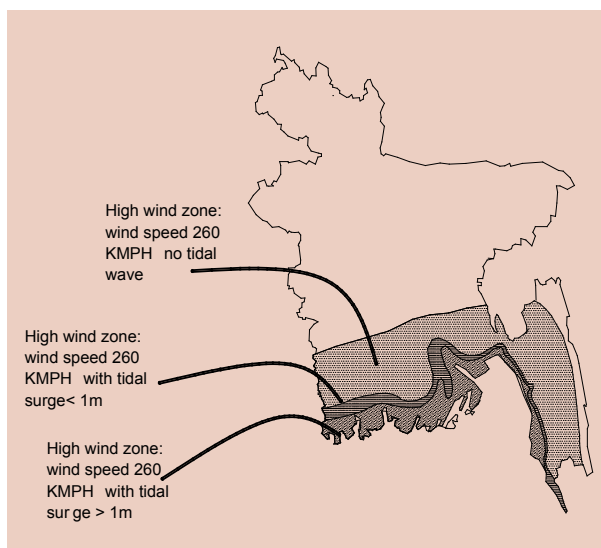


Figure 3.3: Cyclone prone areas of Bangladesh-  
Source: WARPO, 2005

### 3.1.2 Cyclones and Storm Surges

The coastal belt of Bangladesh is frequently hit by devastating cyclones. These are usually with high-speed winds, sometimes reaching 250 km/hr or more and 3-10m high waves, causing extensive damage to life, property and livestock. While cyclone destroys most of the vernacular buildings, very few permanent structures made in brick and RCC have been destroyed by the wind load. However, tidal wave sweeps away even such structures unless they are specially designed for water load, which is highly expensive. Careful site selection by considering the tidal surge map supplied by Meteorological Department is the most prudent way of protecting buildings from tidal waves. The following map shows the high cyclone areas with tidal wave. The Table below shows that most part of the country is susceptible to high wind.

Bangladesh is well known for its tropical cyclones from the Bay of Bengal accompanied by storm surges. These are one of the major causes of disaster 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 mostly associated with storm surges. Storm surge height in excess of 9m is not uncommon in this region. For example, the 1876

### DISTRICTS WIND SPEED KM/HR

Bagerhat	252
Khulna	238
Satkhira	183
Borguna	260
Potua khali	260
Bhola	225
Perojpur	260
Barishal	256
Gopalganj	242
Shariatpur	198
Madaripur	220
Chandpur	160
Jhalokathi	260

Table 3.1: Wind speed

Note: 130 KMPH is the least speed and 260 is the highest: BNBC 1993

cyclone had a surge height of 13.6 m and in 1970 the height was 9.11 m (WARPO, 2005). Among all others, the 1970 Cyclone was the most damaging, with a wind-speed of about 224 km per hour and associated storm surge of 6.1 to 9.11 Metres. It had killed about 3,00,000 people. There are a few maps showing the cyclone and tidal zones of Bangladesh. The one given in BNBC (1993) is old and needs upgrading. The map by SPARRSO (Figure 3.3) shows that the tidal heights in the southern coast can be more than 1 m which had been several metres in the past. Therefore, there is a need for an updated map along with code specifications in the BNBC.

To ensure safer shelters for the coastal people and people living in the vulnerable flood prone areas, the Government has already constructed 2033 cyclone and flood shelters. However, the increased population and the cattle heads require additional 2000 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 school-cum-shelter in the coastal areas. The other Ministries, Divisions, Organizations and NGOs will also construct about 300 shelters. Considering this, the MoFDM has decided to construct the remaining 1200 disaster shelters and

killas (livestock shelter) as per recommendations of the reports of the technical committee. However, it is very important to note that many cyclone shelters built in the past have deteriorated badly due to lack of maintenance and housekeeping. Therefore, community ownership is the key to the success of these life saving buildings designed for 100 years. There are adverse reports on the suitability of the killas, which needs re-examination in terms of suitability, design and technology.

### 3.1.3 Tornado

Local severe storms take place during the two transition periods between southwest and northeast monsoons over the Indian sub-continent. These are referred to as pre-monsoon (March-May), and post-monsoon (October- November) incidences. During the pre-monsoon period 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. Some of these are associated with tornadoes.

While wind-speed in a nor'wester may exceed 162 km/hr, they are generally within 113-130 km/hr. When the winds become whirling with funnel shaped clouds having a speed of several hundred kilometers per hour, they are called tornadoes. They can also cause a lot of destruction. Tornadoes 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 tornadoes.

### 3.1.4 River Bank Erosion

The impacts of river erosion are long term. It takes a few decades to make up the losses for a family. In Bangladesh, there has been inadequate progress towards improving the erosion-affected people primarily due to resource constraint.

Rivers in Bangladesh are highly dynamic. Sometimes the main rivers form islands or chars between channels. Many such Chars (fertile land) are inhabited. The people live there with a philosophy of "move with the flow". Many of these Chars are extremely sensitive to changes in the river conditions.

According a study in 1991, out of the 462 administrative units in the country, 100 were affected by 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). Kurigram, Gaibandha, Jamalpur, Bogra, Sirajganj, Tangail, Pabna and Manikganj districts are the erosion prone zones of Bangladesh. Along Padma River, there are erosion prone districts such as Rajbari, Faridpur, Manikganj, Dhaka, Munshiganj, Shariatpur and Chandpur.

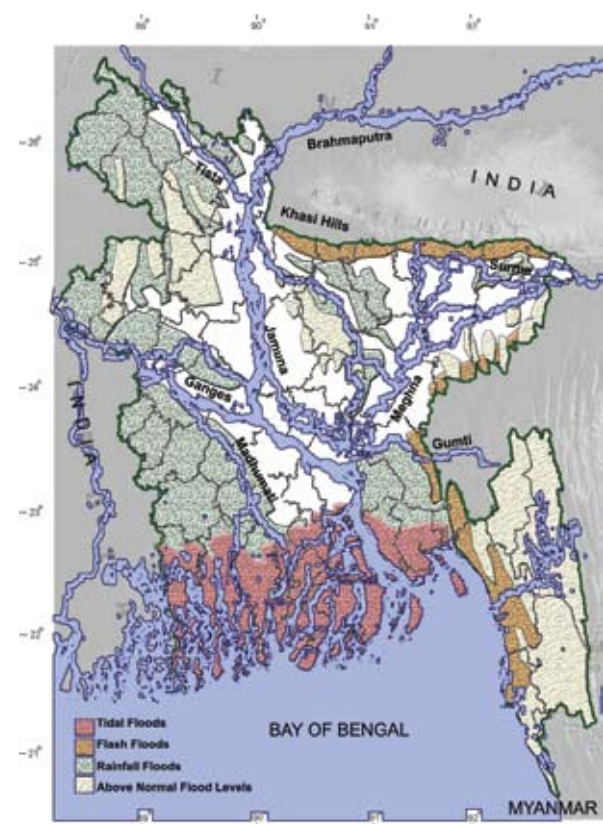


Figure 3.4: The red areas are prone to river erosion (Based on: NWRD 2001)



While community wisdom on responding to the disasters is a proven fact, this has reportedly been failed in the context of river erosion in the recent past. In Kurigram, North Bengal the local NGOs (Solidarity, Esho Desh Gori) reported that community wisdom to determine safe school location has been observed to fail since the river erosion was faster than envisaged.

River erosion has a deep and profound impact on every aspect of primary education. One of the most important ones is the total destruction of the school infrastructure. Since the school infrastructure is designed for at least fifty years, a premature loss poses additional burden on the education department in its already constrained budget. Sometimes a delay between the occurrence of such incidence and replacement of the school leads to increased dropout. Therefore, there is a

need for careful selection of site based on the GIS and making provision for transition school along with education supplies.

The EMIS department of the DoE can do the vulnerability mapping due to river erosion in school location. However, equipment, human resources and capacity are the major constraints for calculating the number of schools and children in the high risk zones. As a result, the present cost of sustaining such school environments is expensive. There are incidences of premature disappearance of school infrastructure. This poses additional burden to the DoE along with negative impacts on the delivery of high quality education, e.g., GPS at Madaripur went into Arial Khan river in 2007 that was built barely ten years back. Figure 3.4 shows the river erosion areas in Bangladesh. However, such map does not provide a lead for sustainable

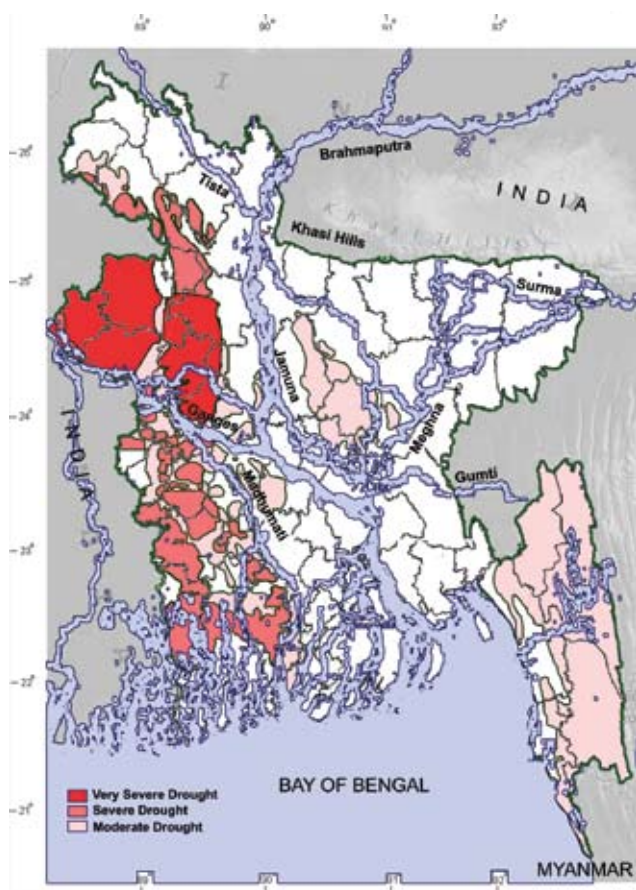


Figure 3.5: Possible drought affected areas in 2035  
Based on: NAPA, 2005:15

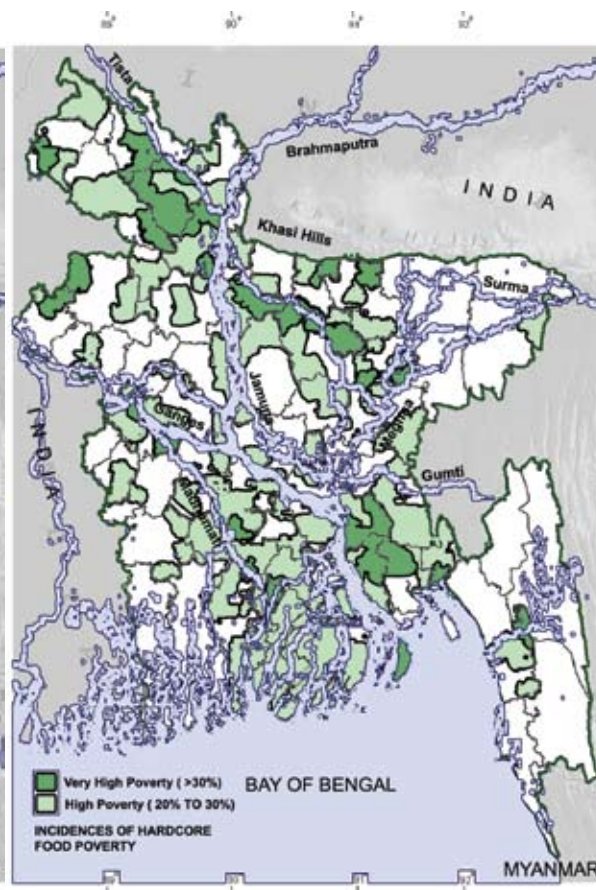


Figure 3.6: Spatial distribution of poverty in Bangladesh  
Based on NAPA, 2005:3

planning since there is a need for micro level maps along with contour and historical data on rate of change of river track to assess the degree of area specific vulnerability.

### 3.1.5 Drought

Droughts in Bangladesh can be categorised into three types as follows;

- Permanent drought are in regions with the driest climate, having sparse vegetation that is adapted to dryness
- Seasonal drought is due to abnormal rainfall-shortage in places with regular and well-defined annual rainy and dry seasons
- Unpredictable drought is due to an abnormal rainfall failure, mostly in localized areas of humid and sub-humid climates.

While droughts are not always continuous in any area, they do occur sometimes in the low rainfall zones. Rajshahi and Dinajpur regions are the most vulnerable areas for drought and heat wave which occur during the months of May and June. Drought affects not only the seasonal crops but also the fruit-bearing trees, forestry and the environment as a whole. Drought causes enormous suffering to the people. It is important to note that children are the most affected by the heat waves.

Management of utilising the water sources (both surface and ground water) is a key to combat drought. However, Bangladesh has increasingly used her ground water resources to such an extent that apart from the depletion of natural water arsenic contamination is occurring at alarming rate in the ground water reservoirs. Surface water utilization projects such as barrages across the rivers, installation of pumping plants for lifting water from the rivers are essential. In general

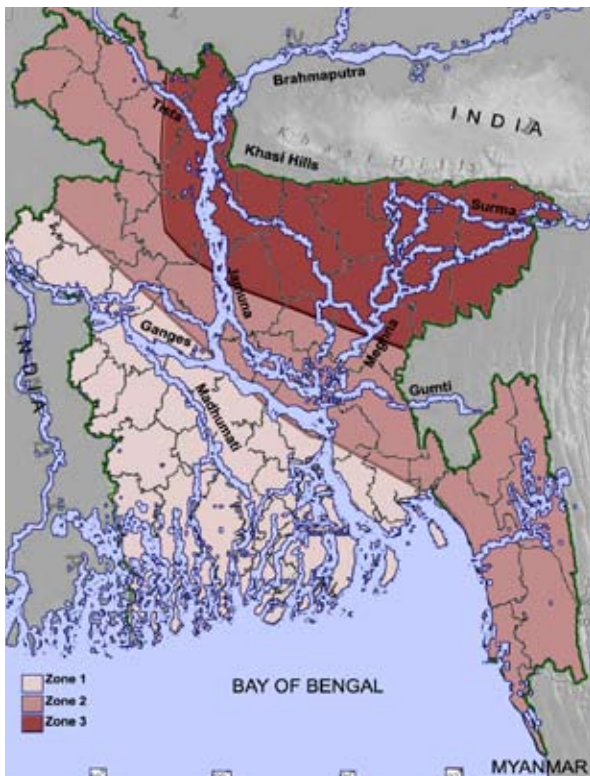


Figure 3.7: Seismic Map, Bangladesh  
Source: BNBC (1993) as reproduced by Choudhury, 2005

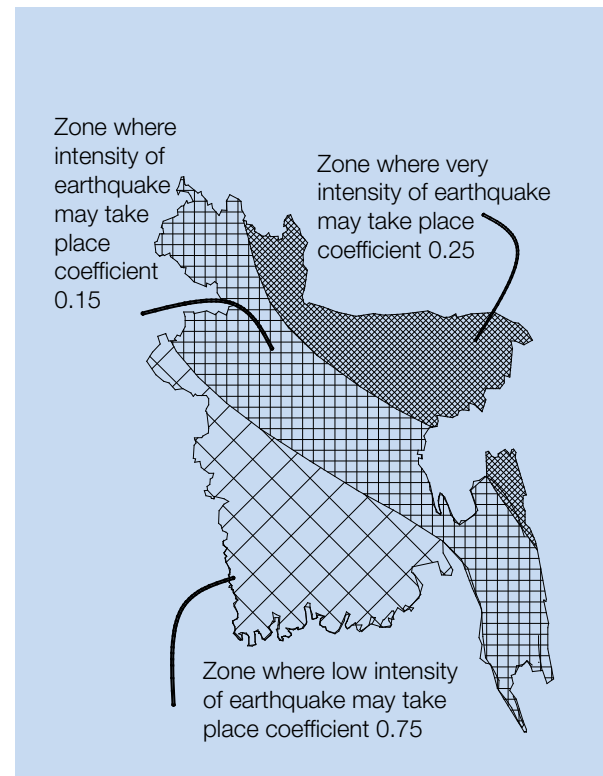


Figure 3.8: Seismic map  
Based on: Meteorology Department Dhaka, 2007



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serious threat to agricultural production is posed if drought continues for a prolonged period having the most negative impact on rice production. This adversely affects people's food, livelihood and health conditions. According to NAPA (2005) the frequency and intensity of drought will increase due to CC. Figure 3.5 shows the projected drought prone areas of Bangladesh in 2030.

There is a direct impact of drought and poverty. According to The United Nations World Food Programme (WFP) the poorest upazilas can be found in the north-west, the coastal belt, Mymensingh, Netrakona, Bandarban and Rangamati. In terms of absolute numbers, districts with more than one million people living in extreme poverty include Sirajganj, Naogaon, Bogra, Mymensingh and Chittagong (GOB and FAO, 2004). Since the children will be affected both by heat wave and food shortage, there will be immediate and long term negative impacts on the primary education in these areas.

Figure 3.5 shows that the north west of the country and Chittagong will have intensified drought in future. Considering the maps in Figure 3.5 and Figure 3.6 a comprehensive development plan could be prepared. However, this will require inputs from the grass root level in order to have a socially acceptable solution. Participatory Vulnerability Analysis (PVA) will be a useful tool in this regard.

### 3.1.6 Earthquake

Bangladesh and the north eastern Indian states have long been one of the seismically active regions of the world, and have experienced numerous high magnitude 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-epicentres have been recorded in Bangladesh and the surrounding areas.

A number of seismo-tectonic studies have been undertaken on the area comprising the Indo-Burman ranges and their western extension and in the northern India. A seismicity map of Bangladesh and its adjoining areas has also been prepared by BMD and GSB. Bangladesh has been classified into three seismic zones with zone-3 the most and zone-1 the least vulnerable to seismic risks (Figures below). The seismic maps of different agencies do not show the same zoning. This is evident in the two maps shown below.

The level of preparedness regarding seismic safety is low. A few NGOs are working in the field, however, the coverage is low and many people including the top government officials have not considered this to be a serious issue. The seismic retrofitting need of the primary education infrastructure is very high in Sylhet and parts of North Bengal.

While the relation between CC and seismicity has not been established, this issue has been considered in the context of its large scale devastating potential. Considering the level of primary school children's' casualty (Gujarat, India) due to the earthquake on 26th January, 2001, it will be morally indefensible to ignore this issue. Therefore, there is a need for an increased emphasis on seismic safety campaign, capacity building, inclusion of this issue in curricula, teachers training, seismic safe school building and non structural mitigation. However, the first and foremost activity is to develop an updated seismic map by the BNBC.

### 3.1.7 Tsunami

Underwater strong earthquakes, volcanic eruption or other undersea landslide usually causes tsunamis. Some tsunamis can be very large. In coastal areas their height can be as high as 9 metre or more, and they can move inland several hundred metres. A tsunami consists of a series of waves. Often the first wave may not be the largest. The danger from a tsunami can last for several hours after the arrival of the first wave. Tsunamis can move faster than a person can run. The most recent tsunami occurred on the 25th December



Table 3.2: Showing the different tsunami zones of Bangladesh

SL	Zone	Areas	Vulnerability
1	Tsunami Vulnerable Zone- I	(Chittagong-Teknaf coastline):	Most vulnerable. The intra-deltaic 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.
2	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.
3	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. Bangladesh needs detailed study to scientifically assess the Tsunami vulnerability. Bangladesh also needs to develop a Tsunami early warning system and mass awareness of Tsunami threat at the coastal areas

Source: National Plan for Disaster Management, 2008-2015:40

2004 with an epicentre at Indonesia. It had a catastrophic effect in parts of India and Sri Lanka. The following is a summary of the vulnerability of tsunami in Bangladesh.

The coastal belt of Bangladesh is prone to cyclone, high wind and tidal wave. Tsunami adds one more to the multi hazard situation of the coastal belt. In addition, some parts of the southern coast of the country have a salinity problem. All these are detrimental to the health, safety and food security of the people especially the small children. Therefore, the multi hazard nature of this zone of Bangladesh needs accurate EMIS and vulnerability situation for sustainable development of primary education system. This demands a high level of preparedness at school level since post disaster trauma along with physical abuse of the children; especially the girl children could leave

permanent negative impact in the household. The macro level maps (which are available) should be supplemented with micro level information which can be acquired through school-based vulnerability assessment of the communities and then made it part of the EMIS data. This bit of information needs to be updated once in two years.

### 3.1.8 Sea Level Rise Hazard

As mentioned earlier, the Intergovernmental Panel on Climate Change (IPCC) projected that global mean sea level is expected to rise between 9 and 88 centimeters by 2100, with a 'best estimate' of 50 centimeters (IPCC, 2001b). A warmer world will have a higher sea level.

The study shows that the rate of sea level rise during the last 22 years is many (4.0 mm/year at Hiron Point, 6.0 mm/year at Char Changa and 7.0

Table 3.3: Trend of tide height in three coastal stations

Tidal Station	Region	Latitude (N)	Longitude (E)	Datum (m)	Trend (mm/year)
Hiron Point	Western	21° 48'	89° 28'	3.784	4.0
Char Changa	Central	22° 08'	91° 06'	4.996	6.0
Cox's Bazar	Eastern	21° 26'	91° 59'	4.836	7.8

Source: SMRC, No. 3

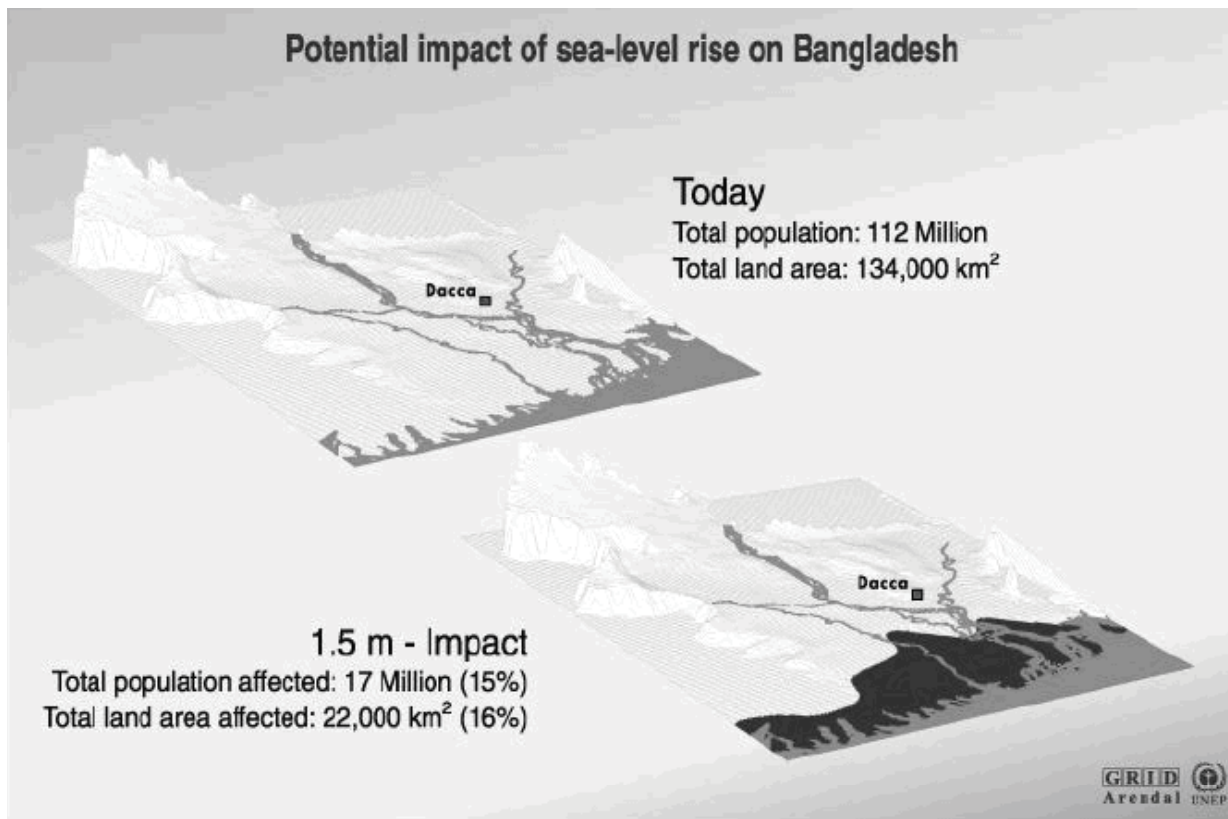


Figure 3.9: Potential impact of SLR on Bangladesh

Source: UNEP/GRID- Arendal 2001

mm/year at Cox's Bazar) times higher than the mean rate of global sea level rise over 100 years. The following Table shows the trend of tidal level in three coastal stations.

The following map shows the present and projected SRL in Bangladesh. The southern part of the country will be the worst hit by SLR. It may be noted that all the coastal districts are already highly vulnerable against cyclone, tidal wave and flood. With the SLR, the condition of primary education in this part of Bangladesh will be in jeopardy and hence, there is a need for being proactive in terms of dealing with the envisaged situation by the DoE. A long term preparedness is highly needed.

### 3.1.9 Landslide

All across the world landslides (large/small) occur almost every year. In the past, landslide was not considered to be a major hazard in Bangladesh.

However, recently landslide has emerged as a major hazard, particularly after the Chittagong Landslide in 2007. Due to heavy rainfall during 10-11 June 2007, landslide and collapsed walls caused widespread damages in six areas of Chittagong city and in different Upazilas of the district. More than 120 people have been reported dead due to Chittagong Landslide.

Landslide is a complex-disaster phenomenon that can be caused by earthquakes, volcanic eruptions, heavy rainfall (typhoons, hurricanes), sustained rainfall, heavy snowmelt, unregulated anthropogenic developments, mining, and others. In Bangladesh, landslide is mostly triggered by heavy rainfall. However, underlying causes of landslide include deforestation, hill cutting, unregulated development work, etc. Moreover, poverty and landlessness force poor people to live in the risky hill-slopes.

In the context of primary school design in the landslide zones, it is of utmost importance to develop a GIS map showing the danger zones and accordingly the safe locations of schools can be determined. Macro level map will not serve the purpose. There is a need for micro level information which, from the DoE's point view could be school based and can be acquired through PVA.

### 3.1.10 Arsenic Contamination

Arsenic contamination is a serious health hazard, which happens at slow pace and goes unnoticed for a while. 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 up to 57 million people in Bangladesh drink water that has arsenic concentration greater than the WHO prescribed value and up to 35 million drink water that has concentrations in excess of the Bangladesh standard. The waters in the southwest and southeast parts of Bangladesh are highly contaminated by arsenic.

In order to mitigate the risks, awareness building in the communities is of vital importance. The most cost effective one will be dissemination of the knowledge through schools. The children can easily adapt their life style to a changed scenario. However, national and international interventions are highly required to mitigate this problem. A school based campaign on rainwater harvesting will reduce the consumption of contaminated water for a few months every year.

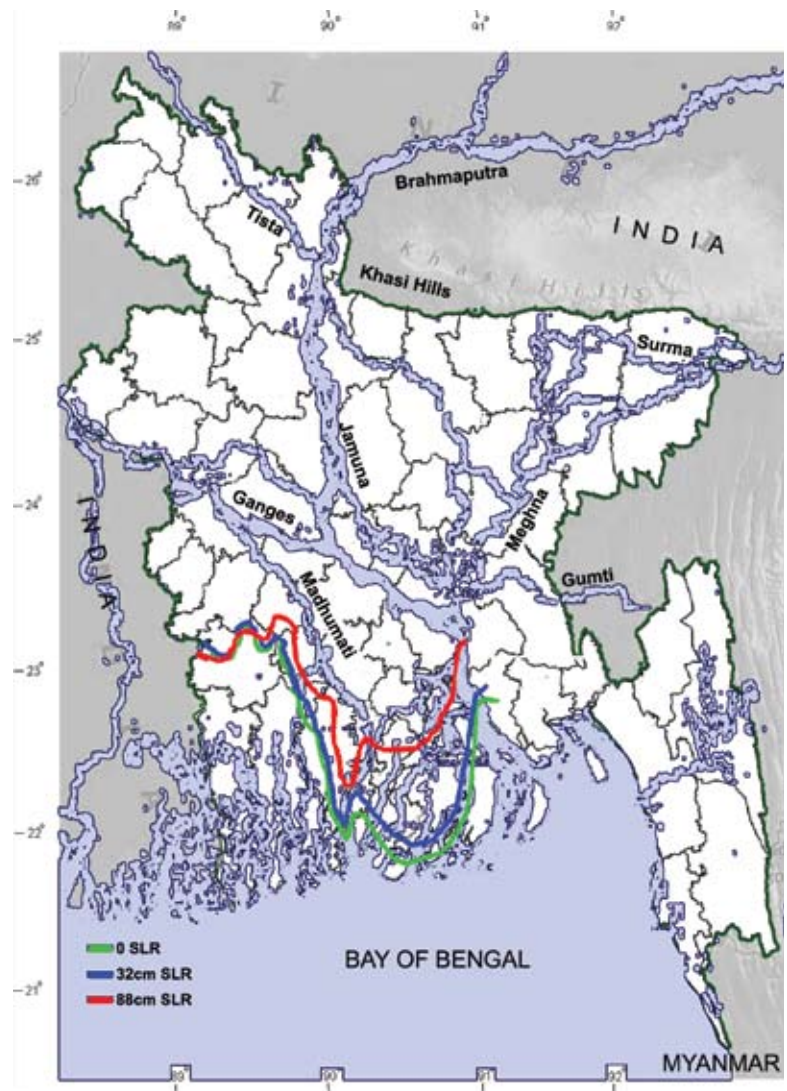


Figure 3.10: Line of equal salinity (5 PPM) for different SLR during the dry season: Based on CEGIS, 2006

### 3.1.11 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, mangrove forests, fisheries, livestock, infrastructure including buildings 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.

### 3.2 SUMMARY OF THE HAZARDS

The above section is a comprehensive documentation of different types of hazards existing in Bangladesh. This is based on available literature, internet, interviewing the specialists, NGOs, communities, etc. Most of these hazards are likely to increase due to climate change. The impact of such disasters on primary education will be very significant.

In order to combat this situation NAPA has put forward the following Figure showing the impacts of

climate change on different sectors. While there can be disagreements on how this chart was arrived at (e.g., what methodology was adopted and what were the assumptions), the communities' reports (during field visits) on the changed weather pattern do indicate that there is probably some degree of change in the weather pattern. It may be important to mention that communities' reporting was not straightway accepted as evidence since the anecdotal statements may not have high degree of reliability. Before carrying out the PVA exercises, the team carried out detailed studies on the scientific reports on climate change in those areas. With that as the background and by following the similarities in the different groups' reporting on climate change related weather conditions, change in weather pattern appeared to be a reality.

The following Figure shows the domain of impacts on the different sectors of Bangladesh due to climate change. It is important to make a note that almost all of these have direct impact on primary education, be it in the urban or in the rural areas. This will have a highly negative impact in the areas having poor and/or disadvantaged people with livelihoods dependent on natural environment. Its impact will be a large scale dropout, malnutrition, migration, damage to school properties, etc. There is an immediate need for a paradigm shift in primary education system to respond to climate change.

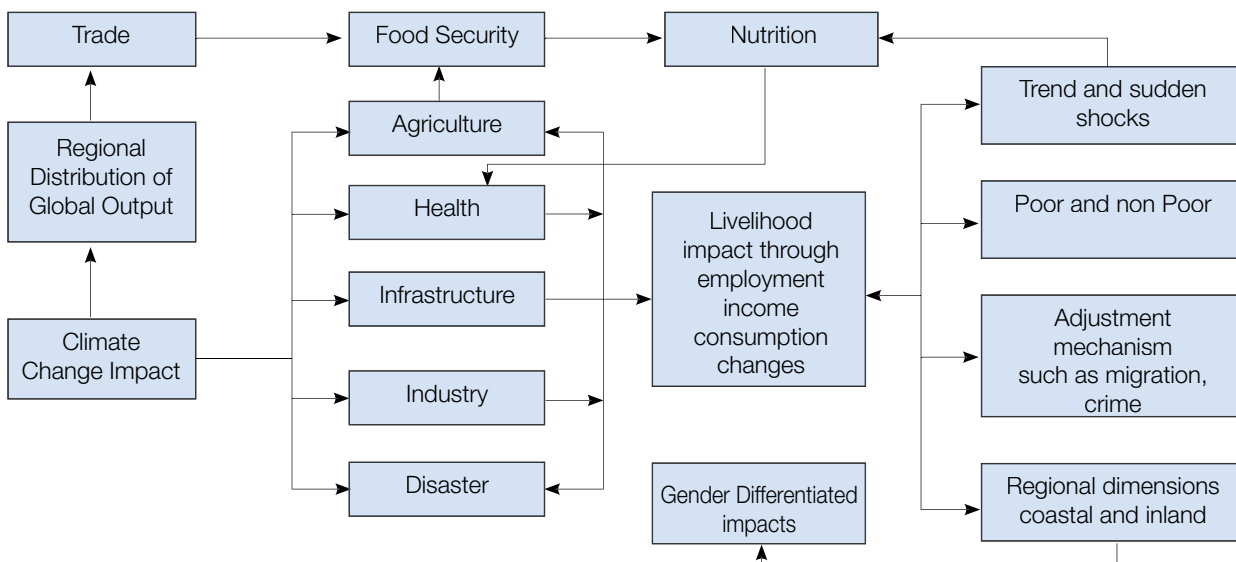


Figure 3.11: Impacts of CC on different sectors in Bangladesh: Source NAPA, 2005



Table 3.4: Intensity of impacts on different sectors due to Climate Change

Sectoral Vulnerability Context	Physical Vulnerability Context							
	Extreme Temperature	Sea Level Rise		Drought	Flood		Cyclone & Storm Surges	Erosion & Accretion
		Coastal Inundation	Salinity Intrusion		River Flood	Flash Flood		
Crop Agriculture	●	●	●	●	●	●	●	
Fisheries	●	●	●	●	●	●	●	
Livestock	●	●	●		●	●	●	
Infrastructure	●	●			●	●	●	●
Industries	●	●	●		●	●	●	
Biodiversity	●	●	●		●		●	
Health	●	●	●		●		●	
Human Settlement							●	●
Energy	●	●			●		●	

Based on NAPA, 2005

Legends: ● refers to high, ● refers to moderate, and ● refers to low level of relationship

The objective is to develop aware citizens by making sure that the young ones gradually internalise the adaptations to combat climate change.

Having discussed the various aspects of climate change and their impacts in general and primary education in particular, it will be worthwhile to study the relation between climate change and vulnerabilities in Bangladesh. In this connection let us analyse the following two Tables put forward by NAPA. The rows show the vulnerability contexts such as agriculture, fisheries, livestock, etc. The columns show the physical vulnerability contexts such as extreme temperature, SLR, cyclone, river erosion, etc.

The above table shows the intensity of impacts due to climate change. It is important to note that the negative impact of climate change related salinity intrusion has been under estimated. Increased salinity in the soil has a negative impact on durability and cost of the buildings. There are evidences of salinity related building deterioration in Patuakhali, and other coastal districts. The PWD specification book of Bangladesh has emphasised on quality control and higher specifications for

buildings in high saline areas. Therefore, salinity intrusion will increase construction costs and will also need special care regarding quality control. Without the latter, enhancing specification alone will not serve the purpose in terms of durability of the buildings. Here is a need for community involvement in infrastructure delivery to ensure the desired quality of construction.

It should be noted that the impact of cyclone and storm surge on infrastructure has been under estimated in the above Table. While there is increased preparedness in this regard, the cost of cyclone shelters is much higher both in terms of supply and maintenance. The present building code (BNBC) needs a review in the light of SIDR and its damage to the infrastructure. NAPA needs to look into this matter and update the above table.

The above discussion on the different types of hazards in Bangladesh tends to suggest that it is one of the most disaster prone areas of the world. Most of these are likely to increase owing to climate change. Some of the vulnerabilities have been tabulated below showing the causes and areas of impacts.

Table 3.5: Causes of impacts, vulnerable areas and impacted sectors  
Source NAPA, 2005

Climate and Related Elements	Critical Vulnerable Areas	Most Impacted Sectors
Temperature rise and drought	<ul style="list-style-type: none"> <li>• North-west</li> </ul>	<ul style="list-style-type: none"> <li>• Agriculture (crop, livestock, fisheries)</li> <li>• Water</li> <li>• Energy</li> <li>• Health</li> </ul>
Sea Level Rise and Salinity Intrusion	<ul style="list-style-type: none"> <li>• North-west</li> <li>• Island</li> </ul>	<ul style="list-style-type: none"> <li>• Agriculture (crop, livestock, fisheries)</li> <li>• Water (water logging, drinking water, urban)</li> <li>• Human settlement</li> <li>• Energy</li> <li>• Health</li> </ul>
Floods	<ul style="list-style-type: none"> <li>• Central Region</li> <li>• North East Region</li> <li>• Char land</li> </ul>	<ul style="list-style-type: none"> <li>• Agriculture (crop, livestock, fisheries)</li> <li>• Water (urban, industry)</li> <li>• Infrastructure</li> <li>• Human settlement</li> <li>• Health</li> <li>• Disaster</li> <li>• Energy</li> </ul>
Cyclone and Storm Surge <sup>1</sup>	<ul style="list-style-type: none"> <li>• Coastal and Marine Zone</li> </ul>	<ul style="list-style-type: none"> <li>• Marine fishing</li> <li>• Infrastructure</li> <li>• Human settlement</li> <li>• Life and property</li> </ul>
Drainage Congestion	<ul style="list-style-type: none"> <li>• Coastal Area</li> <li>• Urban</li> <li>• South West</li> </ul>	<ul style="list-style-type: none"> <li>• Water (navigation)</li> <li>• Agriculture (crop)</li> </ul>

However, such a table is very basic and there is a need to develop the latest multihazard map by involving various related agencies. At present there are too many maps available on the same topic in Bangladesh. Hence, there is an immediate need for convergence of the resources to arrive at a common set of maps relating to hazards. Apart from that a methodology for vulnerability assessment should also be carried out.

The EMIS database should be used to calculate the area specific interventions needed for sustainable development which is possible if CC issues are included in the primary education planning, programmes, projects in a cost effective manner. The above Table shows the domain of CC related disasters which should be the basis for upgrading the curricula and teachers training packages to make the primary education system

more resilient than its present state. The following is a multi hazard map produced after SIDR based on the then available database, which was primarily from the Meteorology department and other sources.

### 3.3 SUGGESTIONS

While CC has not so far been established to have any influence on earthquake and Tsunami, these issues have been included in the present discussion since some of the interventions under adaptation and mitigation could be an opportunity to take care of these hazards.

The flood, river erosion, cyclone and high wind are alarming. The magnitude of cyclone is likely to be similar to that of SIDR in Bangladesh and NARGIS in Myanmar. The multihazard map in the above

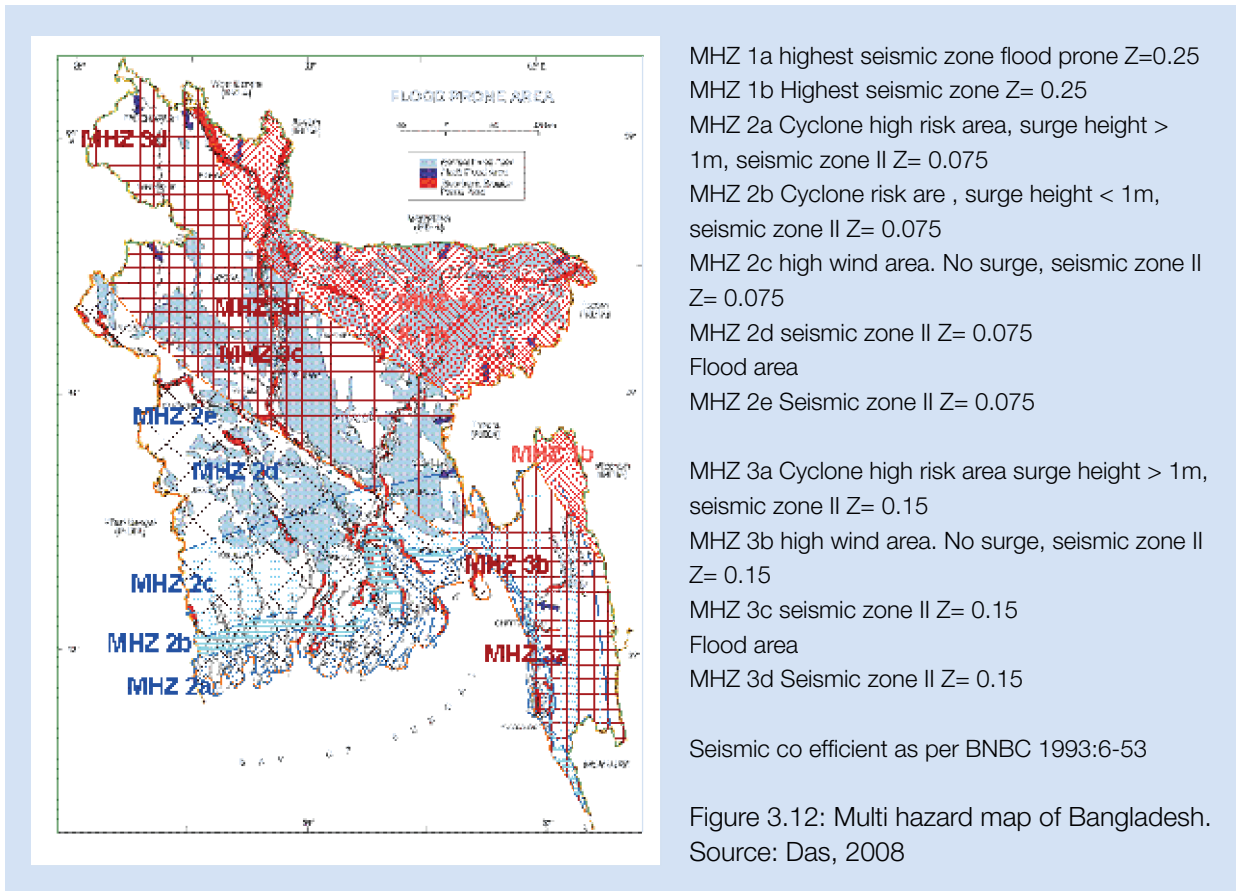


Figure shows that there is a wide variation in types of hazards in Bangladesh. This regional variation needs to be considered while constructing the school and other infrastructure. PVA reports may be used to assess the level of preparedness and gaps at planning level.

The building codes need reviewing and upgrading. The multihazard situation of the country should be reflected in the building codes. There is a need for training of the engineers, architects, contractors and the construction workers to be proactive to protect the country's infrastructure. It may be reiterated that inclusion of CC in course curricula,

text book, teachers' training and evaluation system will be the most cost effective way of adapting and mitigating the impacts of CC. The course curricula of architecture and engineering education also need review in the present situation.

At this point the issue is whether Bangladesh has the required preparedness to cope with CC. The following chapter examines the present level of preparedness of the country. The next Chapter examines BCCSAP, NAPA, Millennium Development Goals (MDG) status, etc. to understand the present status of its preparedness to combat CC.



## SITUATION ANALYSIS

### 4.1 CLIMATE CHANGE AND THE PHYSICAL ENVIRONMENT

Climate change adds a new dimension to community risk and vulnerability due to increase in global temperature. While the magnitude of the temperature rise may appear to be small, they are likely to substantially affect (magnitude and frequency) the existing climatic events (floods, droughts, cyclones etc). One of the most crucial issues of climate change in the context of Bangladesh is its low level of resilience to cope with the negative impacts. This is owing to poverty, dependence of the people on natural products and livelihood. Approximately 40% of the population still continue to live below the poverty line in Bangladesh (BBS, 2005).

NAPA recognises the CC induced challenges in terms of (a) scarcity of fresh water due to less rain and higher evapo-transpiration in the dry season, (b) drainage congestion due to higher water levels in the confluence with the rise of sea level, (c) river bank erosion, (d) frequent floods and prolonged and widespread drought, (e) wider salinity in the surface, ground and soil in the coastal zone.

Historically, the population living in the coastal area has suffered much more than in other areas due to frequently occurring cyclone, tidal wave, etc. Due to CC the agricultural sector will face significant yield reduction. Thus food-grain self sufficiency will be at risk in future. Considering these facts, it is important to understand the level of preparedness of the country to cope with the adverse impacts of climate change on its people. The following paragraphs examine the major interventions from the government's side. These are a) National Plan for Disaster Management 2008-2015, b) National

Adaptation Programme of Action (NAPA, 2005) c) Bangladesh Climate Change Strategy and Action Plan (BCCSAP, 2008). The cross cutting issue is the Millennium Development Goals (MDG). It has been envisaged that the MDGs of Bangladesh will be adversely affected by the impacts of climate change by slowing down the progress towards the targets. The following is a comprehensive discussion on these issues which will highlight the level of preparedness of Bangladesh in the context of CC.

In line with the main objective of the present research, the following discussion will be focused on the impact on primary education due to climate change. This research also probes into the domain of primary school-based response to CC through appropriate adaptation and mitigation actions at grass root level.

### 4.2 NATIONAL PLAN FOR DISASTER MANAGEMENT (2008-2015)

To streamline activities of the Government of Bangladesh towards facilitating adaptation to climate change, the Climate Change Cell (CCC) has been established under the Ministry of Environment and Forest – one of the focal points on climate change issues. Within the Department of Environment, the 'Cell' has been operating with support from the Comprehensive Disaster Management Programme (CDMP), the DFID and the United Nations Development Programme (UNDP).

National Plan for Disaster Management (2008-2015) was formed to support the national and international commitments of the Government of Bangladesh (GoB) and the Ministry of Food and Disaster Management (MoFDM) for addressing the disaster risks comprehensively.



Table 4.1 Disaster management action matrix 2008-2015

Strategic Goal	Key targets
2.0 Mainstreaming Disaster Risk Reduction	2.3 Disaster risk reduction considerations incorporated in NGO programmes and plans
3.2 Create a national training capacity to sustain and progressively expand the training efforts.	3.2.3 All training institutes used the updated module for disaster management
4.0 Empowering At Risk Communities.	4.1 Develop and establish a standard assessment procedure to identify community and household level risks 4.2 Establish a disaster risk reduction action planning framework 4.3 Strengthen community and household level capacity to withstand the disaster situations
5.0 Expanding Risk Reduction Programming across hazards and sectors	Across Hazards: 5.1 Update hazard maps such as flood, cyclone, drought, earthquake and tsunami 5.2 Establish an Integrated Approach to disaster management including Climate Change and climate variability impacts 5.3 Construction of adequate multi-purpose Cyclone and Flood Shelters in cyclone and flood prone areas 5.4 Preparedness for Earthquake and Tsunami risks Across Sectors: 5.6 Develop and establish policy and planning frameworks to incorporate all hazard risk reduction perspectives into sectoral policies and development plans
6.0 Strengthening Emergency Response Systems	6.3 Establish an effective Community Alerting System through capacity strengthening of CPP and DMCs at District, Upazila and Union levels 6.5 Develop and establish emergency response plans 6.6 Develop and establish post disaster recovery and reconstruction mechanism

Source: National Plan for Disaster Management-Final draft 2008-2015  
Disaster Management Bureau Ministry of Food and Disaster Management May 2008

A plan has been developed to reduce the vulnerability of the poor to the adverse effects of natural, environmental and human induced hazards to a manageable and acceptable humanitarian level. It addresses the key issues like risk reduction, capacity building, climate change adaptation, livelihood security, gender mainstreaming, community empowerment and response and recovery management.

A Comprehensive Disaster Management Programme (CDMP) has been designed as a long-term programme of the Ministry of Food and Disaster Management to optimize 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 these events.

MoFDM, is implementing Cyclone Preparedness programmes (CPP) in the 12 coastal districts of the country to minimize loss of lives and properties in cyclone by strengthening the disaster management capacity of coastal people of Bangladesh. The main activities of Cyclone Preparedness Programme (CPP) are to (a) disseminate cyclone-warning signal to local residents; (b) assist people in taking shelter (c) rescue victim affected by a cyclone, and (d) provide first aid to people injured in cyclone.

The Plan has envisaged covering the following crucial aspects for Disaster Management:

- (a) Analyse the natural and man-made disaster threats to their people and society, economy and infrastructure, with a view to identifying where and when these threats are likely to occur and with what frequency
- (b) Identify by further detailed analysis who and what are vulnerable to the occurrence of these threats and how these are likely to be affected in future
- (c) Investigate what measures are possible to prevent occurrences of the human induced disasters, what can be done to mitigate the effects of disasters and what disaster preparedness measures can be put in place in anticipation
- (d) Determine where responsibilities for prevention, mitigation and preparedness, planning and action should lie in Government, in the non-government organisations (NGOs) and in the private sector
- (e) Make provision in the national budget for funding of activities related to Disaster Reduction and a contingency fund to meet the immediate needs of disaster relief, at all administrative levels
- (f) Ensure that the costs of disaster relief and post-disaster recovery are managed and co-ordinated by a high level committee to avoid duplication or waste across the spectrum of donor agencies, including government, national and international NGOs and the private sector
- (g) Ensure an effective system within Government to link and co-ordinate the processes of planning and the management of sustainable development, environmental management and disaster reduction

Out of a long list of strategic goals and key targets, the education related items were identified in the National Workshop at Dhaka. The participants of the workshop were from various government agencies, leading NGOs and researchers. The following is an extract (primary education related only) from the complete actions planned by the ministry.

### 4.3 THE MILLENNIUM DEVELOPMENT GOALS

The following is the summary of Bangladesh's progress towards achieving MDG. This is based on the Millennium Development Goals: Bangladesh Progress Report 2008.

From the Bangladesh Progress Report on MDG, it is apparent that there is a need for more attention to most of the targets than at present. Poverty is still a major concern. There has been slow growth of the employment rate at the national level. In 2006, the adult employment rate was 58.5 percent. The average annual growth rate of adult employment for the last six years has only been 1.1 percent. The estimated national adult employment rate will be 65 percent in 2015, while the target is employment for all. A low female employment rate holds back the total employment rate.

The challenges under Goal 1 include reducing the income inequality and enhancing economic participation of women in the country. There is a need for interventions to focus on the marginalized population, especially in the coastal belt and munga-prone areas. Goal 3 deals with gender parity. Bangladesh has already achieved gender parity in primary and secondary education at the national level. In 2007, girls' representation was more than that of the boys (52:48) at the primary level. Similarly, the girls-boys ratio at the secondary level in 2006 was 52:48. This positive development has occurred due to some public sector interventions focusing on girl students, such as stipends and exemption of tuition fees for girls in rural areas, the stipend scheme for girls at the secondary level, etc.

Bangladesh has performed well in the context of HIV/AIDS, malaria and tuberculosis. However, prevalence of underweight children is a matter of concern since it was 48 percent at the national level in 2005.

Almost half of the area of Bangladesh has some kind of tree coverage. Approximately 19.2 percent of the land has tree cover, which is considered as

Table 4.2 List of education related activities under NAPA, 2005

Activities:
Reduction of climate change hazards through coastal afforestation with community participation.
Adaptation to agriculture systems in areas prone to enhanced flash flooding in North East and Central Region
Providing drinking water to coastal communities to combat enhanced salinity due to sea level rise.
Reviewing existing condition of cyclone shelters
<ul style="list-style-type: none"> <li>• Improvement of design criteria in context of climate change</li> <li>• Adoption of new criteria in construction of new shelters</li> <li>• Engineers for designing shelters</li> </ul>
Climate change and adaptation information dissemination to vulnerable community for emergency preparedness measures and awareness raising on enhanced climatic disasters
Inclusion of climate change issues in curriculum at secondary and tertiary educational institution.
<ul style="list-style-type: none"> <li>• Develop an appropriate curriculum on climate change impacts and adaptation for primary school students</li> <li>• Develop an appropriate curriculum on climate change for secondary school students.</li> <li>• Incorporate the courses on climate change into the school curriculum</li> </ul>
Development of eco-specific adaptive knowledge (including indigenous knowledge) on adaptation to climate variability to enhance adaptive capacity for future climate change.
Promoting adaptation to coastal crop agriculture to combat increased salinity.
Development of eco-specific adaptive knowledge (including indigenous knowledge) on adaptation to climate variability to enhance adaptive capacity for future climate change.
Focus on the most vulnerable communities in each eco-region (with emphasis on women, children and the elderly).

the forest coverage of the country. It is estimated that the target of high-density tree coverage of the country (20 percent) will be achieved by 2015. Carbon dioxide and CFC emissions by Bangladesh are very low. Access to safe water for all is a challenge, as arsenic and salinity have drastically reduced safe water availability. About 39.2 percent of the population has access to improved sanitation system.

Out of the three indicators under Goal 2, the net enrolment rate in primary education is on track and the target will be achieved before 2015. The net enrolment ratio in 2007 was more than 91 percent, with dominance of girls' enrolment. If this trend continues, the target of enrolment may be achieved within 2015. However, quality of education is still a matter of concern considering the large number of multiple shift schools in Bangladesh (Das, 2007).

The completion rate of primary education for boys was less than 49 percent in 2007. In 2015, two-third of the school-going children will complete their primary education. The completion rate varies disproportionately across the country. It was very poor in Rajshahi Division, with a higher dropout rate in the monga-prone areas and in the Padma-Jamuna- Brahmaputra basin. The completion rate was comparatively better in Khulna and Barisal Divisions. A higher completion rate (more than 60 percent) was found in 15 districts in the southern areas of Bangladesh. 56 percent of the people were literate in 2007. The adult male literacy rate was 63 percent, whereas the adult female literacy rate was 54 percent.

Poverty leads to student absenteeism in general due to the high opportunity cost and other hidden costs of attending school. A significant number of

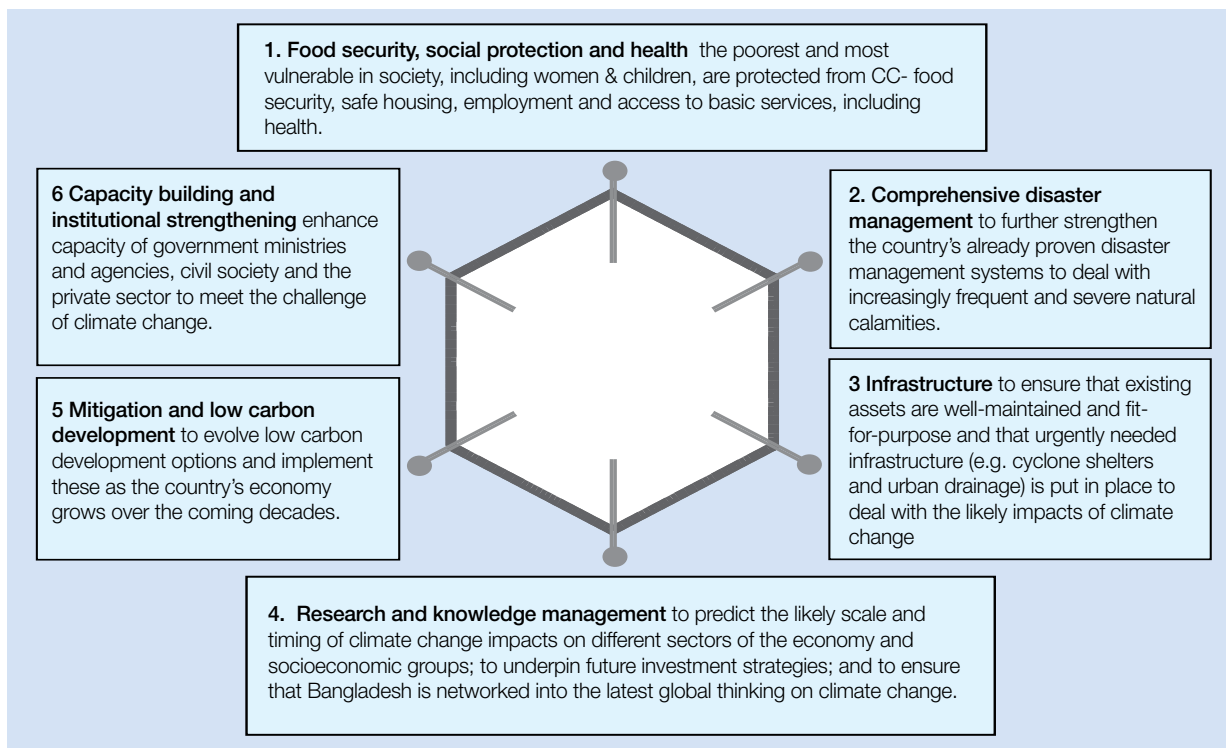


Figure 4.1: The six pillars of BCCSAP, 2008

students are from the marginalised and vulnerable classes in rural areas, urban slums, coastal and tribal areas. A large part of the physically and mentally retarded children remains out of the schooling system. Quality of education is also a challenge at primary education, in particular for the public schools. There are varieties of actions that have been taken by the government at the program and policy levels in order to retain students in the schools. The ongoing interventions include the food for education program, the girl children's scholarship scheme at the primary and secondary levels, etc. These programmes have been introduced to increase retention.

#### 4.4 NAPA AND NATIONAL DEVELOPMENT

The National Adaptation Programme of Action (NAPA) is prepared by the Ministry of Environment and Forest (MOEF), Government of the People's Republic of Bangladesh as a response to the decision of the Seventh Session of the Conference of the Parties (COP7) of the United Nations Framework Convention on Climate Change (UNFCCC).

The strategic goals and objectives of future coping mechanisms are to reduce adverse effects of climate change including variability and extreme events and promote sustainable development. Future coping strategies and mechanisms are suggested based on existing process and practices keeping main essence of adaptation which is a process to adjust with adverse situation of climate change.

Considering the above background, a series of adaptation measures have been suggested for Bangladesh to address adverse effects of climate change including variability and extreme events based on existing coping mechanisms and practices. The following is an excerpt from the main list, which is education related.

Climate change will affect large parts of the country over very long periods of time (several decades). Therefore it is imperative that the younger and future generations are made aware of the problem (and solutions) of the climate change impacts by getting such knowledge incorporated into the school curriculum at both secondary and primary levels.



Table 4.3: Actions/programmes/activities for addressing CC. Source: BCCSAP, 2008

Programme	Themes	Action	Time line
T1P3	T1. Food Security, Social Protection and Health P3. Adaptation against drought	A1.Prepare GIS maps of areas vulnerable to droughts	Short to medium term
T1P6	T1. Food Security, Social Protection and Health P6. Adaptation in health sector	A1. Research on the impact of climate change on health A2. Develop adaptive strategies against outbreaks of diseases	Medium to Long term
T1P7	T1. Food Security, Social Protection and Health P7. Water and sanitation programme for climate vulnerable areas	A1. Monitor changes in water quality and quantity due to climate change A2. Plan & invest in additional water supply & sanitation facilities	Short, medium and long term
T2P2	T2. Comprehensive Disaster Management P2. Improvement of cyclone and storm-surge warning	A2. Improvement in warning dissemination to local communities	Immediate
T2P3	T2. Comprehensive Disaster Management P3. Awareness raising and public education towards climate resilience	A1. Awareness of communities- impacts of CC A2. Train local communities on shelter management, search and rescue & health	Immediate and continuing
T3P1	T3. Infrastructure P1. Repair and maintenance of existing flood embankments	A1 GIS- condition of flood embankments A2 Immediate repair and rehabilitation of existing embankments, etc	Immediate
T3P2	T3. Infrastructure P2. Repair and maintenance of existing cyclone shelters	A1 GIS - showing cyclone shelters A2 immediate repair and, redesign of cyclone shelters, including their approach roads	Immediate
T3P5	T3. infrastructure Programme P5. Adaptation against floods	A2 Flood Vulnerability Map based on future projected CC A4 Flood Plain Zoning	Medium to long term
T3P6	T3. Infrastructure P6. Adaptation against future cyclones and storm-surges	A4 coastal green belts A5. Repair, maintenance, of cyclone shelters	Medium to long term
T3P7	T3. Infrastructure Programme P7.Planning, design & construction of river training works	A1 GIS maps of erosion prone areas	Medium to long term
T4P4	T4. Research, and Knowledge Management P4. Monitoring of ecosystem and biodiversity changes and their impacts	A2. monitoring systems by school teachers, communities and academic researchers	Medium to long term
T5P4	T5. Mitigation and Low Carbon Development P4.Renewable energy development	A1. Investments to scale up solar power programmes	Immediate
T5P7	T5. Mitigation and Low Carbon Development P7.Afforestation and reforestation programme	A4 Support existing forestry and enhance carbon sequestration	Immediate and continuing
T6P4	T6. Capacity Building and Institutional Strengthening P4. Strengthening institutional capacity for climate change management	A1. inter-ministerial and inter-institutional coordination at various levels	Immediate

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#### 4.5 BANGLADESH CLIMATE CHANGE STRATEGY AND ACTION PLAN (BCCSAP)

Following the COP13 at Bali, Indonesia, the Government of Bangladesh increasingly felt the need for a climate change strategy to carry forward and coordinate activities in support of the Bali Action Plan. Subsequently, the Government has developed the Bangladesh Climate Change Strategy and Action Plan (BCCSAP, 2008). The BCCSAP has been prepared through a fully consultative process involving government, civil society and development partners. Its main purpose is to articulate a strategy to manage climate change and its impacts in Bangladesh leading towards an action plan of programmes addressing the needs for substantive interventions with a definitive timeline for their implementation.

The thrust of the strategy is on sustainable development, poverty reduction and increased well-being of all vulnerable groups in society with special emphasis on gender sensitivity. BCCSAP is based upon six pillars or broad areas of intervention (not necessarily mutually exclusive). The BCCSAP sums up Bangladesh' s current thinking on desirable activities to build climate resilience into the economy and society of Bangladesh through adaptation to climate change as well as mitigation for a low carbon development path.

There are 37 programmes listed in Annex 1 of BCCSAP. The annotations for justification, the kind of activities to be undertaken and the responsible ministries/agencies for each of the programme within the six pillars are also provided in the Annex 1 of BCCSAP. The following is an excerpt from the Annex 1 of BCCSAP which is education related.

The following Figure summarises the actions suggested by the different agencies in the context of disaster and climate change. As mentioned before, only the primary education related issues have been considered in the diagram below

Figure 4.2 shows the top down approach of responding to CC through the primary education system. Therefore, primary education may consider this as the premise for its response to CC and

facilitate favourable ground for lifestyle change to adaptation for the future generation.

Bangladesh is one of the most climate vulnerable countries in the world and is recognised by NAPA to 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.

NAPA has a comprehensive plan of action to cope with CC. However, Thomala et al (un dated) state that, in view of the apparent mismatch between the information available and the information required at different scales, there is a concern that the NAPAs may not be able to fully consider local knowledge and local priorities regarding climate variability and change due to limited time and resources. This is obvious since NAPA is a top down system. It is expected that the outputs of PVA exercises at school level will feed the NAPA as a bottom up and grass root level data and information.

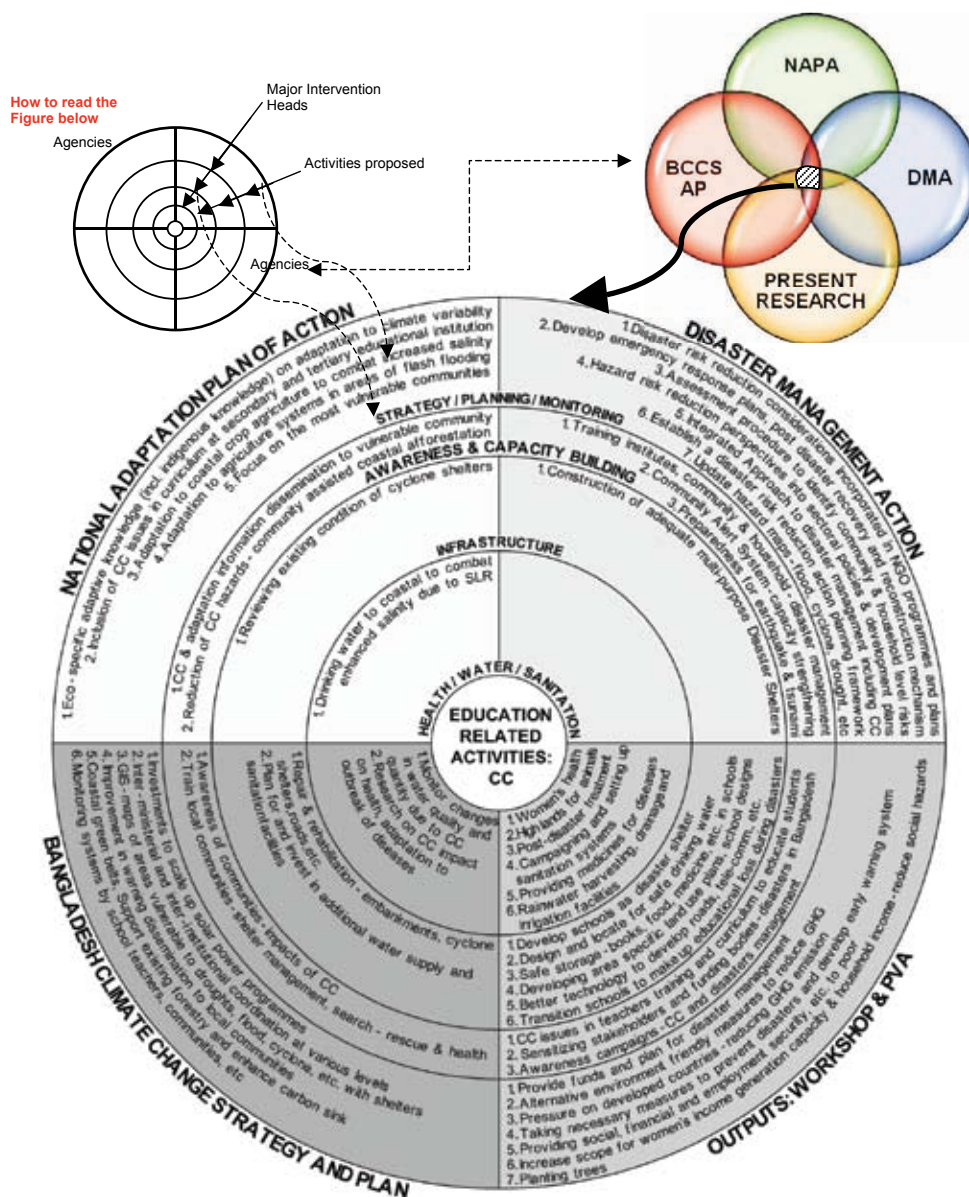
In Bangladesh, almost two-third of the 40 million strong labour force is engaged in agriculture and related activities. Low level of economic development and corresponding low investment capacity, inadequate infrastructure, low level of social development, lack of institutional capacity, and a high dependency on the natural resource-base make the country highly vulnerable to climate change.

The ultimate key impacts of climate change and variability will be on livelihoods of the peoples depending on natural resource base and services of other sectors including infrastructure and industries. For example, the changes in agriculture may lead to a fall in domestic production of food, fodder and fibre. Because of this employment and incomes of the people may fall lowering their consumption that will lead to a rise in malnutrition and income poverty.

From the above discussion, it is apparent that Bangladesh is highly vulnerable to the impacts of



Figure 4.2: Shows the various activities proposed by the four sources that can be implemented through the primary education sector



climate change because of low resilience. This may have some impacts on the targets of MDGs of Bangladesh, especially the primary education. There is a need to do much more than what exists at present to make the country resilient against the disasters which are likely to increase in magnitude and frequency in future.

Children of this country are already the worst affected due to disasters and other socio-economic

reasons. In the event of CC related intensified and frequent disasters, they will be even more affected hampering the future of the country. In order to understand the situation of primary education in the context of CC it is important to examine the primary education system of the country. The next Chapter is focused on the education profile and the risks of Bangladesh.

## PRIMARY EDUCATION PROFILE AND RISKS

### 5.1 OVERVIEW OF THE PRIMARY EDUCATION

Bangladesh sustains one of the largest primary education systems in the world with as many as 80,401 primary institutions of 10 different kinds namely, government primary school (GPS), registered non government primary school (RNGPS), non registered non government primary school (NRNGPS), experimental schools, community schools, kindergartens, NGO schools, ebtedaee madrasahs, primary sections of high madrasahs, primary sections of high schools. According to the School Survey Report 2008, GPS, RNGPS, Experimental and community schools constitute 75% of the total institutions. These four categories of institutions are providing primary education to 81.9% of the total primary school enrolled children of over 16.3 million. The proportions of boys and girls enrolled at the primary level are 49.3% and 50.7% respectively. A total of 364,494 teachers are engaged in primary teaching in all the ten categories of institutions.

A total of 518 NGOs have been engaged in education programs of which more than 450 have adult literacy programs integrated into NFE. The NGOs are providing adult education to 1,19,277 females and 26,193 males through 6,574 learning centers (CAMPE, 2007). However, some of the major NGOs in the country offering adult education are BRAC, Proshika, Dhaka Ahsania Mission, FIVDB, ActionAid, Swanirvar Bangladesh. BRAC has been the largest NGO in the country operating the largest non-formal education program. It runs 34,000 NFPE schools serving 1.02 million un-enrolled and drop out children of the marginal families.

### 5.2 THE CHALLENGES AHEAD

Although there have been satisfactory progress in certain areas in achieving the goal of universal access to education, there are still many challenges that must be met in realizing the MDG 2 targets. Some of the major challenges in basic education are mentioned below.

While the MDG target for net enrolment rate has been set at 100% by the year 2015, in reality it is extremely difficult to achieve for several reasons. One of the reasons is slow down of the rate of growth as it approaches the 100% target. Indeed, it has been empirically demonstrated that, once countries attain a NER of say 90 to 95%, it usually becomes very challenging and costly to reach the last 5-10% of children who, for various reasons, are difficult to cover (nomadic, marginal populations, populations living in remote and land-locked areas, the poorest, and sick or disabled children, ethnic minorities having difficulties in understanding Bangla, etc.). Bangladesh is currently running one of the largest primary education sectors in the world. But the organizational capacity to run such a huge primary education system has indeed been a big challenge for any such country in the world.

Insufficient instruction time, inadequate number of classrooms and teaching staff, low teacher effectiveness, lack of sufficient teaching – learning materials, and lack of adequately trained manpower to manage such a large education system may be identified as some of the major constraints facing the country's primary education system (DPE, 2006).



Government expenditure on education in Bangladesh is still low compared to any other countries in South Asia. Although about 39.51% of the annual budget is dedicated for primary education it accounts for only 2.28% of the country's GDP. The desired proportion is 4-5% for making the efforts effective towards achieving the millennium targets.

Eradicating high incidence of poverty has been one of the biggest challenges on the way of achieving the MDG 2 targets. Low incentives for attending schools vis a vis acute poverty in the families keep the children away from the schools as they have to engage in earning for their living. This contributes to low attendance rate and high dropout rate.

### 5.3 DISASTER AND PRIMARY EDUCATION

In the last two Chapters, vulnerability, risks and hazards have been discussed in the context of climate change in Bangladesh. As mentioned before the hardest hit due to climate change will be the children, particularly in the poor countries. Out of its 145 million (2008) population, approximately 44 percent are children below 18 years age in Bangladesh (2004 estimates by BBS, 2006). In

Bangladesh, a large number of children hailing from poor background are exposed to different types of hazards. These are likely to increase in frequency and magnitude in future due to climate change.

As mentioned before, in Bangladesh, the level of resilience of the primary education system is low. This is because of the poverty, livelihood dependent on natural resources and inadequate climate responsive curricula, awareness and training at primary education system. This makes the children highly vulnerable to disasters which will intensify in future due to climate change.

Many children from the poor families in the Char areas of Bogra, Rangpur, Gaibandha, Kurigram, Nilphamari, Lalmonirhat, Pabna and Sirajgonj districts do not have access to primary education. Many of the primary schools in the low lying areas of these districts have either been washed away by river erosion or have shifted to other places under the threat of erosion. At least 10,000 villages in these districts were lost to the rivers over the years. About 350 government and non-government primary schools in these villages also vanished. Besides that, nearby 300 primary schools in the flood prone areas of these districts were shifted to

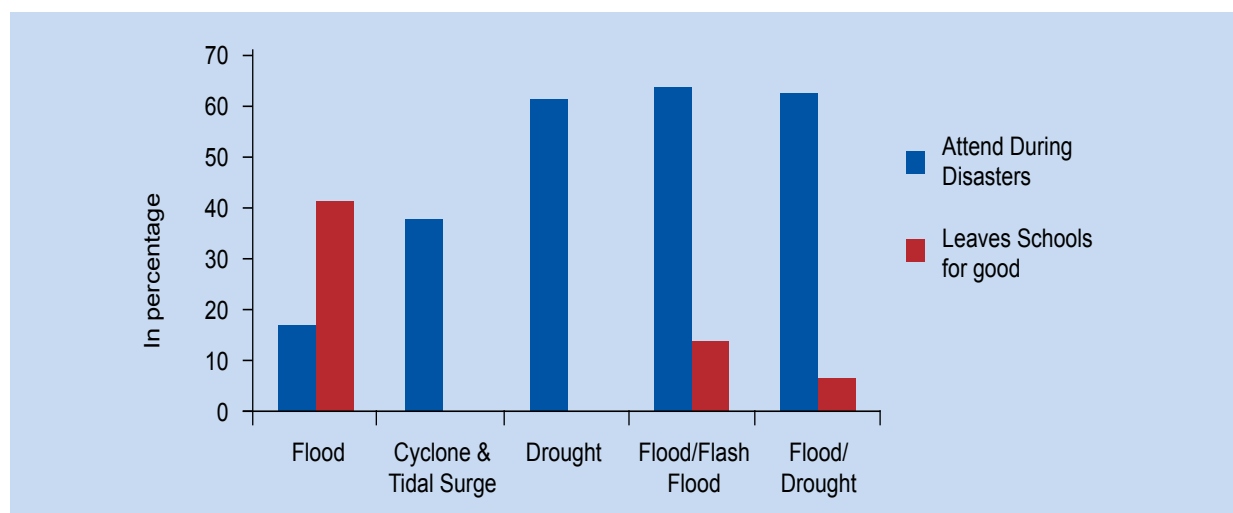


Figure 5.1: Attendance during disasters and dropout rate after the disasters  
Source: as sited in Save the Children report- FGD, 2008



safer places under the threat of erosion. The two, combined, have blocked the opportunity of primary education to the poor children of these districts. (Source: The New Age, June 8, 2005, Asad)

Schools remain closed during floods. This creates a gap in the delivery of educational services, as a result some children cannot perform well in subsequent exams and they lose interest in study and are reluctant to attend schools. It is important for the local schools to consider reviewing their school calendar to ensure that children do not suffer because of flood. Possible options are changing annual calendar of the schools in flood plains, or arranging for temporary schools when schools are being used as flood shelters.

In some of the districts, conditions of the roads are so poor that it becomes difficult for the children to walk to their schools in the rainy season. During this season rural roads gets muddy and slippery. As a result, many parents prefer keeping their children at home than sending them to schools. Children suffer from seasonal sickness or have accidents on roads.

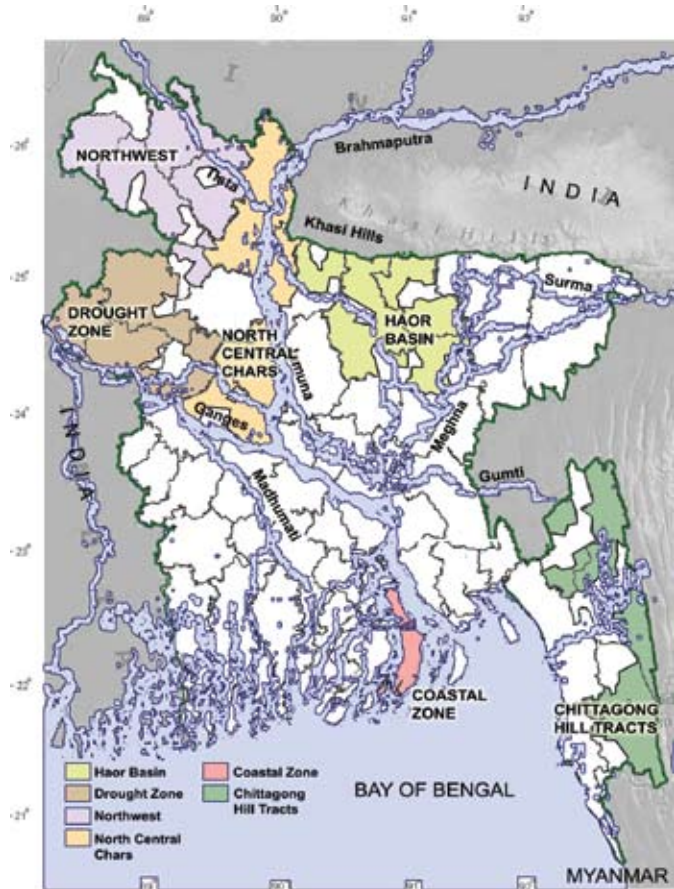


Figure 5.2: WFP priority areas for their country programme 2007-10 Source: WFP

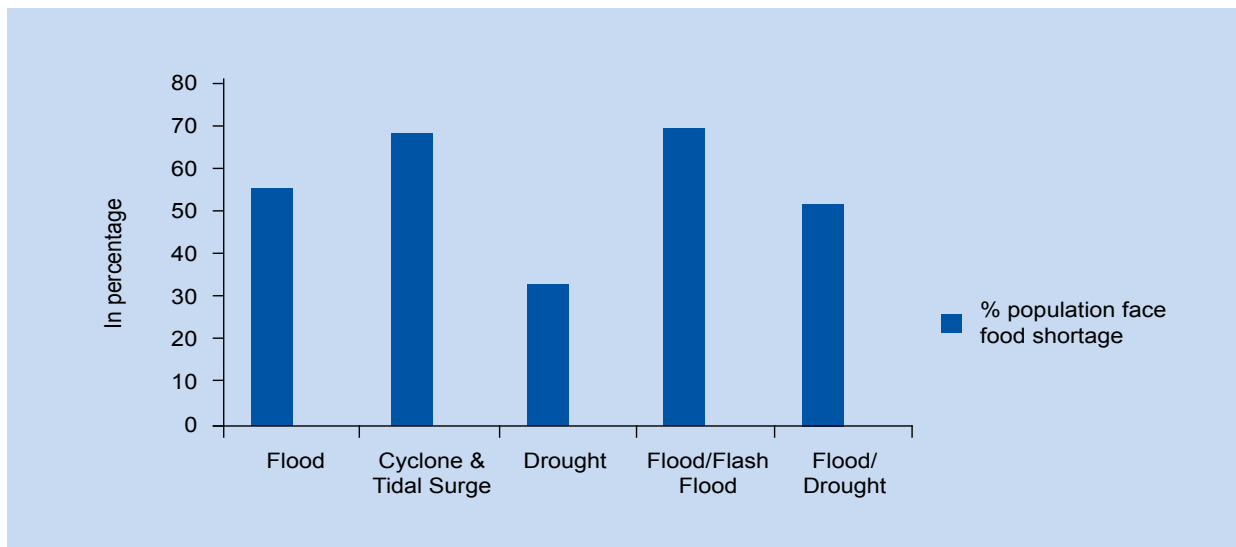


Figure 5.3: Percentage of population facing food shortage Source: As cited in Save the children- original source FGD, 2008



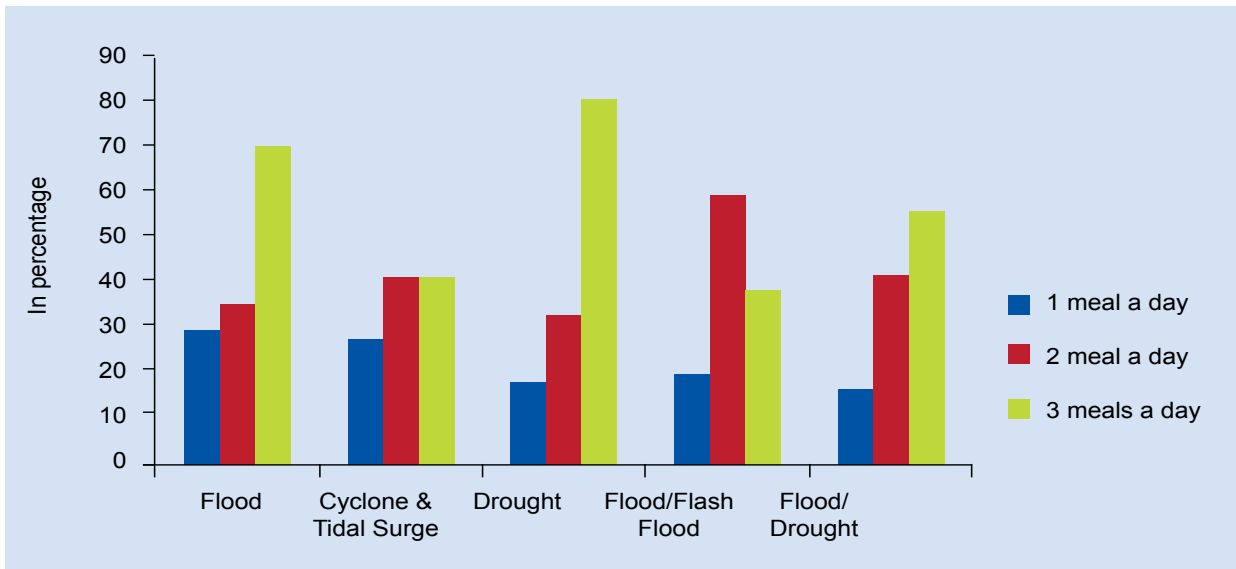


Figure 5.4: Percentage of children having 1 to 3 meals a day  
 Source: As cited in Save the children- original source FGD, 2008

The above Figure shows that the most significant impact on primary education is flood. During flood the attendance is the least and dropout is the maximum. The attendance is significantly low due to cyclone and tidal surge. In coastal zones, more children attend religious schools than in other regions. At the same time, it is observed that a large number of children (between 24 to 33 percent) leave schools in the disaster zones. Nearly one quarter of total population of Bangladesh live in coastal flood plains (Ali, 2000). This exposes the children to a high degree of vulnerability towards flood and cyclone.

Schools remain closed during disasters. In flood-prone areas schools remain closed for as many as 100 days during a disaster. The school attendance reduces to nearly 20 percent in some areas and children drops out of schools (Save the Children Report, no date). Climate change will further deteriorate the situation.

### 5.3.1 Health

A total of 26 to 30 million children are under-nourished in Bangladesh. Diarrhoea, cough and fever are the most common diseases of the children of Bangladesh. Disaster zones further suffer due to low quality of teachers (Save the Children, no date). Because of low income level many people do not have the ability to access medical facilities and the required medicines. This is particularly acute in the aftermath of any disaster when the income level falls to the lowest. This is compounded with non availability of facilities and essential medicines. The school children are highly affected by this.

### 5.3.2 Poverty, Food Shortage, Livelihood

Poverty in Bangladesh is a major constraint for achieving the MDG 2. Poverty will increase significantly due to CC. There is a direct and immediate impact of poverty on primary education in terms of enrolment, retention, quality and more importantly dropout.

The map in Figure 5.2 shows the priority areas under the WFP. By superimposing the multihazard map, the impact of climate change on poverty may be understood, which will enable the planners to make area specific appropriate decisions on primary education in Bangladesh.

The above Figure shows that the food shortage is among the highest ones in the cyclone and tidal surge as well as flood and flash flood areas. From the above Figure it is quite clear that the general level of food shortage is high in Bangladesh due to disasters. This has highly negative impact on the primary education system, especially in the disaster prone areas.

From the above Figure it is evident that cyclone and tidal surge have the worst effect on children's access to food and hence, on their general health conditions. From the discussion, it appears that the map showing the prioritised poverty areas will most likely to change in future as climate change has its increased impacts on weather conditions. The above map could be adopted as a base to start

the adaptation actions to increase resilience of the people. It may be far more cost effective to invest on food and poverty issues than to let disasters happen in future to an extent that the government will find it difficult to cope with very high impact cost.

### 5.3.3 Safety of Children in Disaster prone areas

Poverty in the disaster prone regions often makes it difficult for the children to have a decent life. Most of them suffer due to lack of affection and care as they join the work force at an early life. Migration of parents to cities or to a new locality to avoid disasters, separation of parents due to poverty, joining of workforce at an early age, exposure to criminal activities in the society due to lack of parental guidance or lack of knowledge, etc. are the causes that lead to low level of safety and security for the children in the society. Physical abuse by others (like employer, elderly neighbour, other children) was reported by the children and at the same time, it was evident that children do get involved in crimes due to poverty.

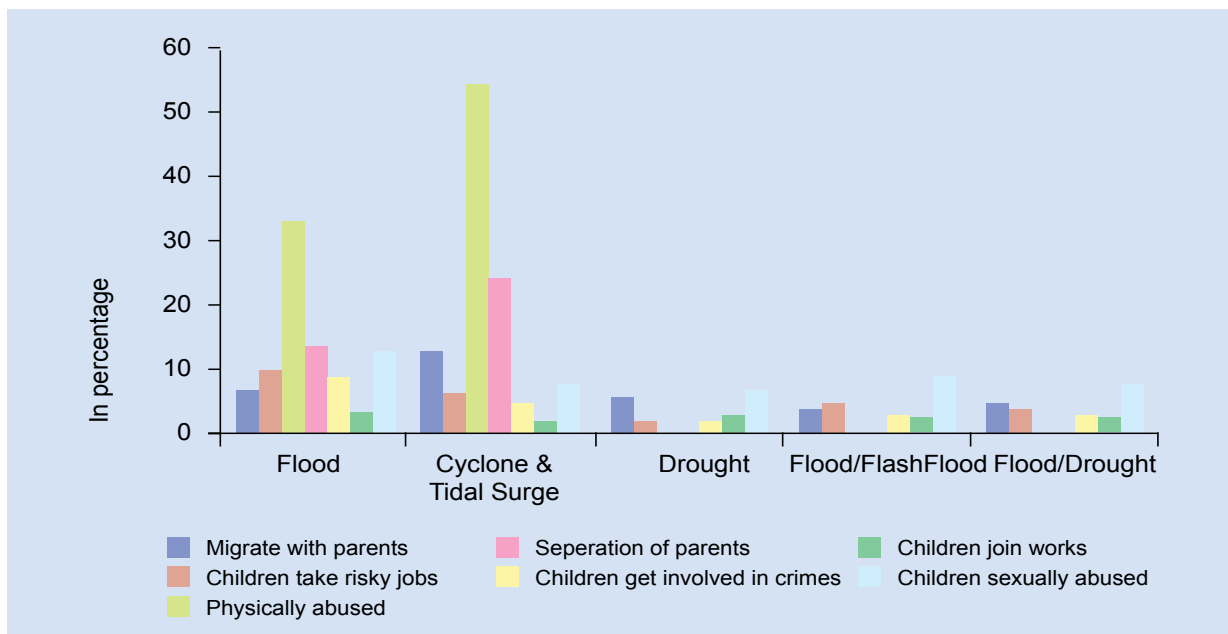


Figure 5.5: Impact on pattern of living of children in disaster zones after disaster  
Source: As cited in Save the children- original source FGD, 2008

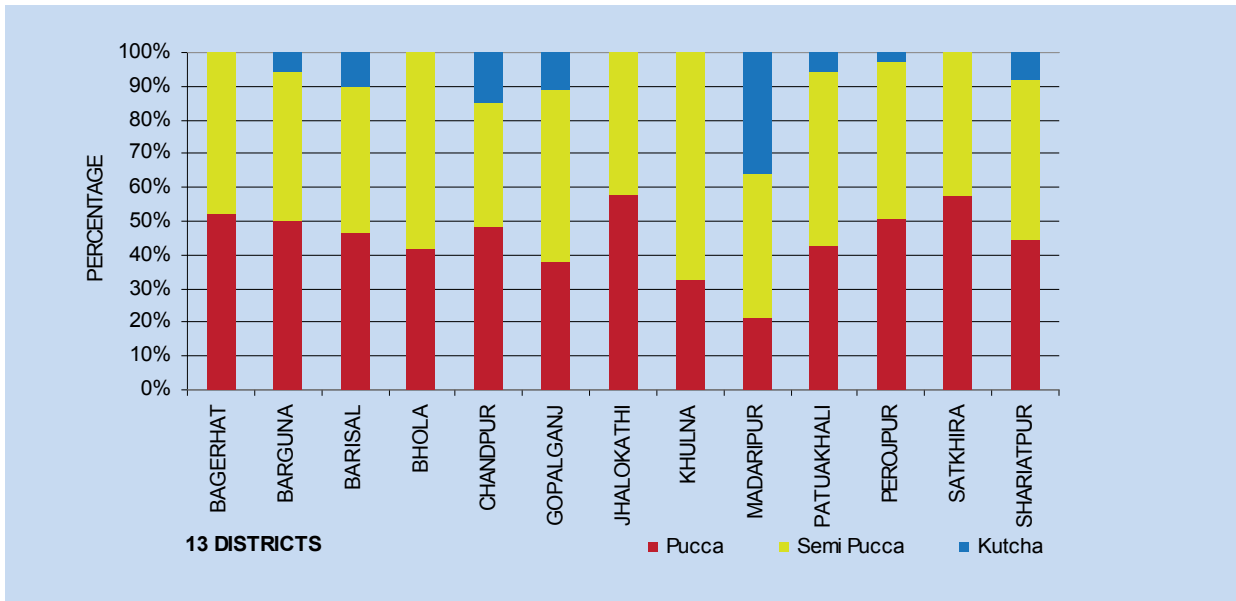


Figure 5.6: Percentage of pucca semi-pucca & kutcha buildings in GPS: 13 SDR affected districts: Source: Das 2008

Since disasters affect the abilities of the people to support their children, the fathers migrate in quest of livelihood. Children are also withdrawn from schools to support the family for earning. These events expose the children to a higher level of risks in terms of safety and protection in the disaster-prone areas. Climate induced disasters will, therefore, add to the sufferings of the children.

The above Figure shows that there are occurrences of children subjected to physical abuse in all kinds of disasters. Children joining income generating activities are the highest in case of cyclone and flood. The issue of Children sexually abused, though relatively small compared to the other parameters, is a matter of great concern. This will make a permanent damage to the physical and cause mental setback in the tender minds. The government should take it up with utmost importance. The root cause of this is poverty and hence, at policy level this issue should be given the highest priority and international assistance will be required for Bangladesh to deal with the situation.

#### 5.3.4 INFRASTRUCTURE

Infrastructure plays a major role in access, retention and quality of primary education. The following analysis of the primary educations situation is based on the field based research after SDR.

The above Figure shows that the schools in the 13 SDR affected district have a high percentage of semi pucca and kutcha buildings having poor resistance to high wind and flood and tidal surge. However, it is important to mention that pucca buildings are not necessarily safe in flood and cyclone. One of the main reasons behind poor performance of some of the pucca buildings during cyclone SDR was lack of maintenance. This had happened especially in those where the community had lack of ownership, which could be attributed to the nature of contractor supplied infrastructures without involving the end users. It is important to note that the issue of quality control during construction and appropriate specifications should be re-examined especially in the coastal belt.

## WATER AND SANITATION

Out of 666 SIDR affected GPS, 269 do not have toilets and 384 do not have drinking water facilities or these were destroyed in the cyclone. The following is an analysis of the WATSAN situation of 666 GPS.

In Bagerhat, Madaripur, Patuakhali and Perojpur the only source of water is river or pond. During disasters this is a major cause of spreading waterborne diseases. The Figure shows that many GPS in Barisal, Chandpur, Gopalganj, Khulna, Madaripur, Pirojpur and Shariatpur do not have drinking water facilities. About 44% of the 666 GPS either have no water or they access water from pond or river.

Figure 5.8 shows almost all the districts under consideration have some GPS without any toilet. This number of such GPS is high in Bhola, Khulna, Chandpur and Madaripur and hence, they need special attention. Out of 666 GPS in the 13 SIDR affected districts, about 20% GPS do not have any toilet of any form.

The above discussion on infrastructure, though based on a limited study, reveals that the basic physical facility is a serious concern since the cost of intervention is much higher than the soft aspects of education. In such a situation, the climate induced increased effect of disasters will have a major impact on primary education in the coastal belt of Bangladesh. It may be noted that just prior to SIDR, the midterm review of PEDP II had set its new target and prioritizing the supply of new classrooms and maintenance in order to maximize the number of children accessing single shift primary education. The super cyclone on the 15th November, 2007, changed the situation overnight and resources were diverted to the coastal belt. This is an ideal example of the high impact cost due to inadequate mitigation and adaptation actions under the DoE.

Bangladesh has many donor partners working in different fields. Many programmes and projects are being implemented for the development of the country with loan and assistance from the development partners. For example PEDPII has

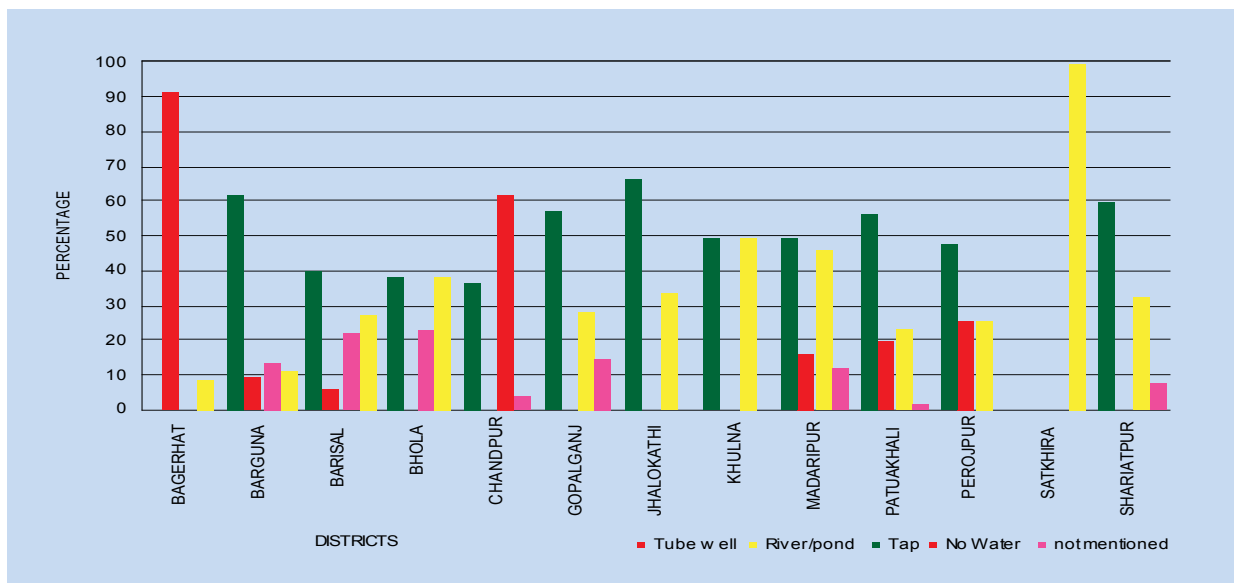


Figure 5.7 Status of drinking water in SIDR affected 13 districts: Source Das, 2008



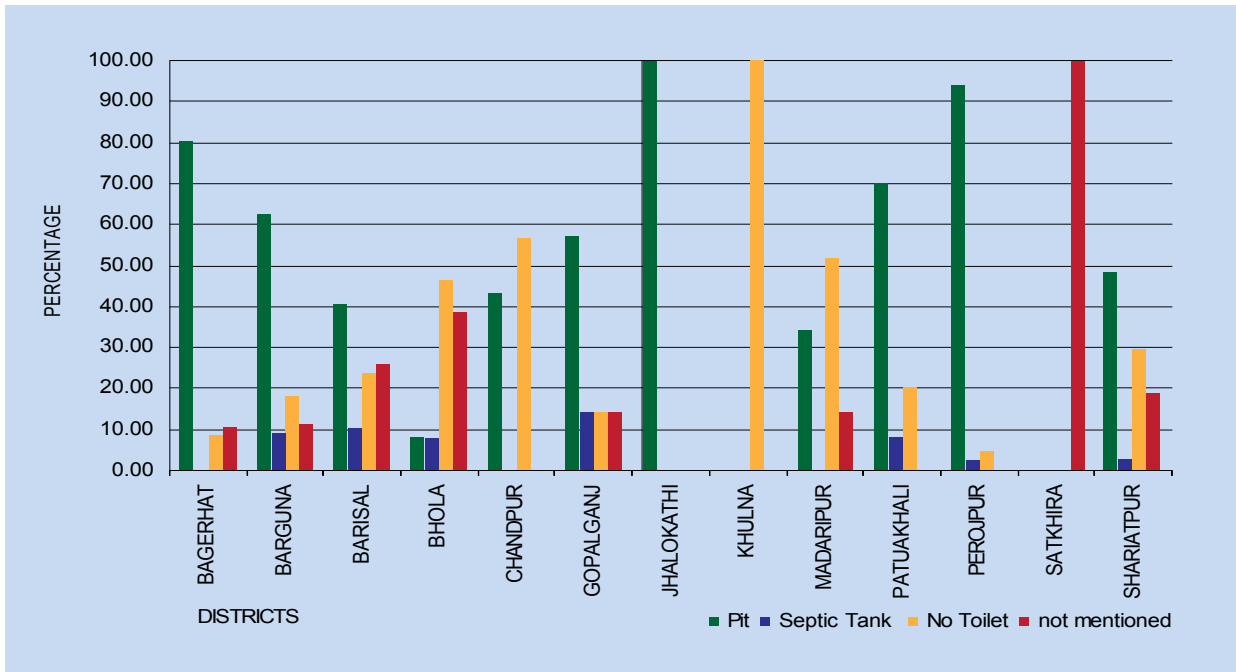


Figure 5.8: Status of Sanitation in SIDR affected 13 districts. Source: Das, 2008

a very large amount of investments from 11 donor partners, which is aimed at achieving the MDG 2. Under PEDP II, the estimated gap in the infrastructure is 0.12 million classrooms. This with toilet and drinking water, etc. is estimated to cost about 1.8 billion USD at December 2007 price. Such investments could be opportunities for adaptation and mitigation to combat climate change. Therefore, there is a need for impact assessment of the programmes and projects and examine how these could help in adaptation and mitigation. It is suggested that this report be shared with them and have convergence to avoid duplication of interventions and facilitate cross learning.

The above Chapters showed that a large number of children, teachers and population are under high physical and social risk. In order to protect these children from the negative impacts of CC, there is a need for sustainable mitigation and adaptation actions at different levels of Bangladesh. The following Chapter shows that a bottom up approach through the experience of PVA can provide a favourable environment for sustainable way of dealing with CC in Bangladesh. The following Chapter shows the process of acquiring appropriate local specific adaptation and mitigation actions through school-based PVA exercise.

## PARTICIPATORY VULNERABILITY ANALYSIS

### 6.1 BACKGROUND

The Chapter on the situation analysis and hazards show essentially a top down preparedness of the government of Bangladesh, the donor partners and the NGOs. However, there is a need for a bottom up feedback to combat disasters in the context of climate change and to address this issue in a sustainable manner. For example, absolute micro level information such as an available small piece of highland in a community that is suitable for a safe school in flood cannot be provided through the existing top down data and maps. Participatory Vulnerability Assessment is one of many methods that can acquire this kind of data at grass root level in a cost effective manner. International experience shows that the reliability and efficacy of data obtained through PVA are very high. Apart from that, PVA assists the country's progress towards achieving Hyogo Framework for Action (2005 – 2015), especially, the goal 3 (use knowledge, innovation, and education to build a culture of safety and resilience at all levels).

While searching for a bottom up knowledge base on climate induced disaster preparedness through primary education, it was identified that the process and the products of ActionAid's PVA is available in 28 schools of Bangladesh. ActionAid had selected the school sites based on the philosophy of supporting the most disadvantaged people living in the disaster prone areas. Establishing the rights of the people was the main focus of ActionAid in Bangladesh. The following Figure shows the locations of the places where PVA was carried out by ActionAid. The purpose of the field level study was also to gather community wisdom on adaptation.

PVA is a stakeholder centred process. It not only helps in understanding the context at micro level, the best of community's wisdom is revealed in the process. The past and present exercises showed that the community is a storehouse idea for dealing with disasters. Therefore, the top down and bottom up data and guidelines will lead to sustainable system. The following is a brief description of the PVA experience in Bangladesh and the detail report has been put forward in Annexure II.



Figure 6.1: Map showing the locations where PVA were conducted

## 6.2 THE PROCESS OF PVA: BANGLADESH

The Participatory Vulnerability Analysis (PVA) discussed in this Chapter is the result of a process undertaken in the various schools of Bangladesh to document local impacts of climate change and to devise appropriate adaptation measures that communities can implement themselves.

The PVA was conducted in three phases as shown below. The detail process of PVA is available in <http://www.ActionAid.org/assets/pdf/PVA%20final.pdf>. Out of the three phases, this Chapter will focus on the Phase 2 because that deals with the most micro level data regarding school based preparedness for climate change.

### Phase 1: Preparation

- Country level awareness-raising
- Defining purpose (TORs)

- Stakeholder analysis
- PVA team preparation

### Phase 2: Understanding the Analytic Framework

- Step 1: situation analysis
- Step 2: analysis of causes
- Step 3: Analysing community action (Adaptations)
- Step 4: drawing action from analysis

### Phase 3: Multilevel Analysis

- Community level analysis - conducting PVA in the selected areas using the step-by-step framework
- District level analysis — analysing vulnerability at district level using the Step-by-Step framework
- National level analysis — analysing vulnerability at national level using the step-by-step framework
- International level analysis — feedback from national level analysis and action planning

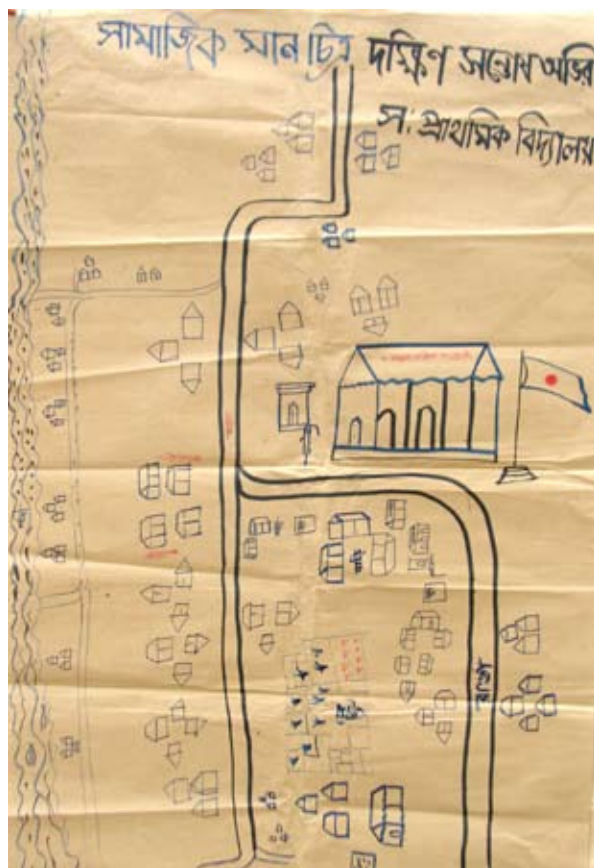


Figure 6.2: Community involvement in village mapping





Figure 6.3: Community involvement in preparing the seasonal calendar

### 6.3 PHASE 2: UNDERSTANDING THE ANALYTIC FRAMEWORK

#### 6.3.1 Step 1: Situation Analysis

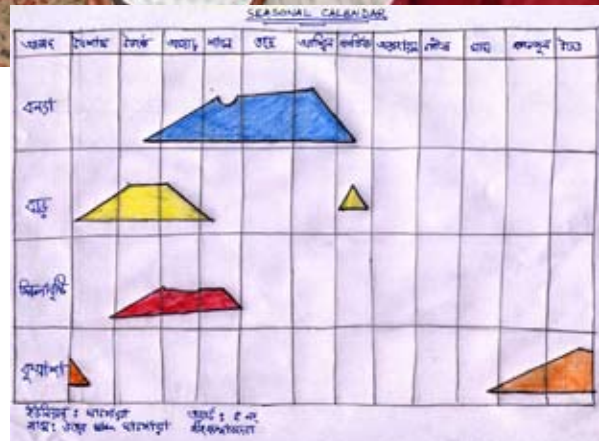
The following were identified in this step

- Prevalence and extent of vulnerability
- How different people are able to cope
- Analyse present threats/vulnerabilities

The Method

- Introduce the concept of vulnerability
- Using a focus group discussion. Get the community to discuss and give examples
- PVA was conducted separately with different groups, e.g., students, teachers, community, PTA etc.
- The first exercise was social mapping followed by timeline analysis and seasonal calendar.

The Outputs of the process are a) Social mapping, b) seasonal calendar and c) timeline. The following is a brief description on the outputs.



Social Mapping

Mapping is a very useful tool to understand the spatial distribution of certain aspects of the environment, may it be traditional boundaries, homesteads, agricultural areas or fishing grounds. This tool is useful in aiding the community to develop, record, organize and present information about their surroundings. Maps can be a simple and quick way of illustrating an issue and may be used as a planning tool. They are also particularly useful all community participants can take part and check the information is accurate.

Purpose: To collect information and develop a community map of resource availability, infrastructure, disaster prone areas and areas of cultural significance.

**HISTORICAL PROFILE**

वर्ष	घटना	कारण/पृष्ठभूमि	प्रकार
1950-55	बाढ़	बाढ़	१: बाढ़
1955-60	बाढ़	बाढ़	
1960-65	बाढ़	बाढ़	
1965-70	बाढ़	बाढ़	२: बाढ़
1970-75	बाढ़	बाढ़	
1975-80	बाढ़	बाढ़	
1980-85	बाढ़	बाढ़	३: बाढ़
1985-90	बाढ़	बाढ़	
1990-95	बाढ़	बाढ़	
1995-2000	बाढ़	बाढ़	४: बाढ़
2000-05	बाढ़	बाढ़	
2005-10	बाढ़	बाढ़	

बाढ़ का कारण: बाढ़ का कारण है कि वर्षा का जल जमीन से अधिक मात्रा में गिरता है।

बाढ़ का प्रभाव: बाढ़ का प्रभाव है कि जमीन से अधिक मात्रा में जल गिरता है।

बाढ़ का समाधान: बाढ़ का समाधान है कि जमीन से अधिक मात्रा में जल गिरता है।

### Seasonal Calendar

A seasonal calendar is a tool for documenting regular cyclical periods (i.e. seasonal) and significant events that occur during a year and influence the life of a community. The seasonal calendar provides a general picture of important environmental, cultural and socio-economic periods throughout the year. The Seasonal Calendar is of particular value as it allows local people to represent their understanding of seasons from their culture. These are often different from 'official' seasons and the International calendar.

Purpose: To develop local community seasonal calendar for the community.



Figure 6.4 Community involvement in preparing the timeline





#### Timeline

A timeline is making a listing of key incidents or hazards in the history of a community or area. The timeline facilitates community discussion and examination of past trends, actions, problems and achievements. It is useful in resource planning and decision making to think back on these past events and experiences and look at how they influence present attitudes and actions.

The events which are recorded on the time line may include spiritual and cultural events, movements of people, introduction of new technology, natural disasters, political events or decisions, development projects and so on.

In developing a timeline, the community members record back as many generations as villagers can recall. Group discussions of the time line provide a good opportunity to ask the elders about previous happenings and traditional community responses.

Purpose: To help the community better understand what natural and human events have influenced the lives of the communities in Bangladesh.

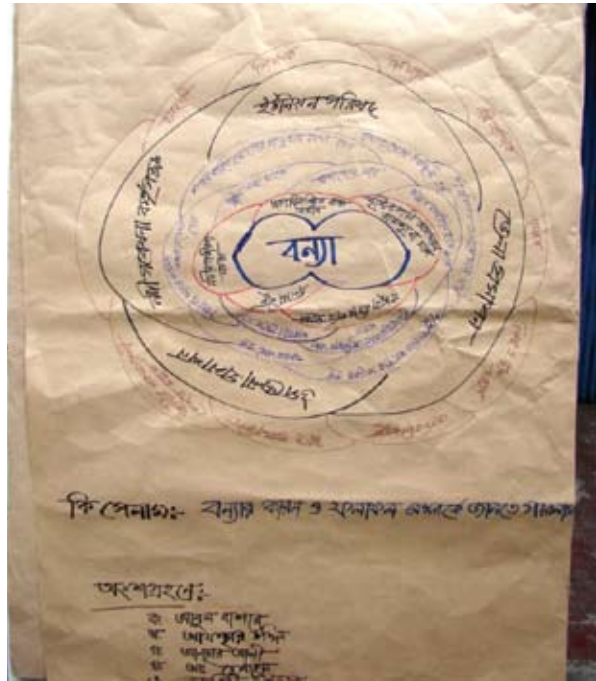


Figure 6.5: Community involvement (above). Cause and effect diagram (below)

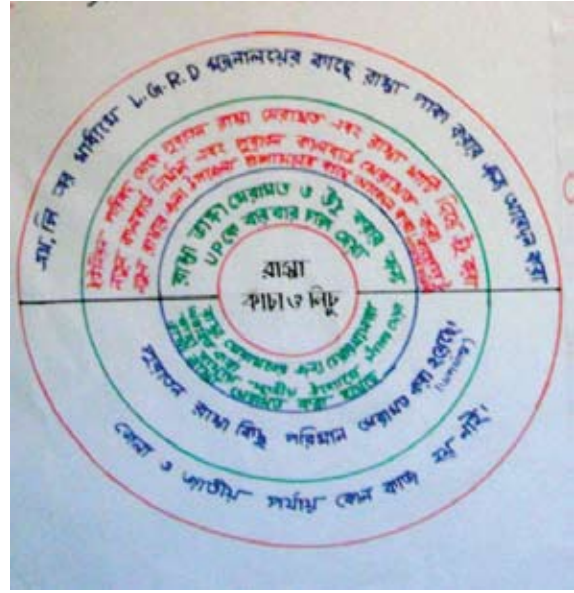


Figure 6.6: Community involvement (left). Diagram (right) shows adaptations for one type of vulnerability

### 6.3.2 Step 2: Analyzing Causes Of Vulnerabilities

This step had enabled the participants to identify causes and effects of the different types of vulnerabilities at micro level. It is always important to allow communities to identify its own needs and arrive at possible solutions. This tool provides a simple but systematic way to help the community to identify and refine the specific issues. It helps them to define the 'causes' of the incidents or hazards that concern them most and to look for possible ways to solve or address these by identifying their 'effects'.

#### Method

A list of Causes and Effects can be generated in several ways. The list might include items generated from many sources, including meetings, brainstorming sessions, individual discussions, small group exercises, transects or theatre sessions. The list should be retained in the community and continually revised to include more information as it comes forward. The output of this process is a diagram that is the result of cause-effect analysis, focus group discussion, impact diagram.

Purpose: To organize community climate change related incidents / hazards and consider options that should help address them.

### 6.3.3 Step 3: Analysis Of Community Actions (Adaptation)

This step establishes the existing strategies, resources and assets used to reduce vulnerability. In short, what has been done so far and where the gap is with regard to disasters specific to the settlement. This step analyses whether there is any need for external assistance to reduce vulnerability at local level.

This step starts with a summary of what the local level vulnerabilities, their causes and what is the community doing about their vulnerabilities (identified in step 1 and 2). List the coping mechanisms discussed in step 1 and some more are added if something has been missed out.

Central to this activity is compilation of the adaptation actions in a circular diagram. The circle is divided by a line at its equatorial level. There are concentric circles each representing a level, i.e., school, Upazila, district, national and



international. In the upper half of the circles, the future adaptive actions are written from absolute local to international level. The lower half shows those adaptations which are already in place. For each type of vulnerability, there will be one such circle with concentric circles. The inner most circle is labelled with the particular vulnerability under consideration.

Purpose: To assist communities in deciding which specific actions will be taken or undertaken by the communities at local level in Bangladesh to adapt to the impacts of Climate Change.

### 6.3.4 Step 4: Drawing Actions From Analysis

The main objective of this step is to organize tasks and resources such that a community is able to implement the identified climate change adaptation options suited at local level. The following process was adopted to carry out this step.

- Ask community members to list the actions or adaptation options that they have agreed to. Record them on a large piece of chart paper in view of everyone

**বর্ষ পরিকল্পনা**  
**স্বাস্থ্যগার শাসনিতা বোর্ডিং: প্র: প্রা: বিদ্যালয়**

ক্রমিক	উপকাজ	কেন করবে	কোন করবে	কিভাবে করবে	কোথায় করবে	কিভাবে করবে	কোন
বিদ্যালয়	* বিদ্যালয় সড়কটি পরিষ্কার করা হবে * বিদ্যালয় ও পরিবেশের মধ্যে সজাগতা * SMC এর সাথে যোগাযোগ।	শিক্ষার্থী	বিদ্যালয় ও পরিবেশের মধ্যে সজাগতা	SMC কমিটিতে সভা ও পরিষ্কার যোগাযোগ করা	বিদ্যালয়	SMC. বিদ্যালয় ও পরিবেশের মধ্যে সজাগতা	২৪/৭/১৩
বিদ্যালয়	* বিদ্যালয় সড়কটি পরিষ্কার করা হবে * বিদ্যালয় ও পরিবেশের মধ্যে সজাগতা * SMC এর সাথে যোগাযোগ।	শিক্ষার্থী	বিদ্যালয় ও পরিবেশের মধ্যে সজাগতা	SMC কমিটিতে সভা ও পরিষ্কার যোগাযোগ করা	বিদ্যালয়	SMC. বিদ্যালয় ও পরিবেশের মধ্যে সজাগতা	১৭/৭/১৩
বিদ্যালয়	* বিদ্যালয় সড়কটি পরিষ্কার করা হবে * বিদ্যালয় ও পরিবেশের মধ্যে সজাগতা * SMC এর সাথে যোগাযোগ।	শিক্ষার্থী	বিদ্যালয় ও পরিবেশের মধ্যে সজাগতা	SMC কমিটিতে সভা ও পরিষ্কার যোগাযোগ করা	বিদ্যালয়	SMC. বিদ্যালয় ও পরিবেশের মধ্যে সজাগতা	১০/৭/১৩



Figure 6.7: The final output: Action plan for adaptation

- 
- Ask the group to rank these from the highest to lowest priority in terms of putting them into action
  - Start and focus on the action of highest priority. Divide into groups and Brainstorm a number of tasks which need to be undertaken to make that action work or to be put in place (the task listed will be in no particular order). As tasks are suggested write on each one to a separate index card or Post – It
  - Draw a horizontal line across a long separate piece of chart paper. Ask the group to set a date on when the community wants all the tasks to be completed and the adaptation action in place. Write the date at the far end of the line.
  - Ask the group to review and evaluate the tasks listed. As they agree with the tasks, post them up along the time line. As they are posted, the group should check to see that they are placed in logical sequence
  - If there are fixed times for completion of certain tasks write them above the tasks on the time line
  - After the tasks are all posted, go through the cards asking who will be responsible for each task. Write their initials on the card. Ask again for each card what resources are required to carry out this task. List the resources needed on a separate card and attach to the ‘task’ card. If gathering those resources requires special tasks, then make additional cards and place them along the time line
  - Go to the next adaptation action and repeat the process
  - When all the adaptation actions listed have been completed, review the action plan. If everyone agrees that the list of tasks is complete and in order, transfer the information to a simple table listing WHAT the task is, WHO will be responsible for it, WHAT resources will be needed and by WHEN it is expected to be complete

The outputs of the PVA exercise carried out by ActionAid Bangladesh has been analysed and the area specific adaptation, mitigation and interdependent (explained in the next Chapter) actions have been determined. The summary of this has been put forward in the following Chapter.

## ADAPTATIONS AND MITIGATIONS

### 7.1 STOCK TAKING: IDENTIFIED AT THE NATIONAL LEVEL WORKSHOP

The BCCSAP, NAPA, etc. are the initiatives to address the issue of CC in Bangladesh. These are the top down interventions through various sectors, Ministries and agencies (national and international). This Chapter aims to identify those aspects of responding to CC in Bangladesh which can be addressed through primary education system.

A National Level Workshop was convened at Dhaka after carrying out a desktop research. The objective of the Workshop was to take the stock of what is available and where the gaps are in the context of adaptation and mitigation to cope with

climate change in Bangladesh. This was followed by a grass root level data collection through Participatory Vulnerability Analysis (PVA) in highly vulnerable areas of Bangladesh. The main objective was to get a bottom up input based on which future actions could be planned. It may be noted that the bottom up field data analysis revealed that the villagers are storehouses of innovative and practical ideas to cope with the negative impacts of CC. The bottom up along with the top down will lead to a strategy and action plan of responding to the CC through primary education in Bangladesh.

Table 7.1: Data/information, etc, available in the context of CC (Bangladesh)  
Output of the National Workshop, Dhaka, July 2009

Description	Remarks
There are school catchments maps showing population of catchments, number of households, etc with the DoE and LGED	Not yet received
NGOs have some data on the past disasters, as well as on the past interventions	Needs strengthening and a data collection mechanism to be in place
Data on the number of people living in disaster prone areas- disaster type-wise population distribution in Bangladesh are available in bits and pieces with different organisation	There is a need for consensus among the organisations in this regard
The health and nutrition status of the children in the country are available	
Data on common ailments e.g. in diarrhoea, cough, fever, etc., are available	
There is migration problem in the country that increases	Data to be made available and updated
There are some research works carried out on impacts of climate change on children and schools.	Needs assessment of the children on a more quantitative basis and space wise
NAPA and BCCSAP and DMB's action plans are in place	Need a bottom up approach to complement the top down system



Table 7.2: The Gaps identified in the National Workshop

1	Building code needs updating and incorporate the requirements of DRR
2	Meteorological data needs to collect data pertaining to CC so that they will help in planning the adaptive and mitigation actions.
3	Capacity building in most of the sectors
4	Identifying and strengthen the interlinks between climate change – health – education
5	Assessments of schools for vulnerability towards disasters. (structural and operational evaluation to climate preparedness. e.g.; Energy efficiency, structural integrity, retrofitting needs)
6	While there are research works done on impacts of climate change on children and schools, it needs in depth study covering representative areas prone to disasters
7	There is an urgent need for multi hazard and vulnerability atlas
8	No GIS mapping on disaster. Resources are there
9	There is a lack of coordination and data sharing between the resource institutions
10	Data on primary education, i.e., EMIS data along with Latitude and Longitude of each primary school to be made available- data on condition of the existing buildings and facilities to be part of the EMIS
11	Education sector not involved in NAPA and BCCSAP, CC addressed only in revised curriculum (but education sector still not formally involved)

The first activity of the desktop research was to identify what exists in the context of CC and its probable impact on Bangladesh. This helped in identifying the gaps in this regard. In a National Level Workshop convened in Dhaka in 2009, the preparedness and gaps were identified in the domain of CC and primary education. The government may like to look at these issues

to mend the gaps and make full use of the preparedness to protect its own people as well as to meet its commitments to the international forum. This exercise is of vital importance towards setting the target of mitigation and adaptation and implementing them in terms of short, medium and long term planning.

Table 7.3: Relationship of Climate Change and Variability with Physical Vulnerability Source NAPA 2005

	Climate Change				Climate Variability		
	Increase avg. temperature		Decrease avg. rainfall	Sea level rise	Erratic temperature (excessive & untimely or lack of timely rainfall)	Erratic tidal wave	Cyclone and storm surges
<b>Physical Vulnerability Context</b>							
Inundation	●	●		●	●	●	●
Low Flow	●		●		●		
Salt Water Intrusion				●		●	●
Flash Flood		●			●		
Drought	●		●		●		
River Morphology		●		●		●	

Note: ● refers to high, ● refers to moderate, and ● refers to low level of relationship

## 7.2 VULNERABILITY TO CLIMATE CHANGE

Bangladesh, being one of the most vulnerable countries to climate change, needs to incorporate effects of climate change in national development plans. New policies need to be developed and existing policies to be strengthened.

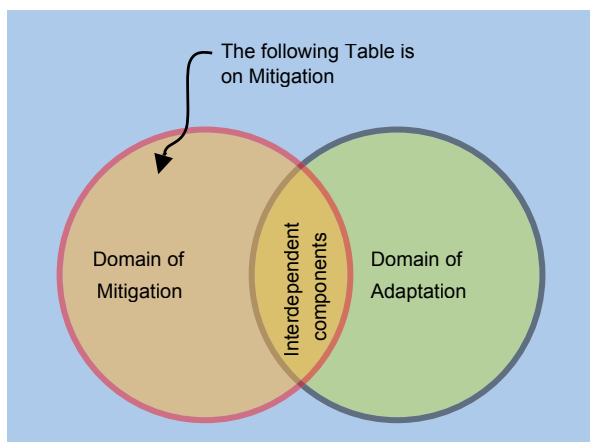
According to the IPCC, vulnerability is the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. According to the NAPA (2005) of Bangladesh the following is Relationship of Climate Change and Variability with Physical Vulnerability Context.

While the top down has broadly been corroborated by PVA exercises (at Kurigram, Manikgunj and Barisal), the latter has provided a much deeper understanding of the grass root level problems and solutions that are suitable to the socio-cultural contexts and hence, sustainable.

In order to minimise the local specific vulnerabilities, there is a need for appropriate mitigation and adaptation actions. The following paragraphs carry out a discussion on Mitigation and Adaptation based on the top down- bottom up knowledgebase.

## 7.3 MITIGATION OF GREENHOUSE GAS EMISSIONS

Mitigation (IPCC, 2001a) is an anthropogenic intervention to reduce the sources or enhance



the sinks. It is very important to state right in the beginning that the National GHG inventory of the Bangladesh shows that its contribution to global emission is very low. GHG emission can be further reduced by using natural gas in brick production and adopting other CDM in industries.

The enhancement of the natural GHG sinks by increasing the vegetation cover has been considered as possible mitigation options. The emission of GHG can further be reduced by adopting less CO<sub>2</sub> intensive construction technologies and appropriate designs that reduce the air-conditioning and electrical loads throughout the whole life cycle of the buildings. This could be demonstrated by building all future schools in this manner.

Increase in sink can be promoted through educating the children, increasing awareness of the community and using the school as a demonstration unit. The school can act as a resource centre in this respect. In order to make it a reality, the teachers need motivation and must believe by heart that there has to be a constant campaign to keep the awareness alive. This requires a thoughtful teachers' training component that deals with right kind of materials and pedagogy. However, motivation of the teachers and political will are the two fundamental pillars of the success towards combating climate change. There follows a summary of the mitigating actions that could be promoted and practised through schools. The matrix reflects the lines of thinking by BCCSAP, NAPA, DMB, the outputs of the National Workshop and the outputs of PVA

## 7.4 ADAPTATION TO CLIMATE CHANGE

Adaptation refers to "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities". This essentially means becoming accustomed, get used to, acclimatize, adjust, etc.

Though possible adaptation strategies have been identified as a top down approach, Bangladesh

Table 7.4: Mitigations at different levels: Primary Education Related

BANGLADESH CC STRATEGY AND PLAN	NATIONAL ADAPTATION PLAN OF ACTION	DISASTER MANAGEMENT ACTION	SUGGESTIONS: NATIONAL WS & PVA
INTERNATIONAL			
1. Investments to scale up solar power programmes			1. Pressure on the developed countries for reducing carbon emission- show them PVA reports- get CDM technologies
NATIONAL			
1. Support existing forestry and enhance carbon sequestration			1. Develop appropriate measures to mitigate greenhouse gas emissions 2. Construct and maintain with less CO2 emission and low energy intensity 3. Reduce GHG due to transportation 4. Planting trees 5. Avoid cutting trees
DISTRICT/UPAZILLA			
1. Develop coastal green belts	1. Reduction of climate change hazards through coastal afforestation with community participation.		1. Adapting alternative environment friendly ways 2. Demonstrating the green belt development in the district education office 3. District office as resource centre
SCHOOL			
			1. Planting trees around school ground 2. School as a model by demonstrating how plantation is a sink for CO2- use posters 3. Environmental club

needs huge financial and technical supports to enhance its capacity to adapt. Therefore, in order to respond successfully and implement appropriate adaptation strategies there is an urgent need for financial resources and technological capability building, including human resource development in various fields. There are steps taken by the NAPA in terms of projects. The education related projects have already been discussed before in this document. However, these are all top down projects and most of them have high financial requirements. It may be emphasised that, through the primary education system the issue of climate

change can be planned and implemented as part of the regular interventions. This will complement the national level projects in a cost effective manner.

As climate change is a global issue, coordination and cooperation programs at international and regional level is also viewed as an integral part of institutional capacity building.

At present the level of public awareness regarding climate change is very low at all sections of the society in Bangladesh. However, there are NGOs

who are currently working in disaster risk reduction through schools in Bangladesh. They need to emphasise the link between disaster and climate change. Under the school based disaster risk reduction programmes the school teachers will be the protagonists for disseminating the knowledge to the students and the community to make them well prepared to cope with climate change.

Following is a summary of the adaptation actions that could be promoted and practised through schools. The matrix reflects the thinking patterns of the BCCSAP, NAPA, DMB, the National Workshop and the villagers (through PVA).

### 7.5 INTERDEPENDENT INTERVENTIONS (ADAPTATION-MITIGATION)

The interdependent activities are the ones which involve both adaptation and mitigation. For example, inclusion of CC in teachers' training, text book revision, etc. are expected to create a favourable environment for reducing CO2 emission, increase in sink and adaptation to CC. The interdependent interventions have been separated out to create the base work for the Bangladesh government to set the priorities of interventions through a participatory process.

The following table is a list of interdependent activities that can be promoted and implemented through the primary schools. It is important to note that the interdependent activities are difficult to isolate out from adaptation and mitigation. Therefore, the list put forward in this document needs wider world interaction especially with the government and the research institutions. There is a need for general consensus at the top level regarding the reasonable definition of the interdependent actions.

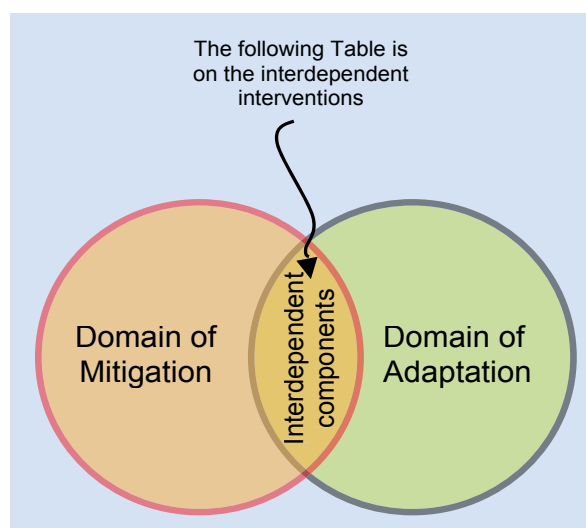


Table 7.5: Adaptations at different levels : Primary Education Related

BANGLADESH CC STRATEGY AND PLAN	NATIONAL ADAPTATION PLAN OF ACTION	DISASTER MANAGEMENT ACTION	SUGGESTIONS: NATIONAL WS & PVA
INTERNATIONAL  1. Research on the impact of climate change on health		1. Establish an Integrated Approach to disaster management including Climate Change and climate variability impacts 2. Preparedness for Earthquake and Tsunami risks	1. Campaign to funding bodies on the disasters occurring in Bangladesh 2. Look for funds and plan for disaster management 3. Awareness campaigns about impacts of CC and disasters occurring in Bangladesh 4. Post disaster trauma treatment- get international assistances

Table 7.5: Adaptations at different levels : Primary Education Related

BANGLADESH CC STRATEGY AND PLAN	NATIONAL ADAPTATION PLAN OF ACTION	DISASTER MANAGEMENT ACTION	SUGGESTIONS: NATIONAL WS & PVA
<p>NATIONAL</p> <ol style="list-style-type: none"> <li>1. Prepare GIS maps of areas vulnerable to droughts</li> <li>2. Develop adaptive strategies against outbreaks of diseases</li> <li>3. Monitor changes in water quality and quantity due to CC</li> <li>4. Improvement in warning dissemination to local communities</li> <li>5. GIS – condition of flood embankments</li> <li>6. GIS – showing cyclone shelters</li> <li>7. Flood Vulnerability Map based on future projected CC</li> <li>8. Flood Plain Zoning</li> <li>9. GIS maps of erosion prone areas</li> <li>10. Inter-ministerial and inter-institutional coordination at various levels</li> </ol>	<ol style="list-style-type: none"> <li>1. Providing drinking water to coastal communities so as to combat enhanced salinity due to sea level rise</li> <li>2. Reviewing existing condition of cyclone shelters</li> <li>3. Development of eco-specific adaptive knowledge (including indigenous knowledge) on adaptation to climate variability.</li> <li>4. Promoting adaptation to coastal crop agriculture to combat increased salinity.</li> </ol>	<ol style="list-style-type: none"> <li>1. Disaster risk reduction considerations incorporated in NGO programmes and plans</li> <li>2. Develop and establish a standard assessment procedure to identify community and household level risks</li> <li>3. Establish a disaster risk reduction action planning framework</li> <li>4. Update hazard maps such as flood, cyclone, drought, earthquake and tsunami</li> <li>5. Develop and establish policy and planning frameworks to incorporate all hazard risk reduction perspectives into sectoral policies and development plans</li> <li>6. Establish an effective Community Alerting System through capacity strengthening of CPP and DMCs at District, Upazilla and Union levels</li> <li>7. Develop and establish emergency response plans</li> <li>8. Develop and establish post disaster recovery and reconstruction mechanism</li> </ol>	<ol style="list-style-type: none"> <li>1. Teachers training to include examples of adaptations</li> <li>2. Land use plan keeping disasters in consideration</li> <li>3. Roads and culverts - use design and technologies that are flood safe</li> <li>4. improve tele-communication system with suitable technology</li> <li>5. Develop early warning system</li> <li>6. Taking necessary measures to prevent disasters in school facilities</li> <li>7. Provision of social and financial security</li> <li>8. Livelihood generating activities round the year work</li> <li>9. Proper assistances to the poor children</li> <li>10. Ensure accountability and good governance</li> <li>11. Improving the health services</li> </ol>



Table 7.5 contd...: Adaptations at different levels : Primary Education Related

BANGLADESH CC STRATEGY AND PLAN	NATIONAL ADAPTATION PLAN OF ACTION	DISASTER MANAGEMENT ACTION	SUGGESTIONS: NATIONAL WS & PVA
<p>DISTRICT/ UPAZILLA</p> <p>1. Awareness of communities – impacts of CC</p>	<p>1. Adaptation to agriculture systems in areas prone to enhanced flash flooding in North East and Central Region.</p> <p>2. Climate change and adaptation information dissemination to vulnerable community</p> <p>3. Focus on the most vulnerable communities in each eco-region (with emphasis on women, children and the elderly).</p>	<p>1. All training institutes used the updated module for disaster management</p> <p>2. Strengthen community and household level capacity to withstand the disastrous situations</p>	<p>1. Community programs to educate people on survival techniques, stock, reserve food and medicines</p> <p>2. Design and locate for safe drinking water</p> <p>3. Essential medicines for water borne diseases and flu increases both in humans and animals, awareness campaign, improve medical facilities</p> <p>4. Provide rain water harvesting systems and drainage and irrigation facilities</p> <p>5. Make provision for keeping animals in high lands</p> <p>6. Awareness building on human rights, equity, general balance, etc</p> <p>7. Women's income generation capacity</p> <p>8. Women's health</p> <p>9. To prevent social hazards against children and women- arrange for transition school and make provision to make up for the learning/ educational loss due to disaster</p> <p>10. Increase household income to stop child labour</p> <p>11. Awareness building on stopping child labour</p> <p>12. Awareness building on the importance of education in the longer run</p> <p>13. Continuing the sanitation campaign and ensuring 100% sanitation in the area</p>

Table 7.5 contd.: Adaptations at different levels : Primary Education Related

BANGLADESH CC STRATEGY AND PLAN	NATIONAL ADAPTATION PLAN OF ACTION	DISASTER MANAGEMENT ACTION	SUGGESTIONS: NATIONAL WS & PVA
<p>SCHOOL</p> <p>1. Monitoring systems by school teachers, communities and academic researchers</p>			<p>1. school design on stilt and strong enough to withstand disasters- school as shelter</p> <p>2. Setting up proper sanitary latrines in schools</p> <p>3. Make provision for safe storage of education materials, emergency food and medicine in the school</p> <p>4. Renovation of the main school-house and arrangement of Table and bench</p> <p>5. To prevent dropout of students from the school- arrange for transition school and make provision to make up for the learning/ educational loss due to disaster</p> <p>6. Implementation of area specific school designs in order to reduce the probability of hindrances in education due to natural disasters</p>

The above section shows three lists of mitigation, adaptation and interdependent activities as a response to CC in Bangladesh at different levels. All these have some direct or/and indirect connections with the primary education system, which is the most widely available and the lowest level of the government institutional interface with the people. Therefore, primary education system is the most important institutional component in the context of CC. The gaps in the boxes above show the idea gaps under a particular column, which is primarily due to the different domains of the respective levels of the institutional system in Bangladesh. Row wise activities enable the planners to consider all the required actions in the context of CC.

## 7.6 COMMUNITY WISDOM ON HAZARDS/ DISASTERS

The last columns of Table 7.4, Table 7.5 and Table 7.6 show the interventions identified under the present research, i.e., the national workshop and the PVA exercises in the case study areas. The Tables show the interventions that are education related and could be supported through the primary education system in Bangladesh. The opinions of the grass root level people have been presented in the Annexure II, which are local specific for 28 sites.

The above Tables show the activities under mitigation, adaptation and interdependent

interventions. They provide a comprehensive idea on how one can get an overall situation of responding to the CC in Bangladesh through its primary education system. The above section will be beneficial for the government of Bangladesh and the various stakeholders to plan, rank the activities, monitor and evaluate the status of the progress towards the targets.

The activities at International, National, District and school levels can be understood better if one gets an in depth view of why they are necessary. As described before, CC is primarily due to global warming. The possible increased vulnerabilities identified by the NAPA, DMB are likely to increase frequencies and magnitudes of different types of hazards. Therefore, it is of utmost importance to understand the causes of the hazards, nature of their impacts and the action required to manage them.

The PVA exercise in a limited number of schools revealed that the communities have in depth knowledge of the types of hazards. Having said that, it should also be noted that community wisdom to cope with the hazards are based on their traditional knowledge and there are examples where the wisdom failed. For example, the traditional wisdom of locating the villages at a safe distance from the river erosion had worked well till about ten years back in Bangladesh (District Kurigram). Recently such efforts have failed in

Table 7.6: Interdependent interventions: Primary Education Related

BANGLADESH CC STRATEGY AND PLAN	NATIONAL ADAPTATION PLAN OF ACTION	DISASTER MANAGEMENT ACTION	SUGGESTIONS: NATIONAL WS & PVA
INTERNATIONAL	1. Inclusion of climate change issues in curriculum at secondary and tertiary educational institution	1. Construction of adequate multi-purpose Cyclone and Flood Shelters in cyclone and flood prone areas	1. Sensitizing stakeholders and funding bodies on the disasters occurring in Bangladesh 2. Look for funds and plan for disaster management related to CC
NATIONAL 1. Plan for and invest in additional water supply and sanitation facilities 2. Immediate repair and rehabilitation of existing embankments, etc 3. Immediate repair and redesign of cyclone shelters, including their approach roads			1. Teachers training to include CC 2. Research on pedagogy to inculcate the knowledge on CC to transform the students' life style 3. Curriculum to include CC 4. Evaluation system to make sure that the competencies have developed
DISTRICT/UPAZILLA 1. Train local communities on shelter management, search and rescue & health 2. Repair and maintenance of cyclone shelters			1. Community programs to educate people on CC- use of street drama, etc 2. Adapting alternative environment friendly ways
SCHOOL			1. Educate the students about CC 2. Educate community 3. Use the school as demonstration 4. Retrofit the schools

many places. Several schools were located based on community wisdom which were envisaged to be safe for fifty years. Within five years some schools have gone into the rivers. Therefore, there is a need for lab to land knowledge transfer along with bottom up knowledge.

The following is the summary of the types of hazards, their causes, impacts and actions to address the problems. This is based on the

PVA exercises which have been documented in Annexure II. A wider study will make it more robust and reliable to combat the negative impacts of CC. The community wisdom is the most useful source to cope with CC since they face the hazards regularly and devise survival techniques on their own. The following Figures show that the communities have provided adequate practical ideas on what are the most effective ways of managing the problems of CC in Bangladesh.

The above Figures show detail lists of the adaptations under each head of hazard. The causes of the hazards, the impacts and the proposed adaptation actions provides the full range of information on the causes and actions leading to the preparedness for CC. Similar data are available on cyclone/ storm surge, earthquake, inundation, etc, in the outputs of the PVA exercises carried out at school level.

The boxes showing impacts in the Figure 7.1 will act as the future reference to examine whether the interventions are leading towards the target and at what speed. The evaluation of the interventions will take place at a periodic interval which could be every year for Bangladesh with less resilience compared to the other countries. The evaluation table has been put forward in Annexure VI.

In summary, it may be said that, while the Tables 7.4, 7.5 and 7.6 show the overall plan of action/ programmes/ activities to respond to CC in Bangladesh, Figure 7.1 will help in designing the hazard specific adaptations at grass root level.

The next chapter will examine the issue of costing of preparedness for CC. It has been envisaged that the government of Bangladesh will come up with the final cost figures based on the Tables 7.4 to 7.6 and Figure 7.1. Figure 7.1 provides cost basis for different types of disasters as envisaged by the grass root level people. It is highly recommended that a nationwide PVA be undertaken to make the Tables more robust and thus will update the present table to make it reliable enough for cost estimation.

Figure 7.1: The following charts show community wisdom on the causes of hazards, impacts, the adaptation/mitigating actions etc.

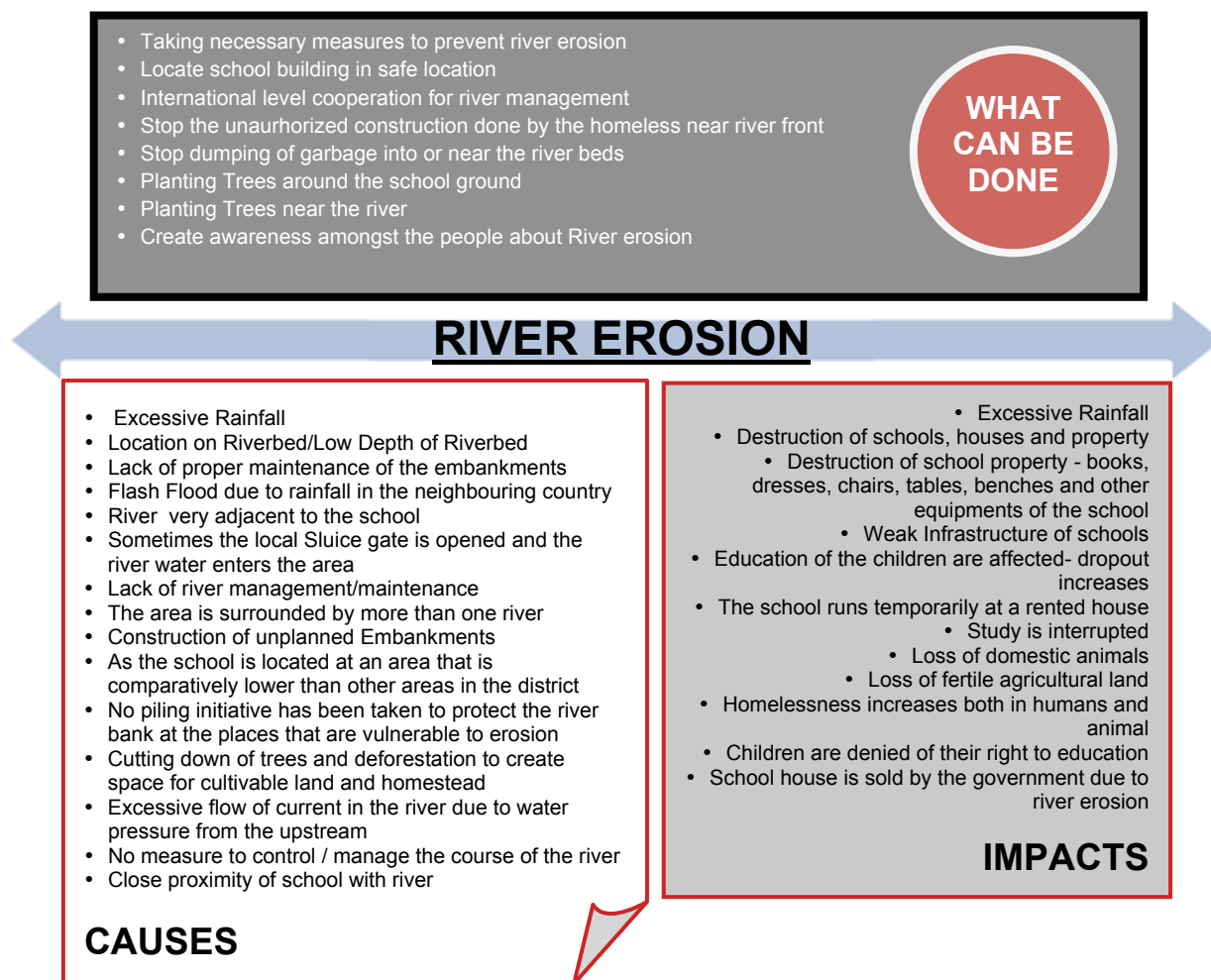


Figure 7.1 contd...: The following charts show community wisdom on the cause of hazards, impacts, the adaptation/mitigating actions etc.

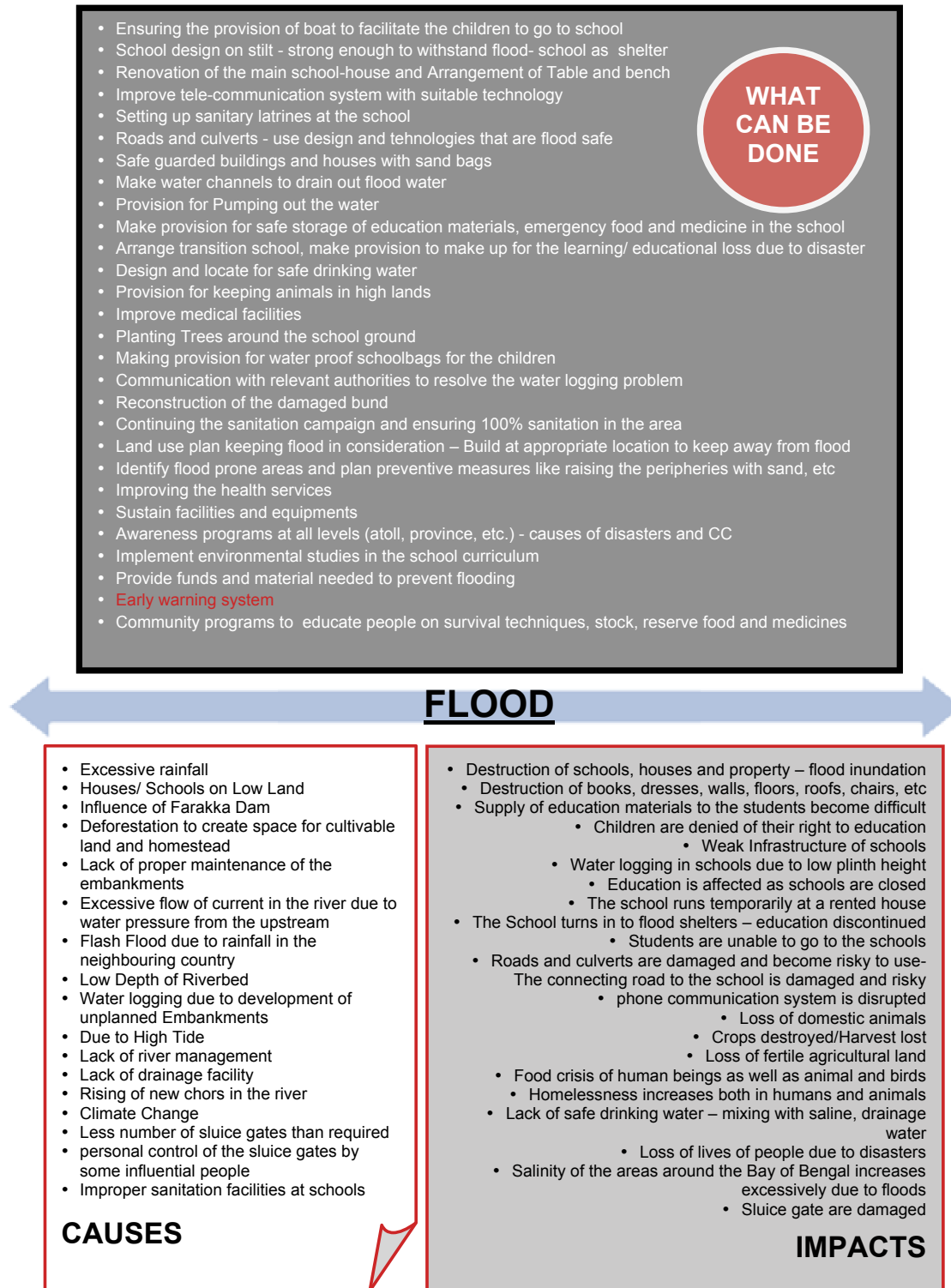
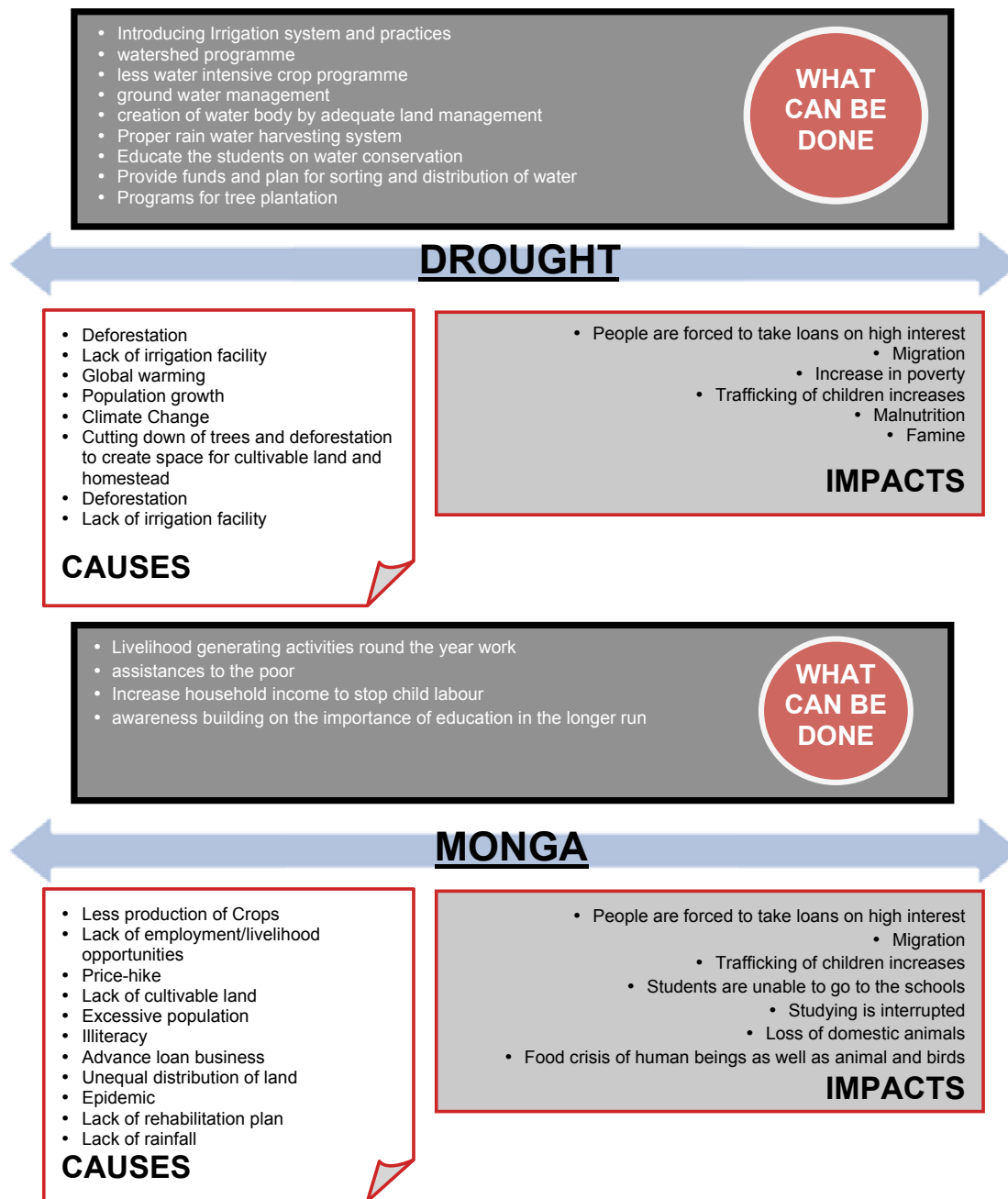




Figure 7.1: The following charts show community wisdom on the causes of hazards, impacts, the adaptation/mitigating actions etc.



It may be noted that the process of PVA is the first step towards preparing for CC through the primary education system. Therefore, Bangladesh needs to have an idea on the whole process of PVA. PVA is a one time major expenditure followed by less

expensive yearly exercises with the help of the developed human resources. The following chapter focuses on the preparedness cost against the example of post SIDR response.

# Chapter 8

## COSTING

### 8.1 RESPONSE COST

The above diagram shows that the impact cost will be high if the investment on mitigation and adaptation are kept low. The response to SIDR may be cited as an example of this kind. SIDR made it apparent that if the adaptation and mitigation are ignored one has to pay heavy price for it in terms of loss of life, properties, etc. The following is the detail of response cost of SIDR based on a limited number of damaged schools.

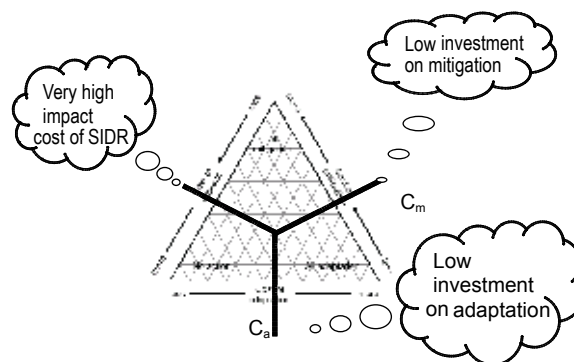


Figure 8.1: Interrelation among mitigation, adaptation and impact costs: SIDR

Table 8.1: Shows the items supplied per school as post SIDR support

1 Education Emergency Response: Student supply items for primary schools		
Sl #	Item	
1	Exercise book (3 types – Bangla, English, Math)	
2	Ballpoint pen	
3	Wooden pencil	
4	Sharpener	
5	Eraser	
6	Water color box	
7	Drawing book (40 pages)	
8	Student bag	
Classroom materials for primary schools		
Sl #	Item	
1	Blackboard with stand (4'-0" x 3'-0") – for 5 classrooms	
2	Chalk (12 pieces in a box)	
3	Duster (for 5 classrooms)	
4	Desk for teachers – for 5 classrooms (plastic)	
5	Chair for teachers – for 5 classrooms (plastic)	
6	Plastic mat for seating (for 30 students per classroom @ 5 students per mat)	
7	Chest for keeping teacher's materials (1 chest/ almira for 5 teachers)	
Recreational and other materials for primary schools		
Sl #	Item	
1	Plastic water tank – 500 liter GAZI tanks	
2	Ludu set – 2 nos. per class	
3	Skipping rope – 5 nos. per class	
4	Tennis ball – 2 nos. per class	
5	Football	
<b>TOTAL</b>		<b>USD 11,89,822.99</b>

Table 8.2: Shows the cost of transition schools

2POST SIDR TRANSITION SCHOOL CONSTRUCTION PROGRAMME					COST IN USD	
A	Basic cost of transition school (5 classrooms)				TAKA	3,07,241.84
B	Transportation Cost (from Upazila to School):For C.I sheet				TAKA	2,000.00
C	Service charge of IA and miscellaneous cost (10% of A & B)				TAKA	30,924.18
A+B+C	TOTAL FOR FIVE CLASSROOMS				TAKA	3,40,166.02
					USD	4,965.93
		<b>FOR</b>	<b>589</b>	<b>TRANSITION SCHOOLS</b>		<b>29,24,931.20</b>

Table 8.3: Shows the cost of replacement of the infrastructure: Past SIDR

A	B	C	D	E	F	G
Item no	DESCRIPTION	Number of schools	Unit cost in Taka Rates 2008	Unit cost in USD (1USD= 68.5 Taka)	Amount in USD	
1	Cyclone shelter-High Risk Area including furniture and electricity	268	1,31,00,000.00	1,91,240.88	5,12,52,554.74	DIFFERENT TYPES OF DESIGNS RECOMMENDED
2	Small cyclone shelter/re-orient is recommended including furniture and electricity	13	1,31,00,000.00	1,91,240.88	24,86,131.39	
3	Cyclone shelter-Low Risk Area including furniture and electricity	114	87,00,000.00	1,27,007.30	1,44,78,832.12	
4	Shiftable design needed	16	16,00,000.00	23,357.66	3,73,722.63	
5	2 rooms similar to severe flood design-modified foundation and including furniture & electricity	32	36,00,000.00	52,554.74	16,81,751.82	
6	Vertical extension- provide 3 rooms at FF including furniture and electricity	40	21,00,000.00	30,656.93	12,26,277.37	
7	2 classroom similar to normal flood design including furniture and electricity	95	24,00,000.00	35,036.50	33,28,467.15	
8	3 rooms similar to severe flood design including furniture and electricity	5	45,00,000.00	65,693.43	3,28,467.15	
9	Vertical extension- 2 rooms including furniture and electricity	6	18,00,000.00	26,277.37	1,57,664.23	
	<b>PART I</b>			<b>USD</b>	<b>7,53,13,868.61</b>	
10	Girls' + Boy's toilet	269	1,70,000.00	2,481.75	6,67,591.24	WATSAN
11	Teachers' toilet	269	80,000.00	1,167.88	3,14,160.58	
12	Drinking water	384	80,000.00	1,167.88	4,48,467.15	
	<b>PART II</b>			<b>USD</b>	<b>14,30,218.98</b>	
13	2% physical contingencies on item number 1 to 3 (i.e. HRA and LRA)				13,64,350.36	CONT,ESC
14	4% price escalation on item number 1 to 3 (i.e. HRA and LRA)				27,28,700.73	
	<b>PART III</b>			<b>USD</b>	<b>40,93,051.09</b>	
	<b>TOTAL (PART I+ PART II+ PART III) USD</b>				<b>8,08,37,138.69</b>	

Table 8.4: Shows summary of impact costs due to SIDR in a limited number of schools

SUMMARY OF INTERVENTION COSTS TOWARDS SUPPLY TO THE DAMAGED SCHOOLS	11,89,822.99	USD			
TRANSITION SCHOOLS	29,24,931.20	USD			
CYCLONE SHELTERS	8,08,37,138.69	USD			
GRAND TOTAL	8,49,51,892.89	USD			
Total number of schools affected and repaired/reconstructed/make shift schools supplied /make shift schools supplied	589		PER SCHOOL COST	USD	1,44,230.72
Total number of children affected	1,03,664.00		PER CHILD COST	USD	819.49
This is excluding the schools which were repaired under the government funds Special Note: The Expenditure Shown Here Is Government Intervention In The GPS Only. The RNGPS, Community Schools, Etc Either Got Fund From Other Sources Or Could Not Do Anything To Restore The Infrastructure Owing To Lack Of Money					

Table 8.5: Complete damage to furniture: Barishal and Khulna

Teachers desk	Student's desk	Chair	Bench	Blackboard	Others
12,607	9,879	21,428	55,603	10,449	27,649

Source: a large number of agencies such BDS, BRAC, etc

While the schools were supplied with just 5 sets of furniture for the teachers the actual damage was far more than what was supplied. Table 8.5 shows the huge number of completely damaged school furniture only in two districts.

From the above tables it is evident that the response cost of about 819 USD per child is a very high impact cost which can be reduced to a great extent by investing on Adaptation and Mitigations actions.

## 8.2 PREPAREDNESS COST

In the last Chapter, a list of Mitigation and Adaptation actions has been put forward in the context of CC in Bangladesh. It has also provided a list of actions to be undertaken to minimise the impacts of the hazards that are likely to increase in magnitude and frequency due to climate change. While the starting point of this research was BCCSAP, NAPA MDG and DMB, the suggested interventions have

primarily been based on the PVA exercises carried out in a limited number of schools.

At this stage, the government of Bangladesh needs to examine the outputs of the present research followed by a detail PVA exercise across the country. Following that, the area specific adaptation and mitigation actions can be promoted/ implemented through the education system, in which the DoE will take the lead role along with DMB. While Table 4.3 in Chapter 4 shows the immediate actions according to the priority set by BCCSAP, there is a need for getting community opinion in this regard during the future PVA exercises. BCCSAP may consider the ranking of the identified Mitigation and Adaptations by the communities and make a final list of prioritised actions that will be categorised into Short term, medium term and long term interventions. These should be area specific because of the variation in micro level situation in different parts of the country.

One of the crucial issues in the context of CC is the probable cost of the interventions. This research provides adequate information on the answers to the following questions. However, this should be examined by the government of Bangladesh and PVA results to be acquired to respond to the following questions in a sustainable manner.

- a) what are the targets and by when to achieve them?
- b) Who and with whom and how should they be done?
- c) what are the indicators to know whether proceeding in the right direction and at right speed
- c) how much to spend and on what?

Among some of the important interventions are Curriculum upgrading, Text book revisions, Teachers training, and production and dissemination of ICT materials. This is not a major cost compared to the investment on capital in primary education. For example Maldives has invested 180,000 USD for the text book redevelopment.

Table 8.3 shows the huge investment cost of post SIDR reconstruction, which is about 81 million USD. This is primarily due to neglecting adaptation and mitigation. Owing to this the impact cost was so high. In comparison, the investment cost

on PVA for the 400 schools is about 1.5% of the onetime investment on infrastructure after SIDR.

It is highly recommended that the investment on the adaptation and mitigation shown in Table 7.4, 7.5 and 7.6 is necessary and it will greatly reduce the impact costs in the event of future disasters. Among the cost of interventions, the last chapter provides adequate points to have a rough estimate of the adaptation and mitigation actions, which the government should be able to carry out. This section will focus on the cost of PVA exercise in Bangladesh. The following is a brief note on that.

PVA starts from the bottom level first so that the top level people could be convinced about the problems at grass root and people's perception and wisdom on what could be done to cope with CC in a sustainable manner. The programme starts with developing a cadre of master trainers who will be the future resources for carrying out PVA for the teachers, students and the community. ActionAid has been carrying out PVA in several countries and they have a reasonably accurate costing for such exercises. In line with ActionAids' main format the following pages show the probable cost of PVA exercise in Bangladesh at 400 schools.

Table: 8.6: Bangladesh: Budget: Participatory Actions towards Resilient Schools & Education Systems to combat Climate Change

ActionAid Bangladesh: Budget: Participatory Actions towards Resilient Schools & Education Systems

SI	Head of Expenditure	Unit	Unit Rate	Duration	To be Procured by UNICEF	Year 1 BDT 2009	Year 2 BDT 2010	Total BDT	Total 18 Months in USD
A	Programme Cost (Cost Direct inputs)								
1	Personnel Cost (Salaries & Support Cost of Implementing personnel)								
a	Programme Manager (Cluster Consortium-AAB)	1	96,735	21.5	N/A	7,25,513	14,87,784	22,13,297	32,311
b	Programme Officer - Cluster Consortium-AAB (Project Support)	2	32,820	21.5	N/A	4,92,300	10,09,543	15,01,843	21,925
c	Programme Officer - Cluster Consortium-AAB (Documentation & Monitoring)	1	32,820	21.5	N/A	2,46,150	5,04,772	7,50,922	10,962
d	Finance Officer - Cluster Consortium-AAB	1	32,820	21.5	N/A	2,46,150	5,04,772	7,50,922	10,962



Table: 8.6: contd....

SI	Head of Expenditure	Unit	Unit Rate	Duration	To be Procured by UNICEF	Year 1 BDT 2009	Year 2 BDT 2010	Total BDT	Total 18 Months in USD
e	Project Coordinator (Concern Worldwide-CW)	1	52,455	21.5	N/A	3,93,413	8,06,758	12,00,170	17,521
f	Project Officer (CW)	2	28,840	21.5	N/A	4,32,600	8,87,118	13,19,718	19,266
g	Finance Officer (CW)	1	25,785	21.5	N/A	1,93,388	3,96,573	5,89,961	8,613
h	Coordinator (National Partner-APIT)	1	30,000	20	N/A	2,10,000	4,20,000	6,30,000	9,197
i	Project Officer (National Partner-APIT)	2	20,500	20	N/A	2,87,000	5,74,000	8,61,000	12,569
j	Finance Officer (National Partner-APIT)	1	26,900	20	N/A	1,88,300	3,76,600	5,64,900	8,247
k	Upazilla Officer (20 personnel of 10 Local Implementing Organisations- LIO)	20	13,000	20	N/A	18,20,000	36,40,000	54,60,000	79,708
l	Finance Officer (10 personnel of 10 Local Implementing Organisations- LIO stationed at the intervention areas)	10	9,000	20	N/A	6,30,000	12,60,000	18,90,000	27,591
m	Support Cost of Implementing personnel	-	N/A	-	N/A	-	-	-	-
m1	Recruitment of human resources of ActionAid	-	N/A	-	N/A	-	-	-	-
m2	Recruitment of human resources of implementing organisations	-	N/A	-	N/A	-	-	-	-
m3	MoU signing between implementing Organisations and lead (AAB)	-	N/A	-	N/A	-	-	-	-
	<b>Sub -Total</b>					<b>58,64,813</b>	<b>1,18,67,920</b>	<b>1,77,32,733</b>	<b>2,58,872</b>
2	Project Related Travel & DSA	-	-	-	-	30,08,000	61,40,000	91,48,000	1,33,547
3	Training, Compilation, Validation, sharing & Coordination Cost	-	-	-	-	1,44,43,800	75,58,749	2,20,02,549	3,21,205
4	Material Production & distribution /Research & Dissemination	-	-	-	-	36,00,990	1,24,10,760	1,60,11,750	2,33,748
5	Cost Of Review, M&E and Impact Assessment	-	-	-	-	19,47,000	48,08,000	67,55,000	98,613
6	Office equipment directly supporting the project	-	-	-	2429000	24,29,000	-	24,29,000	35,460
7	Communication directly supporting project				-	6,000	12,000	18,000	263
	<b>Total A</b>				<b>24,29,000</b>	<b>3,12,99,603</b>	<b>4,27,97,429</b>	<b>7,40,97,032</b>	<b>10,81,708</b>

Table: 8.6: contd...

SI	Head of Expenditure	Unit	Unit Rate	Duration	To be Procured by funding agency	Year 1 BDT 2009	Year 2 BDT 2010	Total BDT	Total 18 Months in USD
B	Project Support Cost (Cost Indirectly) --								
1	Admin & Logistics support	-	-	-	-	15,02,490	25,09,936	40,12,426	58,576
2	Financial Management Cost	-	-	-	-	4,55,000	4,55,000	9,10,000	13,285
3	Rental Office Space	-	-	-	-	2,58,000	5,16,000	7,74,000	11,299
4	Telecommunication	-	-	-	-	2,40,000	4,80,000	7,20,000	10,511
5	Office Supplies	-	-	-	-	3,45,000	6,90,000	10,35,000	15,109
6	Utilities	-	-	-	-	1,29,000	2,58,000	3,87,000	5,650
	<b>Total B</b>					<b>29,29,490</b>	<b>49,08,936</b>	<b>78,38,426</b>	<b>1,14,430</b>
	GRAND TOTAL				24,29,000	3,42,29,093	4,77,06,365	8,19,35,458	11,96,138
							Amount (BDT)	%	
						Total A	7,40,97,032	90	
						Total B	78,38,426	10	
						Total	8,19,35,458	100	
						Exchange Rate 1 USD = 68.5 BDT			

The above cost of 1.2 million USD for the PVA exercise is not a onetime investment. It may be noted that PVA is a continuous process and hence, there is a need for cost effective way of continuing the process by involving the local resources developed under the present programme. The detail estimate is Annexure IV.

## RECOMMENDATIONS

### 9.1 THE SUGGESTED MODEL

Figure 9.1 shows the pathway of climate change towards impact on the children. As mentioned before, NAPA, BCCSAP and MDG formed the premise of the present research which is a top down approach. This report showed that the grass root level findings underpin the national level approach to combat CC. In addition, the PVA exercise has been able to gather together a list of adaptation and mitigation actions that are practical and suitable to the contexts. However, this is based on the studies on 28 schools. Increase in the number of case studies will make the list of adaptation and mitigation robust.

The PVA has provided a deep insight into the realm of response through the primary education system. Very specific recommendations on adaptation and

mitigation have been put forward by the school teachers, students and the communities. The area specific hazards were identified during the PVA exercises. The causes of such hazards, the impacts and the possible interventions were also identified by the communities.

One of the important outputs of this research is a detail discussion on cost of the interventions to minimise the negative impacts of CC on primary education. The last Chapter has shown the cost of PVA exercise for the whole of Bangladesh. The following Figure 9.2 shows the overall process of identifying the different components of adaptation and mitigation as a response of primary education system to CC in Bangladesh. It is impossible

Figure 9.1: Pathways of impact of climate change on children in Bangladesh

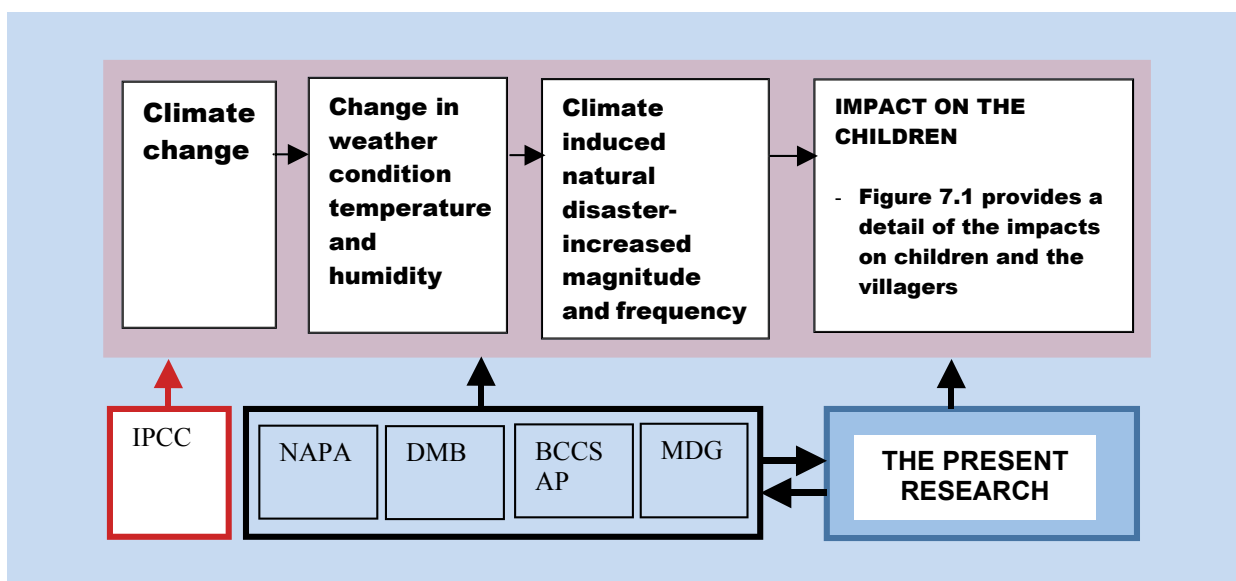
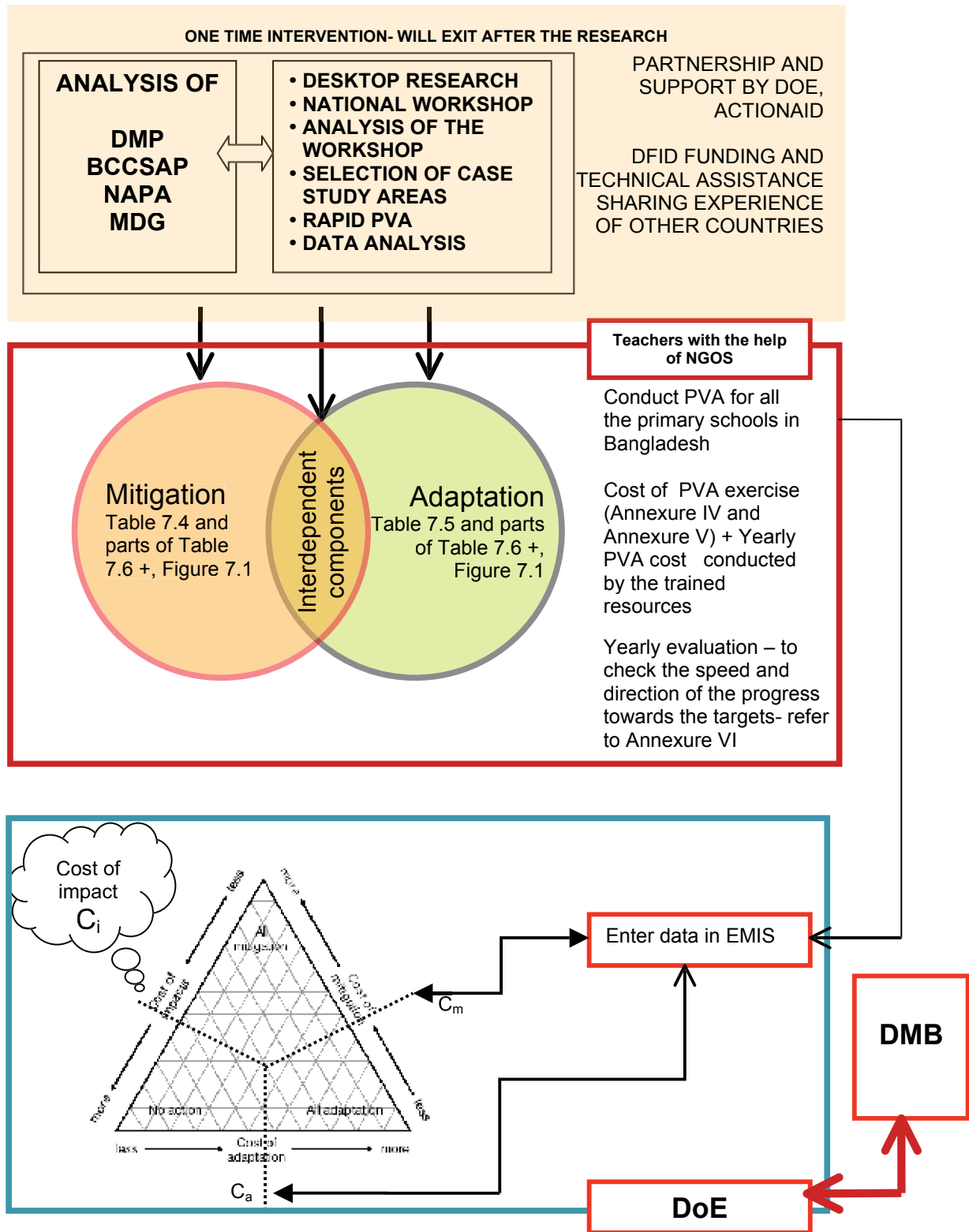


Figure 9.2: The Model: Planning and monitoring adaptation and mitigation actions



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for Bangladesh to invest on all adaptation and all mitigation interventions. Hence, the costs of high priority adaptation (Ca) and mitigation (Cm) interventions (Figure 9.2) should be considered for investment. This will enable the country to identify the unattended interventions to combat CC. Based on that the cost of impacts could be forecast and proactive measures could be designed.

The above Figure is the suggested model to combat CC in Bangladesh through its primary education system. The activities in the top most block are one time investment and the activities below that will continue as a constant endeavour of the government of Bangladesh towards CC.

## 9.2 RECOMMENDATIONS

The following is a list of recommendations. The contents of the recommendations and their ranking should be debated to come to a consensus by the stakeholders in the domain of primary education and climate change. The list is not exhaustive and the stakeholders may add or amend, if needed. This exercise will be led by the Ministry of Primary and Mass Education, government of Bangladesh. The list of recommendations will be robust and may change if more data on vulnerabilities are acquired.

Regarding the response of Primary Education to climate change, the focus needs to be on the grass root level preparedness based on communities' requirements and the most local level situation analysis. This report has demonstrated that PVA could be one of the feasible and cost effective tools that can identify suitable adaptation and mitigation actions in a context. PVA, which is people centric, will enable the education planners to share traditional wisdom on how people deal with disasters.

The field experience reveals that, in school-based institutional system, the teachers will play a very important role in combating climate change. Their training and motivation will be critical for the success of developing a cadre of human resources

who will make Bangladesh climate resilient. This is expected to transform the young students by inculcating a life style change in them. The teachers will also be a constant support to the community's awareness and capacity building in climate change. This is an ongoing process since circumstances may change from time to time. Consequently, there will be need for periodic evaluation of the speed of approaching the targets by context specific adaptation and mitigation actions to combat climate change. The following is a list of recommendations for consideration of the DoE, government of Bangladesh.

- Review BCCSAP, NAPA and DMB in the light of present research and set targets and priorities in primary education sector towards adaptation and mitigation – climate change.
- Make Climate Change Impact Assessment (CCIA) mandatory for all education programmes
- Need for strong political will and commitment.
- Promote political stability to combat climate change
- Regional co operation and knowledge sharing needed
- Involve the community members including the religious leaders in PVA
- Provision for non monetary Incentives to the students and teachers to promote and demonstrate adaptation- best school award could be introduced.
- Need for paradigm shift in Teachers' training, curriculum development, Pedagogy, behaviour change, learning and skills and examination system. It is cost effective to include CC in the primary education through its curricula and extracurricular activities to inculcate a lifestyle change to cope with the changed situation
- Conduct PVA at all Schools and make the model in Figure 9.2 operational. PVA is not about data acquiring alone, it instills a strong feeling of solidarity which is needed before, during and after disasters. The findings of PVA could be a good premise for people centric national strategies on CC in primary education





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- Make a strong case at international level showing that top down policies in the context of climate change are in line with the grass root level reality and hence, sustainable
  - The EMIS department of the DoE to co-ordinate the vulnerability mapping. Ensure adequate equipment, human resources and capacity for calculating the number of schools and children in the high risk zones- link EMIS with GIS
  - The macro level maps (are available) should be supplemented with micro level information which can be acquired through school-based vulnerability assessment of the communities and then made it part of the EMIS data.
  - Immediate need to update BNBC and prepare a multi-hazard map
  - Encourage community based repair and retrofitting with offline support of the engineers
  - Need capacity building of construction workers, engineers and architects towards disaster safe construction- upgrade syllabi of engineering and architecture curricula – include CC and disaster safety of infrastructure