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Climate Change in the Coastal Area -Challenges and Options of Bangladesh

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ABSTRACT

Climate change, as a result of global warming, has become the most dangerous issue for the mankind at this moment. The least developed and the coastal states are the worst victims of this climate change. Bangladesh is recognized as one of them. The evidences are obvious as the country is witnessing floods, cyclones, storm surge and weather related extreme events in recent days. Scientists have also issued warning that Bangladesh is likely to lose a significant part of its coastal areas to the sea due to rise in sea level triggered by melting ice, sea surface temperature changes.

Keywords: Climate, Coastal, floods, temperature, atmospheric, gas.

1.Introduction

1.1 The earth is, so far, assumed to be the only planet to have the habitable conditions for the human and other species. However, we are constantly degrading the environment. As a result, the climate of the earth is becoming vulnerable at a dangerous extent. The average temperature of the earth is increasing at a rate more than the anticipated one. Such an increase is causing the ice glaciers to melt down and increase the sea level. The overall effect of such an increase is dominating the climate change scenario.

2.Reasons of Climate Change

2.1 Global warming is caused primarily by human activities, especially the burning of fossil fuels have significantly increased atmospheric concentrations of greenhouse gases (GHG). The continued build-up of these gases in the atmosphere is expected to cause major disruptions to the global climate system. The reasons of global warming can be summarized in sequence of severity:

2.1.1 The primary reason is carbon dioxide which is released from burning coal, oil and natural gas in power plants, cars, factories, etc.

2.1.2 Methane, released from rice paddies, cattle discharges, rotting garbage in landfills, mining operations and gas pipelines.

2.1.3 Chlorofluorocarbons (CFCs) and similar chemicals, which are also implicated in the separate problem of ozone depletion.

2.1.4 Nitrous oxide (from fertilizers and other chemicals).

2.2 Chemical analysis of the carbon demonstrates that this increase is caused largely due to the burning of fossil fuels - coal, oil and gas. If no action is taken to curb these emissions, the carbon dioxide concentration will rise during the 21st century to two or three times of pre-industrial level. The rich, developed countries are emitting green house gases as a result of their consumption pattern and lifestyle. On the other hand, activities of vast population living in developing countries also contribute to the GHG load at a limited scale. Countries like Bangladesh are not large green house gases emitters whereas green house gases emissions from USA alone accounts for 20% of the total global emissions (Figure 1).

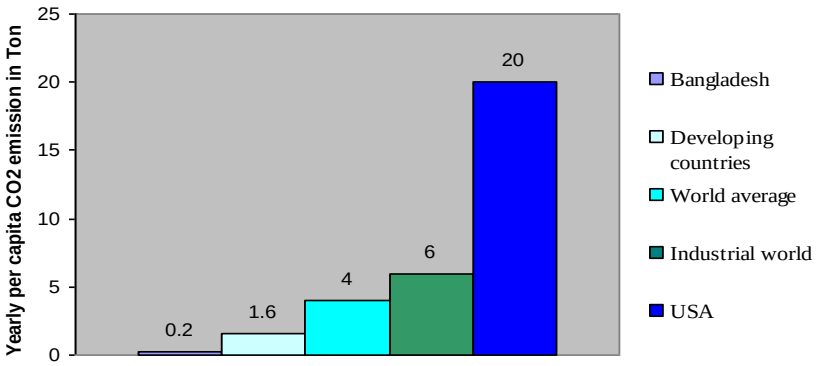


Figure 1: Worldwide per Capita Carbon Dioxide Emission

(Source: Mamunul H Khan; Golam Mahabub Sarwar; Dr Jinnahtul Islam in IDB Bhaban, Dhaka on 27 Feb 08)

2.3 The carbon-dioxide emission will continue to increase even at a greater rate. The following graph shows the past and future atmospheric carbon dioxide concentrations depicting the severity of the climate change in the future days to come.

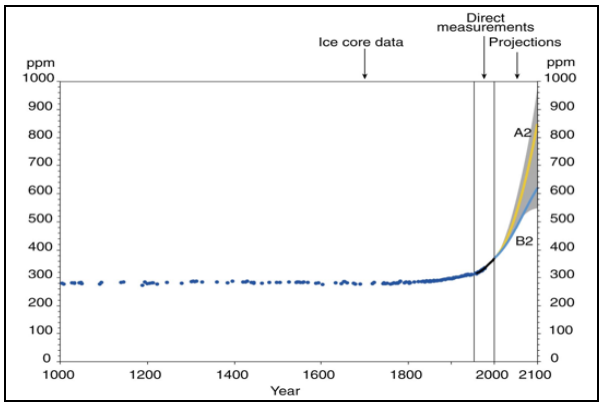


Figure 2: Past and Future Atmospheric Carbon Dioxide Concentrations

(Source: Mamunul H Khan; Golam Mahabub Sarwar; Dr Jinnahtul Islam in IDB Bhaban, Dhaka on 27 Feb 08)

3. Global Impacts of Climate Change

3.1 Climate change will have effect on the entire mankind. The phenomenons are already present in some part of the world which includes South Asian Region. As such, climate change is recognized as the greatest long term threat to the SAARC region. Some of these impacts will be irreversible and will have far reaching consequences. The large scale impacts of the global warming and climate change are discussed in brief in the subsequent paragraphs.

3.2 Rise of Temperature. The rate at which temperature rise is taking place is very crucial factor. Earth's average temperature has risen about 1 degree F during the past 100 years and is projected to rise another 3 to 10 degrees F in the next 100 years. The National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA) of United States of America (USA) notifies that the earth's average temperature in 1998 was 14.46° C (58.1° F)- which is 0.66° C (1.2° F) above the long-term average. Figure 3 shows variation of the earth's surface temperature from year 1000 to year 2100:

3.3 Sea Level Rise (SLR).

3.3.1. One of the serious consequences of an increase in mean global temperatures will be a possible rise in the sea level around the planet. The main cause for rising sea levels is the expansion of water due to an increase in water temperature. Additional factors are the melting of mountain glaciers and the ice crust in Greenland. Observations since 1961 show that the ocean has been absorbing more than 80% of the heat added to the climate system. The warming causes increase of seawater temperatures in the upper several hundred meters of the ocean and in contributing to SLR.

3.3.2 Past Changes in Sea Level. There was a rapid rise between 15,000 and 6,000 years ago at an average rate of 10 mm/yr. Based on geological data, global average sea level may have risen at an average rate of about 0.5 mm/yr over the last 6,000 years and at an average rate of 0.1 to 0.2 mm/yr over the last 3,000 years. Based on tide gauge data, the rate of global average sea level rise during the 20th century is in the range 1.0 to 2.0 mm/yr, with a central value of 1.5 mm/yr.

3.3.3 Present Sea Level Change. The observations indicates a rate of SLR from 1910 to 1990 ranging from –0.8 to 2.2 mm/yr, with a central value of 0.7 mm/yr. The acceleration is at a rate 0.2 mm/yr/century. Based on the available data, the estimated SLR ranges from 0.3 to 0.8 mm/year.

3.4 Increase Number of Natural Disasters. The number of extreme weather condition like flood, cyclone, storms etc will increase in various parts of the world as a consequence of climate change.

3.5 Impact on Ecosystem and Bio-diversity. Climate change is likely to affect the ecosystems and biodiversity. Climate change may accelerate damage to freshwater ecosystems prevailing in the lakes, marshes and rivers. The survival of the wild life will be endangered due degradation of the entire ecosystem causing extinct of some of the species.

3.6 Scarcity of Water Resources. The climate change will instigate serious problem due saline water intrusion. The scarcity of fresh water for drinking and irrigation may become a serious problem in this regard.

3.7 Impact on Food Security and Agriculture. The impact of climate change is far reaching on the economy. SLR will increase the flooding and much area will be under water, specially in the coastal areas. On the other hand the excessive temperature will cause more droughts with more severity. Therefore, the production of the crops will be reduced drastically. In turn, food prices will rise and food security of the country will be adversely affected.

3.8 Impact Zones. The impact of climate change will be severe for the countries with poor economy in the coastal areas across the world including some of the small island countries. It is well established that the Least Developed Countries (LDCs) are the least green house gases producing countries in the world having the potentials to be the most vulnerable to face of climate change. This is due their least capacity to adapt necessary changes. The most affected areas due to climate change are expected to be Sub Saharan Africa, Asia and the small island states. The Third Assessment Report of the IPCC provides information on impacts and vulnerabilities of such countries. Among the Asian countries, coastal zones and low lying delta areas in Asia, such as those in Bangladesh, Myanmar and Cambodia, are at risk from sea level rise and more frequent and severe storms due to climate change.

4 Climate Change – Bangladesh Perspectives

4.1 Bangladesh is a low-lying land comprising mainly the delta of the Ganges and Brahmaputra rivers. Mean elevations range from less than 1 meter on tidal floodplains, 1 to 3 meters on the main river and estuarine floodplains and up to 6 meters in the Sylhet basin in the north-east. Only in the extreme northwest are elevations greater than 30 meters above the mean sea level. The northeast and southeast portions of the country are hilly, with some tertiary hills over 1000 meters above mean sea level. Bangladesh by its location in the far end of the river systems is the largest natural drainage system in the world. Despite having merely seven per cent land mass of South Asia, it drains 90 per cent water of the region into the Bay of Bengal. The country, except for small pockets is an active deltaic region is literally criss-crossed with rivers and canals which play a significant role in the livelihoods of millions of people. Over half the population of the country depends on agriculture for their livelihoods and even minor changes in the agricultural calendar are having a devastating domino effect on the rural economy.

4.2 Current Climate Scenario

4.2.1 Bangladesh has a humid, warm and tropical climate which is primarily influenced by monsoon and partly by pre-monsoon and post-monsoon circulations. The monsoon originates over the Indian Ocean and carries warm, moist and unstable air. Out of six seasons, four seasons are prominent. They are Winter (December to February), Pre-monsoon (March to May), Monsoon (June to early-October), Post-monsoon (late-October to November) are prominent. Generally the winter is cooler with observed lesser temperature in the north. Pre-monsoon is and monsoon are hot and humid with heavy rain fall. The post-monsoon is rather a short lived season characterized by withdrawal of rainfall and lowering of temperature. The mean rain fall in the country is about 2300 mm where the rainfall ranges from 1200 mm to 5000 mm.

4.2.1 The climate models estimate a steady increase in temperatures for Bangladesh, with little inter-model variance. Changes in area averaged temperature and precipitation over Bangladesh were assessed based upon over a dozen of recent General Circulation Model (GCMs) using MAGICC/SCENGEN. At the beginning results for Bangladesh for 17 GCMs developed since 1995 were examined. Next, 11 out of 17 models which best simulate current climate over Bangladesh were selected. The models were run with the IPCC B2 SRES scenario.

5. Impacts Of Climate Change in the Coastal Areas Of Bangladesh

5.1 Coastal Area of Bangladesh

5.1.1 The coast of Bangladesh runs parallel to the Bay of Bengal, forming 710 km long coastline. According to the Coastal Zone Policy (CZPo) 2005 of the Government of Bangladesh, 19 districts out of 64 are in the coastal area covering a total of 147 upazillas of the country. 12 out of these 19 districts meet the sea or lower estuary directly. The area is divided into exposed and interior coast according to the position of land. The areas that face the coast or river estuary are treated as exposed coastal zone. Total number of upazillas that fall on exposed coastal zone is 48 in 12 districts. A total of 99 upazillas which are located behind the exposed coast are treated as interior coast. The key characteristics of the 19 districts for making them eligible as coastal districts are placed.

5.2 Present Condition of the Coastal Area

5.2.3 Geo-Physical Condition. Except Chittagong-Cox's Bazar, all parts of the coastal area are plain land with extensive river networks and accreted land. The Coastal area of Bangladesh is divided in to three zones namely Easter, central and western coastal zones. In addition, there are numerous small islands which are locally known as Chars. There are approximately 60 islands, another 117 Chars are situated in the coastal zones.

5.2.4 Population and the Settlement. Total population living in the coastal zone is 35 million that represent 28 percent of total population of the country. Population density in exposed coast is 482 persons per square kilometer whereas the figure is 1,012 for the interior coast. Average population density of the area is 743 per km^2 and the same value for Bangladesh average is 839.

6. Challenges Of Climate Change In The Coastal Area

6.1 Implications of the Impacts

6.1.1 The previous chapter identified impacts and vulnerabilities which posses threat to the coastal areas of Bangladesh. The impacts have been weighed against the available research data to find out a projected scenario. If, all these impacts are put in the sectoral situation, we will be able to derive the implication of the impacts. The sectoral impacts will be evaluated to find out the challenges posed by the climate change.

61.2 The SLR will inflict its impacts on Bangladesh in the coastal area and through the coastal area, on the whole of Bangladesh. Land loss leads to loss of agricultural land, homestead, communication facilities and biodiversity. The impact of erosion will add up with the problem of SLR to reduce the land mass. All of these will have direct link to the

settlement of the population. As the sea level continues to rise, the displaced population will start to move inshore in relatively safe places. The magnitude of the SLR is critical for the migration and settlement of displaced population. Besides with the increase of flood and cyclones and other natural extreme events, the settlement will be affected. Even the country is well equipped to manage the cyclone and flood disasters; an increased incidence of these disasters implies a major constraint to the country's social and economic development.

6.1.3 Impacts on Human Security. Security is a secure condition or feeling and a broad issue that indicates safe status of the state and its citizen. Anything or occurrence that hurt human being, directly or indirectly considered to be a security threat in present perspective. Sea level rise, reduction of fresh water availability, reduction of fisheries and agricultural production, erosion of coastal land, losing biodiversity and health hazards have raised question of survival creates a danger situation for the people of Bangladesh. However, the most important aspect to survival and well-being is the basic needs of human being. Therefore a contextual evaluation may assist deducing the impact on the human security.

6.1.4 Global Impact

6.1.4.1 The temperature of the earth would increase to another 3 to 10 ^{0}F in the next 100 years i.e. year 2100. Such increase in temperature will cause more rapid melting of glaciers and the rate of SLR will be more than the present prediction in some part of the world. The present observations indicate a rate of -0.8-2.2 mm/year with a central value of 0.7 mm/yr. The coastal and island states are most vulnerable to the climate change. The LDCs in the Asia and Sub-Saharan countries including Bangladesh are likely to be the most vulnerable countries.

5.1.5 Bangladesh Perspectives: The impacts of climate change over are identical. The major findings are:

6.1.5.1 The temperature of Bangladesh is increasing at a rate of 0.621 ± 0.491^0C per 100 year. This rate is observed over last sixty years. If we take that rate in to consideration, the temperature will increase 1^0C by 2030.

6.1.5.2 The rate of SLR is predicted in various rates by different estimation. NAPA predicts an increase of 12 cm, 31 cm and 60 cm by 2030, 2050 and 2100 respectively.

6.1.5.3 The increase of SLR is 4.0 mm/year at Hiron point, 6.0 mm/year at Char Changa and 7.8 mm/year in Cox’s Bazar.

6.1.5.4 The minimum predictions of SLR are 10 cm 25 cm and 60 cm by the year 2020, 2050 and 2100.

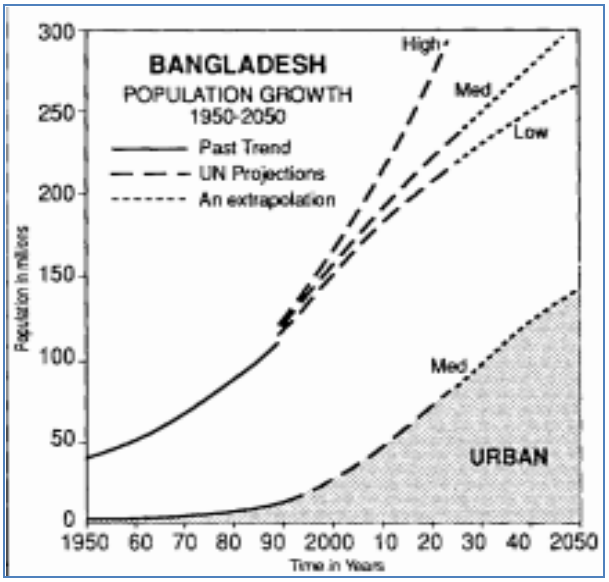
6.1.5.5 The other impacts are loss of land due to SLR and river bank erosion, water logging/ drainage congestion, flood and cyclones, increased salinity, drought and excessive heat.

7.Analysis of the Challenges

7.1 Mitigation. The mitigation of the climate change involves huge finance, technology, experts and finally awareness. Following vulnerabilities are perceived in the mitigation process:

7.1.1 Over population can be a serious concern while the migration is taking place. When we are considering that a portion of the total population will migrate within a given timeline like year 2020, 2030, 2050 or 2100, we have to think about the population projection of that time. Figure shows a growth projection of the population up to 2050.

Figure 3: Population Growth Projection



8.Options Of Bangladesh-Vision For Protection And Security

8.1 It is well understood that the coastal area of Bangladesh are exposed to severe impact of the climate change. The implications of the impacts are extended to the root level involving every sphere of the coastal community. Such challenges include mitigation of the impacts, migration of the huge population by different time frame, and adaptation are also contextually evaluated. Now it is required to draw practicable, realistic, effect based and sustainable protection and security plan to meet the challenges. Bangladesh needs to work in unison to respond for reduction of impacts and risks of climate change in the coastal region on priority basis.

8.2 Managing Climate Risks

8.2.1 Building adaptive capacity to climate change and managing climate risks will be addressed through the mainstreaming of climate risk into sustainable development strategies. Mainstreaming climate change is to engage in a systematic, comprehensive effort to reduce

the negative impacts of climate change through integration into overall national development and planning process of the country. To do this successfully, building of awareness and understanding of climate change issues are required. Specific adaptation actions take place at community or individual level. These actions should build on existing coping methods. Communication between communities will allow coping strategies to be shared. Following factors will be key in managing climate risks:

8.2.1.1 Capacity Building. It will be crucial to take any effective action to build up capacity of both the government and the exposed population to fight the devastation.

8.2.1.2 Mainstreaming Climate Change into Development Plans and Processes. It will be important to embed the whole climate change issue in to the socio economic development plans. In such case, the organizational efficiency will act effectively against the climate change issue. It may include integration of local plans into meso-scale plans, of meso-scale plans into macro-level plans, and of macro-level sectoral plans into national development plans.

8.2.1.3. Promoting Partnership. Partnership among all stakeholders, including partnerships between agencies in charge of implementing development programs and local beneficiary groups. Coordination across institutions and tiers would be very effective.

8.1.2.4. Integration of Resources. Integration of resources will strengthen the fighting capability against the challenges.

8.1.2.5 Awareness Building. Awareness building should be a continuous process against any disaster. The stakeholders should be aware of the events and necessary individual as well as collective actions.

8.1.2.6. Another important key point as it will allow the relevant personnel to actually determine the extent of the impact and also the remedial action with possible rate of accuracy. It will possibly include education, understanding the issue, data, research and development, negotiation etc.

9. International vis-à-vis National Response

9.1. International Response.

9.1.1. Cooperation. It is worth mentioning that the recent development on the

issue is raising rays of hope to everyone that world community would be aware and come in a consensus to collectively fight this menace of climate change risks. The stakeholder groups should further ensure identifying and assessing risks, and scope risk management and adaptation options. Adaptation to climate change requires taking steps to prepare and rationalize costs. The huge exposed coast in vulnerability for mitigation, in the verge of mass displacement needs a strong support for adaptation. Other than funding various activities, the international communities can also contribute in research and development projects. Equity warrants assistance from developed countries as main source of polluters to compensate for the costs incurred to climate change victims in developing countries particularly the poor and already vulnerable suffering for what they are not responsible. Such International support for adaptation to climate change is paramount since links between development and adaptation has implications for official development assistance, in scale as well as focus. For the South Asian Association for Regional Cooperation (SAARC), this could eventually constrain achieving many of other sectoral goals and objectives, namely the 22 SAARC Development Goals (SDGs), SAARC Social Charter, etc. Efforts to address sustainable development goals in every member state could therefore be increasingly challenged by climate variability and change.

10. Conclusion

10.1 Global warming caused by green house gases emission by the developed and emerging countries. The prediction of the carbon-dioxide emission warns us about a possible increase even at a very greater rate. Such increase is giving rise to the average temperature of the earth causing ice glacier melt and increase sea level. The observations indicate that the rate of increasing surface temperature 3 to 10 degrees F while the SLR ranges from 0.3 to 0.8 mm per year. The other effects of the global climate change will be increased natural disaster, hamper ecosystems and bio-diversity and hamper the security. The scientific communities are predicting the worst affected zone will be Saharan Africa, Asia and the small island states. Among the Asian countries coastal zones and low lying delta areas in Asia, such as those in Bangladesh, Myanmar and Cambodia, are at risk from sea level rise and more frequent and severe storms due to climate change.

10.2. Bangladesh, by its location, is in disadvantageous position from the impact of climate change. It is predicted that the significant rate of temperature increase will total at 1^0C by 2030. Such an increase would also mean the other variables of the effect will also increase

having a worse effect on the country. As feared by the experts and the local observation gives enough indication of a sea level rise. The rate of SLR varies on various observation and model run. But the least possible rise is 30 cm by 2050. Considering the impact indicators like SLR, increased natural extreme events it is perceived that the coastal area would be most vulnerable impact zone in the country exposing at least 20 million people at risk.

10.3. The coastal area of Bangladesh houses 19 districts, out of which 12 districts with 48 upazilla would be vulnerable to the climate change. The projected climate change scenario emphasis most severe effect from the SLR. The predictions of the experts on the level of rise and the area to be under water have number of values. However, any level of SLR would mean at least a portion of the land to be disappeared leaving countless number of environmental refugees in an uncertain future. At a rate of 10 cm, 25 cm and 1 meter SLR scenario the projected loss of 2%, 4% and 17.5% of the total land.

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