A Study on Climate Change: Its Effects in Bangladesh and Measures to Reduce Those

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Abstract

The earth's climate is gradually changing due to many natural and man- made reasons. These changes are resulting changes in weather conditions also. Scientists have identified that among these changes increasing in world's temperature is the most dangerous one and causing rapid global warming. Human economic activities, excess production of Carbon dioxide gas, Greenhouse effect, deforestation and various natural reasons are seen as the principle contributor to earth's climatic changes. The world has recognized the threats associated with the climate change and its effect on the earth's atmosphere as well as on the people. Accordingly, different measures are planned and taken to increase awareness among the different nations of the world. A number of agreements have been made by the world leaders to minimize the effects of rising temperature caused by the human, where most of the developed and developing countries agreed to work in harmony in order to reduce the effect of climate changes.

Keywords: Climate change, Climatic Impacts, Global Warming, Greenhouse effect, Renewable Energy.

1. Introduction

The earth is facing change in its climate in a steady pace. These changes are causing the changes in weather conditions of different places of the world. Among these changes increasing in world's average temperature is the most alarming one. Change in climate is caused by both natural reasons and also because of the human activities. A large number of gases are produced by different human activities which are contributing in creating greenhouse effect. This effect causes the earth's temperature to be trapped and thus increasing the existing temperature. Greenhouse effect is mostly caused by Carbon Dioxide that is emitted mostly because burning of fossil fuel and because of deforestation.

Bangladesh is one of the largest deltas in the world which is highly vulnerable to natural disasters because of its geographical location, flat and low-lying landscape, population density, poverty, illiteracy, lack of institutional setup etc. in other words, the physical,

social as well as economic conditions of Bangladesh are very typical to any of the most vulnerable countries to natural disasters in the world. the total land area is 147,570 sq. km. consists mostly of floodplains (almost 80%) leaving major part of the country (with the exception of the north-western highlands) prone to flooding during the rainy season. moreover, the adverse effects of climate change – especially high temperature, sea-level rise, cyclones and storm surges, salinity intrusion, heavy monsoon downpours, temperature rise, increased evaporation etc. has aggravated the overall economic development scenario of the country to a great extent.

Already the world community has acknowledged the threats of climate change to the earth's atmosphere as well as on the peoples. Accordingly steps are taken to increase awareness among the leaders of the world. A number of agreements are made to minimize the increase of temperature caused by the human where most of the developed and developing countries agreed to work in harmony to save our beloved planet. Bangladesh has also under taken number of self-funded projects to minimize the effect on climate.

2. Definitions

2.1 Climate Change: Climate change is identified as an average weather condition of an area characterized by its own internal dynamics and by changing in external factors that affect climate. United Nations Framework Convention on Climate Change (UNFCC) defines climate change as the change resulting from long term direct and indirect activities that induces changes in the compared time which are much more than the natural change. On the other hand, the weather is a set of all the phenomena occurring in a given atmosphere at a given time.

2.2 Greenhouse Effect: The greenhouse effect is the process by which radiation from a planet's atmosphere warms the planet's surface to a temperature above what it would be without its atmosphere.[1]

2.3 Weather VS Climate: Scientists make it a point to carefully illustrate the difference between these two terms. The main difference between the two is temporal. Weather is the condition of the atmosphere of a particular area over a relatively short period of time, whereas the climate of the area is the record of the atmosphere for over 30 years or so.

[1] "Annex II Glossary". Intergovernmental Panel on Climate Change. Retrieved 15 October 2010.

2.4 Global Warming VS Climate Change: A recent study conducted in Greenland by a group of scientists showed that various areas of the country was getting colder. Global warming pessimists would love to jump to the conclusion that the Earth is not getting warmer. However, that is untrue and this where the distinction between global warming and climate change comes into play. While global warming is a way of simply saying that the average global temperature is rising, climate change takes into account other factors such as the melting of glaciers, frequent droughts, change in the time that trees flower, and so on. As such, global warming is just another result of anthropogenic climate change.

2.5 Renewable Energy: Renewable energy is the form of energy that is collected from sources such as sunlight, wind, rain, tides, geothermal heat, and so on. They are called renewable resources because they are replenished fairly quickly and during a person's lifetime.

2.6 Green Audit: While green audit is not something that is very common in Bangladesh, it is quite common in countries like the United States and Canada. This is a process by which businesses or corporations are evaluated on the basis of their impact on the environment. It is used to determine whether the products that companies are selling and the method of production they are employing are both environmentally friendly. Consumers are, thus, given a choice on whether or not they want to support companies that are harming the environment, for instance.

2.7 Carbon Footprint: Carbon dioxide is the largest contributor of greenhouse gases that cause global warming. Almost all forms of human activities result in the emission of carbon dioxide. Carbon footprint, therefore, is the term used to express the sum of all carbon dioxide emission by a person or a firm. It is usually measured in tons depending upon the amount of fuel used by the individual and is calculated for the time period of a year.

2.8 Emission Treading: Emissions trading are a market-based approach to controlling pollution by providing economic incentives for achieving reductions in the emissions of pollutants[2]. This approach is a flexible environmental regulation that allows organizations

[2]Stavins, Robert N. (November 2001). "Experience with Market-Based Environmental Policy Instruments" (PDF). Discussion Paper 01-58. Washington, D.C.: Resources for the Future. Retrieved 2010-05-20.

to decide how best to meet policy targets. Various countries, states and groups of companies have adopted such trading systems, notably for mitigating climate change[3].

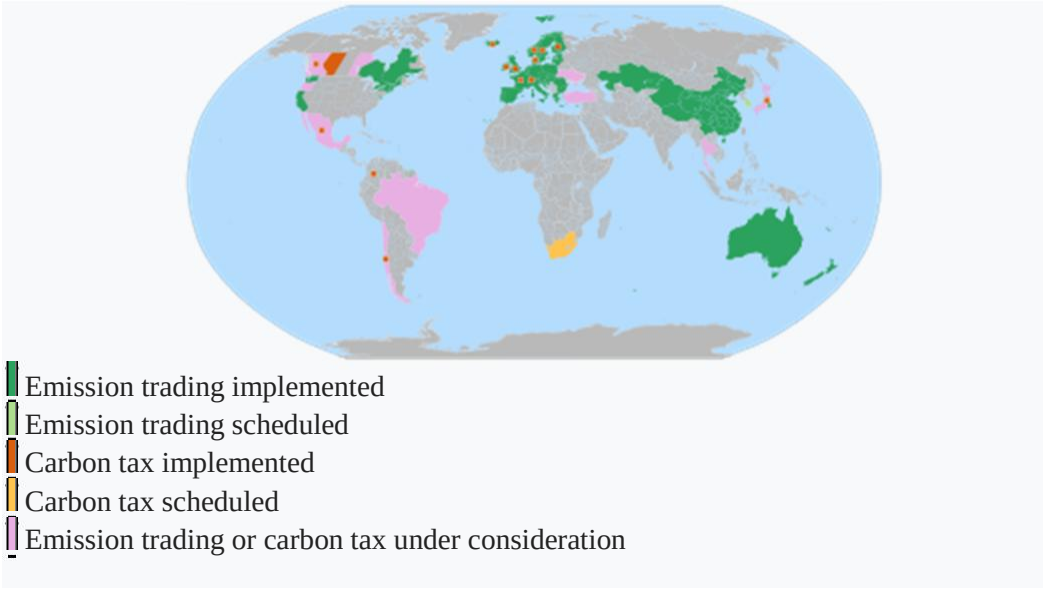


Figure 1: Carbon emission trading and carbon tax around the world

2.9 Carbon Tax: A carbon tax is a tax levied on the carbon content of fuels[4]. It is a form of carbon pricing. Revenue obtained via the tax is however not always used to compensate the carbon emissions on which the tax is levied. Carbon is present in every hydrocarbon fuel (coal, petroleum, and natural gas) and converted to carbon dioxide (CO2) and other products when combusted. In contrast, non-combustion energy sources—wind, sunlight, geothermal, hydropower, and nuclear—do not convert hydrocarbons to CO2. CO2 is a heat-trapping "greenhouse" gas which represents a negative externality on the climate system (see scientific opinion on global warming)[5]. Since greenhouse gas emissions caused by the combustion of fossil fuels are closely related to the carbon content of the respective fuels, a tax on these emissions can be levied by taxing the carbon content of fossil fuels at any point in the product cycle of the fuel.

[3] "Tax Treaty Issues Related to Emissions Permits/Credits" (PDF). OECD. Retrieved 25 Oct 2014.

[4] Hoeller, P.; M. Wallin (1991). OECD Economic Studies No. 17, Autumn 1991. Energy Prices, Taxes and Carbon Monoxide Emissions (PDF). OECD website. p. 92. Retrieved 2010-04-23.

[5] Staudt, A.; et al. (2008). "Understanding and Responding to Climate Change" (PDF). U.S. National Academy of Sciences. Retrieved 2010-11-09.

2.10 Carbon Negative: Carbon negativity is the reduction of an entity's carbon footprint to less than neutral, so that the entity in question has a net effect of removing carbon dioxide from the atmosphere rather than adding it. Carbon-negative status can be achieved by a number of means, including greater carbon sequestration and obtaining carbon offsets from a third party, as well as engaging in activities that directly reduce that amount of carbon dioxide in the atmosphere. Such activities include planting trees, generating green energy and improving energy efficiency[6].

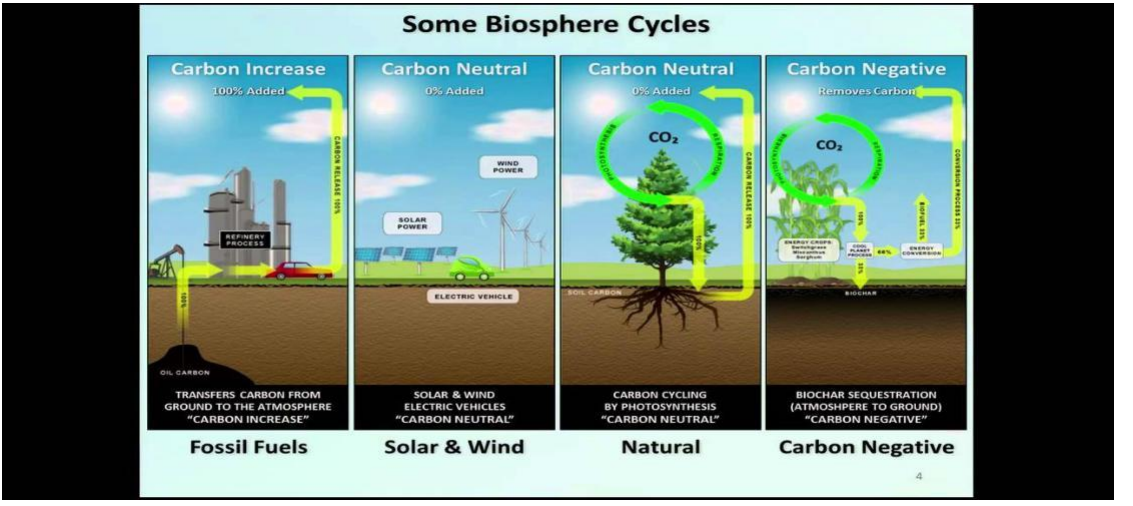


Figure 2: Climate change in general

3. Likely Effects of Climate Change In Bangladesh

3.1 Climatic Impacts: Bangladesh experiences different types of natural disasters almost every year because of the global warming as well as climate change impacts, these are:

a. Floods / Flash Floods (Almost 80% of the total area of the country is prone to flooding).[7]

b. Cyclones and Storm Surges (South and South-eastern Parts of the country were hit by Tropical Cyclones during the last few years).

[6] https://whatis.techtarget.com/definition/carbon-negative

[7] http://www.ncdo.nl/artikel/climate-change-its-impacts-bangladesh

c. Salinity Intrusion (Almost the whole Coastal Belt along the Bay of Bengal is experiencing Salinity problem).

d. Extreme Temperature and Drought (North and North-western regions of the country are suffering because of the Extreme Temperature problem).

3.2 Agriculture and Fisheries: The economy of Bangladesh is based on agriculture mainly, with two thirds of the population engaged on agricultural activities. The country is trying to move towards industrialization slowly during the last one and a half decade. So, the overall impact of climate change on agricultural production in Bangladesh would be wide spread and devastating for the country's economy. Beside this, other impacts of climate change such as - extreme temperature, drought, and salinity intrusion etc. are also responsible for the declining crop yields in Bangladesh. Temperature and rainfall changes have already affected crop production in many parts of the country and the area of cultivable land has decreased to a great extent. the salinity intrusion in the coastal area is creating a serious implication for the coastal land that was traditionally used for rice production. the fisheries sector has also experienced an adverse effect because of the impacts of climate change. The fisheries sector contributes about 3.5% of the GDP in Bangladesh and people depend on fish products in order to meet up majority of their daily protein requirements. There are around 260 species of fish in the country and almost all the varieties are sensitive to specific salt and freshwater conditions.

3.3 Effects on Coastal Areas: Almost one fourth of the total population of the country live in the coastal areas of Bangladesh, where majority of the population are affected directly or indirectly by coastal floods/tidal surges, river-bank erosion, salinity, tropical cyclones etc. With the rise of sea-level up to one meter only, Bangladesh could lose up to 15% of its land area under the Sea water and around 30 million people living in the coastal areas of Bangladesh can become climate refugees [8] . Agriculture, industry, infrastructure, livelihoods, marine resources, forestry, biodiversity, human health and other utility services will suffer severely because of the same.

3.4 Forestry: Bangladesh has a wide diversity of ecosystems including mangrove forests at the extreme south of the country. The "Sundarbans" a world heritage, is the largest mangrove forest in the world, comprising 577, 00 ha of land area along the Bay of Bengal. a total of 425 species have been identified there, the most significant is the famous Royal Bengal Tiger. Therefore, climate change impacts will have negative effects

[8] http://www.ncdo.nl/artikel/climate-change-its-impacts-bangladesh

on the ecosystem of the forest recourses in Bangladesh while the Sundarbans is likely to suffer the most.

3.5 Urban Areas along the Coast: Cities and towns situated along the coastal belt in Bangladesh are at the front line of climate change related disaster impacts and could experience a severe damage directly because of the sea level rise and storm surges. Direct impacts may occur through the increased floods, drainage congestion and water logging as well as infrastructure damage during extreme events. The important urban sectors that suffered severely by the previous floods in Bangladesh include urban infrastructure, industry, trade, commerce and utility services. as consequence, it hampered usual productivity during and after major floods and hence increased the vulnerability of the urban poor by many folds. it should be mentioned here that, around 40 per cent of the urban population in Bangladesh lives in the slum and squatter settlements of the major cities which are highly prone to disaster risk during flooding further[9].

3.6 Impact on Economy: Environmental degradation has negative impact on economy of a developing country like Bangladesh. For example, according to an estimate of the United Nations Disaster Management Team (UNDMT), the total production loss of paddy may increase to the level of 2 million metric ton or more because of a large number of farmer will not be able to go for Aman cultivation (due to flood). Taking into account the 2.9 million metric ton normal food deficit forecast by the UNDMT at the beginning of fiscal year 1998-99,the total food deficit may stand at over 4 million metric tons due to flood[10]. Due to sea level raise the costal ecosystem would be lost which would threaten fishing resources. Much of Bangladesh beaches could be lost causing severe economic and social disruption. Scientist also say that the rapid depletion of the ozone layer, now thinning fast over the large parts of the world would greatly threaten fish stocks and agricultural crops.

3.7 Health Hazard: Our good heath is threatened in two major ways, first by the environmental diseases associated with poverty and underdevelopment, second, a vicious cycle is set in motion – poor health, often caused by adverse environmental conditions. The people who are most vulnerable to environmental hazards are those least able to avoid them or least able to cope with the illness or injury. Infants and young children are at greater risk of dying from many environmental related diseases than older children or

[9] http://www.ncdo.nl/artikel/climate-change-its-impacts-bangladesh
[10] Non-Military Security by RumanaSamiruddin, P.90

adults for instance diarrhea, malaria, and pneumonia or measles etc. A poor physical environment can also inhibit or damage a child's physical and mental development.

3.8 Security Threat: In the closing years of 20th century, environment security has emerged, alongside economic and military security, as the third pillar in international relations. Extensive deforestation, desertification, salination, water scarcity etc are no longer seen as local, state or even regional problems, but have broader international ramifications; for they undermine the economic base and social fabric of weak and poor states by generating or exacerbating inter-state tensions and conflicts. Many of the problems may be localized in their effects, but their causes often lie for beyond national borders. Degradation of environment may, thus, constitute the gravest danger to national security in contemporary times.

3.9 Impacts on 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. Cox's Bazar sea beach is the world's largest unbroken sandy beach having a length of 145 km , attracting the tourists of home and abroad. A study of Bangladesh Parjatan Corporation (BPC) suggests that 19 per cent of foreigners visiting Bangladesh are tourists. BPC has seven motels in Cox's Bazar and one motel in Chittagong and Khulna district each. Besides BPC establishments, private owned hotel, motel, guest house or other mode of tourist accommodations would be around 500 in the same areas. All the tourist facilities in the coastal zone will be affected by sea level rise directly or indirectly. Sea level rise, by affecting this promising sector will affect the national economy and heritage of Bangladesh.

3.10 Rising salinity threatens Sundarban: Decreasing flow of water through the rivers from upstream is destroying the ecosystem of Sundarban. Experts from home and abroad observed that alarming decrease in water flow down the rivers caused high salinity in both water and soil of Sundarban, causing a massive change in faunal composition of the forest. Sundarban, which lies across the outer deltas of the Ganges, Brahmaputra and Meghna rivers, is the largest mangrove forest in the world. The number of timber producing big trees such as Sundari is decreasing at the proportionate rate at the increase of salinity. The latest report of World Conservation Monitoring warned that a long-term ecological change is taking place in Sundarban due to the eastward migration of the Ganges, abandonment of some distributaries and past diversion of water and withdrawals for irrigation.

3.11 Predictive Changes of Climate in Bangladesh: Following are some of the predictions about climate change in Bangladesh:

a. Average increase in temperature in Bangladesh would be 1.3°C in 2030 and 2.6°C for the year 2070.
b. Monsoon rainfall may increase by 11% and 27% by the year 2030 and 2070, respectively.
c. By 2030, an additional 14.3% of the country would become extremely vulnerable to floods, while existing flood-prone areas will face increasing flooding.
d. One meter rise in sea level will directly affect 11% people and virtually will force to lose the Sundarbans.

4. Steps Taken to Restrict the Effects

4.1 The Paris Agreement: The Paris Agreement is an agreement within the United Nations Framework Convention on Climate Change (UNFCCC), dealing with greenhouse-gas-emissions mitigation, adaptation, and finance, starting in the year 2020[11]. The agreement's language was negotiated by representatives of 196 state parties at the 21st Conference of the Parties of the UNFCCC in Le Bourget, near Paris, France, and adopted by consensus on 12 December 2015.[12]As of November 2018, 195 UNFCCC members have signed the agreement, and 184 have become party to it. The Paris Agreement's long-term goal is to keep the increase in global average temperature to well below 2 °C above pre-industrial levels; and to limit the increase to 1.5 °C, since this would substantially reduce the risks and effects of climate change.

4.2 The Kyoto Protocol: The Kyoto Protocol is an international treaty which extends the 1992 UNFCCC that commits state parties to reduce greenhouse gas emissions, based on the scientific consensus that (part one) global warming is occurring and (part two) it is extremely likely that human-made CO2 emissions have predominantly caused it[13]. The Kyoto Protocol was adopted in Kyoto, Japan on 11 December 1997 and entered into force on 16 February 2005. There are currently 192 parties[14]to the Protocol. The Kyoto

[11]https://en.wikipedia.org/wiki/Paris_Agreement
[12]Sutter, John D.; Berlinger, Joshua (12 December 2015). "Final draft of climate deal formally accepted in Paris". CNN. Cable News Network, Turner Broadcasting System, Inc. Retrieved 12 December 2015.
[13]https://en.wikipedia.org/wiki/Kyoto_Protocol#cite_note-UNlist-4
[14]Kyoto Protocol to the United Nations Framework Convention on Climate Change". UN Treaty Database. Retrieved 27 November 2014.

Protocol implemented the objective of the UNFCCC to reduce the onset of global warming by reducing greenhouse gas concentrations in the atmosphere to "a level that would prevent dangerous anthropogenic interference with the climate system" (Article 2). The Kyoto Protocol applies to the six greenhouse gases listed in Annex A: Carbon dioxyde, Methane, Nitrous oxide, Hydrofluorocarbons, Perfluorocarbons and Sulphur hexafluoride.[15]

4.3 Mitigating and Adapting to Climate Change: World Bank-supported initiatives have resulted in a range of outcomes[16], such as:

a. Build 320 solar irrigation pumps benefiting 8,000 farmers.
b. Support 17,500-hectare block plantations and 2,000-kilometer strip plantations from flooding and saline intrusion.
c. Provide basic adaptive services for 40,000 families.
d. Offer trainings on alternative livelihoods for 6,000 poor households in 200 communities.
e. Construct 224 new cyclone shelters and repair 387 kilometers of embankment.
f. Publish research analyzing impact of climate change in urban areas.
g. Provide 3.95 million remote households and rural shops with solar home systems, which increased access to electricity Install seven mini-grids to provide continuous electricity to 2,000 rural businesses and shops.
h. Distribute clean, energy-efficient cook stoves to 750,000 rural women.
j. Improve the availability of energy through electricity transfers in the Haripur, Siddhirganj and Narayanganj regions.

4.4 Greater Use of Renewable Energy: Based on REN21's 2017 report, renewables contributed 19.3% to humans' global energy consumption and 24.5% to their generation of electricity in 2015 and 2016, respectively. This energy consumption is divided as 8.9% coming from traditional biomass, 4.2% as heat energy, 3.9% hydroelectricity and 2.2% is electricity from wind, solar, geothermal, and biomass. Worldwide investments in renewable technologies amounted to more than US$286 billion in 2015, with countries such as China and the United States heavily investing in wind, hydro, solar and

[15] Report Of The Conference Of The Parties On Its Third Session, Held At Kyoto From 1 To 11 December 1997 https://unfccc.int/resource/docs/cop3/07a01.pdf#page=28

[16] http://www.worldbank.org/en/results/2016/10/07/bangladesh-building-resilience-to-climate-change

biofuels.[17] Globally, there are an estimated 7.7 million jobs associated with the renewable energy industries, with solar photovoltaics being the largest renewable employer.[18] India also has plans to generate electricity from renewables. The aim is to install 175 gigawatts of renewable capacity by 2022. With the sharp downturn in renewables like wind and solar, it may be possible to generate electricity from solar and wind at Rs 3.00 per kilowatt hour.[19]

4.5 Landscape Restoration and Reforestation: The landscape restoration is defined as a planned process that aims to regain ecological integrity and enhance human well-being in deforested or degraded forest landscapes. The idea isn't just to plant new trees, but to rebuild successful complete ecosystems within large-scale areas, not just small individual sites. Restoration aims to improve water quality, re-habituate species to their original homes and stabilize healthier soil.

4.6 Bangladesh Climate Change Strategy and Action Plan (BCCSAP): In 2009 Bangladesh developed and released the BCCSAP[20] which was the first of its kind at that time. It was a remarkable document for a number of reasons. Firstly, it was developed entirely by Bangladeshi experts with Bangladesh government's own funds. Secondly, it was developed following an elaborate consultation with a wide variety of stakeholders from different groups as well as from grassroots people around the country. Thirdly, it was actually implemented with funding support from the Bangladesh Climate Change Trust Fund (BCCTF) that was set up by the government of Bangladesh with its own money. The government has been allocating approximately USD 100 million equivalent in Bangladeshi taka each year since then to fund actions identified in the BCCSAP. Ten percent of the money was allocated to civil society groups for community-based adaptation activities, while the remaining 90 percent was given to a wide variety of government ministries and departments that had to submit projects identified in the BCCSAP.

4.7 Bangladesh Delta Plan 2100: Bangladesh is considered to be extremely vulnerable to the impacts of climate change. In an attempt to provide safety and security for people living in low-lying coastal regions against cyclones, tidal surges and flooding, the government has taken various measures over the last few decades, which included

[17] REN21, Global Status Report 2016. Retrieved 8th June 2016.
[18] IRENA, Renewable energy and jobs, Annual review 2015, IRENA.
[19] https://www.thedailystar.net/opinion/no-frills/news/moving-away-coal-isnt-easy-1650493
[20] http://www.icccad.net/updating-bangladeshs-climate-change-strategy-and-action-plan/

building 139 polders. Despite having polders, Bangladesh is facing adverse hydro-meteorological shocks, including inundation of coastal plains due to the high rate of sea-level rise as compared to the global trends, salinity ingress, water-logging, reduction in cropland and crop yield, siltation of riverbeds, and impact on human health. In this backdrop, it is imperative to formulate a long term strategic plan to protect the delta and its environment. Proper land and water management is central to the country's sustained economic development and protection of its environment. Recently, a large consortium, has signed a contract for the development of the Delta Plan for Bangladesh 2100 (BDP2100), which is designed to formulate a long-term delta governance. Only the Netherlands has drawn up such a long-term plan and Bangladesh is the second country in the world to do so.[21]

5. Suggested Measures to Minimize the Effects

5.1 Awareness Raising and Dissemination: Raising awareness among vulnerable communities, agencies, professionals and practitioners at different levels of activity is an important way forward. At the most basic level, there is a need for increased awareness of the general public of Bangladesh regarding climate change, its causes, the risks it poses to life and property, measures for reducing the risks, and the benefits of different courses of action.

5.2 Wide Range Integration: Integrated planning is identified as one of the key adaptations to reduce Bangladesh's vulnerability to climate change. This holds in particular for the coastal zone and fresh water resources. Community participation on different levels and effective strengthening of local management organizations are essential parts of integrated planning. Following actions may be done:

a. Support and continue to improve structures and procedures for Integrated Water Resources. Thorough integrated management the different sectorial interests can be coordinated and links can be made to land use and environmental planning and management.
b. Strengthening of integrated coastal zone management (ICZM) which aims at optimal use of the combined potential of all coastal resources.

5.3 Adaptation and Capacity Building: Low awareness of the long-term changes and lack of capacity and mechanisms to respond to them, contributes considerably to the country's vulnerability to climate change. Adaptation to long-term changes would require

[21] https://www.thedailystar.net/opinion/politics-climate-change/news/aligning-climate-plans-greater-impact-1691281

a change in attitude and strategic institutional arrangements, for example in terms of integrated planning and management.

5.4 Empowering Local Government: Various departments of the local government should be proactive to enforce their authority to ensure that the environment is not polluted. Any breach of the environmental law by any person or organization should be taken care of by the local government. A concerted effort by all the stakeholders of the government may help to face the climate change issues.

5.5 Information Management: Policy and development planning depends on accessible accurate information and on coordinated research and evaluation. The information needed are as follows:

a. Research, analysis and data provision about climate change.
b. Prepare practical guidelines on including climate change issues in planning and design.
c. Climate change impact assessment.
d. Awareness building and dissemination.

5.6 Collective Regional Response: An integrated and coherent plan preserving interest of all the regional countries is necessary to mitigate the climate change issues. Sharing of knowledge base, expertise, equipment etc should be a regular phenomenon among the friendly countries of the region. Honorable Prime Minister of Bangladesh during her latest visit to China raised the issue and urges upon to play important role against the adverse effect of climate change.

5.7 Intergovernmental Coordination: Due to the impacts of climate change, greater intercommunication between ministries and government agencies for both implementation and integration of national adaptation planning should be considered. Climate change adaptation program should, therefore, be considered for all development projects undertaken by different ministries of the Government.

5.8 Government- NGO Collaboration: A network of environment and development NGOs need to be formed. The Government should consider their input into the policy formulation, training, project mobilization and fund facilitation processes by developing formal Government – NGO collaboration system. This also can develop expertise to strengthen the private sector to invest in climate related activities.

5.9 Introduction of Carbon Tax and Emission Treading: As industrialization is a continuous process for a developing or a developed country emission of carbon cannot be stopped completely. In this circumstances carbon tax and emission treading can be introduced. Most countries these days acknowledge environment protection and climate change as an urgent priority. Several countries have taken concrete action. One of the most common instruments adopted is a carbon tax. [22]An alternative instrument to carbon tax is the use of emission trading systems (ETS) whereby the government fixes the total volume of emission for each type of polluting industry and allocates these pollution rights to industries through an auction system. The government of Bangladesh may introduce such system to control carbon emission.

5.10 Protect and Restore Key Ecosystems: Respect for nature is fundamental. Bangladesh Government must protect ecosystems key to the fight against climate change: rivers, wetlands, oceans, forests and mangroves absorb large quantities of carbon, slowing warming. Mangroves also serve as a barrier against tropical storms, and wetlands absorb excess water from floods, both extreme weather events exacerbated by climate change.

5.11 Promote Green Energy: Reducing the amount of electricity generated from coal and gas, and increasing the amount of electricity from clean, renewable energy sources like solar and wind, means less carbon pollution is emitted. This is one of the main ways we can address global warming. Thirty-five percent of all global emissions come from energy production. But as countries bet on more development, they're also betting on more energy production. While thermoelectric and hydroelectric energies were long considered the cheapest options, technological developments have allowed us to find better, cheaper, more efficient alternatives. With proper long-term planning, Bangladesh can avoid old climate-aggravating energy sources and opt for small wind, solar, geothermal, oceanic and other projects that adapt to a place's unique characteristics.

5.12 Direct Air Capture (DAC): The technique that is currently used to remove carbon dioxide from the atmosphere independent of its source is known as Direct Air Capture (DAC). Within the context of DAC, carbon dioxide is sucked out of the ambient air with a giant network of fans. Once carbon dioxide is trapped, it is liquefied and transported through pipelines and stored underground, often in natural reservoirs like depleted oil wells that can hold the gas for millions of years. There is also growing interest in storing the liquid carbon dioxide in saline aquifers due to their enormous storage capacity.

[22]https://www.thedailystar.net/business/news/its-time-seriously-consider-carbon-tax-bangladesh-1650505

Government of Bangladesh can establish such infrastructure near the industrial areas to reduce carbon dioxide in the atmosphere.

5.13 Carbon Capture and Storage (CCS) Technology: Zero or near-zero emission of carbon dioxide could be achieved by using the Carbon Capture and Storage (CCS) technology. The process is similar to DAC technology except that CCS traps carbon dioxide from the exhaust stream of power plants, thereby preventing it from entering the atmosphere. There are a handful of coal-fired power plants around the world that are using the CCS technology. The largest such plant, Petra Nova in Texas, captures around 5,000 tons of carbon dioxide per day from its exhaust. That is about 90 percent[23] of all the carbon dioxide the plant produces. Brick fields in Bangladesh can use this technology in order to reduce air pollution.

5.14 Bioenergy with Carbon Capture and Sequestration (BECCS): Another zero-emission technique is known as Bioenergy with Carbon Capture and Sequestration (BECCS). It involves growing crops, burning them to generate electricity, capturing the carbon dioxide emitted during combustion and storing it deep down into the Earth's crust. Eventually, over the course of millennia, it is converted into carbonate rocks. Clearly, BECCS obviates the need to extract fossil fuels, thus closing the carbon loop and enabling carbon neutrality by replacing fossil fuel with crops. There are about two dozen BECCS pilot projects operated by multi-national companies like Shell, Chevron and Archer Daniels Midland (ADM). Since 2011, ADM has been sequestering about a million tons of carbon dioxide per year[24]. Large industrial groups like BEXIMCO, AKIZ and RAK in Bangladesh can use this technique with the aim of reducing carbon emission.

5.15 Recycling of Carbon Dioxide: At Sandia National Laboratories in Albuquerque, New Mexico, scientists are working on applying concentrated sunlight to the captured carbon dioxide to initiate reactions that yield carbon monoxide, hydrogen and oxygen. Because carbon monoxide and hydrogen are the basic chemical building blocks of synthetic fuels, they call this process "sunshine to petrol". Indeed, researchers have demonstrated that 75 percent of the carbon dioxide captured from the air can be converted into methanol. This shows that the main culprit of global warming can be recycled into useful products. Moreover, production of these carbon-recycled products

[23] https://www.thedailystar.net/opinion/environment/news/discoveries-can-clean-carbon-dioxide-the-atmosphere-1666441

[24] Ibid

would be carbon neutral or carbon negative.[25] At present Bangladesh has number of pharmaceutical industries who all can be tasked to find out similar technology to recycle greenhouse gases.

5.16 Considering Policies for Cities: Three urban policies may be considered by Bangladesh for cities to be an efficient defense against climate change[26]:

a. A city's growth must take into consideration the ecology of the place. Altering the fundamental geography of a place in the name of development would mean tampering with nature's balance which is essential for a place's continued ecological harmony. Consider Chittagong. Rampant hill-cutting in the port city changes its land form, exposing it to natural calamities caused by climatic abnormalities. River-filling in Dhaka would mean fewer drainage arteries for the snow-melted water that descends from the Himalayan plateau and passes through the flat Bengal delta.

b. Cities must be compact, so that they can foster walk able communities and a culture of smaller carbon footprints. Compact cities are served well by a mass transit system, reducing the need for personal cars and carbon emissions from them. A compact metropolis with an urban growth boundary stops sprawl, generates fewer heat-producing surfaces, and preserves carbon-reducing agricultural fields. Lest we forget, buildings and transportation together account for 37 percent of global carbon emissions. A perpetually expanding city, with its built-up area and dependence on personal transportation, is basically a heat island and a carbon factory. Urban compactness has become one of the essential mantras of sustainable urbanism and an efficient strategy against global warming.

c. Implementation of environmental laws should be an unflinching urbanization policy to ensure the preservation of a city's "lifeline" like rivers, hills, wetlands, etc. The protection of natural resources provides cities and their regions with the best ability to be resilient in the face of natural disasters. Cities provide easy access to transportation hubs. Thus, factories tend to flock to cities, so that they can easily and quickly export their products. But, as much as they are stimulants of national economy factories are also environmental pollutants, unless strict

[25] https://www.thedailystar.net/opinion/environment/news/discoveries-can-clean-carbon-dioxide-the-atmosphere-1666441

[26] https://www.thedailystar.net/opinion/the-grudging-urbanist/news/election-manifestos-climate-change-and-cities-1678297

environmental laws are enforced. Consider the air-polluting brickfields on the outskirts of Dhaka. Their environmental hazards may seem local and temporary, but they severely harm the region's long-term climate resiliency.

6. Conclusion

Climate change has become a major concern for the world community in the recent years. Developing and underdeveloped countries are the biggest sufferers for this unwanted change. Already the planet earth has faced number of natural catastrophes causing damage to both man and material, which are believed to be the result of this rapid climate change.

There are few natural causes for climate change like strength of the sun, ocean current, meteor impact etc. However the effects of such cause are very small in comparison with the manmade causes. With the development of the civilization the amount of carbon emission has increased radically. More quantity of greenhouse gas is causing increase in average temperature of the world. Deforestation, desertification, unplanned industrialization and establishment of cities are main causes for increase of carbon dioxide in the air.

The effects of climate change have may cause serious harm to different sectors of Bangladesh. Our agriculture, fisheries, tourism and economy are venerable to the adverse effects of climate change. The Sundarban is in risk of rising of salinity and loosing ecological balance. Our coastal areas are also under threat of sea level rising by which millions of people will be affected. The climate change is also responsible for causing various health hazards.

The leaders of the nations have already acknowledged the problem and numerous steps have already been taken to mitigate it. For example The Paris Agreement, Kyoto Protocol are the internationally recognized steps taken to reduce emission of greenhouse gas. Moreover many countries have generated national policy to control carbon emission and working accordingly. Government of Bangladesh is also concern about the issue and following the developed countries has formulated few long term and short term plans.

Now it is the time to work in harmony in order to restrict global warming. We can make this happen by promoting green energy, restoring ecological balance, use of renewable energy etc. More efficient ways may be developed like DAC, CCS, and BECCS ets to reduce the carbon emission.

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