



Effects of Climatic Change on the Bio-Diversity of Indian Sunderban in West Bengal

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ABSTRACT

Sunderban is situated on the lower end of the Gangetic West Bengal, 22.00° N – 89.00° E, at an altitude 0-10 m above sea level and just south of Kolkata. Sunderban covers an area of 4262 sq. kms, where 70 percent is under saline water. Sunderban is a vast tract of forest and saltwater swamp forming the lower part of the Ganges Delta, extending about 160 miles (260 km) along the Bay of Bengal from the Hooghly River Estuary (India) to the Meghan River Estuary in Bangladesh. Present study was undertaken on climate change and its effect on faunal biodiversity in some selected parts of Indian Sunderban. The study revealed that due to change in climate, the faunal distribution has been affected with many others factors. Details study in this line is further required to save the Sunderban.

Introduction

The Sunderban, covering about one million ha in the delta of the rivers Ganga, Brahmaputra and Meghna met the point where it merges with the Bay of Bengal, is the single largest block of tidal halophytic mangrove forest in the World shared between Bangladesh (62%) and India (38%), which supports a large, biodiversity rich unique ecosystem. With its array of trees and wildlife the forest is a showpiece of natural history. It is also a centre of economics activities, such as extraction of timber, fishing and collection of honey. The area of Sunderban experiences a subtropical monsoonal climate with an annual rainfall of 1600-1800 mm and severe cyclonic storms. Enormous amount of sediment carried by the three rivers contribute to its expansion and dynamics. Salinity gradients change over a wide range of spatial and temporal scale. Interestingly, the Bangladesh and Indian portion of the forest are listed in the UNESCO world heritage list (1974) separately as the Sunderban i.e. *the Beautiful Forest* and Sunderban National Park (1984) respectively, though they are very simple part of the forest. The Sunderban is intersected by complex section of tidal water ways, mudflats and small islands of salt-tolerant mangrove forests, and presents an excellent example of ongoing ecological processes. The area is known for its wide range of flora and fauna. The most famous among these, the man-eating Royal Bengal Tigers, but numerous species of birds, spotted deers, crocodiles and snakes also inhabit. The mangroves have been extensively exploited over centuries for timber, fish and prawn, honey, fodder or converted for paddy and aquaculture and now it faces the serious challenge for its existence. Javan Rhino, wild buffalo, hog deer, and barking deer are already extinct from this area. While conservation efforts have focused on wild life, particularly tiger, through creation of several sanctuaries and a biosphere reserve, reduced fresh water inflows are serious threat as salinity is rising. *Heritiera formos* (from which Sunderban derives its name), *Nypa fruticans* and declining rapidly. Other threats to biodiversity come from the growing human population, pollution and a rise in sea level.

Biodiversity of Sundarban

The Sundarban is the largest contiguous block of mangrove forest remaining in the present day world and a large unique mangrove ecosystem, recognized as a site of national and international importance for conservation of biodiversity. This forest is an independent "Biom", enriched with different biodiversities along with a great variety of wild life. Besides dolphins and porpoises, Sundarban mangroves are habitats

of many rare and endangered animals (*Batagur baska*, *Pelechelys bibroni*, *Chelonia mydas*), especially it is the unique natural habitat of the world famous Royal Bengal Tiger (*Panthera tigris*), spectacular spotted deer (*Axix axix*), jungle fowl (*Gallus sp.*) and rhesus monkey (*Macaca mulata*). The forest has a unique biota comprising 334 species of plants, 49 species of mammals, as many as 400 species of fish, 315 species of birds and 53 species of reptiles; besides numerous species of phytoplankton, fungi, bacteria, zooplankton, benthic invertebrates, molluscs, reptiles, amphibian and mammals. Species composition and community structure varies east to west, and along the hydrological and salinity gradients. Ecologically, the forest is particularly important as a barrier to cyclones, tidal upsurges, etc. It is also acting as a huge sink of unlimited capacity for absorbing CO₂ and other pollutants from air and water which makes the surrounding environment free from pollution.

The mangroves of the Sundarban are unique when compared to non-deltaic coastal mangrove forest. Unlike the latter, the *Rhizophoraceae* are of only minor importance and the prime species are sundri *Heritiera fomes*, from which the Sundarban takes its name, and gewa *Excoecaria agallocha*. The reason for this difference is the large freshwater influence in the north-eastern part and the elevated level of the ground surface.

The Sundarban is the only remaining habitat in the lower Bengal Basin for a variety of fauna species. The presence of 49 mammal species has been documented. Of these, no less than five spectacular species, namely

Javan rhinoceros Rhinoceros sondaicus (CR), water buffalo *Bubalus bubalis* (EN), swamp deer *Cervus duvauceli* (VU), gaur *Bos frontalis* (VU) and probably hog deer *Axis porcinus* (LR) have become locally extirpated since the beginning of this century. The Sundarbans of Bangladesh and India support one of the largest populations of tiger *Panthera tigris* (EN), with an estimated approximately 700 (2004). These tigers are well-known for the substantial number of people they kill; estimates range from twenty and eighty people per year. They are the only man-eating tigers left in the world, though they are not the only tigers who live in close proximity to humans.

The varied and colorful bird-life to be seen along its waterways is one of the Sundarbans' greatest attractions. A total

315 species have been recorded, including about 95 species of waterfowl and 38 species of raptors.

Some 53 reptile species and eight of amphibians have been recorded and of these, mugger *Crocodylus palustris* (VU) is now extinct, probably as a result of past over-exploitation, although it still occurs in at least one location nearby. Estuarine crocodile *C. porosus* still survives but its numbers have been greatly depleted through hunting and trapping for skins.

Four species of marine turtle have been recorded from the area, olive ridley *Lepidochelys olivacea* (EN) being the most abundant. Green turtle *Chelonia mydas* (EN) is rare due to excessive fishing, while loggerhead *Caretta caretta* (EN) and hawksbill *Eretmochelys imbricata* (CR) are not common although there have been some reported on the beaches (Husain and Acharya, 1994).

Ecosystem services in Indian Sunderban

Like any ecosystem services Indian Sunderban mangrove forest rendering ecosystem services a) Direct service, b) Indirect services. Mitigation of natural calamities such as cyclone, Aila, Tsunami, sea surges, strong tidal flow, prevention of coastal erosion, soil accretion resulting in expansion of islands, etc. Ecosystem services, however, get setback when destruction of forest continues. The more forest is reduced, the less the reclaimed areas become fertile. Litter fall from mangrove vegetation, decomposition of litter and thus nutrient release into soil and water, all are cumulative effects of ecosystem services, which diminish with loss of (i) decomposition of litter, release of nutrients, processing and acquisition of nutrients, increase of soil fertility, retention of soil moisture, prevention of salt encrusted layer through leaching of soil surface, waste assimilation, pollination, biological control, pollution control, regulation of atmospheric gases and composition, regulation of climate and water, waste water treatment, lowering the Biological Oxygen Demand (BOD), possibly performing bio remediation. (ii) Provision of breeding, hatching, spawning, rearing of large number of aquatic organisms, including economically important fishes, Vegetation. Even maintaining biodiversity requires reasonable analysis of and protection of ecosystem services. One is integral to another. The mangrove ecosystem alone is a quite productive as measured to yielding as 350-500g C/m²/yr that provide a substantial contribution to the food chain that leads to keep substantiality of coastal fisheries. Dominated forest area of Indian Sunderban has been assessed to produce about 212 tons/ha of biomass. An estimate has shown that a full grown mangrove stand of 10 years old may add the following amount of nutrient through litter decomposition: N:46.6 kg /ha, K:25.6 kg/ha/yr, Mg:34.1kg/ha/yr, Ca:99.3 kg/ha/yr and Na:31.8 kg/ha/yr

Why biodiversity in Sunderban is depleted?

Mangrove forests are one of the most productive and bio-diverse wetlands on earth. Yet, these unique coastal tropical forests are among the most threatened habitats in the world as experts' fear they may disappear more quickly than inland tropical rainforests because of lack of public notice. The Sunderban too is no exception. The threats to the Sunderban mangrove eco-system are arising partly due to biotic pressure from the surrounding environment and, partly due to human induced or natural changes in the upper catchments. These can be outlined as below:

- Anthropogenic impacts like reclamation, human encroachment and influence
- Geomorphic stress caused by the neo-tectonic tilting of the Bengal basin
- Recurrent coastal flooding due to climate change (global warming), changes in sea level (raise in sea level)
- Huge silt deposition, biodiversity loss and regeneration problems of obligate mangrove plants
- High salinity, low water table and acidity problem, loss of soil fertility, coastal erosion and a steep fall in fishery resources.
- Reduction in the periodicity and quantity of freshwater

reaching the mangrove environment due to diversion of freshwater in the upstream areas (especially due Farakka Barrage constructed by India) and change in course of main rivers

- Conversion of mangrove tracts for aquaculture and agriculture.
- Extension of other non-forestry land use into mangrove forest.
- Increasing demand for timber and fuel wood for consumption.
- Poaching of tiger, spotted deer, wild boar, marine turtles, horse shoe crab etc.
- Uncontrolled collection of prawn seedlings.
- Uncontrolled fishing in the water of Reserve Forests.
- Continuous trampling of river/creek banks by fishermen and prawn seed collectors.
- Pollution from both the landward and seaward sides through marine paints & hydrocarbons, usage of excessive pesticides & chemicals for agricultures & industries, exploitation of mineral gas and oil etc.
- Organizational and infrastructure deficiencies.
- Lack of public awareness.

Impact of Climate change has great importance on Bio-diversity of Sunderban:

Most mangrove forests are one of the productive and bio-diverse wetlands on earth. Yet, these unique coastal tropical forests are among the most threatened habitats in the world as experts' fear they may disappear more quickly than inland tropical rain forests because of lack of public notice. The Sunderban mangrove eco system are arising partly due to biotic pressure from the surrounding environment and, partly due to biotic pressure from surrounding environment and partly due to human induced and natural changes in the upper catchments. These can be outlined as **Anthropogenic impacts** like reclamation, human encroachment and influence, **Geomorphic stress** caused by neo-tectonic tilting of Bengal basin, **Recurrent coastal flooding** due to climatic change (global warming), changes the sea level (rise in sea level), huge silt deposition, biodiversity loss and regeneration problem of obligate mangrove plants, High salinity, low water table and acidity problem, loss of soil fertility, coastal erosion and steep fall in **fishery resources**.

Reduction in the periodicity and quantity of freshwater reaching the mangrove environment due to diversion of freshwater in the upstream areas (especially due to Farakka Barrage constructed by India) and change in course of main rivers. Conversion of mangrove tract for aquaculture and agriculture, extension of other non-forestry land use into mangrove forest increasing demand for timber and fuel wood for consumption, hunting of tiger, spotted deer, wild boar, marine turtle, horse crab etc., uncontrolled collection of prawn seedlings, uncontrolled fishing in the water of reserve forests, continuous trampling of river /creek banks by fishermen and prawn seed collectors, pollution from both the landward and seaward sides through marine paints and hydrocarbons, usage of excessive pesticides and chemicals for agricultures and industries, exploitation of mineral gas and oil etc, organizational deficiencies, lack of public awareness. A number of species like Javan Rhino (*Rhinoceros sondaicus*), water buffalo (*Bubalus bubalis*), Swamp deer (*Cervus duvauceli*), Gaur (*Bos gaurus*), hog deer (*Axis porcinus*), and marsh crocodile (*Crocodylus palustris*) become extinct during the last 100 years from Sunderban. The Royal Bengal Tiger is an inseparable part of legend attached to Sunderban. The mangrove forest is a rare habitat for this tiger species. But today they have been pushed due to habitat shrinkage. The tiger population estimate in the past 20 years remained in the range of 350 to 400, the largest discrete population of the species in a single tract of natural habitat in the world. But the preservation of Royal Bengal tiger is the most important challenge for the concerned for the protection of sunderban biodiversity. Incidental mortality due to diseases, illegal hunting and subtle changes in the Sunderban ecosystem poses a serious risk for the survival of the Royal Bengal tiger. Apart from that, the

interaction with the human in the area, particularly the killing of human by tiger, complicates the management of the area. IUCN has listed it as an endangered species in its Red Data Book.

Discussion:

The study has proved various anthropogenic mal-practices in coastal Sunderbans of India. This endangered ecosystem should need conservative use of its resources to attain sustainable development. It can be achieved through a proper Environmental Management plan which should be directed to

- To conserve aquatic resources, local population must be switch over to alternative sources of earning.
- Local Government should form Environmental Monitoring

Cell.

- Only eco-friendly practices of fishing should be adopted.
- Government of India should strictly take disciplinary action against violation of related rules in Sunderban.

Conclusion:

Survey into ecologically as well as economically resourceful area of Indian sunderbans should be finally concluded with conservative use of aquatic resources as the best way to achieve environmental sustainability in Sunderban. It must aim at ensuring protection,conservation and better management of sources which must not debar people from using these resources but aims at a particular pattern of use of resources so that these will neither be exhausted, nor destroyed.



Pneumatophore at mangrove plant



Estuarine ecosystem in Indian Sunderban



Fish seed collection by women fisher folks



Deer, another Faunal resource of Sunderban

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