



Sea level rise, natural disasters and threats to human security in Bangladesh

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Scenario of global warming and sea level rise under alternative assumption of GHG emission

GHG emission	global warming by year (°C)			Sea level rise (cm)		
	2020	2050	2100	2020	2050	2100
Low	0.7	1.2	2.2	8	15	31
Business as usual	1.1	1.7	3.3	18	30	66
High	1.5	2.5	4.9	29	48	110

Source: IPCC

Effect on Bangladesh

- The projected sea level rise poses a significant threat to human security in Bangladesh
- The country is a densely settled delta with low elevation flat land
- It has 710 km long coast to the Bay of Bengal
- One meter sea level rise will inundate about 17.5% of the land mass, and affect livelihoods of 15 million people

Socio-economic progress achieved

- Reduction in population growth from 3% to 1.4% per year
- Acceleration of GNP growth from 4% during 1970-90 to over 6.0% during 2000-2008
- Growth in food production faster than population since 1990
- Reduction in poverty from 70% at independence to 40% in 2005
- Respectable progress in social indicators, such as reduction in infant mortality, achieving gender parity in primary and secondary education, and improvement in nutritional status

Key development challenges

- Despite notable progress in fertility reduction, population is still growing at 2.0 million every year
- A growth in demand of 0.5 million tons of staple food is a constant threat to sustaining food security
- Generating productive employment for 1.5 million new entrants in the labor force is a daunting challenge for policy makers
- Massive investment needed in health and education sectors to improve the quality of the vast human resources, and for development of physical infrastructure to encourage investment from the private sector
- Broadening the base for economic growth, to reduce the risk of dependence on few activities – rice in agriculture, readymade garments in manufacturing and export sectors, and informal trade in services, and exports of unskilled labour

Outline of presentation

- Natural disasters Bangladesh already faces
- Further threat to human security posed by sea level rise
- Adaptation options of people that the government and international community must support to develop resilience

Natural disasters



Increased frequency of floods

- Bangladesh is situated on deltas of large rivers flowing from the Himalayas
- The country is sloping gently from north to south, meeting the Bay of Bengal
- Three major rivers and their numerous tributaries carry water from the catchments of the Himalayas
- One third of the country is flooded at a depth of over 30cm during the monsoon season in a normal year
- When the rivers rise at the same time and drainage to the sea is impeded by high tides, the country suffers from devastating floods with inundation of 50 to 70% of the land area
- Since independence in 1971 Bangladesh experienced such devastating floods in 1974, 1987, 1988, 1998, 2004, and 2007
- Floods are becoming more frequent allegedly due to climate change

Drought is not a serious problem any more

- Late onset of monsoon and long dry spells affect crop production during the rainy season. Climate change has made monsoons more erratic
- Substantial loss of crop production was reported during droughts of 1973, 1979, 1981 and 1984
- But losses from drought have been substantially reduced due to change in cropping system and massive development of ground water irrigation
- About 1.3 million small scale privately owned tube wells now operate to irrigate dry season boro rice which now accounts for 55% of annual production of staple food
- The tube wells are used for supplementary irrigation during dry spells
- The melting of glaciers in the Himalayas might increase the intensity and severity of drought in the long run. Reduced recharge of aquifers will affect the capacity to manage droughts with supplementary irrigation

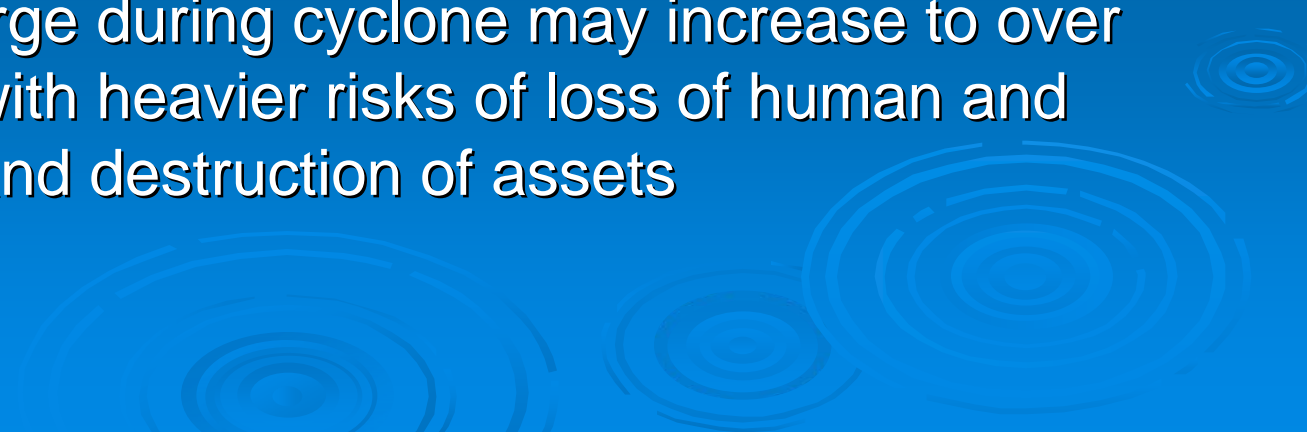
Cyclone is a localized but more devastating disaster

- The coastal zone covers 19 of the 64 districts, and accounts for 32% of the landmass and 28% of the population in the country
- The population density in the coastal zone is about 12% lower than the country average; and only half in the directly exposed zone
- Severe cyclonic storms and tidal surges take heavy tolls on human lives, infrastructure, and livelihoods
- The devastation caused by three major cyclones in 1970, 1991 and 2007 are still vivid in the memory of the present generation
- The 1970 cyclone caused death of 500,000 people, and the 1991 cyclone took a toll of another 139,000 lives
- The loss of human lives caused by last year's cyclone was less (about 4000), but it affected nine million people and destroyed crops in about 2.5 million ha of land

People have developed resilience against natural disasters

- With frequent exposure to natural disasters, people have developed resilience with learning of how to cope with them
- The government, NGOs, and the civil society have demonstrated greater effectiveness in managing relief and rehabilitation efforts
- Farmers in the severe flood affected zones have changed land use and cropping patterns that helped minimize loss of crops
- An improved system of cyclone warnings and building of cyclone shelters have demonstrated positive outcome during the 2007 cyclone
- The floods and cyclones now cause more damage to infrastructures such as house, factories, roads, railway tracks, industrial and business capital and educational and health institutions

Climate change will increase the frequency and severity of natural disasters

- Rising sea level will impede drainage of water from the Himalayan terrain southwards
 - The feedback effect can cause penetration of heavier floods further inland
 - The storm surge during cyclone may increase to over nine meters with heavier risks of loss of human and animal lives and destruction of assets
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Threats to human security



The Sea level rise will aggravate the growing trend towards landlessness

- Bangladesh is an extreme land scarce country
- The cultivable land has been declining by one percent per year since early 1980s due to erosion of river banks and increased use of land for habitation, commercial establishments and infrastructure
- A third of the rural households are landless, and 55% have less than 0.2 ha
- Number of farms operating over two ha has declined from 10% in 1983 to only two percent in 2005
- The average farm size has declined from 0.89 ha in 1983 to 0.6 ha in 2005
- A one meter sea level rise will inundate 30,000 km² area and will make an additional 15 million people landless who might become “environmental refugees”

Achieving and sustaining food security will become more difficult

- The sea level rise will affect food and agricultural production by reducing cultivable land, increasing the intensity of saline water intrusion, and higher depth of tidal fluctuations
- Nearly one million ha of land in the coast suffer from soil and water salinity which inhibits adoption of improved varieties of rice
- In the coastal districts farmers still grow mostly traditional varieties and keep the land fallow during the dry season due to salinity and an exploitative tenancy system
- The central coast (Barisal region) was once the food basket of the country, but has become a food deficit region due to continued pressure of population on fragile land resources
- Sea level rise will further aggravate unfavorable growing conditions for most agricultural crops

Uncertain outcome for fisheries

- Mixed impact on fisheries, a major source of livelihoods for low-income households in the coastal region
- Inundated fields and expansion of estuaries may increase fish habitat
- Shrimp farming in brackish water has indeed expanded from 1,330 ha in 1975 to 116,000 ha in 2004
- Pond aquaculture is much more profitable than rice farming and is an important source of foreign exchange earnings
- But shrimp farming has allegedly caused damage to environment and growing socio-economic inequality in the region
- High tidal surge may flood fish and shrimp ponds, and might make inland fisheries a more risky venture

Increased risk of health hazards

- Lack of pure drinking water is already a health problem in the coast
- Use of tube wells as a source of drinking water is rare in the region because of salt-affected aquifer
- People usually use ponds as a source of drinking water
- The ponds get contaminated with fallen twigs and leaves of trees during high winds
- Outbreak of diarrhea and cholera is a major health risk after every cyclone, because of people drinking contaminated water from ponds
- Increased frequency of depressions, strong winds and cyclones will aggravate the problem

Loss of biodiversity

- The Sundarban, one of the largest mangrove forests in the world is home to many unique species of plants, and is rich in biodiversity
- Sea level rise will cause increasing salt concentration in the soil which might change the habitat pattern in the forest and increase disease pressure
- Aquatic organisms might migrate inward because of increased salinity
- Some fear that the Sunderban will be destroyed by inundation of sea water causing great loss to biodiversity

Adaptation options to develop resilience against sea level rise



Anticipated adaptation strategy

As the sea level will rise gradually, people might opt for the following adaptation strategies:

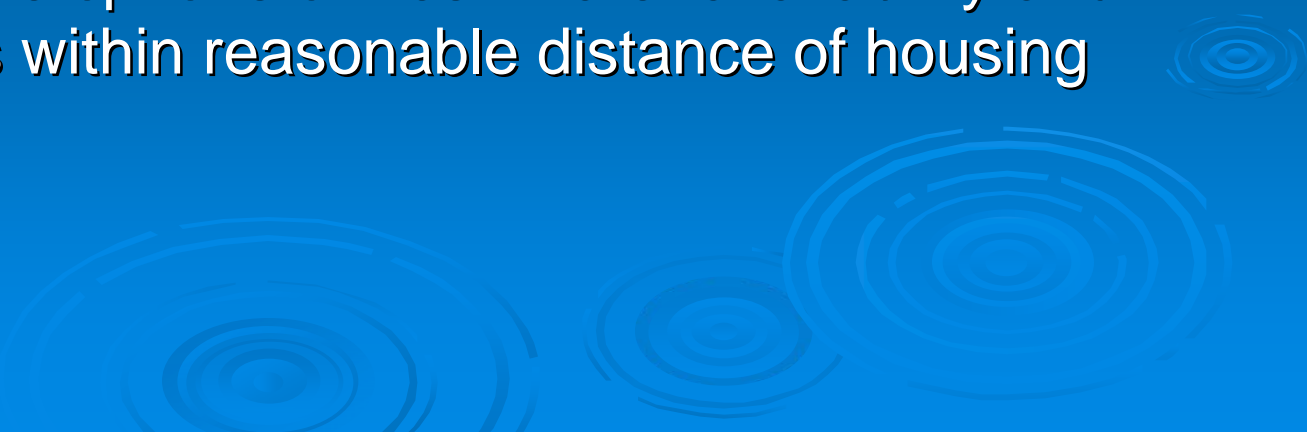
- Raise homestead by land fillings
- Take up fisheries and boat transport as means of livelihoods
- Shift from pond aquaculture to marine and capture fisheries
- Adopt salt-tolerant crops and tree species, if available
- Use boats as a means of transport instead of road transport

The government and the international community must come forward to assist people in their efforts to develop resilience against sea level rise

Development interventions

- Identify patches of high land and reserve them for cluster township with compact housing
- Promote public works programmes in the dry season to raise the height of such land for housing purposes
- Provide housing loans on easy terms for construction of durable housing on raised pillars
- Undertake regular maintenance of polders constructed during the 1960s and 70s, gradually raise the heights of the dykes, and build new dykes in unprotected areas

Development interventions needed

- Build adequate number of multi-purpose cyclone shelters for comprehensive coverage of the entire coastal region
 - Support R&D institutions to develop and extend saline tolerant species of crops
 - Initiate action research on indigenous knowledge of coping mechanism, alternative livelihood options, and context specific needs
 - Explore feasible options of fresh water availability and install facilities within reasonable distance of housing settlements
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Public-private sector partnerships

- NGOs have been playing an important role in disaster management
- The big NGOs engaged in providing microfinance have numerous offices with a cadre of educated field workers
- This huge infrastructure could be effectively used to support public efforts at disaster preparedness and management
- NGOs can be mobilized to raise awareness of the people about climate change and adaptation strategies, activate the early warning system at times of need, and to undertake relief and rehabilitation measures

Conclusion

- Bangladesh is a resource poor country. It will be difficult for the country to address this huge environmental problem on its own
- The international community and development partners must assist the government to develop a SMART action plan to address the impending threat to human security caused by sea level rise and provide financial support to implement such a plan
- The development assistance to address this problem should be additional to the resource that country has been receiving to tackle the other priority development problems