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# Greenhouse Effect on Climate Change and its Impact on Our Economy

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## ABSTRACT

Responding to the threat of global climate change promises to be the most pressing environmental issue as the world enters the 21st century. Greenhouse effect is mainly responsible for the global warming causing the climate change and sea level rise. Countries like Bangladesh faces major challenges to mitigate the effect of global climate change. The climate change due to greenhouse effect is likely to have profound impact on our economy. The study analyses the probable impact of greenhouse effect on climate change and sea level rise. It also makes an in-depth study to evaluate the possible impacts of climate change and sea level rise on the economy of Bangladesh. This research work focuses mainly on the greenhouse effect on climate change and the impact of climate change on our economy.

**Keywords**: Greenhouse,effect, impact ,economy, climate, global, world, atmosphere.

## 1.Introduction

1.1 The greenhouse effect or global warming is very much talked about subjects now a days not because of their newness and prominence but because of severe consequences involved through these processes. The bite of the phenomena though gradual, the greenhouse effect had been subjects of scientific scrutiny for many decades. These phenomena drew world attention by two major events. First, in 1990, the Intergovernmental Panel on Climate Change (IPCC) published its findings on the science, impacts and policy implications of climate change. The findings of IPCC was reviewed by the experts of the world and they confirmed that the greenhouse gases such as carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$) and the chloroflurocarbons ($CFC_s$) concentration are increasing gradually in the atmosphere causing the earth to warm and sea level to rise. Second, the United Nations Conference on Environment and Development (UNCED) in 1992 at Rio do Janeiro of Brazil focused on the threat of global climate change and drew the attention of the whole world

1.2 Bangladesh, it is by now well known, is one of those poor countries which face the irony of adapting to and mitigating the consequences of global warming and climate change which are, by and large, not of their own making while they have in general the least human, societal, technological and financial capability for such adaptation and mitigation. An examination and

analysis of the climate change induced vulnerabilities has to be understood against the backdrop of the physical, economical and social environment of the country. Bangladesh is always affected by natural disaster like cyclones, floods and droughts. All these causes devastating effect on our economy. The problems of population growth, over exploitation of natural resources and environmental degradation have already complicated the situation in Bangladesh.

1.3 Land and life is closely entwined in Bangladesh. Around 84% of the country's 130 million people live in the rural sector. Lands are frequently flooded by heavy rains, over-full river channels and sea surges associated with cyclones. Changes in climate in Bangladesh could, therefore, have serious implications for local economies and human welfare. But above all, it is certain that the global warming will cause severe consequences on Bangladesh. It is assumed that due to one metre rise in the sea level, one-third of the country will go under water by the middle of the next century. Total land area would be submerged is estimated 22,889 square kilometre and which is about 15.8 percent of the total area of Bangladesh.

## 2. Greenhouse Effect

**2.**1 The greenhouse effect is an extremely vital process where infrared rays from the sun come into the earth's atmosphere. The atmosphere then traps these rays after they have come in (like the glass in a greenhouse) keeping the earth warm and habitable. $CO_2$ (carbon dioxide), $N_2O$(nitrous oxide), and $CH_4$(methane) are destroying the atmosphere, causing more infrared rays to reflect on earth. Having more infrared rays reflected on earth makes the earth warmer. As temperatures on earth rise, so does the ocean water level and the ice caps begin to melt. The worst possible scenario with this problem would be mass flooding in low lying areas of the earth including many islands in the ocean which would basically disappear, most of Florida would be underwater, all coastline cities, and river deltas such as Bangladesh, Pakistan, China, Egypt, Louisiana and other parts of the U.S. It will also cause more tropical storms, hurricanes, extreme temperatures and droughts. The main causes of the greenhouse effect are gases called $CO_2$(carbon dioxide), $N_2O$(nitrous oxide), and $CH_4$(methane). Small amounts of carbon dioxide ($CO_2$) in the air help keep heat in the earth in the vital process of the greenhouse effect. As car exhausts and industries continue to shoot $CO_2$ in the air, the amount of $CO_2$ in the will increase. This causes more heat to be kept, increasing the earth's temperature.

## 3. Consequence of Greenhouse Effects

3.1 **Global Warming**: The climate of the earth is controlled by the difference between the

incoming solar radiation from the sun and outgoing infrared radiation emitted by the Earth-atmosphere system- the radiation balance. The Earth's radiation balance can be upset by changes in either of the two components. The major greenhouse gases influence the outgoing infrared radiation. These gases, although transparent to incoming short-wave radiation, are quite able to absorb and emit the infrared radiation, some of which are re-directed back to the earth's surface. This results in an imbalance in the radiation budget- a change in radiative forcing. To re-establish a balanced or equilibrium condition, the earth's surface and troposphere ( the lower 8-16 km of the atmosphere) must warm in order to increase the radiation emitted to space.

3.2 **Climate Change**: From the knowledge of the radiative properties of each gas, the change in radiative forcing can be calculated. In 1990, the IPCC estimated that the overall cumulative change in radiative forcing that has occurred since pre-industrial times (mid-eighteenth century) is about 2.5 Watts per square metre- approximately equivalent to "turning up" the sun by 1 percent (Shine et.al., 1990). Nearly one quarter of the total radiative forcing change since the eighteenth century has occurred over the last decade, which reflects the recent high growth rates of greenhouse gas emissions. Energy use is the key factor in the enhanced greenhouse effect and climate change.

## 4. Concentration of Greenhouse Gases in the Atmosphere

4.1 Sea Level Rise: With the increase of global temperature mountain glaciers are melting, along with the ice at the poles. The oceans are getting warmer and expanding. As a result sea level is rising. There are two main reasons for rising oceans. Firstly, the thermal expansion of water as the world warms and secondly, the melting of the ice above sea level in mountain glaciers and at the poles. Scientists know that the average global sea level will rise with increasing temperatures. In the comparatively recent past, sea level has risen by only 4 to 8 inches per century. If the warming is at the high end of the range predicted, during the next few centuries it could even melt the polar ice cap. The latest estimates say that approximately one fifth to one third of sea level rise over the last century could be because of the thermal expansion, a trend that is bound to continue.

## 5. Possible Effects of Climate Change and Sea Level Rise on Bangladesh

### 5.1 Effects of Climate Change on Bangladesh

5.1.1 Climatic Hazards. Because the economy and food supply are closely linked to climate, significant variations in climate events have profound effects on society. Cyclones, floods and droughts are examples of climatic hazards. Over the centuries, these hazards have occurred in

Bangladesh. The followings are the primary climatic hazards in Bangladesh.

5.1.1.1 **Cyclones**. Cyclones bring severe winds, storm surges and floods that impact on lives, crops and property. While cyclones tend to make landfall along a 710 km strip of coast, they also extend inland, sometimes reaching the northeast corner of the country. The severe cyclone of April 1991 had a surge height in places of over 7 metres and winds upto 235 kilometres per hour.

5.1.1.2 **Floods**. Normal flooding (Barsha) affects about 25% of Bangladesh each year. Abnormal flooding (Bonya) can submerse more than 50 % of the land area damaging crops and property, disrupting economic activities, causing injury and loss of life. The severe flood of 1988 affected about 61% of the country.

5.1.1.3 **Droughts**. Droughts are very common in Bangladesh. They affect both water supplies and plant growth, which in turn leads to loss of production, food shortage and starvation for many people. A severe drought typically affects crop production in about 30% area of the country; reducing crop yields by an average 10%.

5.1.2 **Secondary Hazards**: Important secondary consequences of climatic hazards include riverbank, char and coastal erosion. During the time of flood and cyclones their effects become more severe. About one million people become landless due to land erosion along the rivers.

## 5.2 Effects of Sea Level Rise on Bangladesh

5.2.1 By the twenty-first century, the sea level is expected to rise up to one metre that depends upon the future control of greenhouse gas emissions. The sea level rise is likely to have devastating impacts on Bangladesh in future. Only the coastal effects of a one-metre SLR will displace over 11% of the population. More than 17.5% of the total land area (over 25,000 sq km) will be totally inundated. Some 85 cities and towns, one major port (Mongla) over 800 km of roads, 28 km of railways, 4,200 km of coastal embankments and over 7,500 sq km of poldered areas will be invaded. Sunderbans, the world largest mangrove forest is threatened with extinction by sea level rise. Many coastal islands, covering an area of 3,500 sq km will be inundated.

## 6. Impact on Our Economy

6.1 Bangladesh being a very densely populated (approximately 130 million people) low lying area of only about 144,000 sq km, on the delta of three major rivers of the world, namely, the ganges, the Brahmaputra, and the Meghna, is one of the countries most vulnerable to the effects of global climate particularly sea level rise. Bangladesh is vulnerable to the effects of global climate change and sea level rise. The natural disaster causes devastating effect on our economy. Sea level rise would inundate vast land areas causing salinity intrusion. The country is also vulnerable to coastal erosion due to sea level rise. Bangladesh is a developing country.

6.2 Agriculture dominates both land use and the national economy. Agriculture generated about 39% of the GDP over the second half of 1980s, of which nearly 73% was due to crop agriculture.( Chowdhury and Shahabuddin, 1992). Rice occupies about 80% of the total cropped area. But due to the flooding, rice production is hampered. Huge amount of land goes under water that damages crops.

6.3 Due to shoreline Erosion about 5800 ha area along the shoreline would be lost in 2030, while 11,200 ha would be recessed in 2075. It was also evident that about 13,750 252,000 tons of food grain production would be lost in 2030 and 2075 respectively due to shore line erosion. Salinity intrusion has considerably higher impacts on crop production. Under a severe climate change scenario the potential shortfall in rice production could exceed 30 percent from the trend, while that for wheat and potato could be as high as 50 and 70 percent, respectively.

6.4 The effects of one metre SLR on agricultural production are shown in Table 3. This indicates that over 21% of the country's monsoon rice land producing 16% of the total rice or 3 million acres of Aman (Monsoon) rice, 250,000 acres of Aus (Summer) rice and 34,000 acres of jute will be affected. This area has been a grain surplus area in the past from growing the summer season crops *(Aus, Aman* and jute) but it is unlikely to remain so in future as the rise in sea level will prevent the growing of these crops. This will also affect the livelihoods of millions of farmers living in these areas. It is also likely that salt-water intrusion will affect the land above the one metre contour line and thus the agricultural output will be decreased even more than estimated in the table. Rice production in Bangladesh is also highly dependent on rainfall and other climatic conditions (Mowla, 1978).

6.4 Under ‘Business- as- usual’ (BAU) scenario, inundation due to severe climate change would result in a 10.5 million metric tons reduction in monsoon rice production. This yield loss combined with

other paddy rice affected, the reduction would be nearly 70% of the total rice produced at present (DOE, 1994). In the changed climatic situation, proportion of drought will further increase and in extreme situation, overall rice yield would be reduced by 25% with maximum reduction in high yielding pre monsoon rice.

## 7. Effect of 1m SLR On Infrastructure And Habitant

7.1 The value of the damage to infrastructure capital due to SLRCC, does not only mean a direct loss of GDP. The indirect impacts of this damage consist of two other aspects. The first one is that productivity levels will fall because capital goods are damaged and out of order. So the production capacity shrinks. Especially the capital-intensive modes of production are vulnerable to this. This loss was quantified in GDP terms for the non-agricultural sectors, being manufacturing, other industry and services. The second one is that damage to infrastructure facilities will hinder or even paralyse economic activity. Damaged roads or railways can hinder transport. Energy supply may be interrupted because of broken transmission wires and pipelines. Communication can be hard when the telephone network is out of order. The impact of these problems in terms of a decline in productivity can be substantial and may rise progressive when they last for longer time. This is obvious as infrastructure facilities are one of the fundamental requirements for all economic activity and losses are difficult to estimate.

7.2 The coastal zone, which is on average 0.8 to 2 m above the mean sea level, could be termed as a geographical ‘death trap ‘ due to its extreme vulnerabilities to cyclones and storm surges. Approximately six million people live within ‘high risk’ areas of the coast. Prevalence of salinity intrusion is dependent on the amount and timing of rainfall, tides and surges and surface water supply. Bangladesh National Water Plan (1984) estimated that salinity intrusion could be 150 km within the inland as the surface water supply in the major rivers has lowered thus allowing greater back-thrust of the saline water. With one metre rise in sea level, in the extreme case an additional 25000 sq km would be affected by surface water salinity intrusion, affecting about 35 million people (DOE 1994). Displacement of the population and migration to safer areas give rise to new socio-economic problems besides contribution of the coast towards agricultural productivity in the national context.

7.3 "One metre sea level rise will inundate about 5.608 million acres (22,889 square kilometre) of existing coastal land which is about 15.8% of the total area of Bangladesh. The area comprising of 65% of greater Khulna, 99% of Barisal, 100% of Patuakhali, 44% of Noakhali and 12% of Faridpur will be

inundated. As a result 13.74% of net-cropped area and about 401,600 hectares of mangrove forest along with its wild life will be lost. About 10% of country's 130 million population will be displaced and will not have any option but to migrate to unaffected urban areas especially to major cities like Dhaka, Chittagong, Khulna and Rajshahi and will have to live in perpetual poverty. The output loss is estimated to be about 13% of Gross Domestic Product (GDP) and loss of assets of circa taka 450 billion (US $ 14 billion) at 1984-85 prices".

## 8. Effect of 1 M SLR On Coastal Aera

### 8.1 Forestry.

8.1.1 The forest areas likely to be completely lost are the Sundarbans (5,770 sq km), which is the largest mangrove forest in the world and, home for many rare and endangered species of animals and plants, including the Royal Bengal Tiger. The mangrove forest is already under threat due to the increasing upstream salinity intrusion caused by lower dry season flows down the Ganges river since the construction of a Dam by India, at Farakka, to divert water to flush Calcutta port. This increase in salinity has already caused the death by "top dying" of the major tree species of the Sundarbans, namely, the Sundari tree. Due to one metre sea level rise the entire Sundarban, which has 401,600 hectares of area and newly established mangrove forest along the coast, which has an area of 36,000 hectares will be gradually destroyed.

8.1.2 "Forestry contributes about 3% to the national GDP and employs about 2% of total labour force". The increased need of human activities causes destruction of forests. Again the sea level rise increases the soil salinity levels, which ultimately damages the forest resources.

### 8.2 Fisheries

8.2.1 Fish and fisheries have been playing a very significant role in nutrition culture and economy of Bangladesh from the time immemorial. Currently about 80% of the animal protein intake in the daily diet of the people comes from the fish. The fisheries sectors, it is estimated, contributes 3.5% 0f the GDP of Bangladesh and provides full time employment to an to an estimated 2 million people. The ultra- violet rays of the sun are very harmful for all fish habitats. Again due to sea level rise, the salinity of the river water will increase which will ultimately cause damage to the sweet water fish habitats. The pond culture of indigenous major carps such as Rohu, Catla, Mrigal and exotic carps such as silver carp is practiced extensively in the coastal districts of Cox’s Bazar, Chitagong, Noakhali, Feni, Lakshimpur, Bhola, Barisal, patuakhali and khulna. During the year 1995-96 a total production of 105.5 metric tons

of major and exotic carps were obtained from fresh water ponds of the aforesaid districts. In the event of sea level rise these ponds are likely to be submersed under sea , water which will lend to the total loss of this major carp production. On the other hand, increasing demand for brackish water shrimp facilitated in earning foreign exchange. The production in 1995-96 was 68,349 metric tons. The shrimp grown is mainly for export and represents a major foreign exchange earning for the country amounting to several hundred million dollars a year. These shrimp farms are likely to be all completely inundated by a one- metre SLR. However, it may be possible for them to migrate land wards in response to the rising sea level.

## 9. Quantity of Shrimp Exported and Income Earned in Different Year

### 9.1 Abatement Cost

9.1.2 The study undertook an assessment of the abatement costs to give the minimum protection against a one- metre sea level rise. Bangladesh will have to embank 715 km of coastal island perimeters, 370 km of cost, and 7,600 km of riverbanks. There already exists 4,800 km of embankments and 4,000 km of new embankment would be required. This will cost Bangladesh over US $ billion at current rates. These embankments would protect an area of 16,659 sq km from 1 m SLR that means that the cost per sq km of protected land would be approximately US $ 50.000. Milliman et al. (1989) have estimated total loss at 13% of GDP by the year 2050.

### 9.2 Positive Impacts of Climate Change

9.1.1 Indirect effects of climate change on fisheries may greater than direct effects. Increased CO2 and temperature levels could increase biological activity in all fish habitats, thereby increasing the fish growth directly as well as indirectly through increased food supplies. Projected rainfall increases could extend the period of seasonal flooding of floodplain land, which, combined with higher temperatures, and increased food supplies could extend fish breeding and growing seasons. A positive impact on aquaculture could be an increased in opportunities for shrimp cultivation in coastal zones because of salinity.

9.1.2 Livestock may benefit indirectly from global warming. As higher CO2 and temperatures levels and a longer plant-growing season, could increase crop, weed and pasture growth, thereby potentially increasing the amount of food available to livestock. On the other hand, increased flooding due to increase in monsoon rainfall could increase the frequency of boro, aus, and aman paddy losses and consequently reduce fodder availability (including grain for poultry). Increased

rainfall and flooding could also increase the incidence of humidity-related animal and poultry diseases. The optimum range of temperatures for plant growth varies between crops. In general, with global warming, Kharif crops( aus and aman paddy, jute) would benefit from the higher temperatures in their growing seasons. Projected increases in rainfall should benefit crops production through increased soil moisture and irrigation supplies.

### 9.3 Losses in National Income

9.3.1 A study by the Bangladesh Centre for Advance Study (BCAS) has attempted to calculate the impacts of Sea Level Rise and Climate Change (SLRCC) effects and upstream developments on the national income of Bangladesh. Valuation has been done by monetising the secondary physical impacts on economic sectors. Not all the impacts were considered. From the suite of possible impacts the following were selected for monetisation:

9.3.1 The damage to immobile infrastructure due to inundation.

9.3.2 The decline in agricultural production.

9.3.3 The decline in mainly industrial production because of the damage to infrastructure due to inundation.

9.4 **Procedure Adapted to Determine the Impact on Gross Domestic Product (GDP)**.

9.4.1 The impacts on the above mentioned events have been computed in income terms and stated as a loss in GDP. Therefore projections of the endogenous development of the national income were made. At the end the total impacts on the GDP were summarized and evaluated. As mentioned above several impacts on the economy of Bangladesh were not monestised. Impacts that were not part of the analysis are among others:

9.4.1.1 The decline in fisheries, both open water and aquaculture.

9.4.1.2 The decline in forest assets and produce.

9.4.1.3 The reduction in navigation possibilities due to low flow.

9.4.1.4 The decline in productivity of labour force because of a deterioration of health conditions.

9.4.1.5 The decline in industrial and services production because of communications and interrupted accessibility.

9.4.1.6 The decline of agricultural crops other than rice.

9.4.1.7 The damage to infrastructure and decline in production due to other effects than inundation,

9.5 **Loss in GDP.** The losses caused by this are enormous. In the present situation a loss of 14% would be incurred. A HDO\ Non-share development scenario makes this loss by bigger about 15.8%. The BAU\ share scenario has the lowest loss, but this is still 7.8% or more than twice the annual GDP. Growth in that scenario. Non- sharing adds another 2.2% to this loss as can be seen from the

result of case 5 (10% loss).

## 10. Conclusions

10.1. The greenhouse effect is an extremely vital process where infrared rays from the sun come to the earth's atmosphere. Having more infrared rays reflected on earth makes the earth warmer. As temperatures on earth rise, so does the ocean water level and the ice caps begin to melt. The major greenhouse gases influence the outgoing infrared radiation. In short, increasing greenhouse gas concentrations should cause global warming. Energy use is the key factor in the enhanced greenhouse effect and climate change. Scientists know that the average global sea level will rise with increasing temperatures. Sea level Rise (SLR) would depend on the rate of change of sea level. For adverse situation, the sea level rise may be about one metre by the end of twenty- first centuries. The latest estimates say that approximately one fifth to one third of sea level rise over the last century could be because of thermal expansion.

10.2 The possible effects of the climate change is the enhanced climatic hazards. Cyclones, floods and droughts are examples of climatic hazards. The followings are the primary climatic hazards in Bangladesh. Cyclones bring severe winds, storm surges and floods that impact on lives, crops and property. Normal flooding (Barsha) affects about 25% of Bangladesh each year. The severe flood of 1988 affected about 61% of the country. Droughts are very common in Bangladesh. They affect both water supplies and plant growth, which in turn leads to loss of production, food shortage and starvation for many people. A severe drought typically affects crop production in about 30% area of the country, reducing crop yields by an average 10%. Natural disaster cause devastating effect on our economy. Sea level rise would inundate vast land areas causing salinity intrusion. The country is also vulnerable to coastal erosion due to sea level rise. Bangladesh is a developing country. A recent study by the Bangladesh Centre for Advance Studies (BCAS) has identified the major impacts of a one - metre sea level rise. Due to one - metre sea level rise over 3 million acres of breadbasket land consisting of 21% of the countries monsoon rice land, producing 16% of the countries rice , will be lost. Rice occupies about 80% of the total cropped area. But due to the flooding, rice production is hampered.

10.3 Rice production in Bangladesh is also highly dependent on rainfall and other climatic conditions (Mowla, 1978). Under 'Business- as- usual' (BAU) scenario, inundation due to severe climate change would result in a 10.5 million metric tons reduction in monsoon rice production. A study by the Bangladesh centre for Advance Study (BCAS) has calculated the possible impact of sea level rise and climate change (SLCCC) on food grains production. The largest percent wise impact on GDP occurs in the present situation with one metre SLR where 3.9% is lost. A sharing or non-sharing scenario has no impact on the loss. A sharing or non-sharing scenario has less impact about 1.7% on the GDP loss.

10.4 The Bangladesh Centre for Advance Study (BCAS) has attempted to calculate the impacts of Sea Level Rise and Climate Change ( SLRCC) effects and upstream developments on the national income of Bangladesh. The total losses in GDP due to the impacts of SLRCC effects in the case of 100 cm SLR are enormous. In the present situation a loss of 14% would be incurred. A HDO\ Non-share development scenario makes this loss by bigger about 15.8%. The BAU\ share scenario has the lowest loss, but this is still 7.8% or more than twice the annual GDP growth in that scenario. Non- sharing adds another 2.2% to this loss.

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