

## Climate Change and Bangladesh: Geographical and Socio-economic Impacts

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### Abstract

*Climate change, the effects of greenhouse effect and global warming, is out to alter the global map with its devouring prospects of sending a number of countries under the waves. Unfortunately yet unavoidably, Bangladesh stands at the forefront of climate forays. Its land, water and weather are being severely affected by undesirable climatic changes. Alarmingly, the dangers are to be intensified unless the trend is reversed. However, local initiative will hardly be enough to offset the grave concerns of unintended climatic changes in Bangladesh. The changes will also impact the socio-economic conditions of the country, putting the future of the nation on the line. Some ominous signs are already there for the concerned to respond with required amount of fervour.*

**Keywords:** Greenhouse effect; Salinity; Sea level rise; River bank erosions; Mangrove forest

### 1. Introduction

The global climate has been changing as the world gets warmer largely due to greenhouse gas (GHG) emissions resulting from human activities. This fact is now widely accepted but there are still a few who refuse to accept evidence of human causation of recent observed

warnings. Climate is simply the weather that is dominant or normal in a particular region; the term climate includes temperature, rainfall and wind patterns. Geography, global air and sea currents, tree cover, global temperatures and other factors influence the climate of an area which causes the local weather.

The earth's climate has always varied naturally, in the past cooler cycles due to variations in the earth's orbit round the sun, sunspot activity or volcanic eruptions, have altered the climate. However, large changes have been very gradual over huge time periods; nevertheless they are still blamed for the extinction of the dinosaurs. What is new is that humans are now, due to pollution from industrial processes and wasteful lifestyles, directly influencing the climate of the earth.

Human influence is now believed to be changing the climate much faster than occurring in the past under natural processes. Scientific evidence that humans were changing the climate first emerged in the international public arena in 1979 at the First World Climate Conference (Depledge & Lamb, 2005). At this time when the first effects of human induced climate change were discovered, the changes were so small that it did not seem like a big issue. However, by 1988, when the Intergovernmental Panel on Climate Change (IPCC) was formed, the dangerous consequences of climate change became clearer (Houghton, 2007).

### 1. Climate change, the greenhouse effect and the global warming

The Greenhouse Effect is a natural process through which various gases and water vapour in the atmosphere affects the earth's climate. It is so named because it acts like a glass greenhouse for plants by preventing the incoming heat from the sun from leaving causing warming of the earth just as the inside of a greenhouse warms. The Greenhouse Effect can also be likened to being under a blanket in the sunshine; the body under the blanket will heat up and the blanket will keep the heat from escaping causing warming.

The earth's climate is driven by this continuous flow of energy from the sun, mainly in the form of visible light. About 30% is immediately scattered back into space, but most of the remaining 70% passes down through the atmosphere to warm the earth's surface. Being much cooler than the sun, the earth does not give out energy as visible light. Instead, it emits heat in the form of infrared or thermal radiation. Greenhouse gases in the atmosphere obstruct this infrared radiation from escaping directly from the surface to space (Williams, 2002).

Since the beginning of the industrial revolution around 1750, one of these greenhouse gases, carbon dioxide, has increased by over 30% and is now at a higher concentration in the atmosphere than it has been for many thousands of years. Chemical analysis of the carbon demonstrates that this increase is due largely to the burning of fossil fuels - coal, oil and gas (Houghton, 2005). These are consumed mainly through industry and transportation and along with other greenhouse gases such as nitrous oxide and methane that are also produced by human activity are thickening the natural greenhouse layer. This, thus, leads to a warming of the earth, commonly known as "Global Warming" that may also cause more evaporation and a further increase in the greenhouse layer due to increased water vapour (Williams, 2002).

It has been suspected for the last 40 years that human activity has been altering the earth's climate. To confirm whether this was true or not the Intergovernmental Panel on Climate Change (IPCC) was set up by the World Meteorological Organization and the United Nations Environment Programme, producing its first assessment report in 1990 (Depledge & Lamb, 2005). Hundreds of scientists from many countries across the world review thousands of published scientific articles that include research using advanced mathematical modelling to predict future changes, as well as research monitoring historical and current changes in climate, in order to produce the IPCC assessments. Furthermore the work of the IPCC is backed by the worldwide scientific community, as well as being endorsed by all major world governments (Houghton, 2005).

IPCC predictions from their Fourth Assessment Report reveal that for the next twenty years warming at a rate of 0.2 per decade is expected. While by the year 2100 best estimates predict between a 1.8° C and 4 °C rise in average global temperature, although it could possibly be as high as 6.4C (Alley et al, 2007). How high exactly depends on whether tough action is taken to stop greenhouse gas pollution now or if very little action is taken as at present. However, if current trends are followed, it can be expected that average global temperatures will rise by 1-3°C within the next fifty years or so and the Earth will be committed to several degrees more warming if greenhouse gas emissions continue to grow (Stern, 2006).

Overall global warming is a big threat to human food supply. Around 12% of world's population is already at risk of hunger, but if temperature rises by only 2 to 3°C it will increase the people at risk of hunger, potentially by 30 - 200 million. Once temperatures increase by 3°C, 250 - 550 million additional people may be at risk most in Africa and Asia, where the declines in harvest are greatest, dependence on agriculture highest, and spending power most limited (Stern, 2006). Warming may induce sudden shifts in regional weather patterns such as the monsoon rains in South Asia or the El Niño phenomenon - changes that would have severe consequences for water availability and flooding in tropical regions and threaten the livelihoods of millions of people (Stern, 2006).

## **2. Climate change and Bangladesh**

Effects of climate change are, in fact, too visible in Bangladesh. According to one study, compared to present day temperature, temperature could increase to 2.4 degrees centigrade higher than the current level by 2100, causing hotter summer, and hot winters. The rainfall could increase to 10% at the same time, changing drastically usual rainfall patterns (Ahmed, 2006). The seawater rise would cause more havoc as it is estimated that by 2100 the level would increase by 88 cm from the current level, submerging vast tracts of land with seawater. Frequent and severe floods, frequent storms etc., have

already become regular features and are likely to multiply, affecting lives of tens and thousands of people, who are mostly poor and vulnerable.

**Table 1 Climate Change Impacts in Bangladesh at a Glance**

<b>Crop production and food security</b>	Rainfall patterns are changed due to climate change - crops yields are expected to drop significantly. Crop production will decrease 30% in 2100. Production of rice & wheat will decrease 8.8%, and 32% within 2050 respectively.
<b>Salinity</b>	There are 13% areas are salinity at Bagerhat, Khulna & Sathkhira, the south-western coastal districts of Bangladesh at present which will increase 16% in 2050 and 18% in 2100.
<b>Coral bleaching</b>	Corals are vulnerable to thermal stress. If the sea surface temperature increases 1-3° C then corals bleaching will occur frequently.
<b>Mangrove forest</b>	About 75% area of mangrove forest, <i>Sundarbans</i> (60007 Sq. km) will submerge if the sea level will increase 45 cm. If the sea level rise 1 m then the islands of Bay of Bengal and whole <i>Sundarbans</i> will be destroyed including its fauna & flora.
<b>Fisheries</b>	1. Death rate of shrimp's fingerlings will increase if the water temperature is more than 32°C (CEGIS). 2. Diseases of fish may increase. 3. Carps culture may decrease due to saline water intrusion in the ponds and open water bodies. 4. Production of sweet water fish will shrink and be extinct, if the sea level rises.
<b>Health</b>	1. More floods are contaminating water. 2. Increasing water borne diseases such as cholera, diarrhoea etc. 3. More droughts are

	decreasing food production. 4. Increasing malnutrition. 5. More greenhouse gases are increasing air pollution. 6. Rising respiratory diseases. 7. Rise of temperature will favour pest and pathogen that will increase dengue, malaria, diarrhoea etc. 8. Injuries, disabilities, psychosocial stress and death are becoming severe for more floods, fires, droughts, heat waves & cyclones. 9. High salinity in water will affect human health.
<b>Climate refugee or migration</b>	Every year, rivers engulf enormous agriculture fields and homesteads and make the peoples homeless. Those who have no way to live in the locality migrate to urban areas and live in slum with unhygienic conditions.
<b>Sea level rise</b>	If the sea level rises, following dangers are being visualized: 1. Low-lying non-embankment coastal area may be completely inundated. 2. It will increase the risk of coastal salinity. 3. Scarcity of saline free drinking water will increase highly. 4. Current agricultural practices will change.
<b>Increased evaporation</b>	Global average water vapour concentration and precipitation are projected to increase during the 21st century.
<b>Biodiversity</b>	If the global temperature rises by 2° Centigrade, 30% of all land species will be threatened by an increased risk of extinction.

Source: Alam, 2006 and Climate Change Cell, 2006

In the following discussion, light would be shed upon the major concerns and issues that seriously confront Bangladesh. In fact, almost all the issues, to be discussed, threaten to seriously endanger the present and future geographical and socio-economic landscapes of

Bangladesh. And, the discussion starts with the most horrendous warning.

### 3. Bangladesh under the Waves: The Looming Danger

According to German watch Global Climate Risk Index (CRI) - 2011 report, Bangladesh is one of the top 10 nations mostly vulnerable to climate change. By the end of the century, as US government's NASA space agency puts it, Bangladesh is set to disappear under the waves. The International Panel on Climate Change (IPCC) predicts that by 2050 Bangladesh is on course to lose 17% of its land and 30% of its food production with the result of poverty-increase (Planetizen, 2008). Bangladesh has already begun to feel the pangs of climate change as flood periods have become longer and the cyclones, droughts and earth quakes that hit the country cause greater devastation and adverse affects the country's agriculture and land, and challenges water resources, occupational dislocations, food, health, energy and urban planning (Chimalaya, 2011).

The Healthy Center for Climate Prediction and Research (HCCPR) estimates that sea level in Bangladesh will rise about 40 cm (15 inches) by 2080 (Streatfield, 2008). Now, water level rises by at least 5.6 mm a year at *Hiron* point, 1.4 mm at Cox's Bazar and 2.9 mm at Khepupara, which was cited by Bangladesh Water Development Board 2008 as data of 2008 (ANN, 2010). The climate models suggest that temperature will increase in Bangladesh during all seasons by approximately 1.0 to 15°C by 2030 (Kafiluddin, 2005). However, the Prime Minister of Bangladesh went on to warning that one-metre rise in the sea level would submerge a quarter of Bangladesh's land mass (News Today, 2011).

**Table 2 Abnormalities in Bangladesh due to Climate Change**

Type	Impact
<b>Disappearing seasons</b>	There are six seasons in Bangladesh which are disappearing due to climate change. Summer & rainy seasons are prolonging, whereas winter season is shrinking. Autumn and Dewy seasons are vanishing. Spring season has already been vanished.
<b>Infrastructures</b>	In Bangladesh, 93 disasters have occurred over the period from 1991 to 2000 and Bangladesh incurred loss of US\$ 590 crore in agriculture and infrastructure sectors.
<b>Saline water intrusion</b>	About 830,000 hector cultivable land has been damaged by saline water intrusion from Bay of Bengal.
<b>River bank erosions</b>	Nearly 106,300 hector river bank has eroded over the period from 1982 to 1992 due to climate change induced hazards especially.
<b>Drought</b>	About 21.8 tonnes of rice damaged due to drought over the period from 1973 to 1987.
<b>Flood</b>	Rice of about 23.8 lack tones has been damaged due to flood over the period from 1973 to 1987.

Source: Compiled by the authors

### 4. Disappearance of Sundarbans, the Bengal tiger and birds: The Ecological Disaster

The mangrove forests of the Sundarbans, the Bengal tiger and hundreds of bird species are in fear of being disappeared sooner rather than later (Daily Star, 2011a). It is to be mentioned that Bangladesh and India share important and sensitive ecological treasures, such as the mangrove forests of Sundarbans and hill forests on Bangladesh's

north and eastern border. These forests are very rich in bio-diversity and they are also the areas where members of many ethnic minorities live. It is, thus, the joint responsibility of India and Bangladesh to preserve and promote these ecological treasures. By so doing, they can also protect the rights of the ethnic minorities who have been living there since long (New Age, 2011a).

**5. Rising Salinity: Threat to Sundarbans and Land Productivity**

Declining flow of water through the rivers from upstream is responsible for destroying the ecosystem of Sundarbans. Experts opined that alarming decrease in water flow down the rivers gave rise to high salinity in both water and soil of Sundarbans, contributing to a massive change in faunal composition of the forest. Sundarbans, which lies across the outer deltas of the Ganges, Brahmaputra and Meghna rivers, is the biggest mangrove forest in the world. However, the number of timber producing big trees such as *Sundari* is decreasing at the proportionate rate at the increase of salinity. World Conservation Monitoring warned that a long-term ecological change is taking place in Sundarbans because of the eastward migration of the Ganges, desertion of some distributaries and past diversion of water and withdrawals for irrigation (New Age, 2011b). In addition to causing severe damage to Sundarbans, increase of salinity poses a great to the overall irrigation and production system of the land putting the country’s food security on the line.

**Table 3 Major Cyclones in Bangladesh and their damage since 1960**

Year	Affected area/zone	Death	Velocity of wind and tide	Influence of El Niño and La Niño
1963	Chittagong, Noakhali, Cox’s Bazar	11520	10 to 20 feet high tide	Active El Niño
1970	Whole coastal area	5000	Gusty wind with 220 kilometre	Active La Niño

Year	Affected area/zone	Death	Velocity of wind and tide	Influence of El Niño and La Niño
1985	Chittagong, Noakhali, Cox’s Bazar	11069	10 to 15 feet high tide	Active La Niño
1991	Whole coastal area	150000	Gusty wind with 225 kilometre velocity	Active El Niño
1997	Chittagong	15000	Gusty wind with 224 kilometre velocity	Active El Niño
2008	Coastal districts	3332	Gusty wind with 220 to 230 kilometre velocity	Active La Niño

Source: Compiled by the authors

**6. Proliferation of Diseases: Increasing Vulnerability of People**

It has been anticipated that climate change would make people in Bangladesh vulnerable to increased prevalence of diseases, such as cholera, dengue, cardiovascular, respiratory diseases, and malnutrition due to food scarcity and reduction in food production (ICDDR,B, 2011). In 2030, the estimated risk of diarrhoea will be up to 10% higher in some regions than if no climate change occurred (Kafiluddin, 2005). National Centre in HIV Epidemiology and Clinical Research, NCHECR of Australia warn that climate change will also lead to poorer nutrition, putting people with perilous immune systems at more risk of dying of HIV, as well as contracting and transmitting new and unusual infections (Daily Star, 2010).

The threat of prolonged flooding will also decrease the space available for the cultivation of crops and farming of animals, which eventually will lead humans and animals in migration to urban areas, and beyond. This will bring further pressure on our densely-populated country, more and more people will be living in slums and accelerate urbanization, which, in turn, will result in strong competition between

urban people for access to social and economic opportunities (ICDDR,B 2011) and, increase crime, which will lead to a social instability (Daily Star, 2011b).

Between 35 and 77 million of the 165 million Bangladeshis, are at risk of drinking contaminated water. According to the British medical journal "The Lancet," up to 77 million people have been exposed to arsenic that can cause 200,000 to 270,000 deaths from cancer alone in Bangladesh (Daily Star, 2011c). Climate change can upset the ecological balance between parasites, intermediate hosts, vectors and human, and thereby creating new unusual transmission cycle for infectious diseases. Changes in the infectious diseases transmission patterns are likely major consequences of climate change (Kafiluddin, 2005).

The population density of Dhaka has risen to cramped housing in slums, where at a time 35 to 45% of the people suffer from diseases (Daily Star, 2011d). Dr. Paul Epstein warns that climate change could have an impact on health in three major ways: (1) creating conditions conducive to outbreaks of infectious diseases, (2) increasing the potential for transmission for vector-borne diseases, and (3) hindering the future control of disease. There are instances that this disturbing change has already begun, he added. The World Health Organization (1996) report states that at least 30 infectious diseases new to medicine have emerged in the past 20 years (Daily Star, 2011e).

### 7. Changes on Sea Level Rise: The Constant Concern

Bangladesh's coastal region witnessed dramatic sea-level rise over the last three decades. The ensuing sea-water intrusion is giving rise to salinity in coastal drinking water with severe health consequences for the neighboring populations (Daily Star, 2011b). About 53% of Bangladesh's coastal areas are now affected by salinity. On top of that, millions of people in northern Bangladesh are threatened by riverbank erosion and severe droughts (Daily Star, 2011c). During the current century, climate change is billed to increase the risk of more recurrent and severe floods through higher river flows, resulting from

heavier and more unpredictable rainfall in the Ganges-Brahmaputra-Meghna system during the monsoon and increased melting of the Himalayan glaciers. International Federation of the Red Cross and Red Crescent Societies in 2000 identified river erosion as the largest concern for Bangladesh (New Age, 2011c).

**Table 4 Calamity Prone Periods in Bangladesh**

Type of calamity	Period
Flood	June to September
Excessive rain	July to October
River bank erosion	June to October
Tornado	March to June
Cyclone	April to May and October to November
Flood with tide	April to May and October to November
Cold wave	December to February
Drought	March to May

Source: Compiled by the authors

Scientific researches point to the blatant fact that the earth's freshwater is among the top depleted resources affected by climate change. The International Panel on Climate Change, (IPCC, 2001), reports that groundwater, crop soils and many rivers are likely to become increasingly saline from higher tidal waves and storm surges as a result of climate change effects. Bangladesh's salinity intrusion threatens greater future incursion, for numerous reasons. These include reduced freshwater flows into the Padma River caused by the Farakka Barrage; climate change induced decreases of dry season rainfall, stronger and more frequent cyclones and sea-level rise; and intensified saltwater shrimp farming (Daily Star, 2011b). The resultant salinity will affect crops and need shifts to alternative land use (Streatfield, 2008).

## 8. Policy Recommendations

In the UN Conference on Climate Change held from 28 November to 9 December 2011 in Durban, South Africa, Bangladesh emphasized the urgency of establishing the adaptation fund body as a means of getting easy and direct access to the fund from 2012 (Zaman and Islam, 2012). BCCSAP 2009 has been approved and our strategy would be to follow that and examine which are the urgent tasks that need to be taken up and may be completed by and large within the next few years. The policy recommendation may be categorized under the following sub-heads. Actions to be taken under each sub-heads have been recommended (Government of Bangladesh, 2009):

**Research and Knowledge Management:** Actions under this sub-head may include a) National centre for research, knowledge management, and training, b) climate change modeling and their impacts, c) preparatory studies for adaption against sea level rise (SLR).

**Low Carbon Development:** The following actions and programs are recommended in this category: a) Renewable energy development, b) Management of urban waste, c) Afforestation and reforestation, d) Rapid expansion of energy saving devices, e) Improving energy efficiency in transport sector.

**Capacity Building:** Under this framework, the recommendations are as follows: a) Revision of sectoral policies for climate resilience, b) Mainstreaming climate change in national, sectoral and spatial development programmes, c) Strengthening human resource capacity, d) Gender considerations in climate change, e) Strengthening institutional capacity, f) Mainstreaming climate change in media.

**Comprehensive Disaster Management:** This sub-head may cover actions and programs as mentioned here: a) Improving of cyclone and

storm surge warning, b) Awareness raising and public dissemination, c) Risk management against loss of income and property.

## 9. Conclusion

Though Bangladesh is little responsible for climate change around the world, it has turned out to be one of worst affected countries of climate change vagaries. Most of the developed countries involved in harmful gas emissions are constantly contributing to the dangers of uninterrupted global warming, sea-level rise and many other bad effects of climate change. With the displacement and migration of people due to climate-related disasters, the number of climate refugees is also increasing exponentially home and abroad. Use of adaptation strategies and climate fund will not serve the cause if the countries, especially the ones mostly liable for climate change, do not consider things in the context of the mother earth.

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