

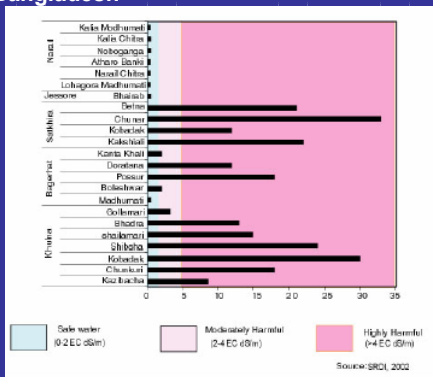
## Introduction

Bangladesh is perspiring with different types of natural disasters. In the foreseeable future, the country is likely to be affected by the biggest ever, long lasting and global scale human induced disaster- the climate change and sea level rise (CCSLR). Bangladesh is thought to be one of the most vulnerable countries of the world to CCSLR. There are a number of environmental issues and problems those are hindering development of Bangladesh. Salinity is a current problem which is expected to be exacerbated by climate change and sea-level rise. Salinity intrusion due to reduction of freshwater flow from upstream, salinisation of groundwater and fluctuation of soil salinity are major concern of Bangladesh.

## Cause of Salinity Expansion

- Salinity is expected to be exacerbated by climate change and sea-level rise.
- Decrease of upstream flow due to *Farrakka* Barrage in the upstream of the Ganges River.
- Horizontal Expansion of shrimp farms
- CEP (Coastal Embankment Project), implemented during the 1960s

Figure: Salinity Context In Southwest Bangladesh



(Ref: N. Mohammad, Addressing Salinity to improve the well-being of vulnerable people in the southwest, RVCC Project, IDEAL Bangladesh)

## Salinity Intrusion in the Coastal Rivers

As sea level continues to raise the associated effects of permanent inundation is likely to increase the salinity near coastal areas. A recent study shows that 5 ppt saline front will penetrate about 40 km inland for SLR of 88 cm which is going to affect the only fresh-water pocket of the *Tetulia* River

in *Meghna* Estuary as shown in Figure A. A big chunk of the fresh- water zone that will be disappearing due to sea level rise near to the estuary will have a far reaching effect on the country's ecology and will extinct some of its endangered

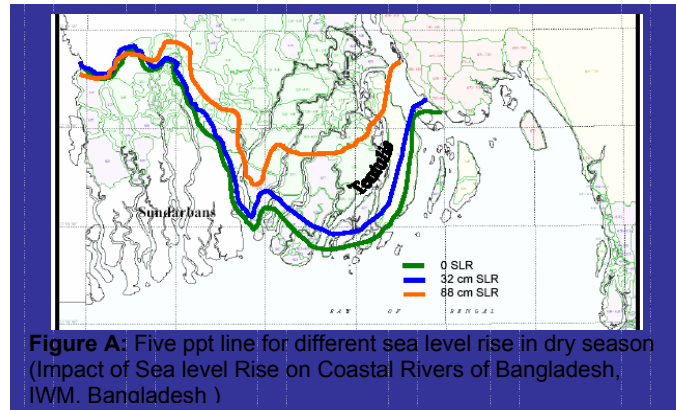


Figure A: Five ppt line for different sea level rise in dry season (Impact of Sea level Rise on Coastal Rivers of Bangladesh, IWM, Bangladesh)

species (marked by IUCN) for ever.

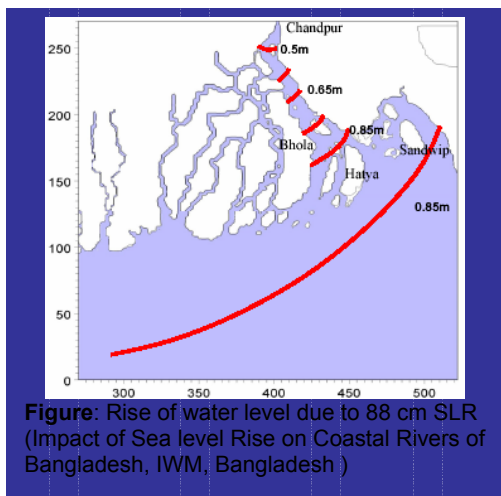
## Ingression of Soil Salinity

Salinity ingress also causes an increase in soil salinity, especially when farmers irrigate their lands with slightly saline surface water at the beginning of the low flow period. SRDI (1997) reported that, soil salinity levels south of Khulna and Bagerhat towns ranged between 8 to 15 dS/m during the low flow season. It is also reported that, several sub-districts (such as Kachua, Mollahat, and Fultali) south of the Sundarbans, " known to be non-saline in the pre-Farakka period " have began to develop soil salinity during the low flow seasons of 1980s. The anticipated results of salinity ingress will be, at a minimum, of the same order for climate change induced low flow regime compared to similar effects shown by deliberate withdrawal of flows at Farakka barrage.

The anticipated sea level rise would produce salinity impacts in three fronts: surface water, groundwater and soil. Increased soil salinity due to climate change would significantly reduce food grain production. Even at present, some parts of coastal lands are not being utilized for crop production, mostly due to soil salinity; and this situation would aggravate further under a climate change scenario. A modeling exercise has indicated that, under the changed climate conditions, the index of aridity would increase in winter (Huq, et al. eds.1999). Consequently, higher rates of capillary action from an increased rate of topsoil desiccation would accentuate the salinity problem.

## Sea Level Rise and Salinity Intrusion

A direct consequence of sea level rise would be intrusion of salinity with tide through the rivers and estuaries. It would be more acute in the dry season, especially when freshwater flows from rivers would diminish. According to an estimate of the Master Plan Organization, about 14,000 sq km of coastal and offshore areas have saline soils and are susceptible to tidal flooding. If some 16,000 sq km of coastal land is lost due to a 45 cm rise in sea level, the salinity front would be pushed further inland. The present interface between freshwater and saline water lies around 120 to 160



**Figure:** Rise of water level due to 88 cm SLR (Impact of Sea level Rise on Coastal Rivers of Bangladesh, IWM, Bangladesh)

km inland in the southwest, and this could well be pushed northward as far as central Jessore region in the event of a sea level rise (BIDS/ADB 1994).

### Impacts of Salinity

- 10% more land (relative to 1990) will be saline-affected and intensity will be increased by 10 %;
- The Figure is 45 % relative with 1990 ;
- Decreases availability/productivity of agricultural land;
- Increased food insecurity as naturally-growing species disappear;
- Serious scarcity of safe drinking water;
- Loss of biodiversity, e.g. decrease in tree species and freshwater fish;
- Creates socioeconomic problems, generally women are more vulnerable.

(Ref: N. Mohammad, *Addressing Salinity to improve the well-being of vulnerable people in the southwest, RVCC Project, IDEAL Bangladesh*).

In the southwest as well as in the estuary, salinity levels are likely to change in the polders due to sea level rise and increased rainfall. The construction of these polders has been started in the 1960s under the Coastal Embankment Project with the expressed objective of flood protection and prevention of saline water intrusion. Since sea level rise would enhance saline incursion, while increased rainfall would dilute the water to reduce salinity, the net effect on polders and other associated croplands is uncertain. Therefore, several studies indicate that the coastal zone vulnerability would be acute due to the combined effects of climate change, sea level rise, subsidence, and changes of upstream river discharge, cyclone and coastal embankments

### How Salinity Threaten Productivity

**Threat to Fisheries Sub Sector:** The CCLSR is likely to affect the fisheries in Bangladesh. Increased water temperature and salinity may not be suitable for many species. Sea level rise, by reducing the fresh water fishing

area, will cause reduction in fish production. Pond culture in the coastal area will be affected by intrusion of salt water into ponds, unless embankments are made around them. Shrimp farming in the coastal area is a lucrative business. Increase in salinity is likely to jeopardize the shrimp farming. For the last few decades, more and more attention is being given to sea fish and brackish water fisheries. The CCLSR may arrest this trend.

### An Example of Salinity intrusion

There is clear evidence of increased saline intrusion in the coastal zones. For example in the coastal city of Khulna the main power station needs to collect fresh water to cool its boilers by sending a barge upstream to get freshwater. Over the last one decade the barge has to go further and further upstream to get suitably fresh water for the purpose. While there are other factors behind the salinity intrusion (such as the withdrawal of water at Farakka by India to divert water flows to Calcutta), the trend towards salinization in the coastal zone is very clear. (NAPA Final Report November 2005, MoEF, GOB)

**Threat to Agriculture Production:** Effect of saline water intrusion in the estuaries and into the groundwater would be enhanced by low river flow, sea level rise and subsidence. The adverse effects of saline water intrusion will be significant on coastal agriculture and the availability of fresh water for public and industrial water supply will fall.

Agriculture is a major sector of Bangladesh's economy and the coastal area of Bangladesh is very fertile for growing rice. Increase in salinity intrusion and increase in soil salinity will have serious negative impacts on agriculture. The presently practised rice varieties may not be able to withstand increased salinity. The food production does not seem to have a better future in the event of a climate change. In Bangladesh, rice production may fall by 10 % and wheat by 30 % by 2050 (Climate change in Asia 'too alarming to contemplate'-report, IPCC, 2007).

### What needs to do

- Emphasize salinity issue in Integrated Coastal Zone Management (ICZM) Plan
- More study/ scientific research for innovating introducing salinity tolerant crop varieties.
  - Incorporate drinking water crisis due to salinity in the National Water Policy
  - Raise global awareness of the need to address vulnerability to salinity as sea-level is rising
  - Upstream flow must be increased

**Challenges:** Of the several factors that affect rice production, abiotic stresses limit rice yields in 9 million hectares in central and inland areas of the country. In India, water available for agriculture has fallen by nearly 10% during the last decade. While in Bangladesh, about 2.8 million hectares of coastal soil has become saline due to heavy withdrawal of surface and groundwater for irrigation and intrusion of seawater. The total saline area forms a third of the 9 million hectares of total national cultivated area in Bangladesh. In addition, drought has adversely affected rice in all three cropping seasons. (Agricultural Biotechnology Support Project-II South Asia).

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