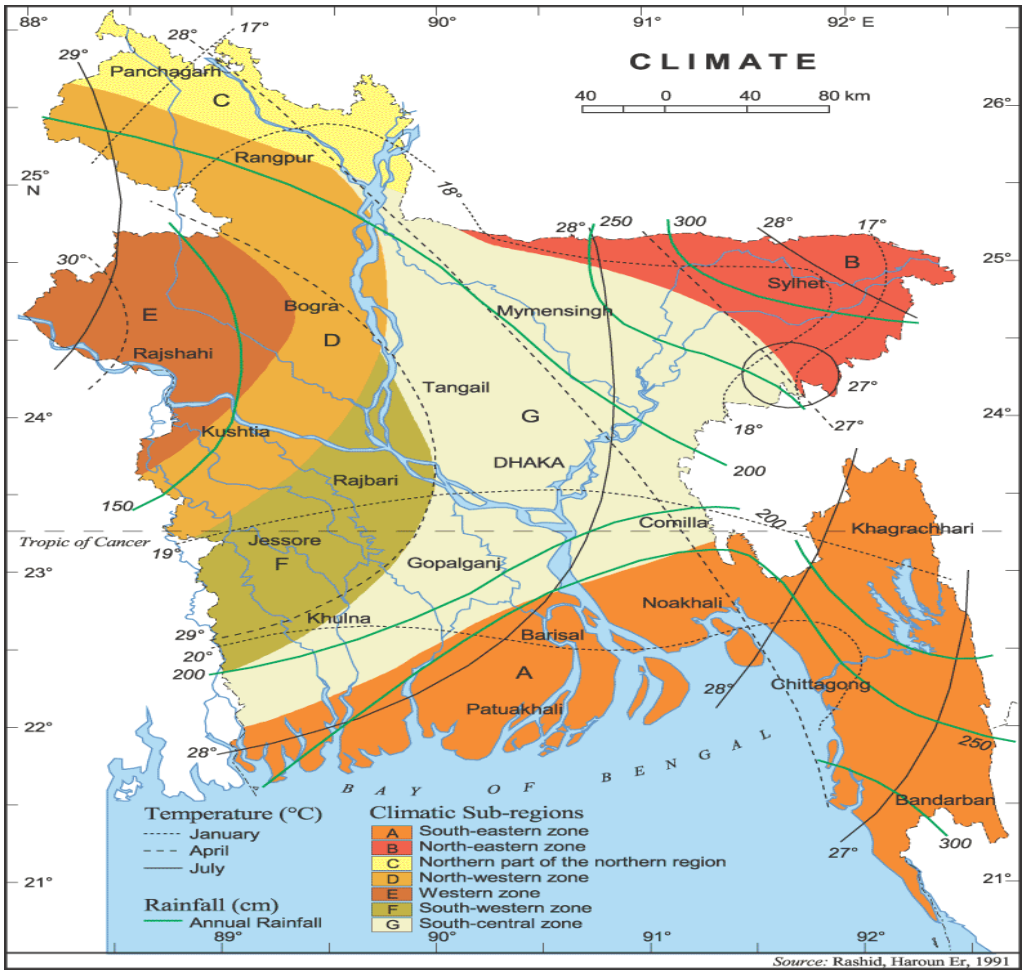
Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.5, No.18, 2014

Impact of Sea Level Rise in the Coastal Areas of Bangladesh: A Macroeconomic Analysis

Md. Arfan Uzzaman
Independent Researcher, and Graduate Student Dhaka School of Economics
arfan@asia.com

1. Introduction

Due to diverse economic activities (mainly burning of fossil fuel), carbon dioxide (CO2) and other greenhouse gases (methane, nitrous oxide, ozone, chlorofluorocarbons and water vapor) are accumulated in the earth's atmosphere, resulting in climate change. Rising temperature expand the ocean volume in two ways. Firstly, it melts mass volume of ice of the polar region and secondly, it causes thermal expansion of water of the ocean (L.Hossain& k.Hossain,2005). Ongoing climate has a greater socio economic and environmental impact on different countries. Bangladesh is considered as one of the most vulnerable countries due to climate change. Among the adverse effect of climate change, it is evident that Sea level rise is the major concern for Bangladesh which can bring a higher cost for the entire economy of this country which is difficult to capture in monetary term also. In this study the exertion is given to analyze the ongoing and long run effect of sea level rise in the coastal areas of Bangladesh. It deserves special mention that the affected districts those who are impacting by the sea level rise will spread out the cost in entire economy in the form of climate migration in cities, regional food insecurity, and poverty.



2. Objective of the study

The border objective of this study is to reveal the overall socio-economic cost of Sea Level Rise (SLR) in the coastal areas of Bangladesh. The specific objectives are to

- Examine the biotic and abiotic stress of sea level rise in coastal Bangladesh

- Investigate the future environmental cost due to sea level rise
- Analyze the socio economic impact of sea level rise in the coastal region.

3. Result and Discussion

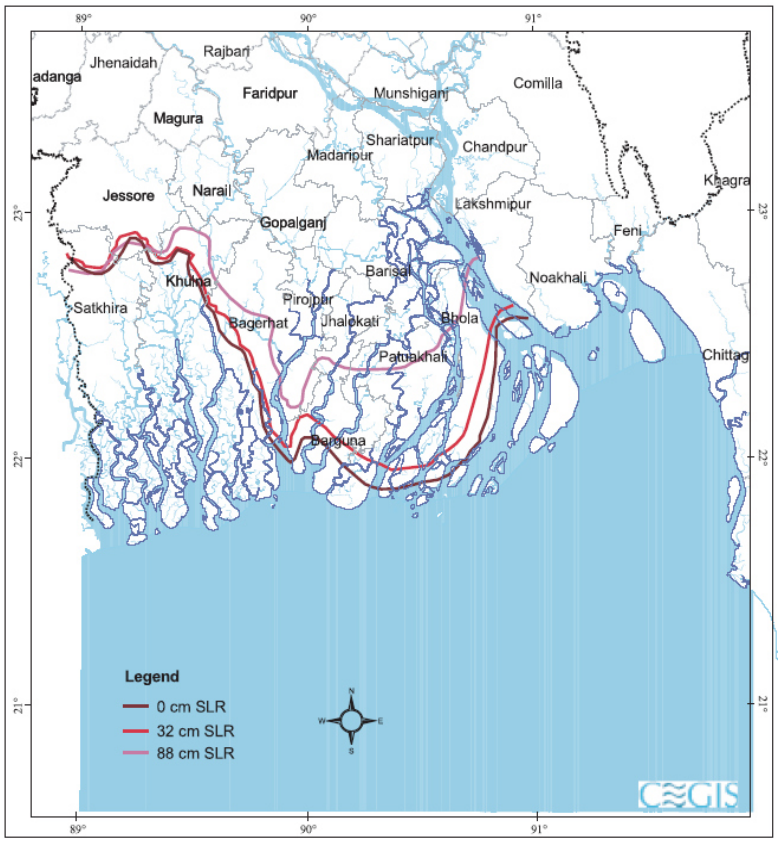


Figure –Increase in sea level in Southern Bangladesh

3.1 Impact of SLR

The right side figure shows the risk line of sea level rise for which a huge part of southern Bangladesh will go under water.

There are environmental, non-environmental, economic, non-economic, social, tangible, and intangible various kind impact of SLR. For better and precise analysis we categorized the impact into three part. These are Biotic impact, Abiotic impact, and Socio-economic impact.

3.2 Biotic Stress:

The human activities those who are affected by sea level rise are fall into biotic stress. The Impact directly affect the Human activities are discussed here. These are

3.2.1 Agriculture:

Salinity intrusion due to sea level rise will decrease agricultural production by unavailability of fresh water and soil fertility. Salinity also decreases the terminative energy and germination rate of some plants (Rashid et al., 2004). Ali (2005) investigated the loss of rice production in a village of Satkhira district and found that rice production in 2003 was 1,151 metric tons less than the year 1985.

3.2.2 Health

Sea level rise may increase the risk of health hazards like diarrhea, cholera, etc. Cholera is an infectious disease of the small intestine of human beings and is common in the coastal area of Bangladesh. Water salinity and its distribution in the coastal area are increasing with the increase of sea level rise (Faisal and Parveen, 2004; IPCC, 2001a; World Bank, 2000). With the increased density and distribution of salinity, cholera germs are getting favorable habitat and spreading in the coastal area. This hypothesis is also supported by Colwell and Huq (2001) that states, most major epidemics that have occurred during the last 50 years originated in coastal region. So, coastal water and its saline environment have close association with cholera disease. Outbreaks of cholera often occur after flooding. Besides, due to SLR the natural disaster becomes more frequent which may bring various unknown disease in future.

3.2.3 Tourism

A significant part of Bangladesh coast is sandy beaches that attract tourists. Kuakata beach in Patuakhali district, Patenga beach in Chittagong district and Cox's Bazar beach in Cox's Bazar district are attractive tourist areas of the country. Out of 18 most lucrative tourist areas identified by Bangladesh Parjatan Corporation , five spots namely Chittagong, Cox's Bazar, Kuakata, Khulna and the Sundarbans are located in the coastal zone are in extreme risk to destroy by SLR.

3.3 Abiotic Stress:

In abiotic stress the Impact directly affect the environment and ecosystem are discussed. These are under mentioned.

3.3.1 Frequent Natural Disaster

Experts explain that rising sea levels will cause water to mix with sea water, thereby making once potable freshwater drinking sources no longer available for human consumption. Moreover, rising sea levels has also been linked to other devastating side effects, such as an increase in earthquakes and other major seismic events. Other drastic weather events that can happen because of melting polar ice caps and glaciers and rising sea levels include an increase in the number of landslides and tsunamis felt around the world. Recently a number of natural disaster has taken place in Bangladesh such as Sidr, Aila, and Nargis.

3.3.2 Monsoon flooding

Under climate change scenario about 18 per cent of current lowly flooded areas will be susceptible to higher levels of flooding while about 12 to 16 per cent new areas will be at risk of varied degrees of inundation. As per NAPA recommendations, SLRs in the coast of Bangladesh are 14 cm, 32 cm and 88 cm for the year 2030, 2050 and 2100. In a recent study, IWM (2006) predicted that flooding of coastal lands may increase by 21% by the year 2001 while it is 10.3% for the year 2050 with respect to ordinary flooding condition when approximately 50% lands go under flood.

3.3.3 Reduction of Agriculture Land

According to the Intergovernmental Panel on Climate Change, Bangladesh is slated to lose the largest amount of cultivated land due to rising sea levels. A 1 meter rise in sea levels would inundate 20 percent of the country's landmass. Reduction of agriculture land is a vast problem for the local people and they are suffering much for the cause.

3.3.4 Decline in Soil Quality

Due to sea level rise salinity intrusion causes decline in soil quality. The soil profile of the affected area is totally changing and this situation led to unproductive land. The soil profile is also changing which has a devastating effect on coastal areas.

3.3.5 Species Disappearing

It is predicted that sea level rise can cause to destroy the forest, land, fresh water resource, and living environment of costal areas. As a result some species may extinct in the coastal zone. Furthermore, species extinction may lead to destroy the traditional biodiversity in the coastal areas of Bangladesh which has a greater environmental cost.

3.3.6 Coastal Erosion

The major factors of coastal erosion in Bangladesh include Strong tidal action and storm surges, High wind waves and current during monsoon, and High river discharge (central coastal zone). There are no accurate measurements on coastal erosion due to SLR. However, many researchers estimated the potential impacts of SLR on erosions. For example, Islam et al. (1999) predicted that average recession of the eastern coastline of Bangladesh would be about 87 times the SLR. If that is true then the land loss is:

- 6.26 sq. km for SLR of 0.1 m
- 18.79 sq. km for SLR of 0.3 m
- 62.64 sq. km for SLR of 1.0 m

3.3.7 Water Logging

The problem of water logging was first started during 1960 after the construction of coastal polders (dikes) with sluice gates controlling river flows and to protect low-lying agricultural lands from tidal inundation and saline water intrusion. After the construction of polders, the silt was deposited on the river beds, resulting in the silting up of rivers. Eventually, the exit points of the sluice gates became blocked, and subsequently, the emboldened areas became permanently water logged.

3.4 Socio-Economic Impact of Sea Level Rise

In this part the environmental impact of Sea level rise (SLR) has been evaluated from the Socio-economic perspective. Here emphasize is given to scrutinize the socio economic vulnerabilities of coastal areas of Bangladesh due to environmental impact of SLR. There are nineteen coastal districts in Bangladesh which are on high risky position in terms of socio economic vulnerability due to Sea level rise. According to BBS, there are

35.1 million people are living in the coastal areas are Bangladesh which are counted as 28 percent of total population size of the country. The economic activities of coastal zone are circulated by fishing, agriculture, salt farming and shrimp cultivation. These economic activities are fully dependent on natural resources and environmental sustainability. Any changes in environmental behavior can bring a significant impact on coastal economy and its players. In this section the socio economic parameters of coastal zone that can be affected by the Sea level rise has been highlighted for economic analysis. Here

3.4.1 Unemployment

Unemployment will be the crucial outcome of Sea level rise in the coastal areas of Bangladesh. According to IPCC (2009), sea level has rising for last 30 years at an average rate of 5 millimeters per year In Bangladesh. After few years rising trend of sea level will triumph over the sea side land and salinity attack the agricultural land and fresh water. Consequently, agricultural production, fishing, and salt farming will be hampered drastically. As a penalty, people those who are relying on this type of economic activities will be unemployed. The socio economic cost of this sort of climate pinned unemployment is higher.

3.4.2 Infrastructure Destruction

There are 35,712 kilometers established roads in the coastal zone (Sarwar, 05). Every year natural disaster causes to destroy a tremendous part of roads. Besides, bridge, culvert, embankment are also harmed. Repairing and reconstruction cost of this sort of infrastructure is high. Sea side ship-breaking industries, tourist spot, public & private infrastructure will also be damaged due to sea level rise. Our most important tourist attraction cox's bazaar, kuakata, st. martin, Sundarbon will be adversely affected by the sea level rise. Near future tourist business will loose revenue from these areas. The people those who are employed in tourist sector in the coastal zone will be in risk on massive job lose.

3.4.2 Emergence of Climate Refugee

According to IPCC 1 meter rise in sea level will lead to go down most of the part of southern and western region of Bangladesh under water. As a result 3 crore people from southern and western part of Bangladesh will be deadly affected. They will loose their land and living place. More than 20 million people will be climate refugee due to sea level rise (khan, 07). These people will create chaos in the city and city may not properly accommodate this huge amount of displaced people.

3.4.3 High Cost of Natural Disasters

There is a significant socio-economic cost of natural disaster caused by sea level rise. According to weather dept. of Bangladesh, during 1990 to 2004 every year 10 cyclone hits the coastal area of Bangladesh. But in 2006 16 cyclone hits Bangladesh & in 2008 it stands to 20. after 2020 cyclone will hit more rapidly and the cost of damage of life, asset, environment, plant, animal will be sky high.

3.4.4 Lost of GDP and Emergence of Macroeconomic Tension

According to IPCC just 1 meter rise in sea level will cause to go down 22000 square kilometers land under water. Which is 16% of our total land area. In this circumstance we will lose our agricultural and industrial production form these areas. According to WB, 1 meter rise in sea level will lead to reduce the rice production by half. Which estimated cost in current market price is $3.5 billion. This consequence will triggered food inflation and food insecurity in the economy. According to MoE, for the consequences of climate change right now we are losing 1.81% GDP annually after 2030 we will lose more than 2.5 percent of our GDP. This sort of economic loss will cause to emerge macroeconomic stress.

3.4.5 Risk on Education System

Due to Sea level rise natural disaster i.e tsunami, cyclone, flood, tidal upsurge, water logging will be frequent. As a result educational institutions near to coastal area get flooded or ruined and remain closed until reconstruction. Most of the time educational institution those are not affected by natural disaster and these are turned into shelter place for the affected people. Furthermore, due to natural calamity affected students are unable to attend classes. Consequently, education system collapse in coastal area. On the other hand natural disaster breaks up social safe net of affected region. People become poor. Death toll of earning person of a household by the natural disaster bound student to do work for survival. Which lead termination of education life of a child. This situation will be more deepen in future when natural disaster will be more frequent and huge amount of land will go under water by the sea level rise. So in upcoming time education system will be hampered magnificently in coastal reason. Which will imply higher level of socio-economic cost.

3.4.6 Appearance of Climate Poverty

As we know due to sea level rise 19 districts of Bangladesh will go under water (IPCC). As a result people will lose their resources. Farmer, fisherman, salt producer will lose their profession and earning source. a large number of people will not find any suitable work. Some of them will choose to work in informal sector to survive. There are about 6.8 million households in the coastal zone of which 52 percent are absolute poor (Islam, 2004).

3.4.7 High Economic Cost of Loosing Natural Resources

Due to sea level rise we will lose our environmentally and economically valuable forest resources. Forest

maintains the ecological balance and also a rich source of firewood, lumber, paper, foodstuff, and raw materials of different industry. According to the prediction of WB (2000) by 2020 Sundarban will inundates 15% and by 2050 it will Inundates 40% and by 2100 whole sundarban will be lost due to sea level rise. Here it is noted that the Sundarbans is a major earning source of 10 million subsistence people (Islam & Haque, 2004). People those who rely on sundarban will be vulnerable and we will also loose forest products. On the other hand to meet the local demand we have to import forest product from abroad by the cost of foreign reserve. So both in the short run and long run the socio-economic cost of loosing natural resources is sky high due to SLR. Moreover, sea level rise will also ruin the rangeland. As a result the supply of beef, mutton, milk, vegetable will be decline considerably. Consequently, people of coastal areas will get less protein which may lead hard core food poverty (According to WFP, per capita calorie consumption less than 1805 kilo calorie per day is categorized as a hardcore poverty).

3.4.8 Diminution of Social Welfare

Sea level rise will cause to disrupt the basic needs of coastal people i.e. Food, Cloths, Housing, Health, and Education. Poor people will be more vulnerable and social safety net will be break down of the affected areas. Hence, the social welfare of the people will be trimmed down. All the socio economic cost of SLR cannot be monetized due to methodology constraint but the welfare diminution of the people of coastal are will adversely affect the overall human development process of the country.

4. Conclusion

It appears in the analysis that sea level rise has a tremendous socio-economic and environmental cost which is anticipated to lead long run macroeconomic shock in Bangladesh. Bangladesh is a growing economy and the country is growing at about 6% rate per year in last decade. The adverse effect of sea level rise will hamper the growth potential of the economy. There are 19 coastal districts which accommodate more than three crore people. Sea level rise will impact the life and livelihood of this huge number of population. At the same time the agricultural production of the coastal region will face greater shock due to sea level rise. Consequently, a remarkable part of GDP will be missed from this coastal zone. This is highly expected to take immediate adaptation policy to mitigate the impact of sea level rise.

Reference(s)

Ali, A., 2000. Vulnerability of Bangladesh Coastal Region to Climate Change with Adaptation Option, Bangladesh Space Research and Remote Sensing Organization (SPARRSO), Dhaka.

Agrawala, S., Ota, T., Ahmed, A.U., Smoth, J., Aalst, M.V., 2003. *Development and Climate Change in Bangladesh: Focus on Coastal Flooding and the Sundarbans,* Organisation for Economic Co-operation and Development (OECD), Paris.

Arfanuzzaman, Md, 2009. Country Risk Analysis And Road To Survive In Terms Of Climate Change, Paper Presented at The Seminar On “Climate Change And The Vulnerability of Bangladesh”.

IPCC,2001b, Climate Change 2001: Synthesis Report,Contribution of Working Group III to the Third Assessment Report of the IntergovernmentalPanel on Climate Change (IPCC), Cambridge University Press, UK.

IPCC (2007), Technical Summary, “A Report of Working Group 1 of the Intergovernmental Panel on Climate Change”.

Sarwar et. al, Sea Level Rise: A Threat to the Coast of Bangladesh, Internationales Asienforum, Vol. 38 (2007), No. 3–4, pp. 375–397

OECD, 2003, “Development and climate change in Bangladesh: Focus on coastal flooding and the Sundarbans”.

Hossain et. al, 2005. Climate Change, Sea Level Rise And Coastal Vulnerabilities Of Bangladesh With Adaptation Options.

World Bank, 2000. Bangladesh: Climate Change & Sustainable Development.Report No. 21104 BD, Dhaka.

The IISTE is a pioneer in the Open-Access hosting service and academic event management. The aim of the firm is Accelerating Global Knowledge Sharing.

More information about the firm can be found on the homepage:
http://www.iiste.org

CALL FOR JOURNAL PAPERS

There are more than 30 peer-reviewed academic journals hosted under the hosting platform.

Prospective authors of journals can find the submission instruction on the following page: http://www.iiste.org/journals/ All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Paper version of the journals is also available upon request of readers and authors.

MORE RESOURCES

Book publication information: http://www.iiste.org/book/

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digtial Library , NewJour, Google Scholar