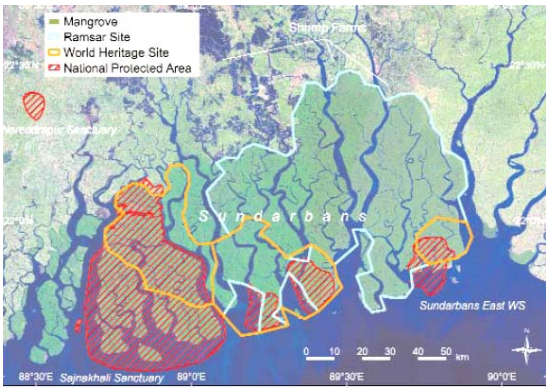
Salinity threatens the World Heritage
The *Sundarban* of Bangladesh

PRDI 3
Climate Campaign Brief

Introduction

The coastal area contains several ecosystems those have important conservation values. In the coastal areas of Bangladesh mangrove forest is considered as a critically important ecosystem, The *Sundarbans*, the world's largest stretch of mangrove ecosystem, lies in the South –Western part of Bangladesh, part of which has been declared a World Heritage Site, whereas coral ecosystems are found around St Martin's Island. Research indicates a network of coastal defences, especially a belt of mangroves, is capable of absorbing 30 to 40 per cent of the total force of a tsunami or typhoon and ensuing waves before they swirl over inhabited areas by the shore. Healthy mangroves not only protect coastal communities from the sea, but they are also profitable ecosystems in themselves. Mangroves act as nurseries for a wide range of species: fish and shrimp spawn and mature in mangrove ecosystems before moving into deep and open waters. As such, mangroves play an important role in the ecology that supports artisan fisheries of coastal communities.

Although mangrove ecosystems have tremendous value for coastal communities and associated species, they are being destroyed at alarming rates. Over the last 50 years, about one-third of the world's mangrove forests have been lost. Human threats to mangroves include the overexploitation of forest resources by local communities, conversion into large scale development such as agriculture, forestry, salt extraction, urban development and infrastructure, and diversion of freshwater for irrigation (UNEP 1994). The greatest human threat to mangroves is the establishment of shrimp aquaculture ponds. Because mangroves are often viewed as wastelands, many developing countries are replacing these forests with agricultural land and/or shrimp aquaculture production. Shrimp aquaculture accounts for the



loss of 20 to 50 percent of mangroves worldwide.

In Bangladesh the natural environment and coastal ecosystem of this Biosphere Reserve and World Heritage Site is also under threat of physical disaster due to unscientific and excessive human

interference. In the 1990s, the 'Shrimp Culture project' in the southern part of Bangladesh resulted complete destruction of '*Chokoria Sundarban*' the second largest mangrove patch of Bangladesh of about 21020.45 acre.

In addition to these anthropogenic threats, mangroves are also threatened by the impact of global climate change. Global climate change and concomitant effects such as changes in temperature and CO_2, altered precipitation patterns, storminess, and sea-level rise as observed over recent decades, are due primarily to anthropogenic activities. Most of the observed warming over the last 50 years is attributed to an increase in greenhouse gas concentrations in the atmosphere.

Rising sea level threatens to inundate low-lying areas and offshore islands in the country's coastal belt and destroy ecosystems such as mangroves and wetlands that protect the coast against storms and surges. Sea level rose between four and eight inches in the past 100 years while, according to the scientists, it can rise between 4 inches and 36 inches over the next 100 years. The *Sunderbans*, has been faced with the threat of going under water because of global warming. (The New Nation Mar 07, 2007)

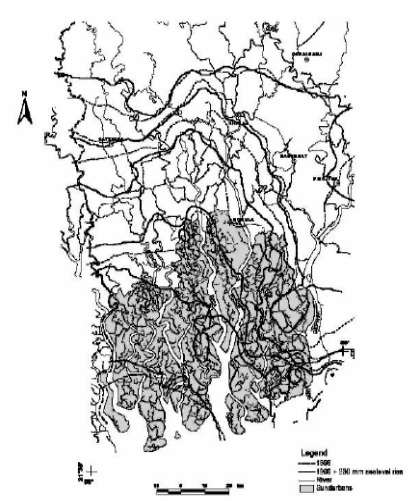
Impact on mangrove bio-diversity

The rise in sea level and availability of less fresh water particularly during winter when rainfall will be less will cause inland intrusion of saline water. As a result, many mangrove species, intolerant of increased salinity, may be threatened. In addition, the highly dense human settlements just outside the mangrove area will restrict the migration of the mangrove areas to less saline area. The shrinking of the mangrove areas will have effect on the country's economy.

Many industries which depend on raw materials from the *Sundarbans* will be threatened with closure and create large unemployment.

Climate change is real a threat to ecosystem and bio-diversity. The *Sundarbans* may be completely inundated by a 1m rise in sea level. Increase in temperature and sea level rise will seriously affect the *Sundarbans*' ecosystem and bio-diversity. The area may shrink and many flora and fauna species may face extinction. Water stress during winter and excess water during summer will have effects on ecosystem and bio-diversity. A wide range of mammals, birds, amphibians, reptiles, crustaceans, and above all the Royal Bengal Tiger will face extinction. The ecosystem of the only coral island of the St. Martin's island may also be affected. The coastal length covered by mangrove forest will be exposed to cyclones and storm surges.

Fig: Salinity ingress in the *Sundarbans* under 23 cm level rise



(Ref:Development and Climate Change in Bangladesh: Focus on Coastal Flooding and the Sundarbans, OECD 2003)

Increased salt water intrusion is considered as one of the causes of top dying of Sundari trees. The impact of sea level rise will further intrude the saline water to landward. Sea level rise of 32 cm will intrude 10 to 20 ppt salinity level more in the Sundrabans. The rate of salt water intrusion will also affect the ability of the ecosystem to adapt. (Ref. Impact of Sea level Rise on Coastal Rivers of Bangladesh, IWM, Bangladesh)

Top dying of *Sundri* tree (*Heritiera fomes*) and salinity increase due to lack of freshwater flush during the dry months. These are causing the negative effects in the ecology of *Sundarbans*. The ODA inventory report presented a table showing number of stem of *H. fomes* (*Sundari*)/ha per 5 cm dbh classes which reveals that about 0.45 million (114 trees/ha on 395.514 ha) tress are already affected by top dying (Mangroves of the *Sundarbans*: Vol. II: Bangladesh).

It was found that the *Sundarbans* mangrove forest would be the most severely affected by climate change. Due to a combination of high evapo-transpiration and low flow in winter, the salinity of the soil would increase. As a result the growth of freshwater loving species would be severely affected. Eventually the species offering dense canopy cover would be replaced by non-woody shrubs and bushes, while the overall forest productivity would decline significantly. The degradation of forest quality might cause a gradual depletion of rich diversity of the forest flora and fauna of the *Sundarbans* ecosystem (Ahmad et al., 1999).

Impact on Mangrove Ecosystem

In recognition of the forest's significance in biodiversity wealth, UNESCO had declared three wildlife sanctuaries in the southern part of the forest (total area: 1.397 sq km) as World Heritage Sites in 1997. The *Sundarbans* is divided into three distinct ecological zones and the tree species vary accordingly:

***Oligohaline* zone (relatively freshwater):** with salinity level less than 6,250 micromhos, and the dominant species is *Sundari* (*Heritiera fomes*) – the most valuable timber in the forest accounting for over 60 percent of the total volume of commercial timber.

***Mesohaline* zone (moderately saline)**: with salinity level between 6,250 and 12,500 micromhos, and the dominant species is *Gewa* (*Excoecaria agallocha*).

***Polyhaline* zone (saline) :** with salinity level exceeding 12,500 *micromhos*, and the dominant species is *Goran* (*Ceriops decandra*).

As a consequence of salinity penetration in the *Sundarbans*, majority of the *mesohaline* areas will be transformed into *polyhaline* areas, while *oligohaline* areas would be reduced to only a small pocket along the lower-Bales war river in the eastern part of the forest, says several research reports.

Therefore, a different environmental condition might be expected in the winter months with lesser freshwater supply in the rivers facilitating greater saline ingress into the *Sundarbans*. If the saline water moves front further inland, *Sundari* (the dominant species in the landward *oligohaline* zone) could be threatened. The existing *oligohaline* zone might even be completely transformed into *mesohaline* zone (Ahmed 1998, quoted in Huq et al. eds. 1999). Species in the two other ecological zones (*mesohaline* and *polyhaline*) would also suffer over time, as salinity increases. In other words commercially more valuable *Sundari* could be replaced by *Gewa* (now dominant in moderately saline waters), and *Gewa* by less valuable *Goran* (now dominant in saline waters). Under ideal plant succession conditions, species might migrate inland in response to advancing salinity. In addition, more than half a million people, dependent on forest products in the *Sundarbans*, would also be exposed to economic uncertainties.

Preliminary estimates suggested that, disappearance of *oligohaline* areas combined with decreasing *mesohaline* areas would result into over 50% loss of merchantable wood from the *Sundarbans* (Ahmed et al., 1998). Increase in salinity in the Indian side of the forest would have compounding effect to the existing poor productivity of the forest.

Recommendations

- Choosing 'soft' environmental reconstruction solutions that work with existing natural environmental features, such as creating mangrove buffer zones, or re-vegetating river banks with natural grass
- International efforts to protect this World Heritage, particularly facing of top dying of *Sundari* trees
- Periodic mapping of *Sundarbans* mangrove forests has to be carried out using the Remote Sensing and GIS technology to monitor the changes in the ecosystem.
- The conservation and management planning of the coastal areas should be based on proper understanding, analysis and assessment of the various complex geomorphologic, fluvial, oceanic and natural climatic characteristics of the whole area plus the unnatural influence by human interventions
- Action has to be taken for reforestation, restoration and development of the mangroves.
- Promotion of integrated conservation and management systems between mangroves and aquaculture
- Public education campaign is to be conducted to make local communities, the tourism industry and other sectors aware of the importance of mangroves.

Participatory Research and Development Initiative-PRDI
House 106/7, Monipuri Para, Tejgoan,
Dhaka 1215. Bangladesh
Email: doha_shams@hotmail.com