



Short Review Paper

Changing Environmental Scenario of Sunderbans, India

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Abstract

Sunderbans, well-known for its mangroves ecosystem, occupies a vast area of 2108.11 sq. km as mentioned in the India State of Forest Report 2019. Mangrove forest area of the Sunderbans has been changing every year along with its other resources including floral and faunal community due to climate change, deforestation and human encroachment. Climatic change has a major impact on sea level rise and the rise of the sea level is observed quite much more at Sunderbans as a result of continuous natural subsidence of the lower part of the Ganges- Brahmaputra Delta (GBD) of which Sunderbans is a part of it. Saline water will gradually intrude into the coastal hinterland which will reduce the fresh water availability. Both water and soil get salinized with time. Production of crops, fruits and vegetables, even the medicinal plants occurred in and around the wetlands will be decreased. Fresh water fishes will be disappeared, although brackish water fish species will be produced more and more that leads to the conversion of fresh water aquaculture into the brackish water aquaculture. Luxuriant growth of mangroves will be stunted due to the adverse effects of increased salinity and humidity due to sea level rise. Reclamation and cultivation, thereon, has been accelerated in the Sunderbans that reduce the forest areas of the Sunderbans. Even the areas of the Sunderbans is going to be decreased by taking initiatives of the tourism hub project by the government in the tigers and crocodiles breeding ground. As a consequence of such environmental degradation, the forest areas of the Sunderbans has been changing year by year as computed by the Forest Survey of India.

Keywords: Past Human Habitation, Medicinal Plants, Molluscan shells, Brackish water fishes, Tourism hub, Mangrove Biome.

Introduction

The area of the Indian part of the Sunderbans is 9630sq km (calculated after imaginary Dampier - Hodges Line) out of total area of 25,500sq km (calculated after imaginary Dampier - Hodges Line) and the remaining 15870sq km covers areas of the Bangladesh Sunderbans. In the luxuriant forest of the Sunderbans, line of mangroves trembling and nodding their tops, still stand lasting, comparable with a poetic appeal, when tidal upsurge flashes its luxuriant canopy during tsunami or Aila-Sidr like super cyclonic storms. This scenic beauty, though devastating in nature, looks like a sky coloured long cloth with bluish border painted in an artist's canvass. Standing brave on the bank, in such a perishing moment, mangroves save not only the lives of their own affectionate like tiger, deer, boar, water monitor, monkeys or birds generation after generation, but keep island dwellers safe pacifying the intensity of forceful wind action and tidal upsurge caused by the super cyclonic storms and natural calamities. So, therefore, mangrove matters in the Sunderbans and that is to be supposed as the green wall covering the islands where human being as the inhabitants of such islands is to be considered as the central character. The author finds it much easier to see that man as a component of the mangrove ecosystem as because man enjoys the practical utility of such dynamic ecosystem surrounding them in various

ways. Man knows the mangroves as the production and protective media to the isolated islands of the Sunderbans standing in the remote areas far away from the mainland locality. Mangroves baffle soils from the sediment-laden water and prepare bed for ensuring birth of their next generation from beneath the ground. This evergreen luxuriant mangrove is destroyed by men for their own uses. But now these men of the soil realize the importance of mangroves as stabilizer of embankment, act as buffer of heavy storms, and regulate breathe of relief during storm surges. Only the man can renew its previous nature of amazingly tranquil environment creating its previous form.

Recent Past Human Habitation

Ancient clay pots and mangrove tree trunk-peat found at the village of Debnagar under Namkhana police station in Sunderbans strikes researchers towards rethinking of human habitation in the recent past. The house hold used clay pots are found at the depth of 230-240cm from the land surface i.e. below modern land level. These clay pots and mangrove tree trunks act as the evidences for computation of years of their occurrences which ultimately tell of the existence of human habitation in the recent past in Sunderbans. The occurrence of such clay-pots and mangrove tree trunks at such depth and their

sinking are due to long-term tectonic subsidence at the rate of 4.1mm/y, sediment compaction, accumulation at the rate of 2 – 4 mm/y inclusive decay of the peat and eustatic sea-level rise at the rate of 3mm/y (excluding extraction of ground water through deep tube well). Researchers reported after thorough experimentation through the uses of optically stimulated luminescence (OSL) and radio carbon dating (^{14}C) techniques upon the samples collected from the submerged kiln-wall last fired and mangrove trunk exposed at riverside of the Sunderbans. Samples of the kiln-wall including charcoal remained inside it are collected from the place of erosion continuing for last 50 years of river flood plains in Sunderbans and the age of those samples of the kiln-wall last fired are calculated about 305 ± 35 years. This periodicity of the occurrence of the human habitation obtained through OSL method has supported almost the same age of the mangrove tree trunk collected from the same site of the submerged kiln for salt preparation and computed by radiocarbon dating (^{14}C). All those above noted data found for the Sunderbans consider the periodicity of the last human habitation in the recent past during 1690 – 1700 in the Sunderbans¹.

The last human habitation in the Sunderbans in the recent past probably destroyed after the 10 years arrival of Job Charnock, the founder of Calcutta, in 1690. The super cyclone of 1699 destroyed the Sunderbans led to the entire area resourceless and in desuetude. People, in majority, died of that super cyclone and the rest destitute families left Sunderbans. After such a natural shock, the destroyed and void area has gradually become full of tidal vegetation and greens i.e. mangroves swamp and marshes during the period of about 80 years till 1783 when Tillman Henckell, the Collector of Jessore, started reclamation of the Sunderbans converting mangrove forest into the agricultural land in order to earn more revenue for the East India Company. Anyway, coming back to the perspective of the lost and last human habitation in the Sunderbans, a desire to resist calamity is implanted in the nature of man, but when natural calamity destroyed almost the human habitation, the Sunderbans had been deserted leaving entire region a desolate and solitary, having no inhabitants about 300 years before present. Thus, the devastating super cyclone blown in 1699 is a signature of commencement of climate change in Sunderbans.

Age Determination

Sunderbans is old enough to be naturally deemed mature upon age. It is seen to be existed with great length of time with its own characteristics since 5000 years back. Existence is rather rhythmic in three different phases with three separate periods of 5000–4500 BC, 100–300 AD and 1600 AD to till date respectively. It has been going on for a long time span of 200 – 300 years, even 500 years of each period of its existence. First time existence is evidenced by the presence of sunken tree trunk in the form of peat at an average depth of 30 feet from the surface as observed at Sealdah and Port Canning station during digging operation for the construction of railway platforms. Age

of these peat collected in the cut-off trench has been determined through C^{14} radio carbon dating technique. Further, it is a well-known fact and accepted thereon by almost all the international bodies of the geologists that the Bengal delta, part of the Bengal basin has been subsiding at the rate of 2.2mm per year. Data reveals after computation of both depth of occurrence of tree trunk and rate of subsidence that the peat of tree trunk seems to be existed about more than 4500 years back. Further, the intact and broken pieces of clayey households, images and toys found at a depth of 12 feet from the land-surface at Namkhana, Patharpratima and Sagar Island expresses much interest of the existence of civilization during the period of 100 – 300 AD. But no evidence for marking the civilization available in between the layer of 30 feet and 12 feet denotes that the Sunderbans was dearth of human habitation in between 4500 BC and 300 AD. Sunderbans stood at the lower portion of the Bengal delta in between 300 to 500 AD. It was perhaps destroyed by super cyclones like present days Sidr, Aila etc or by other natural calamities in between 500-600 AD. Sunderbans is not mentioned or recorded anywhere up to sixteenth century.

Mangroves of Sunderbans were densely generated in the complete vacated areas of the lower deltaic plain. Rulers on behalf of the East India Company of the British India started reclamation of the Sunderbans in order to earn the revenue from the agricultural practices since 1770 AD. And the Sunderbans has been existing for the centuries with the proper reservations from the side of the Government although the areas of the original Sunderbans has been diminished from its original areas and politically divided during independence of India consequent upon the Radcliffe Award. Sunderbans at present belongs to the two separate neighbouring countries of India (one-third) and Bangladesh (two-third portions) forming the world's single largest mangrove chunks.

Medicinal Plants

Global warming, directly related with the climate change, caused either by natural processes or man-made i.e. anthropogenic interferences, has a major impact upon the wetlands. Global warming and huge sedimentation decrease the water depth of the water bodies in the Sunderbans. As a result of such sedimentation and decreased depth thereon, sunlight is allowed to reach even at the bottom of the water body, warming the water mass which help growing of the rooted aquatic plants leads to eutrophication. Eutrophication is a state of an increase in the nutrient supply in the form of primary productivity of such wetlands shifting trophic level of food chain of the water body.

Eutrophication, an extremely slow process, occurred in a wetland of shallow depth, is filled due to erosion or gradual sedimentation processes. Sedimentation increases more and more nutrient supply into the water body as the sediment particles are primarily carried with the water. The man-made eutrophication is very fast by nature and known as cultural

eutrophication. Important factors for such cultural eutrophication in the Sunderbans include agricultural activities, chemical fertilizers etc. applied in the agricultural field from which the runoff flows into the water body. As a result, eutrophication is slowly weeding the wetlands of the Sunderbans. These weeds i.e. the wetland plants are generally useless, though a few of them are beneficial to the human society either providing food stuff, materials required for thatching houses or useful as fodder for the bovines. Medicinal plants and weeds in and around the wetlands are enlisted in the Table 1 & 2 for better representation. Wetland are classified depending on the submergence characteristics, such as – submerged plants, free floating plants, rooted but floating plants, and rooted and emerged plants. Wetland plants particularly with submergence characteristics are also important for rendering help in lowering the pollution level of wetlands water specially the pollution level of wetland water in and around Bidyadhari River catchment area where water affected with the domestic discharges by Bhangarkatakhal, Bagjolakhhal etc. from Kolkata metropolis through various natural processes. We can also enjoy the benefit of wetland productivity without destroying an important habitat of medicinal plants grown up naturally. More than ten species of medicinal plants were identified and enlisted in the Table-1 around a wetland at Debnagar under Namkhana police station when weed eradication drive is taken by its owner. So therefore, climate change and global warming are certainly the causes for the abundant occurrences of weeds around the wetlands of which a few are medicinal plants and essential for day to day life of the inhabitants of Sunderbans.

Table-1: Medicinal plant in and around wetlands of Sunderbans.

Dhutra	<i>Datura metal</i>
Basak	<i>Adhatoda vasica</i>
Kalmegh	<i>Andrographis paniculata</i>
Tulsi	<i>Oscimum sanctum</i>
Bramhi	<i>Bacopa monnieri</i>
Kulekhara	<i>Hygrophilia auriculata</i>
Keshardam	<i>Ludwigia adscendens</i>
Gima	<i>Polycarpon prostratum</i>
Amrul	<i>Oxalic corniculata</i>
Thankuni	<i>Centella asiatica</i>
Hincha	<i>Enhydra fluctuans</i>
Aswagandha	<i>Withania pomnifera</i>
Kanchira	<i>Commelina bengalensis</i>
Mutha	<i>Cyperus rotundus</i>

Table-2: Wetland plant in and around wetlands of Sunderbans.

Local name	Scientific name
Dumur	<i>Ficus hispoda</i>
Sarbajaya	<i>Canna sp.</i>
Hogla	<i>Typha andastata</i>
Kalmi	<i>Ipomoea aquatic</i>
Berakalmi	<i>Ipomoea carnea</i>
Padma	<i>Nelumbo nucifera</i>
Kachu	<i>Colocasia esculenta</i>
Kachuri-pana	<i>Eichhornia crassipes</i>
Lal-pana	<i>Lamna sp.</i>
Matardal-pana	<i>Spirodela polyrhiza</i>
Suji-pana	<i>Wolphea sp.</i>
Indurkan-pana	<i>Salvinea sp.</i>
Topa-pana	<i>Pistia stratiotes</i>
Panifal	<i>Trapa bispinosa</i>
Chesco	<i>Scirpus sp.</i>
Hasnahena	<i>Cestrum diurnum</i>
Sapla	<i>Nymphaea nouchali</i>
Pata-sapla	<i>Oetelia sp.</i>
Jhanjhi	<i>Hydrilla sp.</i>
Pata-jhanji	<i>Vallisneria sp.</i>

Brackish Water Fishes

Brackish water fishes of the Sunderbans are occurring in abundance. Fin fish and shell fish, considered as natural wealth as well as silver crop, are captured both in the Indian and Bangladesh Sunderbans. A fact finding survey shows about three lakh fishermen are engaged in fishing in the interior and coastal areas of the Bangladesh Sunderbans only. These three lakh fishermen use 96 thousand indigenous boat and 3 thousand machine boats (*vatvati*). Only Sunderbans supply about two-third of the total fish produce of Bangladesh and the total catch has been transported to markets of almost all town and cities of the country. People of Kolkata metropolis too receive different kinds of fish catch of the Indian Sunderbans and taste all of

them available categorically purchasing from the market. Most of the brackish water fishes like *amodi*, *fyasa*, *pyrachanda*, *chyala*, *rupapati*, *gung mouti*, *kanmagur*, *loytta* generally make up necessary protein content of the lower middle class family. About 120 species of fishes, 18 species prawns and 34 species crabs enrich the biodiversity of the Sunderbans (Table-3), though the *hilsa*-catch is limited in this area. No fresh water supply from the upstream of the Hugli-Matla estuary results unavailability of *hilsa* fishes².

Table-3: List of the brackish water fish of the Bangladesh Sunderbans.

Local Name	English Name	Scientific Name
<i>Faisya</i>	Mullet	<i>Liza persia</i>
<i>Bhangan</i>	Mullet	<i>Liza cephalus</i>
<i>Tapasi</i>	Paradise Threadfin	<i>Polynemus paradiseus</i>
<i>Bele</i>	Gobbies	<i>Glossogobius giuris</i>
<i>Chhurimach</i>	Ribbon fish	<i>Trichinnus haumela</i>
<i>Maitya</i>	Mackrel	<i>Euthynnus argenteus</i>
<i>Folichanda</i>	Silver Pomfret	<i>Pampus argenteus</i>
<i>Rup chanda</i>	Chinese Pomfret	<i>Pampus chinensis</i>
<i>Taka chanda</i>	Common Penny fish	<i>Leiognathus equulus</i>
<i>Ranga Choukha</i>	John's Snapper	<i>Lutjanu sjohrii</i>
<i>Sagar Koi</i>	Tripple tails	<i>Loobotes surinamensis</i>
<i>Sada Dantne</i>	Lined Silver Grunter	<i>Pomadasys hasta</i>
<i>Loitya</i>	Bombay Duck	<i>Harpodon nehereus</i>
<i>Poa</i>	Goatee Croaker/Jew Fish	<i>Dentrophysa sp.</i>
<i>Kuche</i>	Eel	<i>Chuchi Chuchi</i>
<i>Fansha</i>	Smooth Back Herring	<i>Racondarosselliana</i>
<i>Fyansaa</i>	Anchovy	<i>Satipinataty</i>
<i>Mur Bylya</i>	Rough Flat Head	<i>Platycephalus scaber</i>
<i>Pangas</i>	Fatty Cat Fish	<i>Pangasius pangasius</i>
<i>Chapila</i>	Shad	<i>Gadusia chapra</i>
<i>Saplapata</i>	Ray	<i>Amphotistius zugei</i>
<i>Bagda</i>	Tiger prawn	<i>Penaeus monodon</i>
<i>Harinye or honye</i>	Brown Shrimp	<i>Metapenaeus monocerus</i>
<i>Chaama</i>	Spotted Brown Shrimp	<i>Metapenaeus pinulatus</i>
<i>Kankra</i>	Crab	<i>Scylla serrata</i>
<i>Illish</i>	Hilsha Shad	<i>Hilshailisha</i>

Species of Different kinds

Mudflats, natural levees and river banks of the Sunderbans are the habitat of some animals, very much uncommon to the people in general for years, but the inhabitants of the Sunderbans are habituated to see them all knowingly or unknowingly. These interesting but least understood animals are represented by some species, known of late, throughout the Sunderbans. The estuarine deltaic plains of the area seem to harbour a rich and varied fauna, though much attention has not given to them either by the visitors of the Sunderbans or by the people any way interested about the Sunderbans. Therefore, they are uncommon, unpopular and even somehow unknown fauna, but they are unstoppable in generating attention and curiosity, so they are simply smart in appearance.

Among the faunal assemblage in the Sunderbans, mud skippers, the air breathing fishes, are looking very smart. They sink all on a sudden inside the mud digging into it when they found anybody else outside of their community. They belong to the family *Gobiidae* and are abundantly in the tidal flats or river banks of the Sunderbans. Mud skippers feed only during the ebb tide when the mudflats are completely exposed. They display thus, a very conspicuous biological clock as they appear only in the rhythmic tidal cycle of the dynamic estuarine environment.

King crab couple, in ecstasy, comes in pair during the breeding season drifting in the high tidal waters. A small size male likes a large size female and the bigger female usually carries a relatively smaller male on her back. On contrary, the male remains attached with the female's *opisthosoma* with his modified legs. After arrival to a mudflat or sand flat, they can venture the same ground for looking a suitable place befitted for their copulation. Comparatively bigger female digs a burrow and lays her eggs in cluster and the male sheds sperms upon the eggs finally, makes possible of external fertilization that leads to reproduction. Thus, king crab couple, only available in nature in their breeding season, is seen hugging of male with the female that begins in mid-February and lasts up to June-July. Perhaps king crabs observe valentine day as they fall in love on the second week of February.

Sometimes hugging is not for making love, particularly when snails hug the mussels in the river flood plain or upon beach of the bay. Snails in majority, intrude through the mud and trail like ploughing, find mussel and hug them. Several snails feed usually on mussels, boring through one valve by a combination of chemical and mechanical activity so that some of the organs like *proboscis* and *radula* can be inserted and the mussel tissues torn out. First the snails grip the mussel tightly with their mantles. They then soften the area tightly gripped spraying the mucous materials of their own. Snails exert pressure then with the *radula* at the softened part (with the application of mucous) of the shell of the mussel after being applied with the mucous materials and ultimately a small pore formed. The snails then enter their *proboscis* into viscera of the mussel through the pore

they already made and start sucking all of the flesh of the entire mussel. In this way some snails boring species cause remarkable damage to mussel beds. Almost all the shells of the mussel scattered in the sand flats or sea beach are visible with these types of small pores as a consequence of being eaten up by the snails of the same phylum mollusca.

Mudflats along the river banks support numerous diversified species populations like sea cucumber, sea pen, sea anemones etc. A majority of the intertidal mud-dwelling animals prefer such low-salinity water situations where environmental conditions are marked by different from those of terrestrial or fresh water habitats. Animals in such habitats acquire a certain degree of adjustment or adaptation as insurance against every oscillating environmental condition. Sea cucumber prefers such habitat. These animals are categorically classified as *holothuroid* under the phylum Echinodermata. They are covered with minute spiny projection all over their body surface and contain five stripes in total over their body surface looking almost like a cucumber. They used to eat detritus food materials and therefore they are called detritivores for their food habits. Sea cucumber is a benthic dweller over mud surface when their habitat is inundated with the tidal water and it enters inside the mud layer when water recedes during ebb tide. Sometimes feather-like projection is scattered in some mudflats and the entire animal is seen if it is pulled very softly or sorting out the animal after washing the uplifted lump of mud containing the animal with the river water. The animal looks like a feathered pen that once used by the poets of the medieval era. Certainly these animals are called as sea pen and they are Cnidarians. In addition to the sea pen, enormous sea anemones are available in the same habitat of sea pen which is looking like sun flowers as their tentacles are arranged radially. If somebody likes to touch them, they spray immediately chemically poisonous cnidoblasts cells and the touched portions are felt with burning sensation. Sea anemones are stationary animals, only able to move their tentacles, but never drift or go to the other places from their places of brought up. All these species are not known to the most of the people, they are simply supposed to be unpopular species of the Sunderbans.

Random Exploitation of Molluscan Shells

The Thakuran River Basin of the Sunderbans is very much potential in holding the biodiversity and acts as a unique trap for tidal sedimentation. The health of an estuary is very much concerned with the decrease in carrying capacity of sediments and productivity of ecosystem. Thus any modification of an estuary that results in a loss of habitat will be regarded as loss of resource.

Commercially important mollusks are considered as one of the most important bio-resources and have several impacts upon the mangrove ecosystems due to following reasons: i) the mollusks are known to be very useful biological indicators as they occupy well-defined zones in mud and sand substrates of an estuary and

ii) molluscan species are known to be commercially important so attempts would be made to find out scientific devices for their harvesting not affecting the ecosystem.

River water of the Sunderbans has been becoming polluted gradually due to release of domestic sewage and effluent of sewage sludge from the coastal towns standing at the river banks of Sunderbans as well as through different canals/drains from the Kolkata metropolis. It is well-observed in the field and in the laboratories by the scientists and naturalists that pollutants including heavy metals are assimilated by particular flora and fauna and turn the river environment free from heavy metals etc. But of late those well-known mangrove vegetation (e.g. *Sonneratia* sp) have been destroyed in large scale and mollusks which are well-known to be highly responsible for absorbing contaminants, heavy metals etc have been exploited in such a high rate that gastropods and bivalves are now gradually removed from the Thakuran River bed. The mollusks are also well regarded as bio-indicators as these are useful and important to locate the path of movement of heavy metals, as these carry the contaminants in their body within the estuarine river network. It would be alarmingly difficult to maintain ecological balance in the coastal waters of the Sunderbans if the molluscs, the important members among benthic feeders are destroyed in such a manner.

Identified nine species including bivalves and gastropods are found in almost all the geomorphic zones such as mid channel bars, marginal bars, point bars, river bars and natural levees. Their distribution in the river waters around the Sunderbans is uniform with with abundant occurrences. The gastropods and bivalves characteristically are bottom dwellers and benthic feeders. They generally occupy both the mud and sand substrates enriching the biomass of this zone.

The collection of gastropods and bivalves is a round the year phenomenon and is not restricted as a seasonal catch. Generally a team effort is used to collect the shells manually using numerous child labours scattered in the river beds particularly at mid channel bars, point bars and marginal bars even in the natural levees. Then the shells are sorted out into bivalve and gastropods separately and are stored at any elevated on or back side to the embankments around the collection zone. Only gastropods and bivalves are taken which are viable for commercial exploitation.

The total number of encounter species of both bivalves and gastropods are given in Table 4. Amongst all the collected species two bivalves (*Meretrix* sp and *Anadara* sp) appear to be the most dominant encounter species in the Thakuran drainage basin. Synthesis of data depicts that the bivalves are mostly used for manufacturing of poultry feeds and fish-meal, whereas, gastropods are collected for lime production. Data reveals that the destruction of bivalves and gastropods that belong to the benthic feeder's community leads to the imbalance of the ecological niches. At present the Thakuran River bed is almost devoid of molluscan shells because of random collection.

Molluscan shell dusts are transported from the factories stood at Canning Port. Each lorry carries on an average 300 bags and each bag contains about 50kg of molluscan shell dust. These dusts are mostly transported to the districts of Hugli, Bankura, Purulia, North 24 Parganas for manufacturing of poultry feeds the shell dust costs Rs 280 to 300 per quintal in terms of the demands placed by the poultry-feed manufacturers. The factory owners purchase raw materials i.e. the intact shells from the collectors at the rate of Rs 200 for white-looking shells and Rs 130 for the greyish shells. Shells which become fine powder after grind are in great demand.

The intact shells are sun dried and crushed by the labourers at the rate of Rs 8 per quintal to make it half dust. Then the half-crushed shells are transferred to a motor-driven grinder machine. The half dust shells are sort out into the grade of three sized materials using sieves specially made for this purpose and the three different fractions are then put into plastic bags. The finest one is sold for poultry and fisheries for poultry-feeds and fish-meal respectively and the lime producing factories purchase coarser grains. The molluscan shells are entirely made up of calcium carbonate. *Telescopium* sp and *Cerithidea* sp are used for lime production. Oysters' shells have a fresh look after they are crushed into powder but sold at comparatively lower rate of Rs 130 per quintal due to its poor quality. Thick shells are good in quality as its dust is comparatively better than those of the thin varieties. The forest officials backed these shell factories subject to the payment of Rs 670 per 10 ten of intact shells collected from the river bed.

Destruction of molluscan shells in such a manner may damage the ecological balance of the detritus food chain of the mangrove ecosystems. Regulations must be introduced from the end of the Government for the protection and restoration of the pollutant-regulators and environment-friendly mollusks of the Sunderbans.

Table-4: List of encountered species of bivalves and gastropods randomly exploited from the Thakuran River bed.

Bivalves	Gastropods
<i>Anadara granosa</i> Linnaeus <i>Meretrix meretrix</i> Linnaeus <i>Paphia undulate</i> Bern <i>Pelecycora trigona</i> Reeve <i>Crassostrea gryphoides</i> Schletheim <i>Pharellajavenicus</i> Lamarck <i>Macoma birmanica</i> Philippi <i>Glauconome sculpta</i> Sewerby	<i>Cerithidea cingulata</i> Gmelin <i>Telescopium telescopium</i>

Tourism Hub Project at Jharkhali

Both mother crocodiles and tigress come here in the forest of Jharkhali and Herobhanga as both the places are very much calm and quiet. Surjamani, a creek, traversing the Herobhanga

Island in the east-west direction looks like a canvas of an artist. Here river water ripples are small crested, fisher women even entangled with the households' works and cooking in her boat-family when her husband continues fishing spreading long-spun net (*pata-jal*) in the river waters. Surjamani creek simply a calm and quiet water course with grand symphony of silence is thus befitted as the spawning ground as well as rearing habitat of crocodiles and tigers respectively. Last year, the forest officials captured fifteen siblings of a crocodile-mother floating and swimming in the Bidya River water. Forest officials released those siblings at Bhagabatpur Crocodiles Project of the forest department. Jharkhali, the forest beauty of the Sunderbans, a secured incubation place of mother-crocodiles and place for rearing cubs of the tigress and corridor of migration of Royal Bengal tigers, has been enlightened very recently to come under the project of tourism hub at Jharkhali area. Naturally Jharkhali would be no more a safe place for the juveniles and cubs of the crocodiles and tigers if the project is going to be materialized. Wild boar, deer, monkeys, tigers and crocodiles would be then replaced with the picnic party – tourists and their huge noise. It would be wise to rethink the project and a good deal of rethinking is necessary for coming to a foolproof decision.

Declining River Matla

Matla River has gradually been declining naturally as its river bed at Canning is silted up in such an extent that it is only navigable only during the flood tide either in the full moon or new moon. Once it was a river of vigorous current and navigable for the large ship and steamers only of 150 years back. The then Canning of Matla River was a proposed port, thinking it as an auxiliary port of Calcutta. Actually Matla originates here at Canning taking the waters of the united streams of Karati or Kuriabhanga creek of Sarenger Abad and Sakha Bidyadhari. Before the confluence at upstream of Matla, Amjhara or Bichhuti creek joins Sakha Bidyadhari coming from Sealdah of the then Calcutta taking the waters from Talinala and Belegkata creeks.

The locality at this place of origin of Matla is also known as Matla before it is denominated as Port Canning after the name of the then Governor General Lord Canning. Matla meets the Bay of Bengal after flowing southward a long course of about 120km from Canning, its extreme upstream. At present the river bed is silted up and there is no trace of water during ebb time. But L.S.S.O' Malley wrote in his Bengal Gazetteer, 24 Parganas the Matla River, which flows south to the sea and is navigable by river steamers up to Canning. And that's why Canning had been selected as a proposed port in 1853 by the British India Government, rail services was started from Calcutta to Canning, and the entire activities inclusive management of Port Canning was maintained by the Borradaile, Schiller & Co who constructed a huge brick-built house, red in colour, at the river bank of Matla at Canning³. That building of British era, of late, has been collapsing part by part in every year due to heavy rain in monsoon times.

Discussions

Changing scenario of the mangroves forest areas for deforestation and human encroachment over the years in the Sunderbans has done more to confuse in computation annually and mystify the subject than to clear it up. Certainly, there is considerably discrepancy between the forest areas already recorded and the existing forest in reality. Discrepancy in the estimation of the areas of the Sunderbans arises in the British era mentioned in the Statistical Account of Bengal of W.W. Hunter- Sunderbans comprise a vast tract of forest and mangrove swamps, returned at 5570 square miles by the Surveyor General in 1871, and at 7532.5 square miles by the Commissioner of the Sunderbans in 1873. W.W. Hunter stated the reasons beyond such discrepancy on computation of areas of the Sunderbans. According to him, this discrepancy arises from the circumstance that, in the Surveyor General's estimate, a part of the cleared and more or less cultivated land was included in the 24 Parganas, Jessor and Bakarganj, to which Districts the Sunderbans belong fiscally. W.W. Hunter stated the boundaries of the then Sunderbans - the Sunderbans have an extreme length along the sea face of the Bay of Bengal, from the Hugli to Meghna, of about 165 miles; the greatest breadth from north to south being about 81 miles⁴. They are bounded on the north by the permanently settled lands of the Districts of the 24 Parganas, Jessor and Bakarganj; on the east and west respectively by the estuaries of the Meghna and the Hugli; and on the south by the Bay of Bengal. Reclamation and cultivation, thereon, has been accelerated in the Sunderbans that reduce the forest areas of the Sunderbans as mentioned in the book of Bengal District Gazetteers 24 Parganas by L.S.S.O' Malley. He adds that the cultivation is spreading rapidly in the Sunderbans, and in the other parts of the district swamps are being gradually drained and reclaimed stating the confusion over the actual reclaimed areas and its forest parts of the Sunderbans even in the British era.

Areas of the Bangladesh part of Sunderbans has not been properly classified along with the mangrove forests, salt marshes, grass lands, hinterlands, areas of non-forest uses, clear water and muddy water. At present, the Sunderbans mangrove forest covers an area of more than 10,000sq km, of which forests in Bangladesh's Khulna Division extend over 6,017 sq km and in West Bengal, they extend over 4,242sq km across the South 24 Parganas and North 24 Parganas. In Bangladesh, the Sunderbans Reserved Forest (6,017sq km) encompassed the three protected areas of the Bangladesh Sunderbans: East Wildlife Sanctuary (312sq. km), South Wildlife Sanctuary (370 sq km), and West Wildlife Sanctuary (715sq km)⁵. Indian part of the Sunderbans is covered with an area of 9630 sq km including human habitation which is clearly demarcated with an imaginary Dampier - Hodges Line. The total area of Indian Sunderbans region is about 9630sq km, out of which the Reserved Forest occupies nearly 4242sq km. Sunderbans is an excellent for its amazing quiet and tranquil nature. Further, the report of the Sunderbans Biosphere Reserve West Bengal adds

that the two great rivers, the Ganges and the Brahmaputra meet the Bay of Bengal along India and Bangladesh to form an intertidal zone, developed by the accretion of alluvium by these river systems, covering an area of nearly 25,500 sq km, which is known as the Sunderbans (Table-5).

Table-5: Present areas of the entire Sunderbans.

Total areas of the Sunderbans (India and Bangladesh) including human habitation as demarcated by imaginary Dampier - Hodges Line	25,500 sq km
Indian part of the Sunderbans (including human habitation) as demarcated by imaginary Dampier - Hodges Line	9630 sq km
Total Mangrove forest areas	4242.44 sq km
Mangroves forests (ISFR 2019)	2108.11 sq km
Salt marsh/sea grass/hinterland (GIS Study)	180.59 sq km
Non-forest use (GIS Study)	26.57 sq km
Clear water (GIS Study)	109.58 sq km
Muddy water (GIS Study)	1817.59 sq km
Bangladesh part of Sunderbans (including human habitation) as demarcated by imaginary Dampier - Hodges Line	15870 sq km
Total Mangrove forest areas	6017 sq km
Mangrove forests (Approximately)	4317 sq km
River waters (Approximately)	1700 sq km

Currently, India State of Forest Report 2019 (ISFR 2019) has computed an area of 2108.11sq km (Table-10) mangroves forest (North 24 Parganas: 25.94sq km and South 24 Parganas: 2082.17sq km) in the Sunderbans, India⁶. Then the forest areas of the Sunderbans is 4242.44sq km as following -Mangroves Forest - 2108.11sq km (North 24 Parganas: 25.94sq km and South 24 Parganas: 2082.17sq km).

Conclusion

An Appeal for declaring Sunderbans as 'Mangrove Biome': Sunderbans, a part of deltaic plain of fluvio-marine deposits and the habitat of biggest contiguous mangrove patch of the world is with magnificent biodiversity including world famous Royal Bengal tiger and estuarine crocodiles. For its amazingly quiet nature, and as a biogenous coast of numerous flora and fauna, Sunderbans is declared as Biosphere Reserve by the ministry of Environment and Forests, Government of India in March, 1989. The role of mangrove ecosystem in Sunderbans as buffer against tsunamis, cyclones, as an agent for soil conservation, as sanctuary to many rare endemic flora and fauna, for these reasons IUCN announced Sunderbans as World Heritage Site for its dynamic ecosystem and this Sunderbans contains almost all uniqueness like other biomes to be enlisted as a 'Mangrove

Biome'. Mangrove Biome would be a unique identity of the Sunderbans and greater impetus for the bio-geographical region of the world.

There are 64 species of mangroves and its associated species and 1692 species of fauna are identified till date that enriches the biotic region of the Sunderbans. Covering an entire area of 25,500 sq km of both India and Bangladesh – a part of the world's largest Ganga-Brahmaputra Delta at the confluence of the Bay of Bengal, Sunderbans is excellent for its awe-inspiring abode of Royal Bengal tiger, estuarine crocodiles, king cobra, pythons, otters, water monitors and many other animals including mangroves which constitute the lifeline of the Sunderbans. For this reason the mangrove forest of the Sunderbans, the most nutrient rich and productive environment, is to be considered and enlisted as Mangrove Biome, the largest unit of ecosystem. Biome is a large collection of plants and animals adapted to survive within their geographical zone a region's soil and animal life are closely related to its vegetation. This, in turn, is linked to the climate and nature of the environment, such a system is a biome like Sunderbans including all its characteristics which are unique and different from other biomes. In Sunderbans there is no such borderline between mangroves and water and it looks like a natural art on canvas having different strokes of colours given by an unmindful painter. Sometimes the water here touches the layer at which earth and sky appear to meet; sometimes it kisses the

substrate soil and brackish water of the estuarine environment. All of these characteristics and parameters; the amazingly environment of grand symphony of silence; the forest-beauty; the entire Sunderbans including India and Bangladesh seek the declaration of a completely unique 'Mangrove Biome' by the competent authority like IUCN or UNESCO.

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