

# Climate Change and Extreme Cyclones

Regional Conference on Disaster Risk Reduction and Emergency Response  
in a Rapidly Changing World

17-18 February, 2010  
Lake Shore Hotel, Dhaka, Bangladesh

Supported by





# Climate Change and Extreme Cyclones

Regional Conference on Disaster Risk Reduction and Emergency Response in a  
Rapidly Changing World

Dhaka, Bangladesh

17 to 18 February 2010

## Conference Program

### Organizers



Asian Disaster Preparedness Center (ADPC)



Bangladesh Disaster Preparedness Center (BDPC)

### Local Organizing Committee

Mohammad Saidur Rahman, Chairperson (Director, BDPC)

Dr. Shamim Mahabubul Haque (ADPC)

Dilruba Haider (BDPC)

### Supported by:

Government of Bangladesh

UN International Strategy for Disaster Reduction

Royal Norwegian Government

USAID Office for Foreign Disaster Assistance

### Secretariat

Padma Karunaratne, ADPC

Khondoker Golam Tawhid, ADPC

Hamidul Haq, BDPC

# Background and Objectives

## Background

Typhoon Xangsane of 2006 in Viet Nam, Cyclone Sidr of 2007 in Bangladesh, and Cyclone Nargis of 2008 in Myanmar – these disaster events have highlighted the impacts that severe cyclone events can trigger on human society if early warning systems and disaster risk reduction measures are not in place. According to the Intergovernmental Panel on Climate Change (IPCC, Climate Change 2007: synthesis report), tropical cyclone activity has in fact increased during the last decades in the regions that are originally prone to cyclones, characterized by increased scope/energy of storms, more powerful winds, and torrential rains. The IPCC highlights the devastating impacts consistent with extreme cyclone events such as ecosystems destruction, threat to food security, prolonged disruption of livelihoods, possible increases in the incidence of infectious diseases (such as malaria, dengue fever, hepatitis and cholera), and a decrease in availability and lowering of the quality of water resources.

## Objectives

The conference will aim for a common understanding of the new tropical cyclone surge pattern and its potential impacts, and for examining different cyclone and its impacts risk reduction options/models to increase readiness and awareness of countries, local authorities and communities. Elements at risk include the most vulnerable people, livelihoods, and infrastructure; all these should benefit from actions that will protect life and ensure sustainability. The conference will provide a venue where stakeholders can share experiences, and bridge the gaps between extreme cyclone events and the rapidity to cope with such disasters and reduce durably its harmful impacts.

The conference has the following objectives: (1) to capture lessons from recent tropical cyclones (such as Sidr in 2007, Nargis in 2008, and Xangsane in 2006); (2) understand the implications for disaster risk reduction of the climate change scenarios contained in the 2007 Assessment Report by the Intergovernmental Panel on Climate Change.

# PROGRAM

DAY 1: 17 February 2010	
Time and Room	Events and Program
9:00- 10:15	<p><b>Inaugural Ceremony</b></p> <ul style="list-style-type: none"> <li>• Welcoming Remarks: Dr. Bhichit Rattakul, Executive Director, Asian Disaster Preparedness Center (ADPC)</li> <li>• Dr. Atiq Rahman, Executive Director, BCAS</li> <li>• Dr. Tore Furevik, Scientist, Bjerknes Centre for Climate Research (BCCR), Norway</li> <li>• <i>Address by the Guest of Honor:</i> Jo Lesser-Oltheten, Director, USAID Bangladesh</li> <li>• <i>Address by the Chief Guest:</i> Dr. Muhammad Abdur Razzaque, Hon. Minister, Ministry of Food and Disaster Management</li> <li>• Vote of Thanks: Muhammad Saidur Rahman, Director, Bangladesh Disaster Preparedness Center</li> </ul> <p><b>Chair:</b> Md. Mokhlesur Rahman, Secretary, MoFDM</p>
10:15 - 10:45	Tea/Coffee Break
10:45-11:15	<b>Testimony</b>
11:15- 13:15	<p><b>Plenary 1</b></p> <p>Climate Change Scenarios and their Implications for Disaster Management and Emergency Preparedness</p> <ol style="list-style-type: none"> <li>1. Dr. Tore Furevik, Scientist, BCCR</li> <li>2. Dr. Senaka Basnayake, Scientist, SAARC Meteorological Research Center (SMRC)</li> <li>3. Dr. Ren Fu Min, Professor, National Climate Center (NCC) Beijing, PROC</li> </ol> <p><b>Co-Chairs:</b> Dr. Bhichit Rattakul, Executive Director, ADPC Ahsan Zakir, Director General, Disaster Management Bureau</p>
13:15 – 14:30	Lunch Break

**DAY 1: 17 February 2010**

Time	Events and Program		
<b>Co-chairs</b>	<p><b><i>Thematic Session A:</i></b> Climate change induced extreme cyclones and community preparedness – How ready are we?</p> <p><i>M.A. Wazed</i>, Joint Secretary for Disaster Management, MoFDM</p> <p><i>Prof. Mehedi Ahmed Ansary</i>, BUET</p>	<p><b><i>Thematic Session B:</i></b> Climate change scenarios and the potential social impacts</p> <p><i>Aminul Islam</i>, Assistant Country Director, UNDP Bangladesh</p> <p><i>Nick Russell</i>, CDMP</p>	<p><b><i>Thematic Session C:</i></b> Information technology for reducing disaster risks from climate change</p> <p><i>Prof. A. S. M. Maksud Kamal</i>, National Expert, CDMP</p> <p><i>Dr. Ren Fu Min</i>, Professor, NCC Beijing</p>
14:30- 15:15	<i>Papers 1 to 4</i>	<i>Papers 1 to 4</i>	<i>Papers 1 to 3</i>
15:15 – 15:30	Question and Answer period, Summary		
15:30- 16:00	Tea/Coffee Break		
16:00- 16:45	<p><b><i>Thematic Session A</i></b> <i>Papers 5 to 8</i></p>	<p><b><i>Thematic Session B</i></b> <i>Papers 5 to 8</i></p>	<p><b><i>Thematic Session C</i></b> <i>Papers 4 to 7</i></p>
16:45 – 17:00	Question and Answer period, Summary		

**DAY 2: 18 February 2010**

Time	Events and Program		
9:00- 11:00	<p><b>Plenary 2</b></p> <p>Approaches for Improving Disaster Risk Reduction and Community Adaptation</p> <ol style="list-style-type: none"> <li>1. Hon. Alipio S. Fernandez, Jr. Mayor, Dagupan City, Philippines</li> <li>2. Dr. Bhichit Rattakul, Executive Director, ADPC</li> <li>3. Dr. Jayaraman Potty, RIMES/ADPC</li> <li>4. Dr. Atiq Rahman, Executive Director, BCAS</li> </ol> <p><b>Co-Chairs:</b> Dr. Mihir Kanti Mazumder, Secretary, MoEF Dr. Tore Furevik, Scientist, BCCR</p>		
11:00- 11:30	Tea/Coffee Break		
<b>Co-chairs</b>	<p><b>Thematic Session D:</b> Policy advocacy for climate change adaptation</p> <p><i>Dr. Zafar Ahmed Khan,</i> Director General, Dept. of Environment</p> <p><i>Kathleen McLaughlin,</i> Regional Director (Asia), CECI</p>	<p><b>Thematic Session E:</b> Institutional aspects of climate change adaptation</p> <p><i>Ahsan Zakir,</i> Director General, DMB</p> <p><i>Hon. Alipio Fernandez, Jr.,</i> Mayor, Dagupan City, Philippines</p>	<p><b>Thematic Session F:</b> End-to-end early warning</p> <p><i>Arjumand Habib,</i> Director, Bangladesh Meteorological Department</p> <p><i>Dr. Senaka Basnayake,</i> Scientist, SMRC</p>
11:15- 12:15	<i>Papers 1 to 4</i>	<i>Papers 1 to 3</i>	<i>Papers 1 to 4</i>
12:15 – 12:30	Question and Answer period, Summary		
12:30- 14:00	Lunch Break		
14:00- 14:45	<p><b>Thematic Session D</b></p> <p style="text-align: center;"><i>Papers 5 to 7</i></p>	<p><b>Thematic Session E</b></p> <p style="text-align: center;"><i>Papers 4 to 6</i></p>	<p><b>Thematic Session F</b></p> <p style="text-align: center;"><i>Papers 5 to 7</i></p>
14:45 – 15:00	Question and Answer period, Summary		
15:00- 15:30	Tea/Coffee Break		

**DAY 2: 18 February 2010**

15:30- 17:30

**Closing Ceremony**

**Report to the Plenary on the outcome of the sessions** by *N.M.S.I. Arambepola, Director, ADPC*

**Panel Discussion:** *“What should be our future?: A focus on building climate resilient communities.”*

- Dr. Bhichit Rattakul, Executive Director, ADPC: *on urban community resilience*
- Hon. Alipio S. Fernandez, Jr., Mayor, Dagupan City, Philippines: *on community awareness and preparedness*
- Ahsan Zakir, Director General, DMB: *on the role of disaster management organizations*
- Dr. Atiq Rahman, Executive Director, BCAS: *on targeting the most vulnerable coastal communities*
- Muhammad Saidur Rahman, Director, BDPC: *on livelihood adaptation*
- Dr. Tore Furevik, Scientist, BCCR: *on capacity building and knowledge management*
- Dr. Senaka Basnayake, Scientist, SMRC: *on sub-regional cooperation for effective early warning*
- Dr. Ren Fu Min, Professor, NCC Beijing, PROC: *on the role of the World Meteorological Organization*
- Dr. Jayaraman Potty, RIMES/ADPC: *on the role of regional early warning centers in forecasting and early warning*

**Chair:** Ahmed Hossain Khan, Additional Secretary, Disaster Management and Relief Division, MoFDM



# Table of Contents

Organizers.....	i
Background and Objectives.....	ii
PROGRAM .....	iii

## **PLENARY 1: CLIMATE CHANGE SCENARIOS AND THEIR IMPLICATIONS FOR DISASTER MANAGEMENT AND EMERGENCY PREPAREDNESS..... 1**

Climate change over Central and South Asia - implications for Bangladesh .....	2
Tropical cyclone prediction and early warning activities at SAARC Meteorological Research Centre.....	4
Uncertainties of tropical cyclones in the context of climate change and response strategy .....	6
Session A: Climate change induced extreme cyclones and community preparedness – How ready are we? .....	9
Cyclone Nargis, Myanmar: Lessons learned .....	10
Analysis of climate change phenomena in Bangladesh .....	11
Changing the agricultural habitation and adapting innovative farming practice in the coastal zone in Bangladesh.....	12
Community-based adaptation strategies in coastal areas in Bangladesh: Challenges and responses.....	13
Local strategies to live with cyclones in coastal areas of Bangladesh .....	14
Impacts of climate change: An overview on cyclones on some selected coastal areas of Bangladesh .....	15
Preparedness mechanism to minimize the disaster effects in the coastal area: A study on Latachapli Union.....	16
Community risk assessment technique to reduce the threats of cyclones and climate change .....	17
Session B: Climate change scenarios and the potential social impacts .....	19
Projected risks to health associated with climate change .....	20
Climate change and impact of cyclones on public health: Bangladesh .....	21
Evaluation of water supply facility in the cyclone shelters and the feasibility of rainwater as an alternative source .....	22
Assessment of variations in disaster vulnerability in coastal communities from socio-economic perspective: A study on Assasuni Upazila of Satkhira District, Bangladesh.....	23
Climate change scenarios and impacts on the livelihoods of affected people in coastal Bangladesh .....	24

Climate change in Bangladesh, rural livelihood and impact on cities.....	25
Coastal ethnic minorities' capacity to address the post disaster effects of cyclone and storm surge on livelihood: A study on Rakhain community of Lotachapli Union.....	26
Vulnerability of Chittagong to climate change and future challenges for planning and development .....	27
Session C: Information Technology for Reducing Disaster Risks from Climate Change.....	29
Cyclone wind hazard assessment in coastal Bangladesh.....	30
Monitoring of cyclone Aila and its impact in Bangladesh.....	31
Inundation risk map developed by past storm surge modeling of the coastal region of Bangladesh.....	32
Improvement of cyclone disaster management in coastal area using GIS and remote sensing: A case study at Barguna, Bangladesh.....	33
Disaster risk analysis using GIS approach in Sarankhola Upazila, Bagherhat .....	34
Construction of Disaster Risk Index using GIS for better management of disaster information: A study on coastal communities of Bangladesh.....	35
Cyclone risk assessment and delineation of suitable site for cyclone shelter.....	36

**PLENARY 2: APPROACHES FOR IMPROVING DISASTER RISK REDUCTION AND COMMUNITY ADAPTATION..... 37**

Community based disaster risk management in Dagupan City.....	38
The risks to urban coastal cities .....	39
Cyclone prediction and early warning system: Challenges and successes .....	41
Session D: Policy Advocacy for Climate Change Adaptation.....	43
Linking disaster risk reduction to climate change adaptation: Evolving regional perspectives in Asian countries.....	44
Mainstreaming disaster risk reduction in Bangladesh.....	45
Experiences in integrating disaster risk reduction into post-disaster housing reconstruction in Vietnam .....	46
Critically appraising the issues pertinent to implementing carbon neutral urban development.....	47
Gender issue in climate change discourse: Theory versus reality .....	48
Climate change and conflict: Minding the gap.....	49
Climate migrants and their changing livelihood pattern in the South-West coastal region of Bangladesh.....	50

Session E: Institutional Aspects of Climate Change Adaptation .....	51
Existing and emerging risks and the need for institutional hazard preparedness and governance: Cyclone hazard preparedness.....	52
Disaster risk reduction and climate change education and research in Bangladesh: A progress report.....	53
Local governance for disaster risk reduction.....	54
Climate change adaptation for cities.....	55
Problems and issues of climate change in Bangladesh – Does this matter to urban local governments?.....	56
Furthering institutional strength of local government for climate change adaptation in Bangladesh.....	57
Session F: End-to-End Early Warning .....	59
Developing user-relevant tools and early warning information products for reducing disaster risks.....	60
Improving early warning dissemination system at receiver’s end: Experience of a community-based EWDS in Bangladesh.....	61
Integrating local knowledge and informal practices with early warning system for disaster risk reduction .....	62
Reducing vulnerability in coastal areas of Bangladesh through adaptation and awareness .....	63
Hydro-meteorological study of Sunamganj and surroundings for forecasting flash flood early warning .....	64
Climate change and the behaviour of cyclonic storm formed in the Bay of Bengal and crossed Bangladesh coast .....	65
Impacts of climate change: An overview of cyclone and sea level rise in coastal zone of Bangladesh.....	66



**PLENARY 1:**  
**Climate Change Scenarios and their Implications for Disaster  
Management and Emergency Preparedness**

Keynote Presentations

1. Climate change over Central and South Asia - Implications for Bangladesh by *Dr. Tore Furevik, Bjerknes Centre for Climate Research*
2. Tropical cyclone prediction and early warning activities at SAARC Meteorological Research Centre (SMRC) by *Dr B.R.S.B. Basnayake, SAARC Meteorological Research Centre*
3. Uncertainties of tropical cyclones in the context of climate change and response strategy by *Dr. Ren Fu Min, Beijing Climate Center*

## Keynote presentation

# Climate change over Central and South Asia - implications for Bangladesh

*Dr. Tore Furevik*

*Geophysical Institute and Bjerknes Centre for Climate Research (BCCR)<sup>1</sup>, University of Bergen, Norway; [tore@gf.i.uib.no](mailto:tore@gf.i.uib.no)*

The IPCC climate models project a temperature rise over Bangladesh similar to the global average, or close to 3°C for the A1B scenario. Changes in winter are expected to be slightly higher than in summer. A recent study shows that by the end of this century, virtually every summer is expected to be warmer than ever observed today. The climate models indicate that the winters in Bangladesh will become dryer and summers wetter than today, with an annual mean increase of about 10%. But uncertainties are large, as significant discrepancies exist between the various models. Little is known about frequency changes of extreme precipitation events, and downscaling using medium and high-resolution regional atmospheric models is needed. Measurements from India indicate that the strongest precipitation events are coming more often.

Himalayan glaciers are found to be among the fastest melting glaciers in the world. Recently, there have been much focus on the rate of thinning and the impacts on the billion people living close to the rivers originating in the Himalayas. This threat seems to be less than previously believed, since more snowfall partly compensates higher temperatures, and also since melt water from glaciers is only a tiny contribution to total river flow in monsoon systems. Recent measurements from Greenland and West Antarctica ice sheets indicate an accelerating melting rate.

---

<sup>1</sup> The Bjerknes Centre for Climate Research (BCCR) is a Norwegian *Centre of Excellence*, the only one in climate research in Norway. The scientific staff consists of more than 100 researchers and scholars who come from Norway and several other European, American, Asian and African countries. BCCR offers excellent opportunities for research in the natural part of the climate system. The main focus is on northern Europe and the Polar regions, but the center has increasing activity in the tropics, notably in South East Asia and Africa. BCCR was heavily involved in the fourth assessment report (AR4) from the UN Intergovernmental Panel on Climate Change and is now coordinating the Norwegian activities for developing climate models/earth system models in advance of the next IPCC report due on 2013. On November 2009 a memorandum of understanding was signed between BCCR and the Bangladesh Centre for Advanced Studies at the residence of the Norwegian Ambassador Ingebjørg Støfring.

Currently, more than half of the 3 mm/year increase in sea level is due to the ice sheets, and the fraction is increasing. Recent estimates of sea level rise in this century are close to 1 m. In combination with possibly higher frequency of the strongest hurricanes, this makes Bangladesh one of the most climate vulnerable countries in the world.

## Keynote presentation

# Tropical cyclone prediction and early warning activities at SAARC Meteorological Research Centre

*Dr. B.R.S.B. Basnayake*

*SAARC Meteorological Research Centre (SMRC)<sup>2</sup>, Dhaka, Bangladesh; senakaba@yahoo.com*

Tropical cyclone is regarded as the most destructive meteorological phenomenon that ravages life and property, especially over the coastal belt, through storm surges and extremely strong winds at the time of landfall. It has been evident that mortality associated with tropical cyclones is considerably high especially in the Bay of Bengal region partly due to socio-economic conditions of bordering countries. Since the inception of SMRC, several studies on climatology and frequency of tropical cyclones, impacts and influence on coastal regions have been conducted and reports on those studies have been circulated among the member states for better understanding of the nature of the problem.

With the advent of high powered computers, SMRC has been able to utilize numerical models to simulate tracks, intensities and other important parameters of tropical cyclones, which are of vital importance for making reliable early warnings. Since 2009, Weather Research and Forecasting (WRF), a next generation state-of-the-art numerical model, has been using to simulate tracks, intensities and other dynamic characteristics of tropical cyclones which formed in the North Indian Ocean. Promising results prompted more research, in particular for tuning the model for real-time applications. A training workshop on "Application of WRF model" has successfully conducted in October 2009 to disseminate technical know-how for meteorologists of national weather service agencies of SAARC member states. In addition, a seminar on "Tropical Cyclones and Storm Surges in South Asian Region" has also been conducted to discuss and present the latest development on the issue.

---

<sup>2</sup> SAARC Meteorological Research Centre (SMRC) was established in 1995 under the SAARC umbrella for enhancing capabilities of National Meteorological Services (NMSs) of the member states, particularly in the field of early warning to provide support for preparedness and management of natural disasters. It is also mandated to undertake research into climate change and related issues as it affects all meteorological phenomena in a longer time scale.



Several studies (Webster et al., 2005; Krishna, 2008) have shown that number of intense cyclones reaching up to category 4 and 5 of Saffir-Simpson hurricane scale has increased over the North Indian Ocean in the recent history. Since 2006, four major cyclones have formed, compared with a total of eight major cyclones in the previous 25 years (Webster, 2008). Whether this increase is due to climate change and warming of sea surface temperature in the Indian Ocean, it is difficult to assess the future trend due to limitation of data quality and length of records. However, regardless of future trends, it is timely and important to develop reliable early warning systems for taking proactive mitigation measures to reduce fatalities and property damage.

## Keynote presentation

# Uncertainties of tropical cyclones in the context of climate change and response strategy

*Dr. Ren Fu Min*

*Beijing Climate Center(BCC)/China Meteorological Administration (CMA), Beijing, 100081;  
fmren@163.com*

Both observational studies and projections of tropical cyclones (TC) under climate change show large uncertainties.

Observational TC studies based on different datasets vary significantly in their findings from one to another. So far as the Northwest Pacific TC activities are concerned, by comparing 3 datasets from U.S Joint Typhoon Warning Center (JTWC), China Meteorological Administration (CMA) and Japan Meteorological Agency (JMA) respectively, it is found that CMA and JMA datasets are relatively similar in terms of TC intensity, but the two datasets differ significantly from JTWC dataset in TC intensity. From the historical evolution in the past 50 years, the characteristics of the annual average absolute TC intensities show significant differences between any two datasets mentioned above. The annual average absolute TC intensities in CMA and JTWC datasets give no evident long-term increasing or decreasing trend, but they show a noticeable inter-decadal variation: a relatively high-value period in 1951-1972, followed by a low-value phase in 1973-1987; a gradual TC intensity increase was detected after 1987 and the maximum value (8.8 m/s) appeared in 1997. Although it witnessed a significant decrease from then on, it still remained a relatively high value. The annual average absolute TC intensities of CMA and JTWC datasets in 1997-2005 mainly give a significant rising trend.

Larger differences existed in TC projections, as stated in the IPCC Fourth Assessment Report (AR4) and the Sixth WMO International Workshop on Tropical Cyclones. Through the analysis of TCs over the Northwest Pacific under multiple scenarios with different models, most models project that the number of tropical storms over Northwest Pacific in the 21 century will decrease along with the increasing anthropogenic emissions. For example, relative to the 1971-2000 level, the number of tropical storms will be likely to decrease by 10-30% in the late 21 century, but total number and intensity (in terms of precipitation and wind speed) of strong

typhoons are likely to increase. Two regional climate models project a clear increase in the number of typhoons over the South China Sea in the 21 century; one model predicts a potential increase in number of typhoons affecting and landing on China, another model projects no significant change in number of TCs over Northwest Pacific in July- October.

At the Third World Climate Conference (WCC-3) held in Geneva from 31 August to 4 September 2009, the concept of the Global Framework for Climate Services was put forward, to reduce the losses caused by extreme weather and climate events through delivery of better climate services. Based on the findings of TC research in the context of climate change, and focusing on the uncertainties in TC projections, the planning for future regional activities in response to TCs should actively respond to the outcomes of WCC-3 by involving in the process of establishing the Global Framework for Climate Services.



## **Session A:**

### **Climate change induced extreme cyclones and community preparedness - How ready are we?**

#### Presentations:

1. Cyclone Nargis, Myanmar: Lessons learned *by Sudhir Kumar*
2. Analysis of climate change phenomena in Bangladesh *by Md. Saidur Rahman and Prof. Mehedi Ahmed Ansary*
3. Changing the agricultural habitation and adapting innovative farming practice in the coastal zone in Bangladesh *by Md. Imran Reza and Md. Afjal Hossain*
4. Community-based adaptation strategies in coastal areas in Bangladesh: Challenges and responses *by Mostafa Mahmud Naser*
5. Impacts of climate change: An overview on cyclones on some selected coastal areas of Bangladesh *by Bishawjit Mallick et al.*
6. Local strategies to live with cyclones in coastal areas of Bangladesh *by Md. Bayzidul Islam and Md. Tauhidul Islam*
7. Preparedness mechanism to minimize the disaster effects in the coastal area: A study on Latachapli Union *by Mahfuja Sultana et al.*
8. Community risk assessment technique to reduce the threats of cyclones and climate change *by Md. Tauhidul Islam and Ananya Senjuti*

## **Cyclone Nargis, Myanmar: Lessons learned**

*Sudhir Kumar*

*Asian Disaster Preparedness Center; sudhir@adpc.net*

Myanmar, the largest country in the mainland of South East Asia, was hit by cyclone Nargis on 2 May 2008. It was the worst natural disaster in the history of Myanmar with 4.1 billion USD in damages, 138,373 deaths and the number of people who were severely affected at 2.4 million. It called for an unprecedented response and recovery, which led to constitution of Tripartite Core Group (TCG), an innovative institutional mechanism for relief and recovery coordination, comprising Government of Myanmar, the Association of South East Asian Nations (ASEAN), and the United Nations. The paper tries to capture the lessons learned from the Cyclone Nargis in terms of: 1) the causes which led to the devastating impact, 2) the impact on various aspects including social fabric and environment, 3) the importance of environment and natural resources for mitigation, and 4) innovative coordination mechanisms for response and recovery.

## **Analysis of climate change phenomena in Bangladesh**

*Md. Saidur Rahman and Prof. Mehedi Ahmed Ansary<sup>1</sup>*

*Bangladesh University of Engineering and Technology; <sup>1</sup>ansary@ce.buet.ac.bd*

Climate Change has been identified to be the most unanimous topic in the 20<sup>th</sup> century. Due to climate change, distribution, frequency and intensity of weather related hazards have augmented. In 2008, there were 654 natural disasters worldwide, causing around 93,700 deaths and cost of damage \$123 billion. Bangladesh has been vindicated to be one of the most vulnerable countries according to the Global Climate Risk Index. An average of 8,241 people died each year in 244 instances of extreme weather conditions in Bangladesh with cost of damage \$2,189 million a year and loss of GDP 1.81 percent. Bangladesh is the practical example of severely affected by tropical cyclone, flood, drought landslides, and salinity intrusion as well as other disasters due to climate change. High population density, high level of poverty, its landscape, geographical position and climate variability has been combined to transform highly vulnerable to natural disaster. According to fourth assessment report (AR4) of Inter governmental Panel on Climate Change, predicted sea level rise from 1990 to 2100 is 18-59 cm. Due to sea level rise saline water intrusion will be up to 150 km in inland area and 7-16% of the land will submerge. Proper construction of embankments and polders is important for the survival of our existence against imminent natural disasters. The substantial causes of the embankment failure have not been investigated yet. Forensic research is imperative for investigating such polders. If this research work is implemented, some facilities like impairment of the saline water intrusion, logistics support for proper disaster management, increasing cognizance among the people, reduction of casualties, etc. likely to be resolved. Otherwise it is not possible to cope with the disaster management under the framework of the climate change risk reduction and mitigation.

# Changing the agricultural habitation and adapting innovative farming practice in the coastal zone in Bangladesh

*Md. Imran Reza<sup>1</sup> and Md. Afjal Hossain<sup>2</sup>*

<sup>1</sup>*Social Activities For Environment (SAFE)*

<sup>2</sup>*The Megaurban Food System of Dhaka/Bangladesh. Geography Department, University of Bonn*

Agriculture is one of the most vulnerable systems to be affected by climate change in the South Asian region. Agricultural crops are particularly sensitive to the different variables of climate (temperature, rainfall, humidity) as well as different natural hazards, in particular, salinity intrusion due to sea level rise and storm surges in the coastal zone of Bangladesh. The salinity conditions in the coastal area of Bangladesh could further exacerbate due to reduced dry season freshwater supply from upstream sources resulting from climate change and saline water intrusion due to sea level rise. Changes in the climatic variables and increase in such natural hazards due to climate change will adversely affect the crop production. It is inferred that crop production would be extremely vulnerable under climate change scenarios, and as a result, food security of the country will be at risk. Although the agricultural vulnerability will be extremely high and adaptation needs are paramount, very little efforts have so far been made to understand the potential of agricultural adaptation in Bangladesh. A number of interesting adaptation measures have been promoted and subsequently applied in the southwestern region of Bangladesh. The agricultural adaptations are worth special mention, due primarily to their simplicity and overall social acceptance. Depending on the local agro-climate environment as well as the magnitude of the easing strategies has to be developed. With the available technologies, it would be possible to increase food production substantially, which would depend on the dissemination of these technologies to the end-users and also on the availability and affordability of extra input required for this purpose. However, under changed scenarios, new technologies need to be developed to combat climate change and sea level rise with the great pressure of population increase and adaptation measures or technologies that have the potential to help farmers of the coastal zone to adapt to climate change in future.



# **Community-based adaptation strategies in coastal areas in Bangladesh: Challenges and responses**

*Mostafa Mahmud Naser*

*University of Chittagong, Bangladesh; mnaserbd@gmail.com*

The geographical location, low and almost flat topography, very high population density, etc. have made Bangladesh one of the most vulnerable countries of the world to be affected by the climate change. This is more so for the coastal area of the country. The vulnerability of people living in the coastal zone has been demonstrated in numerous studies and is emphasized in the recent Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2001). The cyclones of 1991, 1994, 1998 and recent SIDR in 2007 have created great awareness of the need and opportunities to prepare for cyclones and to reduce vulnerability. In order to safeguard the country against such a disaster, it is imperative to know the disaster and its impending dangers beforehand and innovative approaches to social protection, adaptation and Disaster Risk Reduction (DRR) are needed to bolster local resilience, support livelihood diversification strategies and reinforce people's coping strategies. The Community-based Adaptation (CBA) has emerged at policy level out of the fact that poor people in Bangladesh often face high risks and use informal and often ineffective means to protect themselves against those risks, in the context of very low coverage of government and market-based instruments. So rather than implementing highly technical, expensive and outsider-led interventions that are often untried in field conditions, priority should be given to using and modifying traditional coping mechanisms developed in the communities in Bangladesh. With these ends in view, the paper will discuss the vulnerability of coastal regions in Bangladesh to climate change and identify some adaptation options. This paper will also investigate simplified 'bundles' of archetypal livelihoods at household and community level and examine the risks these livelihoods and households face under conditions of climate change. Then it will assess the potential for various adaptation strategies at community level for coastal areas and evaluate whether these can be supported through policy.

## Local strategies to live with cyclones in coastal areas of Bangladesh

*Bishawjit Mallick<sup>1</sup>, Utpal Kumar Das<sup>2</sup>, Sk. Shahidul Islam<sup>2</sup>, Sudeb Kumar Das<sup>2</sup>, Md. Nazrul Islam<sup>2</sup>*

*<sup>1</sup>Institute of Regional Science (IFR), Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany; bishawjit.mallick@ifr.uni-karlsruhe.de*

*<sup>2</sup>Coastal Research Foundation, Khulna, Bangladesh*

There is no universal model of disaster risk management in the world. It varies from country to country, region to region, community to community and even individual to individual. The disaster management relationships between developed and developing countries augment the intra-dependency and lead the rich to spend for the problems of the poor. Thus makes the poor countries more dependable and redundant upon rich countries and more vulnerable to natural calamities. Therefore, it is urgent to find out the 'local strategies'. Actually, during any disaster, people exercise their own coping and survival strategies to respond the situation long before outside help from NGOs or the government arrives. This paper is an attempt to find out such locally adopted strategies to cope with cyclone in coastal Bangladesh. It examines the peoples' (re)action and responses during cyclone Aila, which hits coastal belt of Bangladesh in May 25, 2009. Using a combination of socio-spatial data, this study considers the 'household' rather than the individual as the most important aspects for preventing the causalities and damages of cyclone hazards. How they organize their lives during pre- and post disaster situation, and how the external resources could be supported? To through light on these questions, this article present research findings from a village in Koyra Upazila, Khulna and explores their policy implications. Finally, it proposes those possible 'local strategies' that are accepted by the community rather than their needs. Eventually that can contribute to community empowerment and resilience against future cyclone as well as climate change impacts in Bangladesh.

## **Impacts of climate change: An overview on cyclones on some selected coastal areas of Bangladesh**

*Md. Bayzidul Islam<sup>1</sup> and Md. Tauhidul Islam*

*<sup>1</sup> raj040436@yahoo.com*

In the context of climate change and associated impacts such as cyclone, the long-term survival of Bangladesh, which is a low-lying state at the Bay of Bengal, has been questioned with the release of the latest climate change predictions. This study therefore aims to understand the spatial dimension and vulnerability of coastal areas of Bangladesh to climate change by presenting evidence from three unions in the south-west coastal region of Bangladesh. The study initially outlines the spatial dimension of climate change by looking at the historical records of events and their impacts. Based on the meteorological data the study describes the climate trends of areas and finds an increasing trend in cyclone. The successive occurrence of such events is a reminder of the extreme vulnerability of the country to the very frequent hydro-meteorological hazards that threaten Bangladesh, and which are likely to increase due to climate change. To response this successive vulnerability, the aim would be to reduce risk exposure and enhance coping abilities. Many of the projected impacts of climate change will reinforce the baseline environmental, socio-economic and demographic stresses already faced by study area. This study reveals those stresses by using a combination of geographical and social research methods.

## **Preparedness mechanism to minimize the disaster effects in the coastal area: A study on Latachapli Union**

*Mahfuja Sultana, Fawzia Farzana and Abir Ahammad Talukdar  
Khulna University, Bangladesh; sume\_ku@yahoo.com*

The increased temperature and precipitation induced by climate change will cause increased frequency and intensity of natural hazards like extreme cyclones. If tropical cyclone peak wind intensities, and mean and peak precipitation intensities are increased, coastal erosion and damage to coastal buildings and infrastructure, damage to coastal ecosystems will be increased. Natural hazards with warning such as hurricanes, cyclones are generally predictable with a reasonable level of accuracy, and the rate of losses can be decreased through an efficient disaster management program. A well-recognized component of disaster management is disaster preparedness activities. As the disasters visit Bangladesh frequently and the impact is very intense in the coastal region, different preparedness plans are initiated in the coastal areas by the government; among them structural preparedness activities are one of the most long-established. This paper explores and assesses government's structural preparedness activities as well different local mechanisms to minimize the losses. At Latachapli union, structural preparedness activities are not enough nor properly maintained to significantly reduce the suffering of people. However, local people have some traditional preparedness activities to minimize cyclone effects. A guideline is provided to overcome the existing drawbacks and increase the capacity of local people to minimize the possible effects of forthcoming extreme cyclones to a significant level.

## **Community risk assessment technique to reduce the threats of cyclones and climate change**

*Md. Tauhidul Islam<sup>1</sup> and Ananya Senjut<sup>2</sup>*

<sup>1</sup> *Geographical Solutions Research Center (GSRC); tauhid0537@gmail.com*

<sup>2</sup> *Khulna University*

The frequency and magnitude of extreme weather events may increase in the future, due to climate change. The vulnerability of developing countries to extreme weather events may also increase. Developing countries like Bangladesh are having very less preparedness and capacity to cope with the extreme impacts of climate change. Increased capacity to manage extreme weather events can reduce the magnitude of economic, social and human damage and eventually, investments, in terms of borrowing money from the lending agencies. Vulnerability to extreme weather events, disaster management and adaptation must be part of long-term sustainable development planning in developing countries. Community Risk Assessment (CRA) uses participatory action research methods to place communities in the lead role for the assessment, active planning, design, implementation and evaluation of activities aimed at reducing the community's risk to disaster. As the people of coastal areas are the most sufferers of extreme cyclones so there is a need to address this situation through strengthening the community aided by community risk assessment. This process can align the people in self-help approach and they will be taking initiatives to save themselves before a disaster strikes. This paper mainly focuses on the scenario of climate change and cyclones in Bangladesh and toolkits that can be used for community risk assessment.



## **Session B: Climate change scenarios and the potential social impacts**

Presentations:

1. Projected risks to health associated with climate change *by Esther Lake*
2. Climate change and impact of cyclones on public health: Bangladesh *by Dr. Zahidur Rahman*
3. Evaluation of water supply facility in the cyclone shelters and the feasibility of rainwater as an alternative source *by Md. Imtiaz Shahed and Abu Hena Mustafa Kamal Sikder*
4. Assessment of variations in disaster vulnerability in coastal communities from socio-economic perspective: A study on Assasuni Upazila of Satkhira District, Bangladesh *by Madhuri Rani Roy and Prof. Shamim Mahabubul Haque*
5. Climate change scenarios and impacts on the livelihoods of affected people in coastal Bangladesh *by Dr. Khondoker Mokaddem Hossain and Dr. Mahbuba Nasreen*
6. Climate change in Bangladesh, rural livelihood and impact on cities *by Prof. Akhter Husain Chaudhury*
7. Coastal ethnic minorities' capacity to address the post disaster effects of cyclone and storm surge on livelihood: A study on Rakhain community of Lotachapli Union *by Abir Ahammad Talukdar et al.*
8. Vulnerability of Chittagong to climate change and future challenges for planning and development *by Abir Ahammad Talukdar et al.*

## **Projected risks to health associated with climate change**

*by Esther Lake*

*Asian Disaster Preparedness Center, esther@adpc.net*

The paper will discuss the projected risks to health associated with climate change. Impacts in five main areas will be discussed, namely: (i) Direct Temperature Effects; (ii) Extreme Events; (iii) Climate-Sensitive Diseases; (iv) Air Quality; (v) Other Health Linkages drawing from a variety of sources including the USEPA's Climate Change - Health and Environmental Effects; IPCC Fourth Assessment Report (2007), and World Health Organization (WHO), 2003. Climate change and human health - risks and responses.



## **Climate change and impact of cyclones on public health: Bangladesh**

*Dr Zahidur Rahman*

*Dept of Public Health and Hospital Administration, NIPSOM*

In Bangladesh, emergencies can take heavy toll on human life and health. Major cyclones in 1970, 1985, 1991 and 1997 resulted in over 500,000 deaths. Over the year it has been observed that climate changes have been brought changes in the incidence of diseases, injuries and other health problems. Vector borne and water borne disease have been rising along with the increased shortage of water supply and sanitation. Specific health concerns have been heightened from storm surges and from damage of costal infrastructure (water and sanitation systems, housing and roads) consequently on the health, nutrition and safety of the human population. The paper will make specific reference to the health impacts of Super Cyclone Sidr that hit the country on 15 November 2007, and cyclone Aila that hit the coastal part of Bangladesh in 2009.

## **Evaluation of water supply facility in the cyclone shelters and the feasibility of rainwater as an alternative source**

*Md. Imtiaz Shahed<sup>1</sup> and Abu Hena Mustafa Kamal Sikder<sup>2</sup>*

*<sup>1</sup>: Bangladesh Red Crescent Society*

*<sup>2</sup> UN High Commission for Refugees*

Bangladesh is a disaster-prone country that suffers various types of natural disaster almost every year. Among the natural hazards cyclone is one of the devastating phenomena that strikes the coast of Bangladesh. Effective disaster preparedness is an essential requirement especially in the coastal areas which is more vulnerable. The natural disasters have affected adversely the lives and livelihood of the coastal area. After the devastating cyclone of 1970, government took the initiative of constructing cyclone shelters throughout the coastal zone. And the process was exaggerated after the hit of another severe cyclone in 1991. The cyclone shelters were constructed to provide a protected place for the vulnerable coastal communities. Different structural designs were followed during the construction of these shelters. But the common problems of almost all these shelters are water supply facilities. Source of safe drinking water is one of the most critical concerns after striking a cyclone. Water gets contaminated by debris and saline water from storm surge. The water facilities present in the shelters are extremely inadequate. Moreover in most of the shelters the facilities are not functioning properly. On the other hand each of these cyclones brings huge amount of rainfall which could be a useable source of drinking water. In this paper the authors will try to evaluate the existing water supply facilities of 60 shelters in 7 sub-districts of Cox's Bazar and identify the feasibility of rainwater storage system as an alternative source of water supply.

## **Assessment of variations in disaster vulnerability in coastal communities from socio-economic perspective: A study on Assasuni Upazila of Satkhira District, Bangladesh**

*Madhuri Rani Roy and Prof. Shamim Mahabubul Haque<sup>1</sup>  
Khulna University, Bangladesh; <sup>1</sup>shamimhaque67@yahoo.com*

Understanding variations in disaster vulnerabilities is essential for designing an effective Disaster Response Plan. An assessment of disaster vulnerability of coastal communities of Assasuni Upzila was made based on various socio-economic determinants. Besides, vulnerable sectors in the socio-economic gamut of the rural communities were also tried to identify. Assasuni upazila of Satkhira district is very close to the coastline, often ravaged by various types of climate related natural hazards, of those cyclone, salinity intrusion and storm surges are predominant. A questionnaire was designed with 11 variables, selected through Participatory Rural Appraisal as major socio-economic determinants of disaster vulnerability at community level: unemployment, no. of households living in a *kutcha* (structurally weak houses), literacy rate, population density, % of people use sanitary latrine, % of population having disaster and warning knowledge, % of agricultural labor, average income per household, ratio of loan-income per household and % of dependent population. Thirty-five households were sampled from 99 communities spread over 11 unions at Assasuni Upazila. Aggregated scores at union level showed significant variations in disaster vulnerability across unions; agriculture and fisheries were identified as most vulnerable sectors during disasters. Finally, Disaster Response Plans were suggested for the Upazila considering variations in disaster vulnerabilities of the communities.

## **Climate change scenarios and impacts on the livelihoods of affected people in coastal Bangladesh**

*Dr. Khondoker Mokaddem Hossain<sup>1</sup> and Dr. Mahbuba Nasreen<sup>2</sup>*

*<sup>1</sup>Centre for Disaster and Vulnerability Studies, University of Dhaka; mokaddemdu@yahoo.com*

*<sup>2</sup>Department of Sociology, University of Dhaka*

The paper examines the impact of Cyclone Sidr on the livelihoods of coastal zone in Bangladesh. It starts in examining the impacts of Sidr on different socio-economic group of coastal. It further assesses the negative impacts of Sidr on the health of families in relation to access to safe drinking water. The paper also examines the most challenging tasks of coastal dwellers those who were severely affected by the intrusion of saline and contaminated water into the water table. Moreover the paper examines the nature of vulnerability of local people from the perspective of sanitation. The paper, in particular, examines the nature of negative impacts of Sidr on the vulnerable and destitute women, many of whom built their hut on the slopes of the embankment. Finally the paper examines the overall socio-economic, cultural, psychological and environmental implications of Sidr on the livelihoods of coastal people in Bangladesh.

## **Climate change in Bangladesh, rural livelihood and impact on cities**

*Prof. Dr. Akhter Husain Chaudhury  
Khulna University*

As a poverty stricken country with over 70% landless families in the countryside, the livelihood in rural Bangladesh has always been vulnerable for majority of the people. The climate change in recent days has accentuated the vulnerability further through affecting the means of production. Without having any other alternative to livelihood in the villages, and attracted by the opportunities in urban areas caused by globalization, rural-urban migration is more pronounced these days, particularly, in large cities. The result has been pressure on existing infrastructure and services and housing stock, increase in slum and squatter leading to degraded living environment, increase in crime and insecurity.

## **Coastal ethnic minorities’ capacity to address the post disaster effects of cyclone and storm surge on livelihood: A study on Rakhain community of Lotachapli Union**

*Abir Ahammad Talukdar, Fawzia Farzana and Mahfuja Sultana  
Khulna University, Bangladesh; abir\_urp@yahoo.co.in*

In the coastal region of Bangladesh there is an ethnic minority named ‘Rakhain’. In any developing country like Bangladesh, ethnic minorities are very much marginalized due to their social and cultural distinctiveness. Different culture and language often keep them isolated from the majority. Subsequently, they become more vulnerable than others during any natural hazards because of their marginality. Therefore, their vulnerability to natural hazards as well as their existing practice, knowledge and capacity to cope disaster effects should get special attention. This paper aims at assessing Rakhain’s capacity to cope with upcoming natural hazards like extreme cyclones and storm surges in terms of their experiences, practices and strategies.

## **Vulnerability of Chittagong to climate change and future challenges for planning and development**

*Abir Ahammad Talukdar, Dilara Mehrab Arif, Mahfuja Sultana, Mitun Talapatra and Md. Sharoar Hossain Apo*

*Khulna University, Bangladesh; abir\_urp@yahoo.co.in*

Climate change in Chittagong city in Bangladesh is a sophisticated issue. It contributes water logging, heavy rainfall, temperature rise and other climate-related disasters that hamper development. Excessive and uncontrolled population growth and urbanization rate in the city are major problem that accelerates the climate changes. This paper aims to keep glance on- the vulnerabilities of major cities to climate change, the hazard type those are responsible for the vulnerabilities. And finally to denote the future challenges for urban planning and development.





## Session C: Information Technology for Reducing Disaster Risks from Climate Change

### Presentations:

1. Cyclone wind hazard assessment in coastal Bangladesh *by Kazi Nusrat Jahan et al.*
2. Monitoring of cyclone Aila and its impact in Bangladesh *by Mehrunnessa et al.*
3. Inundation risk map developed by past storm surge modeling of the coastal region of Bangladesh *by Dr. A. S. M. Maksud Kamal*
4. Improvement of cyclone disaster management in coastal area using GIS and remote sensing: A case study at Barguna, Bangladesh *by Munir Siddiquee and Md. Sohel Rana*
5. Disaster risk analysis using GIS approach in Sarankhola Upazila, Bagherhat *by Dr. Md. Mujibor Rahman and A.K.M.Humayan Kabir Dewan*
6. Construction of Disaster Risk Index using GIS for better management of disaster information: A study on Coastal Communities of Bangladesh *by Mohammad Shahidul Hasan Swapan and Dr. Shamim Mahabubul Haque*
7. Cyclone risk assessment and delineation of suitable site for cyclone shelter *by Taposh Dutta and Mohammad Shariful Islam*

## **Cyclone wind hazard assessment in coastal Bangladesh**

*Kazi Nusrat Jahan, Dr. Mohammad Shakil Akther<sup>1</sup>, Shakil bin Kashem, Shakila Kayum and Sayed Rokkanuzzaman*

*Bangladesh University of Engineering and Technology; <sup>1</sup>[email of Dr. Akther]*

Bangladesh often suffers from many climate induced disasters such as flood, drought, cyclone etc among which the cyclone is the most catastrophic one. The coastal morphology of Bangladesh influences the impact of cyclone hazards on the area. Especially in the south western area, cyclone hazards increase the vulnerability of the coastal dwellers and slow down the process of social and economic development. This includes districts like Chittagong, Noakhali, Patuakhali, Barisal, and Khulna where the cyclones strike most in Bangladesh. Wind hazard assessment of the cyclones that make landfall in the coastal regions of Bangladesh is of great significance. Hazard assessment can be done through the application of GIS in the wind speed analysis of cyclones for the purpose. It is hoped that this study will contribute to taking proper disaster planning efforts in Bangladesh especially in the mitigation phase for the reduction of damage from the cyclone hazard.

## **Monitoring of cyclone Aila and its impact in Bangladesh**

*Mehrunnessa, Engr. Mozammel Haque Sarker and Suraiya Begum  
Bangladesh Space Research and Remote Sensing Organization (SPARRSO)*

The study of climate change along with the hazardous weather events is very important for all developing countries. The country is vulnerable to all types of meteorological/hydrological extreme events like cyclones, floods, drought, etc. every year which causes losses to lives and properties. We cannot avoid them but can mitigate their impacts by providing timely warning and disaster management. We have studied the cyclone Aila with help of remote sensing and GIS. In this paper, we have monitored and analyzed movement and devastation of the cyclone Aila over the country. The maximum sustainable wind speed within 54 km of the storm center was about 80 KPH rising to 100 KPH in gusty and squirrel wind on 25 May 2009. The analysis also revealed that sixteen coastal districts were mostly affected and about 4,586 sq km area were inundated.

## **Inundation risk map developed by past storm surge modeling of the coastal region of Bangladesh**

*Dr. A. S. M. Maksud Kamal*

*National Expert, Comprehensive Disaster Management Programme (CDMP);  
maksud.kamal@cdmp.org.bd*

During last 50 years, 18 cyclones hit coastal area of Bangladesh, where the cyclones of 1970, 1991, 2007 (Sidr) and 2009 (Aila) can be noted for causing casualties and huge economic loss. Though casualties of Sidr were around 3500, very lower in comparison to that of 1970 and 1991 but the economic loss was too higher as measured around \$1.6 billion. Considering the frequent visit of cyclones and corresponding storm surge events in the coastal region of Bangladesh, an inundation risk map has been developed for the entire coast of the country under Earthquake and Tsunami Preparedness Component of the Comprehensive Disaster Management Programme (CDMP) of the Ministry of Food and Disaster Management (MoFDM). Digital Elevation Model (DEM), land use and geomorphological maps, and decay factor of surge to inland caused by variation in slopes and existing polders were prepared to simulate the inundation risk map. Inundation map was generated using MIKE 21 modeling system based on the maximum inundation depths of past 18 cyclones. Institute of Water Modelling (IWM) was commissioned to provide technical support for generating the map. It has been seen that the highest inundation depth is in the order of 5-7.5 m within the Meghna Estuary area. The eastern coast experiences maximum inundation between 4 –6 m while the western coast experiences inundation within the range of 3-5 m. This inundation map will be instrumental for planning of adequate number and proper location of cyclone shelters, re-engineering of existing coastal infrastructures, designing future infrastructures in the coastal area considering worst case scenario as well as planning of mangrove afforestation for reducing surge height and damage of embankment.

# **Improvement of cyclone disaster management in coastal area using GIS and remote sensing: A case study at Barguna, Bangladesh**

*Munir Siddiquee and Md. Sohel Rana*

*Local Government Engineering Department (LGED), Bangladesh*

Disaster management of an event like cyclone, flood or earthquake requires some ingredients such as incident mapping, establishing priorities, developing action plans, and implementing the plan to protect lives, property and the environment. GIS in combination with remote sensing (RS), can be used very effectively to identify hazards and risk for cyclone. The main focus of the study is to develop a model that could be used for disaster planning and management. A storm surge model has been developed integrating historical cyclone data with Digital Elevation Model (DEM), which generates the cyclone hazard maps for different return periods. Satellite images and field survey data are used in GIS and RS platform to assess the vulnerability of lives and infrastructures. Cyclone risk is assessed considering the hazard and vulnerability analysis for the study area which can be implied to give a signal of awareness to the local community and the decision makers to provide advance planning for cyclone disaster management.

## **Disaster risk analysis using GIS approach in Sarankhola Upazila, Bagherhat**

*Dr. Md. Mujibor Rahman and A.K.M.Humayan Kabir Dewan*

*Environmental Science Discipline, Khulna University, Khulna 9208 Bangladesh*

The aim of disaster risk analysis (DRA) is to determine the nature and dimensions of disaster risk within a defined geographical area. A review of the literature indicates that disaster risk assessment practice lacks a single spatial-analytical framework that is both conceptually holistic and supports diverse methodologies. In the southeast coastal region in particular the development of a regionally applicable method for assessing the risk in the region is particularly warranted and for this reason the area Sarankhola upazila, Bagherhat district was taken as my study area. Disaster risk analysis are made with the objective of measuring hazard assessment for disaster, indentifying the disaster risk index (DRI) and preparing hazard, vulnerability and disaster risk map using GIS. A GIS adaptive participatory disaster risk analysis method is developed, wherein selected criteria were fixed to identify which area is severe in risk, moderate in risk slight in risk. The risk assessment method will consist of mapping and compiling hazard and vulnerability data onto a GIS platform and weighting and combining each component (layers) into a single representation of risk. This study reveals that Southkhali and Royenda are more risk prone for flood due to high tide and dam collapse (risk score at 1.43 and1.16), Southkhali and Khontakata are more risk prone for cyclone (risk score at 1.52 and1.31), while the overall highest disaster risk area is Southkhali union.

## **Construction of Disaster Risk Index using GIS for better management of disaster information: A study on coastal communities of Bangladesh**

*Mohammad Shahidul Hasan Swapan<sup>1</sup> and Dr. Shamim Mahabubul Haque<sup>2</sup>*

<sup>1</sup>*Curtin University of Technology; m.swapan@curtin.edu.au*

<sup>2</sup>*Khulna University, Bangladesh*

Combined effects of prevalence, geographic variations of impacts and variations in socio-economic profile of the communities results in the variations in their disaster vulnerabilities. A GIS based Disaster Risk Index (DRI) has been proposed in the current study for better management of information which ultimately will lead to more informed decision making regarding disaster response management. The risk analysis procedure is divided into two stages adopting the concepts of participatory disaster risk analysis and GIS based risk analysis. A global scale was used to measure and assess the intensity of risk, where value/score close to 1 refers to extreme condition and close to zero refers to less critical condition. At first, a database was developed using SPSS to identify the hazard score of thirteen hazards prevailing in Assasuni upazial of Satkhira district. Vulnerability of the local people was determined by scoring along 11 socio-economic and demographic attributes. The score for each indicator finally summed up for the aggregate value of a particular hazard or vulnerability of a spatial unit. From the field survey, it was noticed that vulnerability of many disasters (e.g., flood, cyclone and erosion) may increase due to several spatial factors which were not considered in the previous analysis. This attempt towards holistic analysis led to integration of three available spatial data using GIS for some selected hazards. As vulnerability created by few hazards among the eleven hazards are not related with any spatial factors, their vulnerability score remain same. At the second stage, vulnerability score were recalculated for those hazards adding the spatial data in a raster based GIS environment. Finally a combined disaster risk index (CDRI) for Assasuni was developed calculated from hazard and overall vulnerability score.

## **Cyclone risk assessment and delineation of suitable site for cyclone shelter**

*Taposh Dutta<sup>1</sup> and Mohammad Shariful Islam*

*<sup>1</sup>dutta03\_ku@yahoo.com*

Tropical cyclones have demonstrated the most serious natural hazard in the coastal areas of Bangladesh. In the past century, two of the deadliest tropical cyclones occurred in the Modern history hit the coast of Bangladesh and caused more death counts than the total Number of casualties. About 15.0 million people live in the vulnerable areas, covering 21,000 sq. km in the coastal and offshore islands of Bangladesh. A total of 1350 cyclone shelters are located now in this zone in which 1.3 million people can be accommodated. About 2.3 million more people take shelter in the school and office buildings, altogether 4.0 million people could be accommodated in the existing facilities, but remaining 11.0 million people (about 73.3%) are still unsafe. Approximately 12.5 million more shelter places will be needed in the cyclone prone zones by the year 2021. As a developing country, government cannot afford to construct required cyclone shelters in the hazard prone areas to reduce the impact of damage from tropical cyclones. The present study aimed to understand the cyclone risk and delineation of suitable site for cyclone shelter, which can help to proper mitigation measures and would contribute towards effective disaster planning. This study mainly focuses on locating suitable site for cyclone shelter by using GIS and, at the same time, has prepared a risk index to assess risk of the study area for selecting most vulnerable area. Both spatial and non-spatial data are used for this study. Then selected criteria were fixed to identify the suitable location for cyclone shelter on the basis of the characteristics of the study area.



## PLENARY 2: Approaches for Improving Disaster Risk Reduction and Community Adaptation

### Keynote Speeches

1. Community based disaster risk management in Dagupan City *by Hon. Alipio S. Fernandez, Mayor, Dagupan City, Philippines*
2. The risks to urban coastal cities *by Dr. Bhichit Rattakul, ADPC*
3. Cyclone Prediction and early warning system: Challenges and successes *by Dr. Jayaraman Potty, Scientist, RIMES/ADPC*
4. Presentation *by Dr. Atiq Rahman, BCAS (not available)*

## Keynote presentation

# Community based disaster risk management in Dagupan City

*Hon. Alipio S. Fernandez, Jr.*

*Mayor, Dagupan City; City Hall Complex, A.B. Fernandez Avenue, Dagupan City 2400, Philippines;  
Tel: 63 75 522 2859; Fax: 63 75 515 4241*

On October 8, Dagupan City in the Philippines was submerged by the worst flooding in Northern Luzon history with over 500 casualties and at least PhP 7 billion-worth of damage to properties. Other cities and municipalities were also badly affected by floods that came from a combination of rain from Typhoon Parma and emergency dam. Unlike the neighboring localities, Dagupan City was well-prepared even before the storm entered the country and had no casualties. Components of a disaster preparedness system were developed and institutionalized through the capacity building and initiation of the Program for Hydro-Meteorological Disaster Mitigation in Secondary Cities in Asia (PROMISE).

The presentation will show how Dagupan City built up its disaster preparedness against typhoons through a series of efforts in capacity building, early warning, non structural mitigation, structural mitigation, networking, and partnership among stakeholders for disaster risk reduction. In addition, efforts were made towards emergency preparedness with the holding of annual evacuation drills for earthquake and fire hazards, of city-level and community-level flood simulation exercises, and with city legislation that instituted an Emergency Operations Center for Dagupan City.

## Keynote presentation

# The risks to urban coastal cities

*By Dr. Bhichit Rattakul*

*Asian Disaster Preparedness Center: bhichit@adpc.net*

Urban areas are recognized as economic engines of any country, but even these engines can fail if action is not taken to address the soaring reconstruction costs and to minimize significantly the losses to shelter, infrastructure, and commerce. Asia has large coastal urban areas of low elevations are located in the flood plains of major rivers and, at the same time, are densely populated. It is our position that the rapid pace of urbanization, unplanned expansion of the built-up area, the land use change that leads to unsustainable development, development planning that contributes to social inequality and economic inequity that ultimately produce vulnerability to disasters. This paper will discuss these drivers of rising disaster risks in such coastal cities, set out priorities for disaster management, and adopt proactive approaches and practices for mainstreaming disaster risk mitigation within the efforts for sustainable development.

ADPC has been advocating since 1995 for programs to reduce the vulnerability of urban populations, infrastructure, livelihoods, etc. to multiple hazards including climate hazards. Urban disaster risk, in particular, must be managed and mitigated by creating an enabling environment through building the capacity of stakeholders, use of information on hazard potential, facilitating structural and non-structural interventions and effective emergency response planning process. ADPC created a team dedicated to urban disaster risk management in 2003 and launched its Strategy 2020 for Urban Disaster Risk Management. This provides for a specialized concentration on the capacities of local governments in urban and urbanizing areas for risk assessment, long-term mitigation and disaster risk reduction, and on improving urban governance in order to achieve disaster management goals. Other areas of specialization include improving institutional arrangements for disaster management at national and regional levels, and raising public health standards for pandemic preparedness, urban search-and-rescue, and preparedness of critical facilities such as hospitals.

Finally, ADPC is working in a number of coastal cities vulnerable to climate hazards, including sea level rise, storm surges and cyclones, that are additional major stresses on an already risky situation. The projected and associated risks for coastal cities are

related to salinization of groundwater and availability of safe drinking water, a projected increase in frequency and intensity, coastal flooding and landslides on geologically unstable slopes, stress on sewage treatment. ADPC therefore promotes both capacity building of both national and local institutions for long-term forecasting of climate risks, as well as the development of end-to-end early warning systems for multiple hazards, including cyclones and floods. The paper includes ADPC's exposure in working in coastal cities, particularly on interventions designed for long-term sustainability through disaster risk reduction for making cities safer.

## Keynote presentation

# Cyclone prediction and early warning system: Challenges and successes

*Dr. Jayaraman Potty*

*Regional Integrated Multi-hazard Early Warning System (RIMES), Asian Disaster Preparedness Center (ADPC); potty@adpc.net*

The prediction skill of track and intensity of tropical Cyclones for appropriate disaster management actions has improved tremendously for the past few decades in all the basins including Bay of Bengal. Advancements in observational systems that includes *in situ* and remote sensing methods and prediction techniques lead us to improvements in forecast the track and intensity of storms well in advance. Research efforts are going on to further improve the initial data sets and modeling aspects for raising the forecast skill. An appropriate early warning system to enhance disaster preparedness and response to deal with recurring cyclones is still a daunting task as the risk is a function of complex socio-economic factors such as population density, land use pattern and livelihood system etc.

In this presentation, the scientific advancements in cyclone prediction methods and the challenges for the generation of accurate forecast with enough lead time to aid managerial actions are discussed. An Early Warning System framework for cyclone preparedness is also discussed in this paper.



## Session D: Policy Advocacy for Climate Change Adaptation

### Presentations:

1. Linking disaster risk reduction to climate change adaptation *by Atiq Kainan Ahmed*
2. Mainstreaming disaster risk reduction in Bangladesh *by Mohammad Abu Sadeque*
3. Experiences in integrating disaster risk reduction into post-disaster housing reconstruction in Vietnam *by Kathleen McLaughlin*
4. Critically appraising the issues pertinent to implementing carbon neutral urban development *by Md. Abdul Awal Sarker*
5. Gender issue in climate change discourse: Theory verses reality
6. Climate change and conflict: Minding the gap
7. Climate migrants and their changing livelihood pattern in the South-West coastal region of Bangladesh *by Md. Sultan Mahmud*

## **Linking disaster risk reduction to climate change adaptation: Evolving regional perspectives in Asian countries**

*Atiq Kainan Ahmed*

*Asian Disaster Preparedness Center; atiqka@adpc.net*

The two recent discourses – disaster risk reduction (DRR) and climate change adaptation (CCA) – have evolved differently and uniquely in a parallel manner in Asian countries. Each has its own institutional framework, political process, information exchange forum, and practitioner community:

(1) Disaster risk reduction, on one hand, has aimed at addressing existing risks from all types of hazards, utilizing a full range of established tools and practices at the local level. Climate change adaptation, on the other hand, is concerned at addressing climate risks at a distant future, with a limited range of tools and very limited application at the local level. (2) In many Asian countries, DRR is the concern of National Disaster Management Offices, while CCA is led by the Departments/Ministries of Environment; interactions between these two are usually ad-hoc and there have been limited systematic efforts made to sustain and institutionalize these interactions. (3) Many DRR actions can contribute to adaptation but there are limited appropriate mechanisms to transfer these for climate change adaptation. (4) In most countries, adaptation is yet to be guided by the scientific information because climate change information tries to communicate uncertainty that is not immediately usable (e.g. anticipated change in temperature is expressed as 1.4 to 5.8° Celsius by 2100) while disaster risk reduction practitioners use probabilities (e.g. 40% likelihood that rainfall is above normal); it is no wonder that the DRR institutions and community find it hard to use climate change information for decision-making.

Keeping the above issues in mind, recent attempts are made to link DRR and CCA in an innovative way in some ongoing initiatives from various institutions such as UNISDR, ADPC, and others. This presentation will talk about these issues and will focus on some of these ongoing initiatives towards defining and establishing enabling environments for the practical integration of disaster risk reduction and climate change adaptation in Asian countries.



## **Mainstreaming disaster risk reduction in Bangladesh**

*Mohammad Abu Sadeque*

*Deputy Secretary, Ministry of Food & Disaster Management, Government of Bangladesh*

Almost every year, Bangladesh is experiencing flood and cyclone and river erosion is a continuous process. In 2007, Bangladesh has experienced devastating cyclone once (Category 4 cyclone Sidr) and floods twice, causing severe damage to lives and properties. Bangladesh has significant achievement regarding cyclone risk reduction. Category 4 cyclones had landfall to Bangladesh during the years 1970, 1991 and 2007 and causing a corresponding casualties count of 500000, 138000 and 3500. The secret behind the reduction of deaths is adopting the risk reduction concept and cyclone risk reduction mainstreaming in the policy folder and effective implementation of DRR agendas following the instructions of HFA. This paper will share the experiences of how Bangladesh approaches to leading countries of cyclone disaster risk reduction.

## **Experiences in integrating disaster risk reduction into post-disaster housing reconstruction in Vietnam**

*Kathleen McLaughlin*

*Centre for International Studies and Cooperation, Asia; KathleenM@ceci.ca*

The recurrence of extreme cyclones in certain geographic areas such as Central Vietnam, is resulting in the need for more frequent relief and reconstruction investments in highly disaster prone areas. It is becoming even more critical that post-disaster reconstruction be optimized as a means to invest resources in disaster resistant building design and raise residents, builders and local government awareness about disaster risk reduction. While the integration of disaster risk reduction into housing reconstruction seems an obvious imperative, the time pressure for reconstruction programs, the trade-offs involved in stretching resources across affected people, problems of land availability, and continuing outlooks that 'lightning does not strike twice in the same place' means that the 'opportunity' to invest in disaster risk reduction in the rehabilitation and reconstruction phase is often lost. The presentation will highlight the opportunities and constraints that post-disaster rehabilitation and reconstruction present in promoting disaster risk reduction and provide examples of techniques for integrating DRR into reconstruction programs applied by CECI and its various partners in coastal and upland areas of Central Vietnam.

# **Critically appraising the issues pertinent to implementing carbon neutral urban development**

*Md. Abdul Awal Sarker*

*Curtin University of Technology*

Carbon neutral urban development involves calculating total climate-damaging carbon emissions from energy use for constructing and servicing new buildings, using transport, or energy used for everyday life, reducing where possible and balancing the rest through using green technologies or solar energies. The carbon neutral concept developed as a flexible tool that has been used by a wide range of businesses, public sector organizations and individuals to take early action on climate change. Developed countries like Japan, US and other European countries has set their target to reduce the impact of urban development on climate through practicing carbon neutral development practices. Developing countries are also trying to contribute to protect climate change they are facing constraints due to the poor economic and social condition; the challenge for them is to enhance development while considering environmental issues. The technologies used in carbon neutral urban development practices are not available to every country, and those available are expensive to use. Based on some existing practices and secondary data from different literature the study is conducted in a competitive view whether carbon neutral technologies are sustainable or not in current urban development practice. In this study we will explore the idea of carbon neutral development while examining its feasibility in terms of economical, social, regulatory and technical aspect.

## Gender issue in climate change discourse: Theory versus reality

*Mohammed Abdul Baten<sup>1</sup> and Niaz Ahmed Khar<sup>2</sup>*

<sup>1</sup>*Stockholm Resilience Centre, Stockholm University, Sweden; baten\_123@yahoo.com*

<sup>2</sup>*Department of Development Studies, University of Dhaka*

Gender refers to the social roles and relations between women and men, which include different responsibilities of women and men in a given culture and location. Even though gender has become one of the themes of analysis in development policy discourses, yet it received little emphasis in climate change policies. By reviewing literature related to climate change and gender issue this paper finds that women are more vulnerable to climate disasters than men through their socially constructed roles and responsibilities, and their relatively poorer and more economically vulnerable position, especially in the developing world. In Bangladesh, gender inequalities with respect to enjoyment of human rights, political and economic status, land ownership, housing conditions, exposure to violence, education and health (in particular reproductive and sexual health) -- make women more vulnerable before, during and after climate change-induced disasters. The authors argue for the enhancement of institutional capacity to mainstream gender in global and national climate change and disaster risk reduction (DRR) policies and operations. The process will include: the development of gender policies, gender awareness, internal and external gender capacity and expertise, and the development and application of relevant mechanisms and tools.

## **Climate change and conflict: Minding the gap**

*Maria Catalina Jaime*

*National Society for Earthquake Technology, Nepal; mjaime@hotmail.com*

The first part of this research is a contribution to the theory and evidence that climate change effects, such as natural disasters, can increase the risk of violent conflicts. The second part intend to propose that the designing and implementation of Community Based Disaster Risk Management (CBDRM) strategies aiming to develop community resilience and adaptation capacities, may provide a significant contribution not only to minimize the negative impact caused by natural disasters, but also to prevent violent conflicts. In order to understand this crucial link between climate change and violent conflicts, one documented case study about the People's war in Nepal, has been analyzed, aiming to show some evidence supporting the above thesis.

## **Climate migrants and their changing livelihood pattern in the South-West coastal region of Bangladesh**

*Md. Sultan Mahmud*

*Khulna University, Bangladesh*

Climate change has created a new social community as 'Climate Migrants' or 'Climate Refugees'. As climate change increases the frequency and intensity of natural hazards such as cyclones, floods, and droughts, the number of temporarily displaced people will rise. Disasters continue to be a major driver of shorter-term displacement and migration. The breakdown of ecosystem-dependent livelihoods is likely to remain the premier driver of long-term migration during the next two to three decades. Climate change will exacerbate this situation unless vulnerable populations, especially the poorest, are assisted in building climate-resilient livelihoods. South-West coastal region is the most vulnerable for climate change in Bangladesh. Natural disasters are more frequent in this area due to climate change. The productions of Sundarban are reduced day by day for destruction of the ecosystem for climate change. Climate change impacts to their livelihood of south-west coastal region, and so people migrate to urban areas. Most people migrate to their nearby upazila and a portion of the migrants migrate to major cities due to job availability and security.

## Session E: Institutional Aspects of Climate Change Adaptation

### Presentations:

1. Existing and emerging risks and the need for institutional hazard preparedness and governance: Cyclonic hazard preparedness *by Denis Chang Seng*
2. Disaster risk reduction and climate change education and research in Bangladesh: A progress report *by Dr. Mahmudul Islam*
3. Local governance for disaster risk reduction *by Gabrielle Iglesias*
4. Climate change adaptation for cities *by Prof. M. Alimullah Miyan*
5. Problems and issues of climate change in Bangladesh – Does this matter to urban local governments? *by Prof. Md. Ghulam Murtaza et al.*
6. Furthering institutional strength of local government for climate change adaptation in Bangladesh *by Ronju Ahammad*

# **Existing and emerging risks and the need for institutional hazard preparedness and governance: Cyclone hazard preparedness**

*Denis Chang Seng*

*United Nations University for Environment and Human Security (UNU-EHS);  
chang seng@ehs.unu.edu*

In December 2006, cyclone “Bondo” in the southwest Indian Ocean became the first tropical cyclone in recordable history to reach intense category (i.e. Davorak scale) with average maximum wind speed of over 230 km per hour to penetrate the relatively “cyclone free zone” of the Seychelles to make direct landfall on Providence and Farquhar islands. Intense tropical cyclone Bondo caused extreme environmental and infrastructural damage, while the island residents narrowly escape the ordeal of a lifetime. Two days later intense tropical cyclone Bondo weakens considerably in strength but tracks towards Madagascar to makes landfall over northern Madagascar with disastrous consequences. The key challenging and confronting questions to many are: What is happening? Is the cyclone event related to the likely background effect of climate change? What are the implications of the emerging cyclone risk?

This paper reviews the evolution of the extreme cyclone event and outlines the existing and emerging risks and key deficiencies in the disaster and risk management cycle. Such rare extreme events reveal pre-existing vulnerability, and therefore a synthesised framework is employed to analyses, capture and uncover key deficiencies, weakness and gaps in the context of institutions and governance as the cross cutting issues for effective early warning and disaster risk reduction.



## **Disaster risk reduction and climate change education and research in Bangladesh: A progress report**

*Dr. Mahmudul Islam*

*Comprehensive Disaster Management Programme (CDMP), Government of Bangladesh*

The Comprehensive Disaster Management Programme (CDMP) has completed a number of activities on incorporation disaster and climate change (CC) risk management issues in national education and research system. The National Curriculum and Text Book Board (NCTB), public training institutes, academies and universities are being periodically reviewed. Their progress was measured by experts from the enlisted organizations (grouped together as the Bangladesh Disaster Management Education, Research and Training network or BDMERT). Four expert consultation meetings of BDMERT held in 2008-2009 and found out that a substantial progress has been made during these years on education and research to disaster resilience. This paper will demonstrate the progress made in the education sector on incorporating DRR and climate change.

## Local governance for disaster risk reduction

*Gabrielle Iglesias*

*Asian Disaster Preparedness Center; iglesias@adpc.net*

Institutional and governance preparedness are proposed as important factors affecting the capacity of cities to cope with hydro-meteorological hazards. Disaster risk reduction includes tackling development challenges that lead to the accumulation of hazard and human vulnerabilities that precede disaster. Within the concept of urban disaster mitigation, there may be a need to integrate the consideration for local governance to deal with issues that may enhance or deter its institutionalization. This paper will present some experiences of different cities where governance and local hydro-meteorological disaster mitigation came together. The author will identify the complementary roles of municipal governments and urban communities, and suggest approaches for institutionalizing DRR efforts.

## **Climate change adaptation for cities**

*Prof. M. Alimullah Miyan*

*South Asian Disaster Management Centre (SADMC); miyan@iubat.edu*

Cities are the colonized places of high-dense population, where the inhabitants enjoy easy livelihood, communication, healthcare, education, security and recreation facilities. Due to climate change effects, the basic ingredients namely air, space, light, water and other logistic support and services of a citizen are increasingly hampered and the cities are becoming inhabitable. The present study analyzes the magnitude of climate change effects on city lives and works out the ways of adaptation to reduce the risk of the anticipated disasters. Migration towards the cities for livelihood is increasing at a very high rate and the cities are increasingly facing various crises like accommodation, energy, transportation, pollution, wastes, insecurity, crimes and social unrest. Resource management and biomass recycling have been seriously affected. It is also investigated that the poor planning and administrative weakness aggravate the crises. However, it has been found that the cities are the ultimate shelter during major disasters like floods, tidal surge, cyclones, tornadoes and famine. To keep the cities safe and habitable, the ways for mitigation of climate change effects are focused, and appropriate ways are recommended for better adaptations.

## **Problems and issues of climate change in Bangladesh - Does this matter to urban local governments?**

*Professor Md. Ghulam Murtaza<sup>1</sup>, Fawzia Farzana and Mohammed Shariful Islam  
Khulna University, Bangladesh; <sup>1</sup>smgmurtaza@gamil.com*

The impact of the climate change is multi-dimensional. The institutional aspect to address such phenomenon is very important but it has been barely acknowledged. It is noticed that the compulsory and optional functions of the urban local bodies of Bangladesh have not duly encompassed the matters relating to climate change. Constitutionally, institutionally and financially, the urban local governments of Bangladesh are not capable enough to address such colossal damages and massive problems that occurring in the urban areas due to the climate change. In fact, the urban local governments should have institutional mandate to address this critical and recently emerged problem. Form the point of views of functional and institutional, the urban local governments of Bangladesh have not been equipped enough to address such emerging problems relating to climate change. As a result, it is anticipated that the effects of the climate change it will be colossal. There is urgent need for undertaking appropriate measures so as to strengthen the capacity of the urban local governments to deal with such arising problems and issues.

## **Furthering institutional strength of local government for climate change adaptation in Bangladesh**

*Ronju Ahammad*

*Dhaka Ahsania Mission, Bangladesh; ronju222@yahoo.com*

Climate change has already posed a massive demand on governance structure in such a way that local institutional capacity is increasingly considered as one of the key factors in implementing adaptive actions to transcend the traditional coping capacity of extreme vulnerable community in Bangladesh. If climate change institutions development is rooted in reducing extreme vulnerability, the actions that needed to adapt must be based on reinforcing local capacity for increasing resilience of affected communities that serve from immediate output to a long-term adaptation. Undertaking literature review on climate change and disaster management policies of Bangladesh, along with examining the roles of multi-level stakeholders, the paper tries to make out how local institutional capacity might be facilitated for adapting to climate changes through enhancing coping capacity of vulnerable communities. Among others notably, a centralized decision-making process that does not consider the capacity of local government agencies, poorly defined roles and responsibilities, and/or weak coordination with extreme vulnerable communities, impede rigorous adaptation practices in the local context. In addition, despite being experienced on climate change induced natural disasters as a negative standpoint over the time in Bangladesh for short-term responses, this paper argues for climatic surprises are yet to solicit blending local skills and resources with policy intervention that could be anchored within local institutional regime to address extreme vulnerable communities and underpin to secure their livelihood components in terms of long-term adaptation practices.



## Session F: End-to-End Early Warning

### Presentations:

1. Developing user-relevant tools and early warning information products for reducing disaster risks *by S.H.M. Fakhruddin*
2. Improving early warning dissemination system at receiver's end: Experience of a community-based EWDS in Bangladesh *by Dr. Shamim Mahabubul Haque and Md. Rejaur Rahman*
3. Integrating local knowledge and informal practices with early warning system for disaster risk reduction *by Bijayananda Dash*
4. Reducing vulnerability in coastal areas of Bangladesh through adaptation and awareness *by Md. Mostafizur Rahman and A.K.M. Fazlur Rahman*
5. Hydro-meteorological study of Sunamganj and surroundings for forecasting flash flood early warning *by Md. Zillur Rahman et al.*
6. Climate change and the behaviour of cyclonic storm formed in the Bay of Bengal and crossed Bangladesh coast *by Md. Abdul Mannan*
7. Impacts of climate change: An overview of cyclone and sea level rise in coastal zone of Bangladesh *by N.S.M. Asad and Md. Sohrab Hossain*

## **Developing user-relevant tools and early warning information products for reducing disaster risks**

*S.H.M. Fakhruddin*

*Asian Disaster Preparedness Center; fakhruddin@adpc.net*

About 3% of Asia's land area is classified as low elevation coastal zone, yet it is home to 13% of the region's population. Of the top ten countries in the world with largest population counts in low elevation coastal zones, eight are in Asia. Early warning is a key element of disaster risk reduction. National Meteorological and Hydrological Services (NHMSs) are mandated to observe, understand, and predict the weather and climate of the country, and provide meteorological, hydrological, and related services to contribute to the safety and to the socio-economic benefit and welfare of their communities through reduction of the impact of natural hazards, and safety of life and property. After the Indian Ocean tsunami in 2004, the task of establishing a national tsunami warning system was also added to most NHMS' responsibilities. All the advances in research for generating hazard risk information is not incorporated into operational forecast system and not all operational forecasts are integrated into decision making process to reduce disaster risk. In order to address these gaps, a user-relevant tool (DSS) for early warning information products for reducing disaster risks proposed to develop. The research will use the data from Bangladesh and Vietnam, as these are the most vulnerable countries exposed to multiple coastal hazards. Data collection on digital elevation model, historical hydrological data, satellite images to combine hydrological and GIS tools will be used in the DSS. Based on the downscaled products from NHMS, hydrological modeling tools will be combined with GIS tools to support emergency managers and decision makers to prepare for response activities. The paper will present the methodology for this.



## **Improving early warning dissemination system at receiver's end: Experience of a community-based EWDS in Bangladesh**

*Dr. Shamim Mahabubul Haque<sup>1</sup> and Md. Rejaur Rahman  
Khulna University, Bangladesh; <sup>1</sup>shamimhaque67@yahoo.com*

At community level, major concerns related to effective dissemination of early disaster warning include: credibility of warnings, proper and understandable warning messages, appropriate responses through community engagement, issues of responsibility and authority, as well as access to warnings by different vulnerable groups within the communities. Existing EW network ends at Upazila level, leaving remote communities out of the network. Poor communities having no or minimal electricity connection and very low TV and radio and tele-communication density remain out of the network. With these gaps in the existing system, an improved was designed to be low-cost, SMS-based and in Bangla. It was piloted in the communities of Assasuni Upazila of Shatkhira District of Bangladesh. The system design includes: developing appropriate SMS templates in Bangla, and the SOPs and design of the dissemination network was extended up to community level. Disaster Information Centers (DIC) were established with necessary dissemination equipments at Union Parishad level, which is the lowest tier of local government in Bangladesh and were connected with Upazila Headquarters. Besides, 5 volunteers, who reside in the remote communities, from each of the unions were supplied with mobile phones. Operational responsibility of these centers, were given to Union Disaster Management Committees (UDMC). A 'guidebook' was prepared that includes a manual for text message dissemination, roles and responsibilities of different stakeholders in Warning Dissemination, routes for using hand mikes in each union so that all communities are covered, and SOP to be followed for warning dissemination. The developed system was tested through several mock drills and in two real situations,- tsunami warning dissemination on 12 September 2007 and cyclone SIDR warning dissemination on 15 November 2007; it was found to be very effective. Keeping the enthusiasm of the community volunteers intact and proper functioning of UDMCs in accordance with the Government's SOD were identified as the key for the sustainable operations of such EWDS in future.

## **Integrating local knowledge and informal practices with early warning system for disaster risk reduction**

*Bijayananda Dash*

*Dip ECHO Project Sahbhagi Shikshan Kendra Lucknow, India; dash@sahbhagi.org*

The impact of climate change manifested in terms of floods, cyclone, or drought is expected to be severe in the Asia-Pacific region in the coming years. But the coping capacity is weak in most countries and communities. As much of the management is site specific and has to be developed at the individual and community level. It is crucial to harness local knowledge in designing adaptation strategies. Early Warning System plays a crucial role especially in disaster risk reduction, but in most cases it is a highly technical process wherein the community has little role to play. This paper will discuss how communication is not a function of technology alone: it has to reach all sections of people irrespective of their level of education, understanding, etc.

## **Reducing vulnerability in coastal areas of Bangladesh through adaptation and awareness**

*Md. Mostafizur Rahman and A.K.M. Fazlur Rahman  
International University de Catalunya; urp\_402@yahoo.com  
Technical University of Darmstadt*

World climate scenario has changed negatively since last decade and Bangladesh became the worst victim of the changed climatic condition ranking 141<sup>st</sup> in the ecological footprint list. Evidently the past couple of year's disaster experiences i.e. SIRD, AILA, etc. symbolize the scenario will become more vulnerable than the past. This paper focused on vulnerability assessment due to shrimp cultivation and salinity intrusion in Koyra, Bangladesh, one of the most remote coastal areas ultimately resulting resource vulnerability and food insecurity. Identifying community in risk, focus group discussion in 25 different places showed 60 percent farmers are highly affected and became more poor. Nevertheless in five years the vulnerability index increased from 2.3 to 4.8 considering the return from the same land and stock of food. Additionally, around 60 percent stakeholders don't have transport facilities and near about 80 percent depend on the Sundarban. Since last decade 40 percent agricultural land transformed into shrimp cultivation areas along with the leased government canals that totally destroyed the biodiversity of that area. Adaptation of environmentally friendly production system i.e. rice-shrimp-rice in relation with awareness building through extensive media campaign and knowledge promotion for capacity building can establish collective efforts not only economically but also environmentally.

## **Hydro-meteorological study of Sunamganj and surroundings for forecasting flash flood early warning**

*Md. Zillur Rahman, Mohammad Saiful Islam, Subrota Kumar Saha, A. S. M. Maksud Kamal  
M. Qumrul Hassan, A. S. M. Woobaid Ullah  
University of Dhaka, Bangladesh*

Hydro-meteorological conditions of Sunamganj and surroundings reveal that the rainfall in the area during the months of April and May is not a contributing factor for the cause of flash flood in this region. The frequency of rainfall in Meghalaya and Assam of India is the main factor for the occurrence of flash flood in Sunamganj and surroundings.

The hydrological data analyses such as the water level data in the rivers of Sunamganj and surroundings show that the influence of the upstream rivers on the downstream ones is prominent. While the water in the upstream tributaries of the Surma River starts receding, the downstream reach of Surma River starts swelling. This depends on the topography and magnitude of the rainwater onrush in the catchment of the Surma River. Combined affects of different channels aggravate the situation which ultimately leads to flash flood within a short span of time. The confluent flow in and around Sunamganj further aggravates it.

It is possible to determine the lead time as to when and where the flash flood will take place. For this purpose detailed study on time series data is required. It is essential to have time series data on each and every point of all the rivers flowing to and from the study area. It is also equally important to have the hydrologic data of the upper riparian India. Otherwise it will not be possible to develop a comprehensive early warning system for flash flood in Sunamganj district and other flash flood prone areas of Bangladesh.

## **Climate change and the behaviour of cyclonic storm formed in the Bay of Bengal and crossed Bangladesh coast**

*Md. Abdul Mannan*

*Bangladesh Meteorological Department*

Bangladesh is the most vulnerable to natural disasters and every year natural calamities upset people's lives in some part of the country. The major disasters concerned here are the occurrence of flood, cyclone and storm surge, flash flood, drought, tornado, riverbank erosion and land slide etc. Cyclone and associated storm surge is one of the most extreme natural event which adversely affect the whole environment including human beings, their shelters and the resources essential for their livelihood in the coastal areas and offshore islands of Bangladesh. Fluctuations of tropical cyclone activity are of obvious importance to society, especially as populations of the afflicted areas increase. Tropical cyclones account for a significant fraction of damage, injury and loss of life from the natural hazards and are the costliest natural catastrophes in the world. In addition it is suggested that global tropical cyclone activity may play an important role in driving the oceans thermohaline circulation, which has an important influence on regional and global climate. In response to global warming the observed warming in the tropics is around 0.5°C. The significant increase in Sea Surface Temperature (SST) is also established. This increased SST is mostly responsible for the changing behavior of tropical cyclones which influences the disaster related risk in the coastal areas of Bangladesh. To understand this situation attempt has been made learning about the cyclones which formed in the Bay of Bengal and crossed Bangladesh coast during last few decades.

# Impacts of climate change: An overview of cyclone and sea level rise in coastal zone of Bangladesh

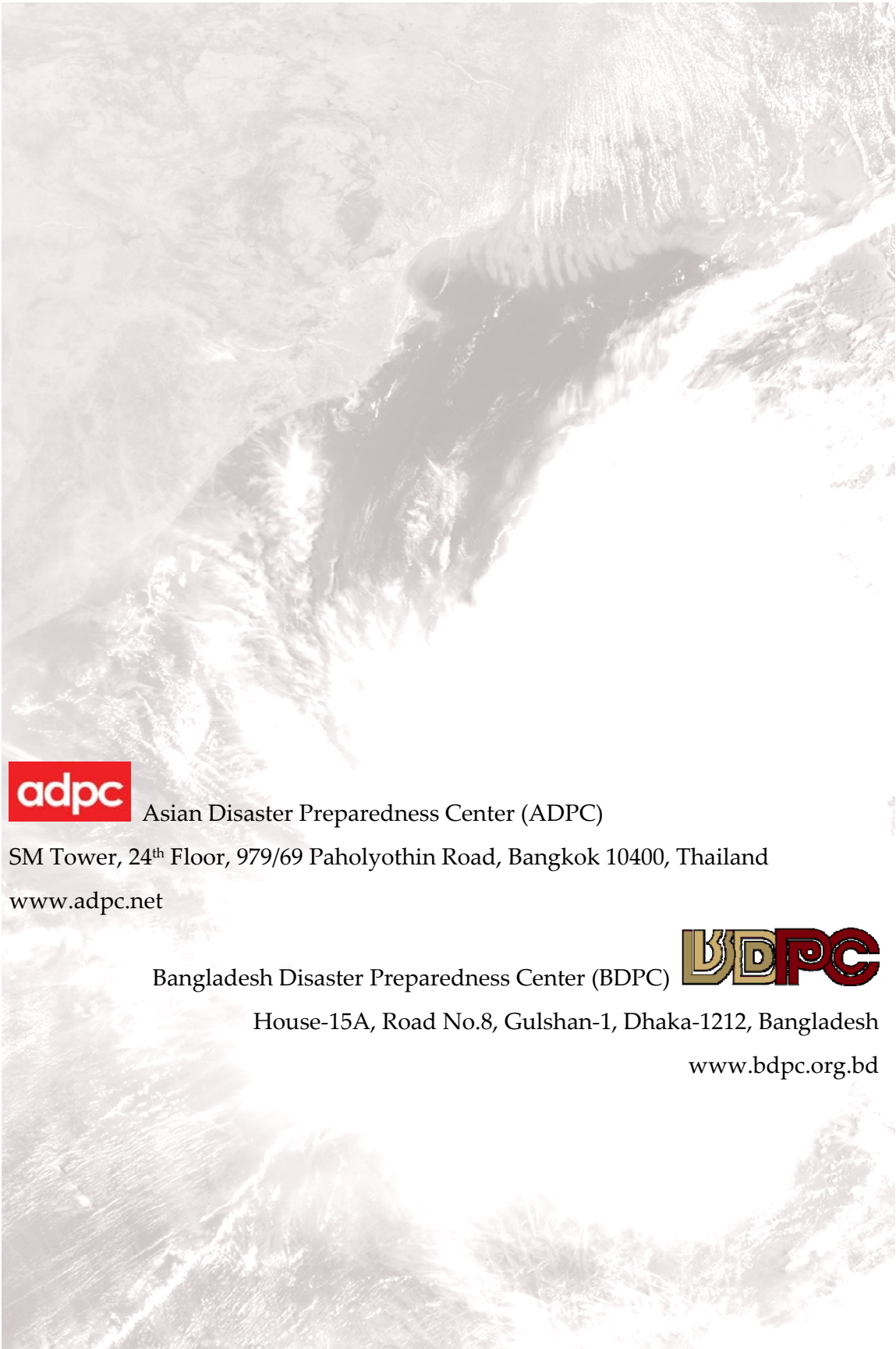
*N.S.M. Asad<sup>1</sup> and Md. Sohrab Hossain<sup>2</sup>*

*<sup>1</sup> Bangladesh University of Engineering and Technology (BUET); nsmasad@gmail.com*

*<sup>2</sup> CEGIS, Bangladesh*

Though climate change is a global issue, Bangladesh is highly impacted by it. This paper explores the impact of climate change with emphasis on cyclone and sea level rise based on secondary data source. It also explores the future impact of cyclone and sea level rise and possible options to face the challenge. There are only two options to cope with the situation- mitigation and adaptation. Mitigation demands collective efforts of global communities and adaptation is country specific, or even local specific. However, capacity building of the communities and institutions, proper planning for structural and non-structural measures, plus economic and moral support by the global communities, are required for sustainable development of Bangladesh.





Asian Disaster Preparedness Center (ADPC)

SM Tower, 24<sup>th</sup> Floor, 979/69 Paholyothin Road, Bangkok 10400, Thailand

[www.adpc.net](http://www.adpc.net)

Bangladesh Disaster Preparedness Center (BDPC)



House-15A, Road No.8, Gulshan-1, Dhaka-1212, Bangladesh

[www.bdpc.org.bd](http://www.bdpc.org.bd)