



Climate Change in Bangladesh – Context Analysis

World Economy and Climate Change

Each year, the World Economic Forum issues its Global Risks Report. The 11th Edition in 2016 showed the risk with the higher impact for the global economy was the failure of climate change adaptation and mitigation¹. In the 15th Edition issued in January 2020, this risk is still number one in terms of impact severity, followed by biodiversity loss, extreme weather and water crisis, ranking at 3rd, 4th and 5th position respectively. In terms of likelihood, all first global risks for the world and its economy are related to the environment, and hence aggravated by climate change, namely extreme weather events, climate action failure, natural disasters and biodiversity loss².

For the last couple of years, climate and economical experts from all over the world agreed that climate change is one of the biggest threat on economic prosperity. In the Global Resource Challenges Report, 66% of executives surveyed said climate change had affected the resource challenges that their businesses face³. To take just one of the examples of climate change direct impact on the economy, the drought in California in 2014 cost the state an estimated \$2.2 billion and almost 17,000 farmers lost their jobs due to this extreme climate event⁴. Climate change has the potential to slow world's economic growth in the coming decades as temperature changes could reduce incomes globally by roughly 23% by 2100⁵. In that context, while many companies are focusing on sustainability, a step forward is emphasizing on climate change adaptation and on ecosystems and communities resilience⁶.

Geography and Environment of Bangladesh

The People's Republic of Bangladesh is a low-lying country in South Asia, located between 20° and 27° N and 88° and 93° E. The country has a total area of 147,570 km² and is bounded by India to the West, North and Northeast, Myanmar to the Southeast and the Bay of Bengal to the South. Hilly terrain covers only some 12% of total land area in the North/Northeast and Southeast, with average elevations of 244m and 610m, respectively⁷. Most of the country lies below 12 meters in altitude and 80% consists of floodplains and wetlands created by more than 300 rivers and channels that flow through it, including the major river systems of the Ganges, the Brahmaputra and the Meghna. Approximately two-thirds of the Ganges-Brahmaputra-Meghna delta, which covers 80,000 km², is located in Bangladesh, the rest in neighboring West Bengal state of India.

¹ http://www3.weforum.org/docs/GRR/WEF_GRR16.pdf

² http://www3.weforum.org/docs/WEF_Global_Risk_Report_2020.pdf

³ <https://sealedair.com/insights/leading-businesses-focusing-climate-change>

⁴ <https://www.theatlantic.com/business/archive/2015/03/the-economics-of-californias-drought/388375/>

⁵ <https://sealedair.com/insights/leading-businesses-focusing-climate-change>

⁶ Ibid.

⁷ UN-REDD Programme 2012. *Bangladesh REDD+ Readiness Road Map*. Draft. April 2012.



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Climate is subtropical and heavily influenced by the Southeast monsoon, which generates significant rainfall and high humidity. Four seasons can be distinguished: a hot humid, rainy monsoon season from June to September; a progressively cooler, drier season from October to November; a cool dry winter from December to February; and a progressively hotter and drier summer from March to May. Average annual temperatures vary between 18-29°C. However, maximum summer temperatures vary between 38°C and 41°C, while winter temperatures generally vary more, by between 10°C at night and 16-20°C in the day. Average annual rainfall ranges from 1,429 mm to 4,338 mm, with the bulk of annual rainfall (80%) occurring during the monsoon.

Bangladesh's major natural ecosystems include terrestrial forest ecosystems, coastal and marine ecosystems and inland freshwater ecosystems. Wetlands, which include both inland and coastal systems and a variety of different types of lakes, mudflats, mangrove forests and other ecological systems, are the country's most significant natural ecosystem. Bangladesh was once renowned for its greenery, the flora and fauna and century old trees, among which the world's largest mangrove forest. Forest cover had declined by more than 90% over the past 100 years and per capita forest area is amongst the lowest in Asia⁸. Forests cover has reduced due to many factors such as population growth leading to transforming forests into cultivable land to feed and accommodate the vast population and livestock but also due to the lack of environmental awareness about the benefits of the forests. Nowadays, although some 2.56 million ha of land are classified as forests (according to Forestry Sector Master Plan 1993), representing 17.8% of the country's total area, only around 1.4 million ha or 11% of the country are considered as forests according to the latest FAO Global Forest Resources Assessment⁹. Natural and planted mangroves form an important part of the coastal belt in Bangladesh. Natural mangroves cover an estimated 601,700 ha (representing 37.6% of all classified state-owned forest land) and occur mainly in the Sundarbans Reserve on the Western part of the coast, a globally renowned transboundary national park and UNESCO World Heritage Site. Mangrove plantations cover some 201,142 ha, but the erosion and accretion balance result in substantial loss of coverage and represent 9.2% of all classified state-owned forest land¹⁰.

Climate Change in Bangladesh

As a low-lying country with a large area of deltaic floodplains, Bangladesh is well-recognized as being particularly vulnerable to the impacts of climate change^{11 12}. It is one of the most disaster-prone countries in the world and the most disaster-prone of the LDCs. The country is frequently subjected to heavy monsoon downpours and extreme weather events such storm surges and cyclones¹³, which in turn often lead to riverine and coastal flooding and saline intrusion and exacerbate existing problems of coastal erosion. Of the 250,000 deaths resulting from cyclones worldwide between

⁸ MoEF/GoB 2012. *Rio +20 National Report on Sustainable Development*.

⁹ [Global Forest Resources Assessment 2015](#), Food and Agriculture Organization of the United Nations.

¹⁰ World Bank – Climate Resilient Participatory Afforestation and Reforestation Project under BCCRF (2013).

¹¹ <https://www.thedailystar.net/environment/climate-change/news/bangladesh-7th-worst-weather-affected-country>

¹² https://germanwatch.org/sites/germanwatch.org/files/Global%20Climate%20Risk%20Index%202019_2.pdf

¹³ <http://www.ncdo.nl/artikel/climate-change-its-impacts-bangladesh>



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1980-2000, 60% occurred in Bangladesh¹⁴. Cyclones are especially common before and after the monsoon, in May and October, respectively. Recent well-known events include super cyclone Sidr in 2007 and cyclone Aila in 2009. However, in the past two hundred years, the coastal zone has been affected by at least 70 major cyclones, of which 40 have occurred since 1948. The most serious ones in terms of fatalities were in 1970, with 250,000 deaths and 1991, with 138,882 deaths¹⁵. Eighty percent of annual rainfall occurs during the monsoon months and flooding is a major recurring problem that affects between 30-50% of the country each year. Between 1991 and 2000, 93 major disasters were recorded, resulting in nearly 200,000 deaths and causing at least US\$5.9 billion in damage with severe losses to agriculture and infrastructure.

There is also concern that the combination of a continued population increase (population of Bangladesh is currently 163.05 million¹⁶), environmental degradation and climate change could undermine further development and reverse recent hard-won achievements. Multiple natural disasters compounded with other vulnerability factors have particularly marginalized coastal communities, who are among the poorest in the country, and at the same time slowed down social and economic development processes. Climate Change is projected to change the frequency, intensity and location of existing climate hazards and thus challenge people's existing coping mechanisms as well as their economic opportunities and hope for a better life, with poor people and women being most acutely affected.

Those living in coastal areas are also particularly vulnerable to the effects of sea level rise (SLR), coastal erosion and salinization. Climate change projections suggest that a rise in global temperature of 4°C is likely to raise sea level by 100cm by 2100, which would inundate 15% of the country's land area and displace tens of millions of people. Meanwhile, historical tidal data from various coastal measurement stations suggest that the rate of SLR in Bangladesh is many orders of magnitude higher than the global mean projected rate of SLR over coming decades (cf. 4.0 mm per year at Hiron Point, 6.0 mm per year at Char Changa and 7.0 mm per year at Chittagong). It means that only a 45 cm SLR could result in the inundation of 10 to 15% of Bangladesh's land by 2050, resulting in over 25 million climate refugees from the coastal districts¹⁷. With 100cm rise in sea level, the Sundarbans, the world's largest natural mangrove forest and a UNESCO World Heritage Site would likely be lost, which would affect not only unique coastal ecosystems and biodiversity, but also thousands of poor households that currently rely on a range of resources and services supplied by the Sundarbans.

Existing problems of saline intrusion would be further aggravated by SLR and high winds, which would result in seawater overtopping existing coastal protection measures such as embankments and submerging polders with disastrous

¹⁴ World Bank 2010. *Country Assistance Strategy for the People's Republic of Bangladesh for the Period FY11-14*.

¹⁵ According to the statistics of Disaster Management Bureau of GoB. <http://www.dmb.gov.bd/pastdisaster>

¹⁶ <https://www.worldometers.info/world-population/bangladesh-population/>

¹⁷ Climate Change Cell, DoE, Bangladesh: https://www.preventionweb.net/files/574_10370.pdf + <https://eifoundation.org/reports/climate-displacement-in-bangladesh>



FRIENDSHIP

consequences for local agriculture and livelihoods¹⁸. Salt water from the Bay of Bengal is already reported to have penetrated 100 km or more along tributary channels during the dry season in past years¹⁹. Approximately, 1.02 million ha of arable lands have been affected to varying degrees by soil salinity, and vast areas of croplands in the lower estuary of the coast remain fallow during the dry (rabi) season due to high salinity²⁰.

Climate Change and Economy in Bangladesh

The economy of Bangladesh is one of the fastest growing in the world. The Asian Development Bank (ADB) ranked Bangladesh as the fastest-growing economy in the Asia-Pacific region, even eclipsing China, Vietnam and India²¹, and the garment industry plays an important role in this economic growth. But a fast growing economy also contributes to global warming leading to climate change.

The fashion industry is considered as one of the most polluting industries in the world²². This fact has been recognized by the industry itself at COP 24 in Poland and is stated in the UNFCCC Fashion Industry Charter for Climate Action²³. The garment industries contribute to the pollution of soil, water and air. One of the biggest sources of the environmental pollution of Bangladesh is the industrial pollution, mainly the textile dyeing and washing industries negatively impacting the local environment through their dye effluents, which contain both chemical and organic pollutants²⁴. Air pollution results from exhaust gases emitted from poly-condensation and melt spinning process and during steam generation process. According to the State of Global Air Report 2017, Dhaka ranked second on a global list of cities with worst air pollution, which claims 122,400 lives in Bangladesh a year. According to a 2017 study by Fayez A. et al.²⁵, the greenhouse gas (GHGs) emissions from garments and textiles industries in Dhaka peaked to 58,177.812 tons CO₂ in 2015. The study is based on the energy consumption of 50 selected garment and textile industries and data calculation is based on 2006 IPCC guidelines for national greenhouse gas inventories.

Better disaster preparedness strategies and practices have reduced the numbers of deaths due to disasters, but the loss of assets and livelihoods remains very high (estimated to be as much as 0.5-1% of annual GDP²⁶). In considering the economic losses due to the natural disasters, Bangladesh lost US\$2.4 to 4.0 billion in the year of 1991 due to the cyclone. The cyclone Sidr in 2007 caused economic losses for about US\$ 3 billion. Now that the frequencies of the disasters are increasing, the

¹⁸ CEGIS, 2006. *Impacts of Sea Level Rise on Landuse Suitability and Adaptation Options, Final Report*

¹⁹ IPCC, 2007. *Climate Change 2007*

²⁰ Soil Resources Development Institute (SRDI), Bangladesh

²¹ <https://www.dhakatribune.com/bangladesh/development/2019/04/03/adb-bangladesh-to-see-8-gdp-growth-in-fy19-20>

²² <https://www.ekoenergy.org/how-polluting-is-the-fashion-industry/>

²³ [Fashion Industry Charter for Climate Action](#)

²⁴ <http://ijesd.org/papers/164-D580.pdf>

²⁵ [Fayez A., Islam M.S. & Hasnat M. A., Energy consumption and estimation of greenhouse gas emission from garment and textile industries in Bangladesh: A case study on Dhaka City, in Academia Journal of Environmental Science 5 \(4\): 065-075, 2017](#)

²⁶ Economics of Adaptation to Climate Change in Bangladesh published by World Bank in 2010.



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losses are also increasing year by year²⁷. So, even if Bangladesh has become better equipped to deal with climate-related variability and disasters, its public finance and its economy remains very vulnerable to natural hazards and climate change.

According to many studies the widespread effect of climate change can be observed in every aspect of the economy of Bangladesh, from procuring raw materials to distributing the end products to the consumers. Loss of biodiversity, decrease in crop yields, decline in fish production, hindrance in transportation of goods via river routes or roads because of extreme weather conditions, infrastructural damage, all such instances are examples of climate change adding obstacles to the path of the country's economic growth²⁸.

Addressing Climate Change in Bangladesh

The Government of Bangladesh (GoB) is acutely conscious of the country's vulnerability to climate change. Current and future climate-related risks to Bangladesh and key areas of vulnerability have been analyzed in the country's Intended Nationally Determined Contributions (INDC) prepared for the United Nations Framework Convention on Climate Change (UNFCCC) and the 2005 National Adaptation Programme of Action (NAPA), which was further updated in 2009.

One of the finest ways of tackling CO₂ emissions responsible for global warming and climate change is planting more mangrove trees because they can literally suck CO₂ out of the atmosphere at an exceptional rate. According to some research in Australia²⁹, coastal ecosystems absorb CO₂ up to 40 times faster than forests and have a carbon storage capacity about 4 to 5 times more than rainforests, because mangroves grow very quickly and develop a significant biomass. So, mangrove trees can compensate CO₂ emissions by giving off oxygen that we need to breathe. But they have many other advantages as they are uniquely adapted to the coastal areas of Bangladesh. They are able to filter out salt and hence stop soil salinization, which in turn preserves the productivity of food crops. Mangroves also play an important role by reducing pollution in waterways, improving water quality and controlling coastal erosion caused by storm surges. Mangrove forests also reduce the impacts of climate change by mitigating the effects of weather events (wave energy decreases by up to 75% when they pass through 200 metres of mangrove swamp in good condition). Mangroves help to limit embankment erosion, stabilize soils and thus protect human lives, crops and infrastructure. Mangroves provide food, protection and habitats for many birds and mammals and are known as 'shelters', acting as nursery grounds for economically important fishes, prawns, crabs and provide multiple resources (wood and fibre, fruits, honey, etc.). Many people living in coastal areas depend directly on mangroves for their livelihood. Researchers estimate the monetary value of all these benefits – or “ecosystem services” – provided by mangroves at US\$194,000 per

²⁷ http://www.equitybd.net/wp-content/uploads/2015/10/Disaster_BD.pdf

²⁸ <http://bbf.digital/climate-economic-consequences-bangladesh>

²⁹ <https://www.theguardian.com/environment/2019/oct/01/australias-vast-carbon-sink-releasing-millions-of-tonnes-of-co2-back-into-atmosphere?fbclid=IwAR05WdqCNDubh0s2jL4o9rvR7pqLL03BZGhUmSnpSA22NrelB3cKl2LQMw>



FRIENDSHIP

hectare annually. Multiplied by their global extent, that means the world's remaining mangroves provide around US\$2.7 trillion in ecosystem services every year³⁰.

For all these reasons and according to scientific researches, mangroves are prime ecosystems for afforestation and reforestation. That is why planting mangrove trees in Bangladesh is more and more becoming a national priority to address the current situation of climate change mitigation and future resilience of coastal communities. Specifically, the National Strategy for Accelerated Poverty Reduction II (NSAPR II) aims at mainstreaming and strengthening climate change adaptation across various sectors and reinforces the need for climate change resilient afforestation and reforestation in newly accreted coastal lands and degraded hill forests³¹. The National Strategy is aligned with the Bangladesh Climate Change Strategy and Action Plan (BCCSAP 2009)³², which presents a comprehensive 10-year action plan (2009-2018) for both climate adaptation and mitigation³³. The national Strategy also emphasizes community participation, especially greater women's involvement in the afforestation programmes. Bangladesh's Seventh Five Year Plan, which is aligned with the NSAPR II and the Sustainable Development Goals, envisages social forestry and the expansion of coastal 'greenbelts' as a key adaptation-mitigation strategy³⁴. At the occasion of World Environment Day (June 5, 2017), Sheikh Hasina, Prime Minister of Bangladesh, said that *"the Sundarbans is not only a heritage site for Bangladesh; it is also important for the country's existence... Bangladesh survives because of the Sundarbans. To expand the Sundarbans, we need to take initiative to the expansion of mangrove forest in the coastal areas of the country"*³⁵. In brief, creating a coastal greenbelt with mangrove planting along the shoreline will reduce damages caused by cyclones and tidal surges, will protect people, infrastructure and cultivation and will bring new livelihoods.

Mangrove Plantation = Climate Action

The southern part of the districts of Satkhira, Khulna and Bagerhat in Bangladesh covers two thirds of the Sundarbans, the world's largest mangrove forest, a UNESCO World Heritage Site and biodiversity sanctuary. Although this UNESCO site is currently relatively well protected in Bangladesh, mangroves forests have historically been degraded and mangrove trees continue to be felled as a result of human activities to reach cultivable areas or as a result of natural disasters such as Cyclone Sidr in 2007. As explained above, mangrove afforestation/reforestation is of prime interest for the country. However, previous plantation experiments conducted by the Government of Bangladesh have shown a number of limitations. First, plantations are often made up of a single tree species. Secondly, local communities are not involved in the maintenance of these young forests and are not aware of the need to do so. Third, the

³⁰ <https://news.mongabay.com/2018/05/new-study-finds-mangroves-may-store-way-more-carbon-than-we-thought/>

³¹ [The National Strategy for Accelerated Poverty Reduction II \(Revised\) FY 2009-11](#), p.32

³² [Bangladesh Climate Change Strategy and Action Plan](#)

³³ BCCSAP estimates that the total cost of programmes in the action plan is \$500 million in the first 2 years of implementation and in the order of \$5 billion for 5 years.

³⁴ [Seventh Five Year Plan 2016-2020](#), p.418

³⁵ [Govt to create artificial forest to expand the Sundarbans](#), Dhaka Tribune, June 4th, 2017 and [Country exists for Sundarbans](#), The Daily Star, June 4th, 2017.



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budget of the Bangladesh Forest Department does not allow it to guarantee that the young plants will mature. The reason is that coastal communities living adjacent to mangrove forests are extremely poor, mostly landless and often earn their living from Sundarbans resources. In short, their poverty often forces them to 'plunder' the forests resources. This illegal deforestation, done without weighting because needs-driven, further contributes to the loss of biodiversity and environmental degradation, with all the negative effects above-mentioned. As climate change impacts become increasingly visible and sustaining such livelihoods becomes more and more difficult, these communities usually perceive planted as well as existing mangrove forests more as an immediate source of income substitute through exploitation rather than something that potentially offers a protective buffer against natural calamities or a sustainable stream of income.

Participative and inclusive projects remove these three limits to mangrove afforestation and reduces pressure on the Sundarbans. To stem the loss of mangrove land and ensure expansion of sustainable plantations, it is important to consider the development of local people's livelihoods and their active involvement as stewards of the planted forests. By doing so, planting mangrove will not only contribute to Bangladesh's mitigation efforts to absorb CO₂ out of the atmosphere but also create scope for people's participation in afforestation programmes, including employment and economic opportunities, maintenance of ecological stability and biodiversity and awareness raising about the benefits of mangrove to reduce their vulnerability.

In order to enrich and sustain coastal vegetation and improve biodiversity, it is recommended that mangrove plantation should introduce 5 or 6 commercially important mangrove species. Trees provide fuel, food for people and livestock, building materials, shade, soil fertility, and most importantly, each hectare of plantation will absorb every year 23.76 tons of CO₂. This will in turn provide oxygen while also creating a lovely landscape and climate. Hectares of mangrove plantation can create greater direct economic value to the local communities comprising short-term and longer-term benefits, such as fruits, thatch, honey, bee wax, fish, prawn, crab and shrimp³⁶. In addition, mangroves also plays an important role in controlling erosion caused by flooding and storm surges. They also act as a barrier during cyclones and protect the coastline.

Among the challenges for mangrove plantation, it was found that there are currently limited availability of mangrove seeds and saplings. Establishing mangrove trees seeds collection and then nurseries to raise saplings is therefore strongly needed in the Districts of Satkhira and Khulna. The effective engagement of local communities in the establishment of the nurseries and maintenance of the plantation will build capacity, raise awareness and can create new income generating activities.

Another challenge of mangrove plantation – and probably the most challenging one – is the protection of the plantation area. Indeed, without any active protection (solid

³⁶ Based on NTFP collected in Sundarbans. See for example, Singh, A., P. Bhattacharya, P. Vyas, & S. Roy. (2010). Contribution of NTFP in the livelihood of mangrove forest dwellers of Sundarban. *Journal of Human Ecology*. Vol: 29. Issue: 3. pp: 191



FRIENDSHIP

fencing and active monitoring), there is very little chance that the planted trees will reach maturity. As explained above, population pressure on Bangladesh's natural resources and environment is huge. Without any protection and surveillance, it is very likely that a newly planted area will soon be either 'plundered' again by local poor people in search of some livelihood resources or that the small plants will be eaten by cattle (mainly goats) rearing on the areas. That is why a sustainable mangrove plantation in coastal Bangladesh requires active protection for at least 3 to 4 years.

Sustainability of Planted Mangroves

In a long-term perspective of safeguarding the coastal communities by enhancing the resilience of protective ecosystems, the implementation process of a mangrove plantation should change the attitude and mind set of the individuals and nearby communities. Therefore, capacity building and awareness raising are key. It is expected that when the key stakeholders are capacitated, they will take this initiative forward. For example, when poor communities have new skills and realize that collecting seeds, growing saplings and maintaining mangrove trees is good for them, it is very likely that they will continue these activities and pass it on to their children.

Involvement and support of different stakeholders including government departments, forests specialists, district authorities, local duty bearers and other relevant stakeholders will guarantee a long-term and sustainable impact of the project.

Social sustainability will be achieved as a result of the emphasis on empowerment of the poorest and the most vulnerable, especially women, living in coastal areas, and recognition of these groups as partners for better management of mangrove forests for enhanced climate resilience.

In brief, planting mangroves actively contributes to the United Nations Sustainable Development Goals and especially Goal 13: *take urgent action to combat climate change and its impacts*.

