

Disaster Due to Climate Change: Its Effects and Management in Coastal Areas in Bangladesh

Babul Chandra Shil*

Abstract

Bangladesh is now widely recognised to be one of the countries which are most vulnerable to climate change. Natural hazards that come from increased rainfall, rising sea levels, and tropical cyclones are expected to increase as climate changes, each seriously affecting agriculture, water and food security, human health and shelter. Present study has carried out to see the effect of climate change and find out its management strategies. The study was survey in nature; the study was conducted at Satkhira, Barguna and Cox's Bazar District of Bangladesh. Data were collected from primary and secondary sources. Primary data were collected from face to face interview with the respondents of the study area. Secondary data were collected from books, journals, research reports, internet etc. Total sample size was 300. From each district 100 respondents were selected. The respondents were elected representatives of the local areas. 7 Chairmen, 23 Councilor, 66 Members, 2 Mayors, and 2 Secretary were interviewed for the study. Respondents were selected randomly. Random sampling method has been used for the study. Questionnaire was used for data collection. The collected data were tabulated and analyzed by using Computer Program Microsoft Excel. From the result it was found that in case of priority 1 maximum 94 % respondents agreed that Tornado/Cyclone is the main climate induced hazards, and other climate induced hazards are soil erosion, salinity increase, communicable disease and Other Specified hazards are 2%, 1%, 2%, and 1% respectively. In case of Priority 2, it was found that maximum 53% respondents agreed that soil erosion is the main climate induced natural hazards and other climate induced natural hazards are salinity increase, tornado/cyclone, communicable disease and other specified hazards are 41%, 2%, 1% and 3% respectively. In the case of priority 1 in case of management of climatic hazards, 91% respondents were agreed that shelter house is the most effective coping mechanism against natural disaster and other coping mechanisms are food protection, other specific adaptation measure like take shelter in embankment/dam during disaster period, raised homestead, short durable crop, relocate resources and cultivable saline crops are 1.0%, 2.0%, 1.0%, 1.0%, 2.0% and 2.0% respectively. In case of Priority 2, maximum 52% respondents

* Additional Chief Engineer, Eastern Zone, Bangladesh Water Development Board, Comilla.

agreed that relocate resources is the most effective coping mechanism against natural disaster and other coping mechanisms are food protection, other specific, raised homestead, short durable crop, relocate resources and cultivable saline crops are 4.0%, 7.0%, 8.0%, 17%, 8.0%, and 4.0% respectively. Vulnerability and adaptation assessments should be developed for prioritizing adaptation policies and measures. Adaptation has to be mainstreamed in investment planning both in public and private sector. Capacity needs to be built for both short-term and long-term adaptation planning. More Shelter Centers should be built to give shelter during the natural hazards. Living house should be built in such a way so that the houses can resist the tidal surge and cyclones. Governmental institutions (ministries, governmental organizations and agencies), private entries and NGOs should consider integrating climate change in their planning and budgeting at all levels of decision making and coordinate their actions among themselves.

Key Words: *Hazards, adaptation, capacity building, priority, shelter, environment.*

1. Introduction

Climate change is a problem that is continuously affecting people and the environment. Historically, Bangladesh is one of the most susceptible countries of the world to bear the burden of the negative impact of climate change. The coastal areas are worst affected and the coastal population are the sufferers. Climate change refers to any significant change in measures of climate (such as temperature, precipitation, wind, sea level, and natural phenomena), lasting for an extended period of time (decades or longer) that negatively affects the terrestrial and aquatic ecosystems (all living things: plants, animals and organisms, interacting with each other, and also with their non-living environments: weather, earth, sun, soil, climate, and atmosphere). Greater energy efficiency and new technologies hold promise for reducing greenhouse gases (such as Carbon dioxide- CO₂, Methane- CH₄, Nitrous oxide- N₂O, water vapor, while others are synthetic. Those that are man-made include the chlorofluorocarbons-CFCs, Hydro-fluorocarbons-HFCs, Per-fluorocarbons-PFCs, Sulphur- hexafluoride- SF₆) and solving this global challenge. Greenhouse gases and certain synthetic chemicals, trap some of the Earth's generated energy, thus retaining heat in the atmosphere. Efforts are being made for reducing, reusing and recycling solid waste to decrease the amount of heat-trapping greenhouse gases released.

Bangladesh is prone to floods, tornados and cyclones. Also, there is evidence that earthquakes pose a threat to the country. Evidence shows that tectonics have caused rivers to shift course suddenly and dramatically. It has been shown that rainy-season flooding in Bangladesh, on the world's largest river delta, can push the underlying crust down by as much as 6 centimetres, and possibly perturb faults. It is believed that in the coming decades the rising sea level alone will create more than 25 million climate refugees. Bangladeshi water is contaminated with arsenic frequently because of the high arsenic contents in the soil. Up to 77 million people are exposed to toxic arsenic from drinking water.

The extreme variations in the meteorological phenomena, pose a threat to the coastal zones. The observable weather events are primarily: Earth's atmosphere: temperature, air pressure, water vapor, mass flow, floods/flash floods, cloud burst, heavy precipitation; tropical cyclones and their associated storm surges; severe convective storms - thunderstorms, hailstorms, tornadoes, lightening, dust storms, sand storms; heat/cold wave; land-slides; and river/sea erosion. The spatial and temporal scales of these hazards vary widely from short-lived, violent phenomena of limited extent (e.g. severe thunderstorms), through large systems (e.g. tropical cyclones). These events can subject large regions to disastrous weather phenomena like strong winds, heavy flood-producing rains, storm surges and coastal flooding, freezing rain and extreme hot or cold temperature conditions for periods of several days. With this wide variety of the scales of weather phenomena, the requirements of meteorological and hydrological forecasting for effective early warning of these hazards also vary spanning over a very broad spectrum. These can range from very short range forecasts of less than one hour in the case of severe thunderstorms and flash floods; through short and medium range forecasts of - from a few hours to days for tropical cyclones, heavy rains, extreme temperatures and high winds. According to the 3rd assessment report of International Panel on Climate Change, South Asia is the most vulnerable region of the world to climate change impact (Mc Cathie, et.al--2001). Bangladesh ranks high in respect of vulnerability due to its topography and other factors such as hydro-geological and socio-economic factors mentioned below:

1. Its Geographical location in South Asia
2. The Ganga-Brahmaputra-Meghna Catchments area includes a great diversity of Physical environment
3. Its flat deltaic topography with very low elevation
4. Its extreme climate variability droughts; cyclones; and the monsoon season, when much of the country is routinely inundated

2. Objectives of the Study

The overall objective of the research is to find out the effects of climate changes over the vulnerable population of the coastal districts - successful strategies for coping with different climate induced disasters through lesson learnt documentation and analyzing national and International actions for achieving sustainable development. However the specific objectives of the study are as follows:

1. To find out the climatic hazards faced by the coastal population of Bangladesh.
2. To identify management strategies used by the coastal population of Bangladesh.
3. To analyze vulnerability of the areas.

3. Methodology of the Study

3.1 Study Design: The study was survey type.

3.2 Study Area: The study was conducted at Satkhira, Barguna and Cox's Bazar District of Bangladesh.

3.3 Sources of Data: Data were collected from primary and secondary sources.

3.4 Sources of primary data: Primary data were collected from the respondents of the study area.

3.5 Sources of secondary data: Secondary data were collected from books, journals, research reports, internet etc.

3.6 Method of data collection: Data were collected from the field by face to face interview with the respondents.

3.7 Sampling Method: Random sampling method has been used for the study.

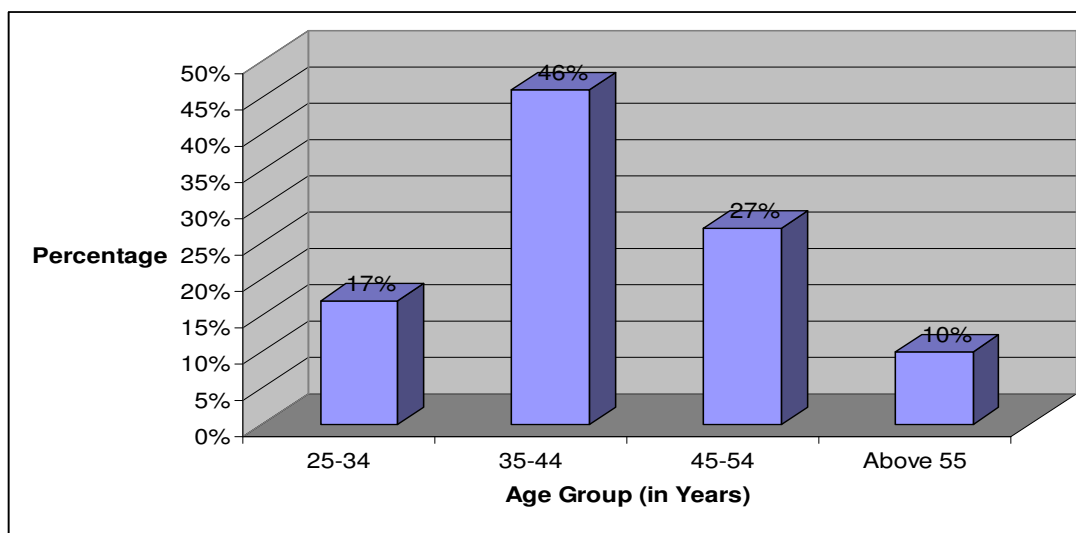
3.8 Sample Size: Total 300 respondents were interviewed for the study. From each district 100 respondents were selected. The respondents were elected representatives of the local areas. 7 Chairmen, 23 Councilor, 66 Members, 2 Mayors, and 2 Secretary were interviewed for the study.

3.9 Tools for Data Collection: Questionnaire was used for data collection.

3.10 Data Analysis: The collected data were tabulated and analyzed by using Computer Program Microsoft Excel.

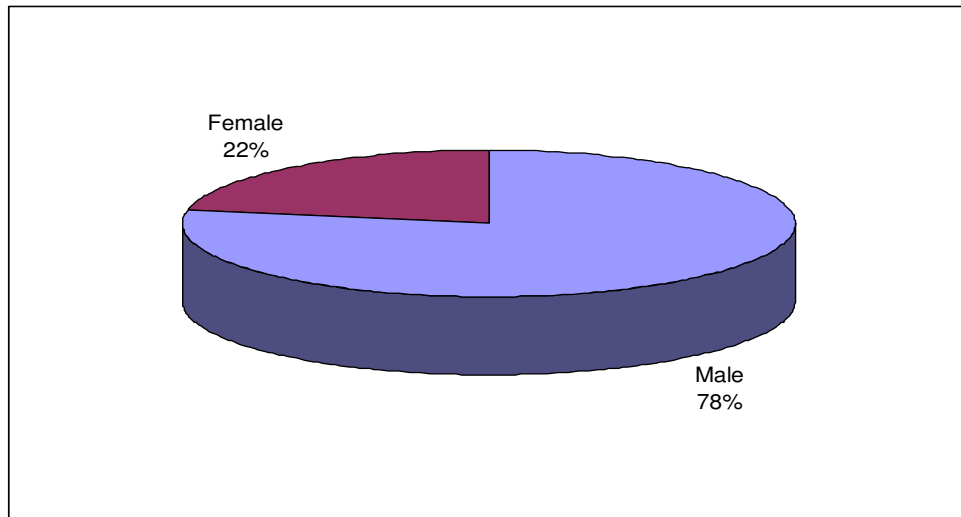
4. Results and Discussion

Graph 1: Age Group of the Respondents



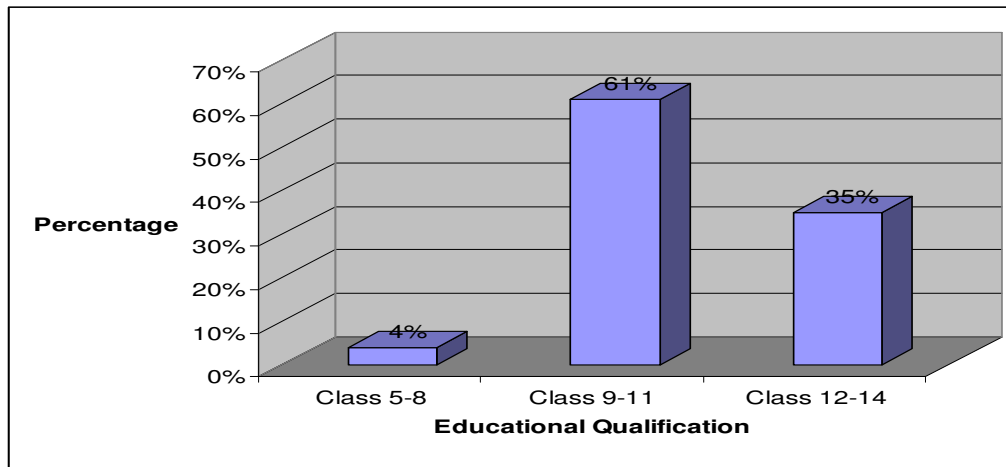
Age groups of the respondents are described in the above graph 1. From the graph it was found that age group 35-44 is 46 % which is the maximum and age group above 55 is 10 % which is the minimum. Age group 25-34, 45-54 years is 17% and 27 % respectively. The selection of the participants was done randomly. It indicates that most of the elected representatives are from 35-44 age groups. On the other hand, there are very little number of participants is elected from this above 55 age group.

Graph 2: Gender of the Respondents



Gender of the respondents is described above graph 2. From the graph it was found that out of 300 respondents, 78% respondents were male and 22% respondents were female. Because, the female representatives are few in numbers. Recently the female are coming more in elected representatives.

Graph 3: Educational Qualification



Educational qualifications of respondents are described above graph 3. From the graph it was found that out of 300 respondents, 61 % respondents completed class 9~11 which is the maximum and 4.0% completed class 5~8 which is the minimum and 35% respondents completed class 12~14.

Table 1: Type of Job of the Respondents

Sl. No.	Type of Job	Percentage
1	Government	2.0%
2	Public Representatives	98%
Total		100%

Job category of the respondents is described above. From the graph it was found that out of 300 respondents 98% respondents are Public Representative and 2.0% respondents are Government Service holder.

Table 2: Type of Organization

Sl. No.	Type of Organization	Percentage
1	Union Parishad	75%
2	Municipality	25%
Total		100%

Category of the Organization is described above. From the graph it was found that out of 300 respondents, 75% respondents engaged in Union Parishad and 25% respondents are engaged in Municipality.

Table 3: Designation of Public Representatives

Sl. No.	Designation	Percentage
1	Chairman	7.0%
2	Councilor	23%
3	Member	66%
4	Mayor	2.0%
5	Secretary	2.0%
Total		100%

Designation of the Public Representatives is described above. From the graph it was found that out of 300 respondents, 66% was Member of Union Parishad which is the maximum and 2.0% are Mayor of Municipality and Secretary of Union Parishad. Other representatives are Chairman of Union Parishad, Councilor of Municipality are 7.0% and 23% respectively.

Table 4: Coping Mechanism of Climate Induced Hazard

Category	Priority 1	Priority 2
Food Protection	1.0%	4.0%
Other Specifie	2.0%	8.0%
Shelter House	91%	3.0%
Raised Homestead	1.0%	14%
Short Durable Crop	1.0%	8.0%
Relocate Resources	2.0%	59%
Cultivate Saline Crops	2,0%	4.0%

Coping mechanism of the disaster prone areas are described above. Here opinions of the respondents are categorized into Priority 1 and Priority 2. From the graph it was found that in case of priority 1, out of 300 respondents, 91% respondents were agreed that Shelter House is the most effective coping mechanism against natural disaster and other coping mechanisms are Food Protection, Other Specific adaptation measure like take shelter in embankment/dam during disaster period, Raised Homestead, Short Durable Crop, Relocate Resources and Cultivable Saline Crops are 1.0%, 2.0%, 1.0%, 1.0%, 2,0% and 2.0% respectively. In case of Priority 2, out of 300 respondents, maximum 59% respondents agreed that Relocate Resources is the most effective coping mechanism against natural disaster and other coping mechanisms are Food Protection, Other Specific, Shelter House Raised Homestead, Short Durable Crop, and Cultivable Saline Crops are 4.0%, 8.0%, 3.0%, 14%, 8.0%, and 4.0% respectively.

Table 5: Climate Induced Hazards

Hazards	Priority 1	Priority 2
Soil Erosion	2.0%	53%
Salinity Increase	1.0%	41%
Tornado/Cyclone	94%	2.0%
Communicable Disease	2.0%	1.0%
Other Specified	1.0%	3.0%

Climate Induced Hazards are described above. Here opinions of the respondents are categorized into Priority 1 and Priority 2. From the graph it was that in case of priority 1, it was found that out of 300 respondents, maximum 94 % respondents agreed that Tornado/Cyclone is the main climate induced hazards, and other climate induced hazards are Soil Erosion, Salinity Increase, Communicable Disease and Other Specified hazards are 2%, 1%, 2%, and 1% respectively. In case of Priority 2, it was found that out of 300 respondents, maximum 53% respondents agreed that Soil Erosion is the main climate induced natural

hazards and other climate induced natural hazards are Salinity Increase, Tornado/Cyclone, Communicable Disease and other Specified hazards are 41%, 2%, 1% and 3% respectively.

Table 6: Duration of Living

Sl. No.	Duration	Percentage
1	25-35 years	17%
2	35-44 years	46%
3	45-54 years	27%
4	Above 55 years	10%
Total		100%

Duration of living of the respondents is described in the above graph. From the graph it was found that duration of living 35-44 years is 46 % which is the maximum and duration of living above 55 years is 10 % which is the minimum. Duration of living 25-35, 45-54 years is 17% and 27 % respectively. The selection of the participants was done randomly.

Table 7: Degree of Climate Hazards Vulnerability

Degree	Priority 1	Priority 2
Degradation of Assets	3.0%	30%
Poor Communication	6.0%	49%
Shortage of Facilities	2.0%	1.0%
Weak Housing	88%	16%
Lack of Technologies	1.0%	4.0%

Degree of Climate Hazards Vulnerability is described above. Here opinions of the respondents are categorized into Priority 1 and Priority 2. From the graph it was that in case of priority 1, out of 300 respondents, 88% respondents agreed that Weak Housing is the effect of natural disaster which is the maximum and lack of technologies is 1% which is the minimum effect of natural hazards. Other effects of natural hazards are Degradation of Assets, Poor Communication, Shortage of Facilities, is 3%, 6%, 2% respectively. In case of priority 2 out of 300 respondents, 49% respondents agreed that Poor Communication is the effect of natural disaster which is the maximum and Shortage of Facilities is 1% which is the minimum effect of natural hazards. Other effects of natural hazards are Degradation of Assets, Weak Housing and lacks of Technologies are 30%, 16% and 4% respectively.

5. Conclusion and Recommendation

A study was conducted to identify the adaptation and mitigation strategies of climate induced hazards in the coastal areas and understand the climate hazards and degree of vulnerability caused by these disasters in coastal zone in Bangladesh. Adaptation to climate change is a complex topic that presents a number of challenges. This involves a process of sustainable

and permanent adjustment in response to new and changing environmental circumstances. So adaptation cannot be treated as a stand-alone issue and should be premised on the following factors.

1. Vulnerability and adaptation assessments should be developed for prioritizing adaptation policies and measures. Adaptation has to be mainstreamed in investment planning both in public and private sector. Governments therefore need to devise policies, incentives, and regulation to public and private initiative toward strengthening adaptation.
2. Capacity needs to be built for both short-term and long-term adaptation planning. Innovative risk sharing mechanisms (insurance) are needed to respond to emerging challenges including biodiversity loss and land degradation.
3. Adaptation, rather than being concentrated in one sector, should essentially be dispersed across all socio-economic sectors including water, health, agriculture, and infrastructure, each of which presents in own challenges, and will involve stakeholders in different if overlapping groups. Adaptation measures are likely to be less capital intensive and more amenable to small scale interventions.
4. More Shelter Centers should be built to give shelter during the natural hazards.
5. Living house should be built in such a way so that the houses can resist the tidal surge and cyclones.
6. Governmental institutions (ministries, governmental organizations and agencies), private entries and NGOs should consider integrating climate change in their planning and budgeting at all levels of decision making and coordinate their actions among themselves.

Still many climate change impacts timing and exact magnitude are uncertain. Hence, the strategy and Action Plan will require periodical revision. The following enhancements should be considered by Government of Bangladesh to their policies and programs.

1. Government should adopt meaningful, achievable climate change targets.
2. Government should pursue strong, binding emissions targets in international negotiations.
3. Government should ensure commitment of developing countries fair share to climate change adaptation for Bangladesh.
4. Government should provide education, training and public awareness.
5. Government should Seek more support for climate change mitigation and adaptation research: The Government of Bangladesh should look for increased funding support to research into innovative technologies including renewable energy, understanding climate change dynamics, carbon capture and sequestration, energy efficiency, crop varieties, and other adaptation and mitigation innovations.
6. Government should encourage environmental solutions in other counties.
7. Government should collaborate with our neighbors who are victim of climate change.

References:

- Adger, W.N. (2006), *Vulnerability Global Environmental Change*. Vol 16, pp 268-281.
- Checkland, P. (1985), *From optimizing to learning: a development of systems thinking for the 1990s*. J. Opl Res. Soc. Vol 36(9). pp 757-767
- Carpenter, S.R., Brock, W.A., Ludwig, D. (2002), *Collapse, learning and renewal*. In Gunderson, L.H. and Holling, C.S. (eds.). *Panarchy, understanding transformations in human and natural systems*. Washington D.C.: Island press
- Eakin, H and Luers, A.L. (2006), Assessing the vulnerability of socio-ecological systems. *Annual Review of Environmental resources*. Vol. 31. pp 365-394.
- Eakin, H., Winkels, A. and Sendzimir, J. (2008), *Nested vulnerability: exploring cross-scale linkages and vulnerability teleconnections in Mexican and Vietnamese coffee systems*. Environmental Science and Policy
- Fussler, H.M. (2005), *Vulnerability in climate change research: a comprehensive conceptual framework*. UC Berkeley: University of California International and Area Studies, UC Berkeley.
- Gallopín, G. C. (2006), Linkages between vulnerability, resilience and adaptive capacity. *Global Environmental Change*. Vol 16.293-303
- IPCC, 2007: Summary for Policymakers In: *Climate Change (2007), Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 7-22
- Climate Change (2000), *Impacts, Adaptation, and Vulnerability, Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge.
- Moss, S. , Pahl-Wostl, C. and Downing, T. (2000), Agent-based integrated assessment modeling: the example of climate change. *Integrated Assessment*, Vol2. pp 17-30.
