Threats to Ecosystem Services of Mangroves and Its Associated Environment in Context to North-East Coast of India

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Abstract: *The present condition of Indian mangrove is very deplorable. 50% of mangrove cover is Geo-physically and Athropogenically affected. They safeguard community lives and properties in coastal areas during storm surges, tidal flood, cyclones and tsunamis etc. Global estimate shows that the declination of mangrove vegetation covers to ~150,000 sq. km. Degradation of mangrove ecosystems in India are mainly due to continuous increase in anthropogenic activities such as conversion of mangrove wetlands for aquaculture and destruction of mangrove forest for timber, industrial wastages and agricultural wastages and due to few physical events like sedimentation, siltation, climatic hazards etc. In the coastal areas inhabitants are at risks of losing their livelihood and ecological communities are in the verge of extinction. Due to abruptly cutting of trees, huge amount of soil erosion is dangerous threats for this area. The objective of this study is to review current threats and vulnerabilities to mangrove ecosystems around the world with a special emphasis to east coast of India and summarizes key management considerations for protection.*

Key words: *Ecosystem, Mangroves, Tribes, Cost area,*

1. INTRODUCTION:

Estuaries are formed along the coastline at points where rivers meet the sea. These points become semi-enclosed coastal bodies of water having a free connection with the open sea and within which seawater is measurably diluted with freshwater. The estuarine water is of mixed origin with fresh water supplied by the river and land run off and seawater by the state of tide. The water of mixed origin does not occupy a constant position. The zone of mixing can remain static of the freshwater discharge is fairly constant throughout the year and the tidal incursion negligible. These two important variables are not strictly applicable to Indian conditions where the freshwater regime becomes highly variable with the onset of monsoon and the tidal range becomes dependent with the geographical location of the estuary and the phases of the moon. Depending on the tidal regime, the distribution of mangroves occurs. Mangroves are special types of vegetation with salient feature like pneumatophores, stilt roots, viviparous germination etc. Mangroves provide several ecosystem services which are of great commercial importance. Mangrove forests on the banks of estuaries provide a quiet and well protected environment for marine organisms to survive and thrive. These include algae, barmacles, oysters, and sponges. Shrimps and crabs make their home in muddy bottoms of mangrove forests (Shetye, 2011). There are marine organisms that spend a part of their lifecycle in mangroves. For examples, penned prawn laid eggs in the open sea. Depletion of mangroves in the country at the rate of several hundred hectors per year ,for their use as firewood and for the wood-chip industry and their conversion as aquaculture farms is shrinking the estuarine environment rapidly .Mangroves of the Gangetic Sundarban, and the estuarine areas of Cauvery ,Godavari and of the Gujarat region ,have degraded considerably due to expansion of Shrimp farms, salinity alteration etc.The present research programme aims to focus on the ecosystem services of mangroves in context to Indian Sundarbans , where about 34 species of mangroves are present. Various species of oysters and moll uses shells are elicited for the manufacture of lime. In addition many mangroves plants have a number of traditional uses such as fodder, fuel wood, house posts etc.

Traditional uses of mangroves species

Aegiceras corniculatum	Bark used as fish poison .Also contains tannin
Avicennia alba	Used for fodder and fuel
A.officinalis	Used for firewood. Bark contains tannin.
Bruguiera caryophylloides	Wood used for firewood and
Bruguiera gymnorhiza	Wood used for house posts. Excellent fuel .Bark contains tannin.
B.sexangula	Timber used in house building.
Ceriops tagal	Used for keels of boats and house posts. Provides good fuel charcoal. Bark is rich in tannin used for dyeing fishing nets.
Rhizophora muconata	Bark is used for tannin and cattle fodder.
Sonneratia acidia	Excellent fuel. Pneumatophores used as substitute for cork.
S.apetala	Wood used in house building, packing cases and yields excellent fuel.

Xylocarpus granatum	Yields gum, resin which is used in local medicine .Bark contains tannin.

The tribes residing in the mangrove forest areas of Malaysia, Indonesia and Philipines use mangrove products for various medicinal purpose. Such use of plant parts is not extensively prevalent with the tribal people residing in the reclaimed areas of Sundarbans perhaps due to the fact that the tribal people of the Sundarbans migrated to the area from Bihar and Orissa and did not develop an extensive use of the flora and fauna of the Sundarbans.

Sl. No.	Vernacular Name	Scientific Name	Part Used	Disease	Traditional Use
1.	Garia	Kandelia Candel	Stem bark	Diabeties	used to cure diabetics.
2.	Bakul Kakra	Bruguiera Parielora	Fruit	Eye diseases	used for the treatment of some common eye diseases.
3.	Jhamti Garan	Ceriops Decandra	Leaf	Haemorrhage	used to stop haemorrhage.
4.	Oda	Sonneratia Alba	Fruit	Acidity	used as a good digestive agent.
5.	Jat Baine	Avicennia Officinalis	Fruit	Blisters	Warm juice extracted from screen fruits of the Jat Baine tree helps in the treatment of sore or blisters.
6.	Chak Keora	Sonneratia Caseolaris	Stem bark	Haemorrhage	The Chak Keora tree is used to prepare vinegar and helps to stop haemorrhage.
7.	Kripan	Lumnitzera Racenosa	Young twig	Skin diseases	Young twig juice of the Kripan tree is used to cure skin diseases.
8.	Garjan	Rhzophora Mucronata Lamk	Stem bark	Diabetes & Throat ache.	|Dust from stem bark of the Garjan tree helps to stop haemorrhage as well as cures diabetes.
9.	Keora	Sonneratia Apetala	Leaf and fruit	Diarrhea ,Haemorrhage & Blisters	Leaf decoction of the Keora tree helps to cure stop haemorrhage and cures blisters . Fruits are also used to prevent in diarrhoea.
10.	Peyara Bain	Avicennia Marinavierh	Leaf	Pain	Leaf decoction of the Peyara Bain tree is used in aeration and seeds are used as anti ache agent.
11.	Math garan	Ceriops Tagal	Stem bark	Skin diseases	Juice from the stem bark of the Math garan tree is used to stop haemorrhage and it is useful to cure eczemas disease.
12.	Tara	Aegialitis Rotundifol	Leaf	Pain	Leaf decoction of the Tara tree helps to remove the pain .So it is used as anti ache agent and one type of salt is prepared from it.
13.	Banjui	Clerodendrum Inerme	Leaf	Bubo diseases	Leaf decoction of the Banjui tree is used to cure fever and leaf dust is also used to cure bubo diseases.
14.	Chhagal kuri	Ipomoea Pescaprae Sweet	Leaf	Stomack infection	Chhagal kuri tree is useful to cure arthritis and help to cure stomack infection.
15.	Shukhdarsan	Crinium Defixumker	Leaf	Ulcer and Blisters	Used in removing of ears ulcer and blisters.
16.	Banlebu	Atalanta Correa	Fruit	Arthritis	
17.	Kau	Tylophora Coarctata	Root	Foot Pain	
18.	Kakra	Bruguiera Gymnorrhiza	Stem bark	Diarrhea and Dysentery	
19.	Golpata	Nypa FruticausFruit	Fruit	Stomack infection	
20.	Sundari	Heritiera Fomes	Leaf	Haemorrhage	

21.	Khalshe	Aegiceras Corniculatum	Stem bark	Vomiting and Dehydration	
22.	Gat Garan	Ceriops Tagal	Stem bark	Injury infection	
23.	Garan	Ceriops Decandra	Leaf	Hemorrhage	
24.	Gemo		Glutinous	Injury infection	
25.	Dhudul	Xylocarpus Granatum Koen	Seeds	Dehydration	
26.	Hargos	Acanthus Llicitolius	Roots	Pain	

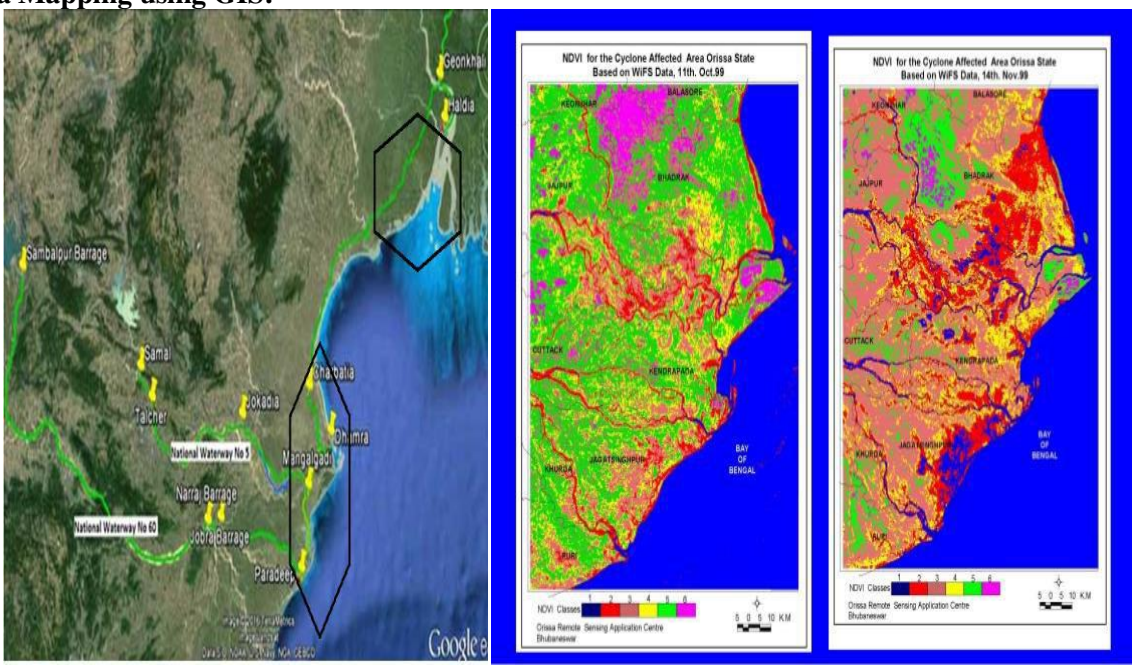
2. STUDY AREA:

My present study on Sundarban and Bhitarkanika which are the main mangrove vegetation cover of north-east coast of India. Among this two, Sundarban covers maximum proportion of mangrove vegetation. Both this two mangrove sites are fall into a great danger at present.

Picture of Our Field Study on Sundarban and Bhitarkanika

North-East coast of india consistes two major state, i.e, Orissa and West Bengal. Total coast line is 700 km along with these two states.

Study Area Mapping using GIS:



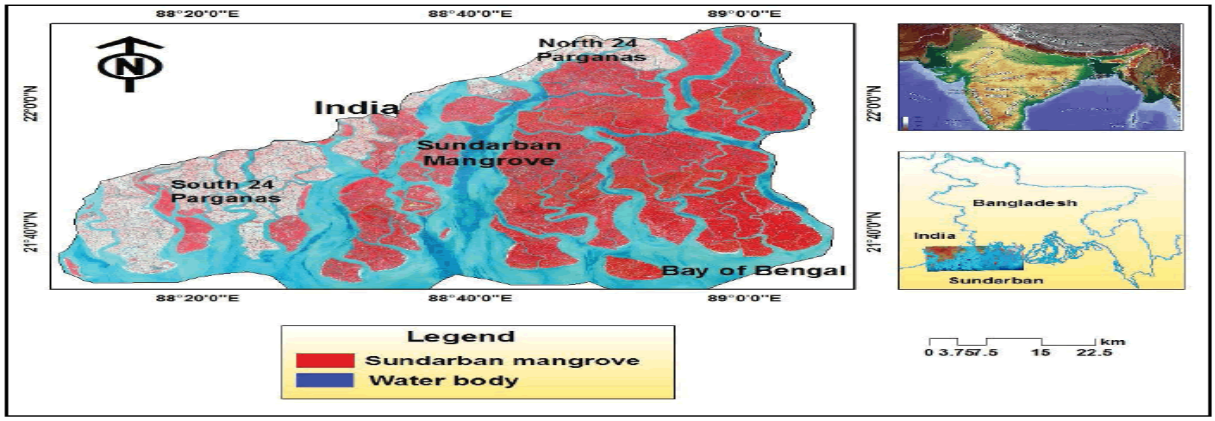


Figure 1: Map of the study area.

3. NEED OF THE STUDY:

Mangroves are extremely useful for their provisional services, regulatory services and cultural services. The provision of economically resources like timber, fuel, honey, fishes etc. Provide economic benefit to the coastal population. The livelihood of the people of Indian Sundarbans greatly dependent on the provisional services of mangroves. Because of the presence of the city of Kolkata, Howrah and Haldia around Indian Sundarbans, the water of the deltaic complex get polluted; in this context the regulatory services of mangroves have immense value because mangroves can purify the water by absorbing the pollutants. Also the sea level rise, erosion of mud flats is also regulated by mangroves. The presence of the goddess Baobab is an example of cultural and religious convergence in the framework of Sundarbans. Thus there is a great need to focus on the ecosystem services of mangroves.

4. OBJECTIVES OF THE STUDY:

- Primary data collection for surface water salinity in study area.
- Interaction with various stakeholders for secondary data collection in context to ecosystem services of mangroves.
- Management plan for plantation related programme.
- Conduction of Awareness and training programme regarding the livelihood generation from mangrove ecosystem.

5. RESEARCH METHODOLOGY:

The present research programme will be basically based on secondary data collection (80%) from identified stakeholders as listed in table 3.

TABLE 3

List of Stakeholders identified for taking spatial data.

Sl. No	Stakeholders
1	Department of environment.
2	Fisheries Department.
3	State Pollution Control Board.
4	Central Pollution Control Board.
5	Tourist Department.
6	Forest Department.
7	Kolkata Port Trust.
8	Archives of different Universities and Academic Institutes.
9	NGO`s related with mangrove based researches.

In addition to collection of secondary data also consultation with the stakeholders will also be carried out. The details of which is explained below.

1 .Informal stakeholders consultation: This consultation will be conducted an important environment during the various phases of data collection and interaction during the site visit. This interaction will help in developing and understanding of the aspiration of various stakeholders based upon which policies and proposals will be suggested in the upcoming deliverables.

2. Structured stakeholder consultation: The structured stakeholder's consultation is the formal intermittent component of the consultation framework. This set of consultation will be needed to sensitize the local people about the plans and proposals in each component.

3.Focus Group Discussion: FGD`s ,there are trade unions for major industries ,port trust ,fishing commuters and others whose expectations and aspiration need to be considered. The consultant will invite some NGO`s, Unions, Councils, and Association at the field and or their place of establishment in order to hold dismissions and select primary data which can save as an inspiration for the present research programme.
4. Field interaction: Livelihood analysis including detailed informal and structured consultations will be carried out for fishing, agriculture, tourism and other non-farming sectors at various stages of deliverables.

Bhitarkanika mangrove wetland: Bhitarkanika wildlife sanctuary (latitude: 20° 40' to 20° 48' N and longitude: 86° 45' to 87° 50' E) is the second largest mangrove forest in India, located in Kendrapara district of Orissa. The total mangrove cover is 183 sq. km [29]. Twenty-eight species of true mangroves and four species of mangrove associates have reported so far, among them Exocoecaria agallocha, Heritiera littoralis, Avicennia officinalis and Cynometra ramiflora are the most dominant species. Local inhabitants collect timber and non-timber forest resources for fire wood, house and boat making, thatching and fodder. The collection of forest wood has decreased following declaration of a wildlife sanctuary in 1975 by the Govt. of Orissa. Fishing is the main source of livelihood for majority of inhabitants living in this region. Reddy et al. estimated 180 sq. km of mangrove cover during 1973, consisting of both dense (147 sq. km) and open (33 sq. km) mangrove forests [77]. The estimate during 2004 shows no change in dense mangrove cover but open mangrove forest decreased to 18 sq. km. But due to proper restoration and rehabilitation programs the total mangrove cover was increased to 183 sq. km which includes 161 of dense mangrove and 22 sq. km open mangrove [29].

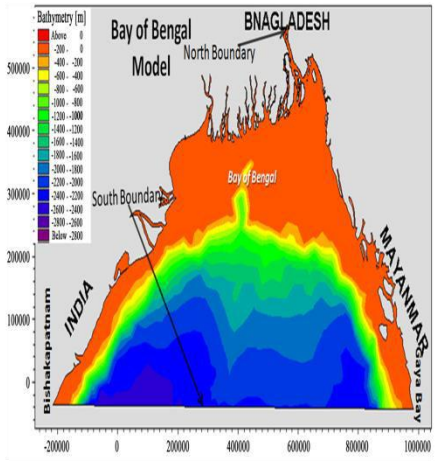
Sundarbans mangrove wetland: The Sundarbans (latitude: 21° 31'to 22° 30' N and longitude: 88° 10' to 89° 51' E) is the home of world's largest continuous block of mangrove wetland. Sundarbans is bordered by river Hooghly in the west and river Baleshwar (in Bangladesh) in the east. River Harinbhanga demarcates Indian and Bangladesh part of Sundarbans. Indian part of Sundarbans covers an area of 4,246 sq. km [78] whereas Bangladesh part covers an area of 6,017 sq. km [79]. About thirty species of true mangroves have reported so far [80]. Sundarbans is a highly fragile ecosystem due to its complex geological and environmental settings consistent with increasing population density and climatic variability [81]. The region is vulnerable to coastal erosion and inundation due to rise in sea level. Ericson et al. reported sea level rise in the Bay of Bengal of >10 mm/year, which is the world's highest rate of sea level rise [82]. This trend was confirmed by recent report of 4.0 mm/year sea level rise in the western part and 7.8 mm/ year in the eastern part [83,84]. Most of the distributaries of river Ganges has silted up and carries very little quantities of fresh water except during monsoon causing increase in salinity. Thus high salinity tolerant species, e.g., Avicennia Alba and Exocoecaria agallocha are gradually replacing Heritiera fomes and Sonneratia casoelaris that require regular supply of fresh water for their growth [80]. Biodiversity of Sundarbans has exploited by humans for several decades, where conversion of mangrove wetlands to paddy cultivation or shrimp farming is a common practice. Sundarbans has many densely populated villages and local inhabitants rely on wetland forests for livelihood. Local inhabitants are involved in commercial exploitation of Heritiera fomes and Avicennia marina for boat making, poles and rafters. They collect fire wood, leaves for roofing (especially from Nipa fruticans and Phoenic paludosa), grass for fodder and fish and shrimps [80]. Local people collect honey and wax from mangroves trees, especially from Aegialitis rotundifolia, Aegicerus corniculatum, Avecennia marina and Ceriops decandra species [85]. Prior estimate reveals that Sundarban mangroves was originally covered >40,000 sq. km in coastal West Bengal and Bangladesh. Conversion of mangrove forests for cultivation was actively promoted by Turk sultans of undivided Bengal. During British colonial era (ca. 1793), Sundarbans covers an area of 19,508 sq. km. British authorities actively promoted conversion of mangrove land for cultivation. As a result, by 1870 ~2,790 sq. km and by 1930 further 2,750 sq. km of mangrove forests were converted for other land use practices. A further ~1,570 sq. km of mangroves were converted within three decades of India's independence [80,86].

Recognised Threats in Mangrove:

1) Mangrove deforestation
2) Siltation and sedimentation
3) Deterioration of water quality
4) Natural calamities like cyclones, Tsunami etc.
5) Harmful algal bloom
6) Capital dredging of river beds
7) Unscientific Brick Factory beside estuary area
8) Miscellaneous

Some of the picture of several threats:

1. Mangrove Deforestation



2. Coastal Siltation through industrial wastage

3. Impact of Aiyla

4. Unscientific Brick Factory in Mangrove

6. RESULT AND DISCUSSION:

In order to conserve these fragile ecosystems the following strategies may be implemented. 1) The local governments should formulate proper management policy by involving local people who have a stake in the conservation and management of mangrove forests in their areas. 2) Efforts should be made at village, district and state levels by the policy makers and NGOs, to educate the local people about the economic and ecological values and functions of mangrove forests, and the negative results of their mismanagement. There is a need to involve people at the grassroots level, in protection of these forests. 3) The government should also encourage and involve ecologists, researchers and specialists to work on various aspects of ecological management of this resource. 4) Long-term research activities should be undertaken in collaboration with various premier organizations to increase the productivity of mangrove forests and also to develop various management models which can give added benefits to local communities involved in protection and conservation. 5) Added to these, the local educational institutions should chalk out the programme in

unison along with the students and their parents to create awareness on the ecological significance of these fragile and sensitive ecosystems and the prime necessity of their conservation.

7. CONCLUSION:

Mangrove ecosystem in the world covering an area of approximately 190,000 to 240,000 distributed in about 117 countries, harbour 193 plant species, 397 fishes, 259 crabs, 256 molluscs, 450 insects and more than 250 other associated species. Mangrove ecosystem has the highest level of productivity among natural ecosystems, and performs several ecosystem services. However, the continued exploitation of mangroves worldwide has led to habitat loss, changes in species composition, loss of biodiversity and shifts in dominance and survival ability. Worldwide, about half of the mangroves have been destroyed. For that matter India has reduced from 6000 km2 in 1953 to 2000–3000 km2 in 1989. These forests now occupy an area of about only 4871 km2 area. The Indian mangrove biodiversity is rather high. The increased anthropogenic pressure on mangroves in India has been mainly due to land use changes and on account of multiple uses such as for fodder, fuel wood, fibre, timber, alcohol, paper, charcoal and medicine. A larger area of approximately 40% of the coastal land in the west coast has been converted to agriculture and urban development. Environmental awareness, proper management plan and greater thrust on ecological research on mangrove ecosystems may help save and restore these unique ecosystems.

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