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COASTAL ISSUES AND MANAGEMENT STRATEGY FOR SAGAR ISLAND IN BAY OF BENGAL

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Abstract

Sagar Island, situated in the east coast of India is one of the biggest deltaic Islands in Sundarban group. This Island is unique with its natural ecosystem and has a potential for becoming a prime eco-tourism destination. The natural and man-made problems affect the quality of environment and life of people in Sagar Island. This paper examines the severe coastal issues of Sagar Island that include coastal erosion, threat to biodiversity, natural hazards, tourism and livelihood insecurity of local communities. It recommends adoption of a management strategy by implementing the Integrated Coastal Zone Management (ICZM) in order to mitigate these coastal issues and to ensure sustainable development of the coastal environment of Sagar Island in Sundarban Biosphere Reserve.

Keywords: Sagar Island, coastal issues, ICZM, Sundarban

Introduction

Island coasts are unique and complex in their nature of formation, environmental settings and composition of biodiversity. Coastal zones constitute the interface areas where the land meets the ocean, enveloping shoreline environments and coastal waters. [4] As a tropical country, Indian coasts are endowed with a wide range of natural habitats and some of them are increasingly threatened not only by natural reasons but also due to developmental activities and indifferent attitudes of the people [11]. This paper deals with the coastal issues of Sagar Island, one of the estuarine islands of the Sundarban region. Sagar Island is in precarious position due to many natural and anthropogenic reasons that include erosion and accretion, cyclone, flood, climate change, pollution, inadequate infrastructure, etc. After analysing the coastal issues of Sagar Island, this paper suggests management strategy for the conservation and sustainable use of coastal resources of Sagar Island on the basis of emerging coastal issues.

Study Area

Sagar Island is (21^0 31' 21'' to 21^0 52'28'' N lat. and 88^0 2' 17'' E long.) is one of the largest estuarine island system at the confluence of River Hoogly, in Sundarbans in Bay of Bengal. It has very low elevation. The central part of the Island is 2.22 to 2.23 meters and that of the peripheral portion is 2.18 to 2.22 meters from mean sea level [5]. For this reason, during cyclones and tide surges, the margins of the island are usually inundated [7]. The coastal zone of Sagar Island consists primarily of mudflats / salt marshes/ mangroves and sandy beaches/ dunes. Sand content is greater on the western coast, while silt predominates on the eastern side of the island [6]. The Island constitutes the western fringe of the Sundarban forests and is included in the Sundarbans Biosphere Reserve. It is a large island with an area of about 282 sq.km. spread over 43 villages with a population of over 1,85,600 [3]. The literacy rate of this Island is about 80% and about 70% of the women are literate. Historical significance of Sagar Island dates back to 3000 BC as it is a holy place of Hindus situated on the mouth of the river Hoogly (Bhagirathi, Ganga) falling into the Bay of Bengal.

Methodology

Standard methodologies were used to collect a number of different data on the coastal issues of the study area. These include: (i) site visits to Sagar Island in order to gain first hand understanding of the nature of the site, its habitats, coastal processes and landscape characteristics and their problems; (ii) interaction with the local community in Sagar Island and meetings with the officials of relevant government departments working on different issues of the Island, and (iii) analysis and interpretation of available environmental information on Sagar Island by searching relevant databases and expert publications.

Coastal Environmental Issues of Sagar Island

Sagar Island faces severe threats from both natural and anthropogenic reasons. The natural reasons include coastal erosion, breach of embankments, loss of landmass and biodiversity and rising sea levels etc. Besides these, the human

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interventions also have huge impacts on the vulnerable island ecosystem. Livelihood insecurity of local people, lack of infrastructure like power supply, environmental pollution caused by tourists and degradation caused by other the human activities that need immediate attention. The pressing issues of Sagar Island are discussed below to pin down the magnitude of the problem.

(i) Coastal Erosion

Sagar Island has been subjected to rapid erosion by natural processes and to a little extent by anthropogenic activities over a long period of time. Studies based on topographic maps and satellite imageries reveal that about 29.8 km^2 of the island has been eroded between 1967 and 1999 and the accreted area is only 6.03 km^2. Between 1996 and 1998, the area underwent erosion of 13.64 km^2 while accretion was 0.48 km^2. From1998 to 1999, 3.26 km^2 additional area was eroded with meagre accretion. Erosion from 1997 to 1999 was estimated at 0.74 km^2/year. However, from 1996 to 1999, the erosion rate was calculated at 5.47 km^2/year. The areas severely affected by erosion are the north-eastern, south-western and south-eastern faces of the island [6]. As a consequence of coastal erosion, the mud flats/salt marshes, sand beaches/dunes and mangroves have been eroded considerably. Fig. - 1 shows the magnitude of costal erosion in Sagar Island.

Fig. - 1. Coastal erosion in Sagar Island

According to a study, since 1860 nearly 71 km^2, which is equal to one fourth of the island area, has been eroded [1]. Another study reveals that between 1898 and 1995 the land loss through erosion was 3.88 km^2. The continuous decline in the size of the island might also be influenced by steady rise in sea levels accompanied by subsistence of the lower delta plain [10]. Erosion and decline in the size of the island is emerging as a big problem for the inhabitants of the island [2]. The population of the island in 1864 was 1,466 persons i.e., 5.2 persons/km^2. However, as per 1991 census, the population was 1,49,222, while the 2001 census indicates that the population was 1,85,301 which is 914.6 persons/km^2[6]. This shows that there is a steady increase of population growth in the island, whereas the land area is eroded rapidly. In very near future, the present population density will increase manifold with growing population and reduction of land area. This is expected to create a serious ecological imbalance in the otherwise fragile ecosystem of Sundarbans, unless some effective coastal management measures are taken up. Coastal erosion has direct effect on the island population too.

(ii) Threats to Biodiversity

The biodiversity of the Sundarban mangrove has been affected by human exploitation of forests, their conversion to paddy field and reclamation of land for various uses [6]. Over exploitation of timber and conversion of the mangrove forest land for agriculture and aquaculture purposes have enormously affected the coastal ecosystem. Numerous people are engaged in the commercial exploitation of *sundari* and other tree species, while the local people depend on the forests for firewood, timber for boats, poles for house-posts and rafters, golpatta leaves for roofing, grass for matting and fodder, reeds for fencing, and fish for their own consumption. Honey and wax are collected during the summer season [9]. In the recent years, collection of shrimp juveniles has increased manifold, particularly for aquaculture in reclaimed areas [12]. It is estimated that upto 60 percent of the shrimp post-larvae (PL) collected from nature die during sorting, transportation and stocking. Although the ecological impacts of this activity are uncertain because of this lack of detailed information, the field visit by the author to the collection areas revealed that the by-catch which is discarded and usually dies. Fig.- 2,3,4, show the actual collection

shrimp juvenile, sorting, disposal of other aquatic biodiversity. The shirimp farming is also causing rapid deterioration in the Sundarbans similar to that in other mangrove areas. Large-scale collection of shrimp from estuaries directly affects the other species of biodiversity that depend upon shrimp for food. Efforts are being made, however, to rehabilitate certain degraded areas through afforestation programmes. Among the faunal species, the estuarine crocodile and the Olive Ridley turtle are receiving some attention by way of captive breeding.

Fig. 2. Collection of Shrimp juvenile

Fig. 3. Sorting of shrimp juveniles

Fig. 4. Discarded aquatic biodiversity during the sorting of shrimp juveniles

(iii) Natural Hazards

The sea front part of Sagar Island is characterised by the presence of beach and beachfront dune complex. Conservation and management of dunes in the beach face-dune complex is necessary to avoid natural disasters caused by the coastal hazards. The island is traversed by a major tidal creek and several smaller ones. It has very low elevation. For this reason, during cyclones and tidal surges, the margins of the island are usually inundated [8]. Due to closeness to the sea, the island is frequently affected by the cyclonic storms generated from the Bay of Bengal. The Cyclones at times bring in high tidal bore causing damage to the existing earthen/brick lime dykes, producing devastating results. As a remedial measure such embankments can be built with the help of modern technology and skill [3].

(iv) Tourism

Tourism is the major source of income for the local people of Sagar Island. As stated already, the historical significance of the island dates back to 3000 BC as the Gangasager has been a very important holy place of Hindus because of its location. It is situated on the mouth of the river Hoogly (Bhagirathi, Ganga) falling into the Bay of Bengal. Over 1000 tourists visit the island every week to have dip in Gangasagar and offer prayers in Kapil Muni Temple. Once in a year during Sagar Mela in the second week of January on Makar Shankranti day the temple attracts about 3 lakhs of pilgrims and tourists. Accommodation and toilet facilities for the pilgrims and tourists is a major challenge for local administration. A study shows that nearly 2 lakh pilgrims want to stay in the night shelters in the fair ground. Others get spread over other transit points and in other accommodations like ashrams, hotels, hostels, guest houses etc. At present the Sagar Panchayat arranges temporary shelter for around 50,000 pilgrims [3]. If the main bottleneck of problems of communication involving crossing of river by ferry and lack of grid electricity are solved, Sagar Island can grow into a viable coastal tourist attraction.

(v) Livelihood Insecurity

Sagar Island is home to about 40,000 families engaged in different types of livelihoods, namely, agriculture, aquaculture, prawn seed collection, and capture fisheries. Some depend on tourism/pilgrimage at Kapil Muni temple. Agriculture is the main occupation of the islanders. About 50,000 acres of land is under cultivation, mostly with food crops. Nearly 80% of total cultivable land of this island is coastal low land. As the land is too saline for cultivation of paddy, rainwater harvesting helps rabi cultivation in Sagar. Due to presence of many constraints like salinity, impedd drainage, lack of irrigation potentiality and communication problems, most of the areas are monocropped. In the rainy

seasons, the salinity of the water of the tank decreases due to dilution with atmospheric fresh water and turn to brackish water as observed in some lined tanks. This water is used for cultivation. Therefore, available surface water is limited [3]. Power supply for irrigation is also problematic in the island as it is not provided with electric supply. Rain water harvesing structures offer scope for enhancing crop intensity. Betel leaf is grown in about 2400 acres and 1300 farmers are engaged in this livelihood.

Fisheries is the second largest livelihood after agriculture in the island. There are about 200 trawlers on the island. The poor are engaged as fishing labour on trawlers of island and some of mainlad. Livelihood based on livestock is not promising as the number of livestock is declining due to absence of grazing lands. Landless livelihoods include agriculture and construction labour, shrimp seed collection, transport and ferry labour, beedi rolling shell craft, etc. Some people make life by plying rickshaws in the island. About 1,500 families are engaged in beedi rolling and about 500 are engagede in beach combing and sea-shell handicrat. About 8,000 to 10,000 people are engaged in self employment such as tuition centres and trading.

An estimated 15,000 families constitute the poor and marginalised in Sagar Island. Of these 800 to 10,000 families live in close proximity to embankment areas. The poor are either landless or small and marginal farmers. They work as agricultural labourers and wage labourers in fishing trawlers. Some are engaged in construction works. They also make their living by working as wage labour in causarinas plantations and mangrove generation on the western side by Muringana River. Those living close to the waters egage in prawn/shrimp seed collection. Beach combing is done to gather sea shells. These shells are sold to the local traders and artists. Farmer's livelihoods in this Island is also affected or threatened by sea erosion and tidal floods.

Management Crisis

The Sagar Island exhibits a high-energy, macro-tidal coast. The marine coastal landforms show dune ridges along with intervening flats beach on the other side. The western part of the beach is dominantly of fine sand; whereas the eastern part is silty and clayey. The erosion takes place in the central part of the beach indication that this part acts as a pumping station from where sediments are sometimes transported inland forming coastal Aeolian dunes and sometimes transported to the offshore are forming and sometimes transported to the offshore are forming sand bars or ridge [1].

In case of Sagar Island, recent observations suggest that four major areas of erosion are present: in the north east (Kuchuberia); the south east centre; Dublat on the south coast, and Beguakhali on the south coast. In contrast to these erosional areas, the remainder of the Island appears to be accreting. Large areas of recently developed mangrove and salt marsh are present on both east and west coasts and a substantial area of accretion was observed in the centre of the south coast east of Sagar Mela ground. Sand accretion on the north-east coast is particularly rapid these sand beaches appear to play a central role in protecting the embankment from erosion and encouraging mangrove and salty marsh colonisation. All inhabited islands of Sundarbans including the Sagar Island have embankments along the periphery of the islands to prevent over topping due to high flood/tide and erosion by meandering creeks bordering them. In addition to the low standard of defence provided by the embankment, a further hazard is presented by the erosion of the largely earth embankment. In order to plan strengthening of any existing remedial measures and to bring in new remedial measures thorough understanding of the coastal processes is required.

Frequent embankment failures, submergence and flooding, beach erosion and siltation at jetties and navigational channels, cyclones and storms surges made this area increasingly vulnerable [1].

Sagar Island depends on diesel generator sets for electricity requirement and electricity is available on an organized scale only during the evening hours. The inadequacy of power supply hits at the root of any substantial developmental activities and livelihood upgradation/ enhancements of the inhabitants. The immense possibilities of development of tourism, of multi-crop cultivation through energized drawal of ground water and of fish preservation and processing could be explored with the availability of grid electricity. The majority of coastal people from Sundarbans have adopted prawn seed collection as their profession almost throughout the year as an important source of earning. The users are neither trained nor guided at any stage from collection to marketing and are fully dependent on traditional methods. They first sort out the tiger prawn seeds (mainly the post-larval stage PL 20) accounting only 0.25–0.27 percent of the total catch and thereafter the major portion of the haul are thrown away on the beach flats or the tidal mudflats. This wasted by-catch contains the juveniles of economic and uneconomic varieties of finfish and shellfish. Fish culture is one of the important sources of livelihood in Sagar Island. Output and consequently income from traditional and unorganized practices can be augmented further by way of adaptation of organized and co-operative approach as part of integrated coastal zone management of Sagar Island. To make the necessary intervention, a fisheries development scheme for the Sagar Island should be

initiated with the support of local unemployed youth through formation of self help groups (SHG), local NGOs and the concerned Gram Panchayats (GP).

A study shows that nearly 2,00,000 pilgrims want to stay in the night shelters in the Sagar Mela ground. Further, there should be a limit of the number of people staying in a crowed place for various strategic hygienic and management reasons. Sagar Island has immense potential as a planned eco-tourism destination. If this potential is realized through development of infrastructural facilities compatible with its ecosystem, there will be phenomenal increase in the volume of quality tourists throughout the year apart from mass pilgrimage tourism during the Makar Sankranti Mela. This will create a positive impact on the socio-economic status of the local community.

Recommendations

The above analysis reveals that Sagar Island is unique with its natural ecosystem and has a potential for becoming a prime eco-tourism destination. The natural and man-made problems affect the quality of environment and life of people in Sagar Island. Although solutions to the coastal issues caused by nature could not be solved completely, effective coordinated efforts of the local people and the government could make a great difference. If the human activities could be improved in an eco-friendly manner, it will lead to sustainable development of Sagar Island and the local communities could have a healthy living in the Island. If the eco-tourism potentials of the Kapil Muni temple are tapped properly, it will create many alternative livelihood options for the local communities paving way for their prosperity.

An integrated approach is required to manage the coastal issues and community interests. The Integrated Coastal Zone Management (ICZM) would be the ideal choice for balancing such interests. It is an overarching concept that could provide solutions to coastal zone management as well as local community development. The following recommendations will help in improving Sagar Island ecosystem and livelihood of people.

As a first step, an Integrated Coastal Zone Management Plan (ICZMP) should be prepared for Sagar Island. This Plan shall identify and prioritize the problems faced by the Island and suggest proper management strategies for solving them in a fixed time frame. The following elements should form part of the ICZMP.

- Identification of specific coastal problems to be addressed;
- Prioritization of the problems;
- Analysis of specific processes that cause these problems;
- Devising specific management techniques designed to mitigate these problems;
- Setting up of organizational arrangements and administrative procedures for implementing the management Plan;
- Creation of organizational linkages necessary for coordinated approach; and
- Finding proper fund flows through internal and external sources for implementing the Plan.
- Establishing monitoring agencies for overseeing execution of the plan.

Participation of the local communities in the execution of the ICZMP will infuse a sense of belongingness among the local people and they will be motivated to contribute positively towards the sustainable management of Island coastal ecosystem. Local community participation will also provide for the attitudinal change of people relating to conservation. The following activities will be helpful in this regard.

- Involving the villagers of the adjoining area in management of the plantations jointly with the Forest department and/or local self government who will also be entitled to the share of usufructs which may accrue from the plantations.

- Approaching soft protection measures like planting mangrove and vegetative covers along the coastal zones.

- Organizing capacity building programmes with the help of training need assessment for stakeholders through communication, people participation in making political decision, involving local people for government schemes, integrated departmental meetings to take decisions on relevant issues and to protect our environment.

- Providing general Awareness programs to emphasize for grass-root public education so that local people come to understand support and implement sustainable resource conservation and environmental protection activities now and in the future.

Conclusion

Natural hazards like flooding, beach erosion, cyclones and storms, and frequent embankment breaches have huge impacts on coastal ecosystem and biodiversity of the Sagar Island. This also affects the livelihood security of local people who largely depend on the coastal resources. Proper diagnosing of coastal issues at the grass root level, timely stakeholder participation for coastal management and the use of soft technologies with the help of bioshields

to combat erosion and environmental protection through capacity building and awareness programmes for local communities will provide significant opportunities for effective management and development of the Island coastline. As coastal protection is integrally linked to coastal zone planning and development, it should move from stand alone coastal protection to sustainable development and conservation of resources for ensuring healthy environment. ICZM will provide a base for such an approach and it will serve as an effective environmental management strategy to solve the coastal issues of Sagar Island.

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