

Climate Change Impacts, Actions and Programs (Adaptation, Mitigation) for A Most Vulnerable Country- Bangladesh

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Abstract

Bangladesh is a country in South Asia (147,570 km²), a country prone to major disasters (cyclones/floods), where 80% of land is flood plains, one fifth is low-lying coastal zones, having 700 rivers, densely populated (161 million people; 1,203 people km²), mostly poor (43.3% earns <\$US \$1.25 per day) and three quarters of people live in rural areas, relying on mainly agriculture, fisheries, ecosystems, biodiversity (for food, water and livelihoods). Climate change (the rise of temperature, carbon dioxide, sea-level rise (SLR), ocean acidification and extreme events-floods/droughts/cyclones) will cause significant economic, social and environmental challenges/problems for Bangladesh. Some projected impacts of climate change on Bangladesh are increasing flooding of low lying coastal areas; loss of biodiversity (tiger habitat in the Sundarban mangroves), possible drowning and bleaching of corals in the lone St Martins Coral Island; loss and shifting of natural breeding ground of iconic fish- the Gangetic major carps in the Halda River; salinisation of rice lands in the coastal areas; negative effects on coastal agriculture, freshwater aquaculture, surface and groundwater; increased cholera outbreak and breeding of salinity-tolerant mosquitoes; loss of tourism and recreation in the Sundarbans and St Martins Coral Island; possible displacement of 27 million people due to SLR; damage to coastal infrastructure/assets (roads, schools, mosques, temples, airports, sea ports, and tourist places). To reduce impacts of climate change on Bangladesh, a number of climate resilient/climate smart Adaptation and Mitigation measures would be required which may include conserving species with higher genetic diversity; conserving wetlands/mangrove habitats (which are biodiversity 'hot spots', and act as major carbon sinks); removing barriers and assist in migration of species; seed banking; use/promote climate resilient crops and fast growing crops/fish; shifting in cropping patterns/shifting in sowing dates/transplantation dates/harvesting dates; no-tillage agriculture, reducing emissions of methane (CH₄) from rice cultivation; nutrient/manure management (to reduce N₂O emissions); use of renewable energy; promoting agroforestry, triple F models (simultaneous forestry, food and fish production in coastal areas); rainwater harvesting; floating agriculture; brackish water fish/prawn aquaculture; energy efficient aquaculture; diversification; afforestation/reforestation/REDD; investment in renewable energy/clean energy/energy efficiency, green buildings/building codes; imposing some sort of carbon pollution tax (fuel levy/carbon tax/ETS as appropriate), behaviour change programs; improved early warning systems, new designs for cyclone-resistant homes/storm-proofed/wind resistant huts; capacity building of communities (women & men); disaster preparedness/disaster risk management; social protection; climate resilience funds/insurance; awareness, education and research on climate change. Bangladesh would have to build infrastructure/assets, and shift cropping patterns so that the country can withstand new climatic conditions and transit towards low emissions, climate change and disaster resilient development for the foreseeable future while preserving ecosystems.

01: Introduction

Bangladesh is a country in South Asia (147,570 km²), a country prone to major disasters (cyclones/floods), where 80% of land is flood plains [1], one fifth is low-lying coastal zones [2, 3], having 700 rivers [4], densely populated (161 million people; 1,203 people km²) [5], mostly poor (43.3% earns <\$US \$1.25 per day) [3] and three quarters of people live in rural areas, relying on agriculture/fisheries [3] (agriculture accounts for 20% of GDP and 65% of the labour force) [6].

The article highlight the projected impacts of climate change to a most vulnerable country-

Bangladesh (world ranks #1) [6] and suggest actions and climate resilient adaptation and mitigation programs to reduce such impacts (based on relevant peer reviewed- journal articles/books/reports; the references of which are given at the end).



02: Impacts

Climate change (the rise of temperature [current 0.8°C, future 2°C-2040, 4°C-2100 from preindustrial levels], carbon dioxide, sea-level (SLR), ocean acidification and extreme events (floods/droughts/cyclones/hot extremes/bush fires) will cause significant economic, social and environmental challenges/problems for Bangladesh [6,7,8,9,10]. Climate change is projected to increase the intensity and frequency of disasters, hot and drought spells and SLR in Bangladesh, the consequences of which change will be felt across the various sectors of Bangladesh including ecosystems, biodiversity, water resources, agriculture, fisheries, aquaculture, human health, infrastructure, livelihoods [6,10,11]. Some projected impacts of climate change on Bangladesh are summarised below:

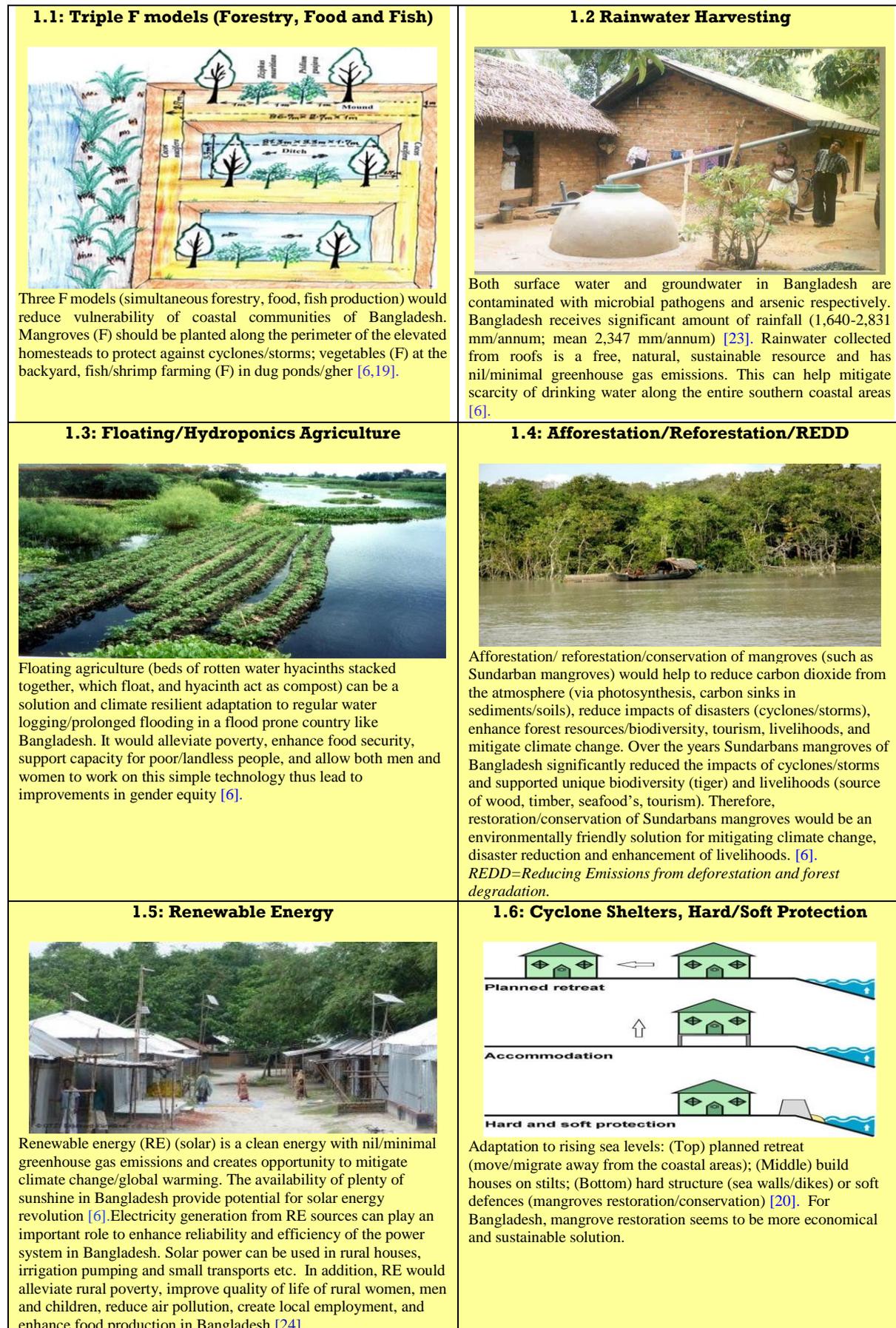
- Increasing flooding of low lying coastal areas (a 1.5 m of SLR would flood 16% of land and affect 18 million people [12].
- Loss of biodiversity (a 28 cm SLR will cause a decline of 96% tiger habitat in the Sundarban mangroves) [13]; drowning and bleaching of corals in the lone St Martins Coral Island [6,14]; loss and shifting of natural breeding ground of iconic fish- the Gangetic major carps in the Halda River, Chittagong [15].
- Salinization of rice lands in the coastal areas [6]
- Negative effects on coastal agriculture, freshwater aquaculture, surface and groundwater (due to salt water intrusion/chloride contamination) [6,14].
- Increased cholera outbreak (cholera bacterium survives longer in saline water), and breeding of salinity-tolerant mosquitoes [14].
- Loss of tourism, recreation in the Sundarbans and St Martins Coral Island (due to loss of biodiversity) [14].
- Displacement of 27 million people due to SLR by 2050 [16].
- Damage to coastal infrastructure/assets such as roads, schools, mosques, temples, airports, sea ports, and tourist places (SLR) [14].

03: Actions and programs

To reduce impacts of climate change on Bangladesh, a number of climate resilient/climate smart **Adaptation** (*adjustment/actions to reduce vulnerability and exploit beneficial opportunities*) and **Mitigation** (*reduce or enhance sinking of greenhouse gases (GHGs)- CO₂, CH₄, N₂O*) measures would be required. These should include:

- Conserving species with higher genetic diversity; conserving wetlands/mangrove habitats (which are biodiversity 'hot spots', and act as major carbon sinks); removing barriers and assist in migration of species; seed banking [17,18].
- Use/promote climate resilient crops (salinity/drought/flood tolerant, pest/disease resistant crop varieties); fast growing crops/fish [6,21]; shifting in cropping patterns/shifting in sowing dates/transplantation dates/harvesting dates [10]; no-tillage agriculture, reducing emissions of methane (CH₄) from rice cultivation; nutrient/manure management (to reduce N₂O emissions); use of renewable energy in irrigation pumping; promoting agroforestry; triple F models (forestry, food and fish production) [19; Figure 1.1]; rainwater harvesting [6; Figure 1.2]; floating agriculture [6; Figure 1.3]; brackish water fish/prawn aquaculture (in SLR areas); energy efficient aquaculture; diversification [6].
- Promotion of low-water-use toilets (3–5 liters capacity), ecological sanitation approaches (ecological toilet/Ecosan toilets) to reduce greenhouse gas emissions [22].
- Afforestation/reforestation/REDD [6; Figure 1.4]; investment in renewable energy/clean energy [Figure 1.5] and energy efficiency, green buildings (building codes- installation of energy and water efficient appliances in new and old buildings, low/zero carbon homes) [6,8].
- Impose some sort of carbon pollution tax (fuel levy/carbon tax/emissions trading scheme) [8] and behaviour change programs [6].
- Build cyclone shelters (Figure 1.6), improved early warning systems, new designs for cyclone-resistant homes/storm-proofed/wind resistant huts [8].
- Capacity building of communities (women & men); disaster preparedness/disaster risk management; social protection; climate resilience funds/insurance; awareness, education and research on climate change.

Figure 1: Examples of climate change adaptation and mitigation models for Bangladesh



04: Conclusion

Climate change will impact Bangladesh very severely, being economically poor; it has very limited financial resources. Besides local forces do not have the skills/technology to adapt to climate change efficiently and effectively. Therefore, Firstly, Bangladesh needs to **Act Now** to reduce impacts of climate change on agriculture/fisheries/ecosystems/biodiversity on which majority of people depends for food, water and livelihoods. Some of the adaptation and mitigation models proposed in Figures 1.1-1.6 are simple, low-carbon/low-cost technology, easily adaptable to Bangladesh. Secondly, climate change is a crisis of commons; therefore, Bangladesh would need to **Act Together** and work unitedly to reduce global emissions of GHGs and to keep global warming < 2°C. Thirdly/lastly, Bangladesh would have to **Act Differently** to build infrastructure/assets, and shift cropping patterns so that the country can withstand new climatic conditions and transit towards low emissions, climate change and disaster resilient development for the foreseeable future while preserving ecosystems.

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Image sources:

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