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ECO-TOURISM TO PROTECT THE THREATENED BIODIVERSITY OF SUNDARBAN BIOSPHERE RESERVE

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ABSTRACT

Sundarban is a nature's school for the Eco-tourists. The beautiful forests of Sundarbans embracing a mysterious tract of wilderness are located in the lower Ganga delta of Bengal. The mangrove forests and the overall ecosystem in Sundarbans are the ideal habitats for large group of terrestrial, avian and aquatic fauna, starting from Protozoa to Mammals. It contains the richest biodiversity among the inter-tidal forest in the world and is the only natural mangrove forest in the world, where the tiger (Panthera tigris tigris L.) resides. The succession from ocean to land and to fresh water/ brackish-water through estuaries, change in water salinity from almost nil to high through grades of different concentration; newly formed islands with soft swampy mud to mature old islands with hard saline banks provides fascinating habitat opportunities to various organism.The nature's magic of high tide-low tide, the Mangrove species like Rhizophores having stilt roots, or Pneumatophores having breathing roots, or Phoenix (Golpata) providing perfect camouflage for the tigers, teach the tourists about Nature's determination to survive and sustain. The pre-historic Mudskipper or many species of crabs, fish and oysters/mollusks can make the visitors enthralled. And a nature's trail at Burir dabri camp, glorious Sunrise at Kalash, or enchanting Sunset in the Sundarban Tiger Reserve can be a "Joy forever".

A genuine understanding of the interaction of responsible factors should be of paramount interest to the estuarine ecosystem and for prosperity. Recently, it has been established that natural factors along with direct and indirect human interferences have largely changed the biological composition, ecosystem function, productivity, and regeneration and succession patterns within the mangrove ecosystem.

KEYWORDS: Biodiversity, Threats, Sundarbans, Eco-tourists

INTRODUCTION

The Sundarban, covering about one million ha in the delta of the rivers Ganga, Brahmaputra and Meghna is shared between Bangladesh (~60 %) and India (~40 %), and is the world's largest coastal wetland. It is a land of majestic beauty for its tropical humid forest, luxuriant mangroves, wide rivers, sea facing islands and extensive estuaries. It lies between 21o0' - 21o21' N and 88o0' - 89o0'E covering an area of 9,630 sq. km, out of which 4,096 sq. km. is under Indian administration. The area experiences a subtropical monsoonal climate with an annual rainfall of 1,600-1,800 mm and severe cyclonic storms. Enormous amounts of sediments carried by the rivers contribute to its expansion and dynamics. Salinity gradients change over a wide range of spatial and temporal scales. The biodiversity includes about 350 species of vascular plants, 250 fishes and 300 birds, besides numerous species of phytoplankton, fungi, bacteria, zooplankton, benthic invertebrates, molluscs, reptiles, amphibians and mammals. Species composition and community structure vary east to west, and along the hydrological and salinity gradients. Sundarban is the habitat of many rare and endangered animals (Batagur baska, Pelochelys bibroni, Chelonia mydas), especially the Royal Bengal tiger (Panthera tigris). Javan rhino, wild buffalo, hog deer, and barking deer are now extinct from the area. Large areas of the Sundarban mangroves have been converted into paddy fields over the past two centuries, and more recently into shrimp farms. The Sundarban has been extensively exploited for timber, fish, prawns and fodder. The regulation of river flows by a series of dams, barrages and embankments for diverting water upstream for various human needs and for flood control has caused large reduction in freshwater inflow and seriously affected the biodiversity because of an increase in salinity and changes in sedimentation. Heritiera fomes (locally called Sundari, from which Sundarban derives its name), Nypa fruticans and Phoenix paludosa are declining rapidly. During the past three decades, large parts of the remaining Sundarban have been protected for wildlife, particularly tiger, through the creation of several sanctuaries and a biosphere reserve. Parts of the Sundarban in both India and Bangladesh have been declared World Heritage sites. However, its biodiversity continues to be threatened by a growing human population that not only places pressure on its biological resources, but also impacts on the freshwater inflows from upstream areas.

The major land use patterns of the mangrove regions involve areas meant for agriculture, wildlife, forestry and recreation. The people have

reclaimed the mangrove areas of the Sundarbans for many years for their settlement and agriculture. Most of the mangrove areas in the Indian Sundarbans have been degraded and converted to busy areas for the construction of harbours, industries, agricultural fields, human habitation, grazing grounds or for regular exploitation of the forest products and also for the enhancement of eco-tourism.

Oil exploration in coastal areas is also emerging as a new threat. Further threats arise from global climate change, especially sea level rise. The future of the Sundarban will depend upon the management of freshwater resources as much as on the conservation of its biological resources.This rapid rate of degradation affects the other living organisms and leads to occurrence of natural calamities like floods, droughts, hostile climates, colossal loss and soil erosion considerably.

Government of India constituted Sundarban Biosphere Reserve (SBR) in 1989 and it received the recognition of UNESCO under its Man and Biosphere (MAB) Programme in November 2001. Sundarban National Park, forming the core area of Sundarban Tiger Reserve, received recognition as World Heritage Site by UNESCO in 1987. It has been nominated by Government of India for recognition as Ramsar Site (a wetland of international importance). Sundarban Tiger Reserve was constituted by Government of India under Project Tiger scheme, in 1973. Sundarban is the only mangrove forest in the world, which is the home of Tiger. Sundarban Tiger Reserve has the highest tiger population in the world.

Importance of Sundarban Ecosystem

Sundarban has extremely rich diversity of aquatic and terrestrial flora and fauna. Sundarban's highly productive ecosystem acts as a natural fish nursery. Sundarban Mangrove reduces the fury of cyclonic storm and prevents erosion due to tidal action. Finally, millions of people depend on Sundarban Ecosystem for their livelihood and sustenance through fishing, collection of honey and fuel wood/timber.

The SBR is bounded by Hugli river on the west, Ichhamati-Kalindi-Raim angal rivers in the east,Dampier-Hodges Line in the north and Bay of Bengal in the south.

It hosts a national park, a tiger reserve and three wildlife sanctuaries, namely, Sajnekhali, Haliday island and Lothian Island. It has also been declared as World Heritage site for its conservation.

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Eco-tourism

The term nature-based tourism is generally applied to tourism activities that depend on the use of natural resources which remain in a relatively undeveloped state, including scenery, topography, waterways, vegetation, wildlife, and cultural heritage (Ceballos-Lascura´in, 1996, p. 19). Boo (1990) defined the construct in a similar manner identifying nature-based tourism as ''tourism that consists of travelling to relatively undisturbed or uncontaminated natural areas with the specific objective of studying, admiring, and enjoying the scenery and its wild plants and animals, as well as any existing cultural manifestation found in these areas'' (Boo, 1990, p. 3).

Various authors have described nature-based tourists as individuals who are interested in experiencing wilderness and undisturbed nature; seeing lakes, streams, and mountains; being physically active; and engaging in outdoor activities (Fennell & Eagles 1990). They also may be socially and environmentally conscious. As such, (Ryel and Grasse 1991) define nature-based tourists as individuals who have a strong interest in exploring the natural wonders of the world and who also possess a built-in appreciation for natural history, as well as a desire to preserve wildlife and traditional culture.

Millions of people travel to see and experience natural environments each year. Nature-based tourism is reported to be growing at a rate of 10__to 15__annually, the fastest growth rate in the travel market (see e.g., Robotham 1994; Motavalli & Ivanko 1995).

Eco-tourism Destinations and Access

The entry point to Sundarban Tiger Reserve is either Sonakhali via Canning, or Bagna via Dhamakhali. For visiting South 24 Parganas Forest Division, on the western part of river Matla, the entry points are Namkhana, Raidighi or Jharkhali via Canning/Basanti.. Entry Permits are available at Canning, Sonakhali and Bagna for STR and at Canning, Namkhana and Raidighi for Western part of Sundarban Forest. The Eco-tourism Centres are located at Sajnekhali, Dobanki, Netidhopani and Burir Dabri in STR, and at Bonie camp (Sundarikati), Bhagabatpore Crocodile Project, Lothian Island sanctuary and Kalash beach. There are two Nature Interpretation Centres located at Sajnekhali and Bhagabatpore, and one Eco museum at Sudarikati. The Canopy walk at Dobanki, the mangrove trail at Burirdabri and the tallest Watch Tower at Bonie camp are added attractions for the Eco-tourists.

The Sajnekhali Bird Sanctuary is situated on the confluence of Matla and Gumdi within the buffer zone that extends over an area of 885 sq km. The wide variety of birds, the most popular among them being the spotted billed pelican, cotton teal, herring gull, Caspian tern, grey heron, large egret, night heron, open-billed stork, white ibis, common kingfisher, brahmini kite and paradise flycatcher. This area is also important for waders, including the Asian dowitcher (Limnodromus semipalmatus R), a rare winter migrant. Among the birds of prey are osprey (Pandion haliaetus), Pallas's fish eagle (Haliaeetus leucoryphus), white-bellied sea eagle (Haliaeetus leucogaster), grey-headed fishing eagle (Ichthyophaga ichthyaetus), peregrine falcon (Falco peregrinus), Oriental hobby (Falco severus), northern eagle owl (Bubo bubo) and brown fish owl (Ketupa zeylonensis).

The beauty of the mangrove forests and the presence of a large variety of wildlife in this region of Netidhopan, It has the ruins of a 400-year-old temple, The legends that prevail here lend a mysterious touch to the atmosphere. Holiday Island, which is a retreat of the barking deer and Kanak, which is the nesting place of Olive Ridley Turtles. Piyali is 72 km from Calcutta and is a gateway to the Sundarbans. It is being developed as a tourist complex.

The Department of Sundarbans Development of the West Bengal Government has taken up a scheme to project Jharkhali as the new tourist destination .It will now act as a tourist hub along with Sagar, Fraserganj, the crocodile project at Bhagabatpur and the tiger reserve (Ganguly, 2002).

250 meter buffer zone to protect wild life

Although wildlife occurs throughout the Sundarbans, being protected by law, the concentration and visibility by the eco-tourists is higher in the southern part of the forest due to the open spaces and grassland. Fishing birds, dolphin and crocodiles can be readily seen along the rivers and their tributaries in the forest without disturbance.

An increase in tourists is likely to increase pressures on wildlife within sanctuary areas. To reduce problems, a 250-meter buffer zone around the sanctuaries is proposed, based on remote sensing imagery, using the DISTANCE operator in GIS software. Tourists could use small boats to view the wildlife both in the Sundarbans and inside the sanctuaries without disturbing the animals, thereby creating jobs.

Uniqueness of Indian Sundarbans Biosphere Reserve

In terms of zoogeography the situation of Sundarbans is better than

that of any other regions of India. The strategic advantages are due to its unique physical factors, which no other districts in the sub-continent (except the adjoining delta regions of Bangladesh) enjoy. Three great biocycles of ocean, freshwater and land come into contact around the margins of this largest delta of the world. The succession from ocean to land and to the freshwater through estuaries is the most outstanding field for the huge amount of biodiversity. The gradient from saltwater to brackish-water to entirely freshwater fluctuates back and forth with the tides. Since freshwater is less dense and warmer, it flows over the top of the saltwater, with the result that strata with different physical characteristics are formed, which are inhabited by different kinds of fauna.

The various species thriving in this vibrating ecosystem exhibit high degree of adaptive modifications as protection against the fluctuating environmental conditions. Topography of Sundarbans is also useful for all kinds of animals. Muddy and sticky substratum is the adobe of many groups of animals whereas deep, dense, mangrove forest is useful for the others who could also very well choose alternative suitable habitat. Burrowing animals easily withstand the cyclone, tidal inundation, weather hazards, etc. by simply retreating themselves completely within the holes. The diversity of animal life in Sundarbans is very vast, which cannot be restricted to their distribution.

The animal fauna can be subdivided on their range of salinity tolerance, which is a deciding factor for the zone closely associated with its mangrove forest, its salinity, its muddy and subsoil chemistry, tidal fluctuation, temperature and humidity. So due to the full adaptation of all the animals with the surrounding environment of Sundarbans, this region contains the richest biodiversity among the inter-tidal forest in the world.

Hidden beauty of Sundarbans

Sundarbans environment supports excellent wildlife resources in the mangrove swamps and is a host to important economic species in its aquatic ecosystem. The faunal resources can be utilized for industrial development and exports. Scientific utilization of these faunal resources through fishery, froggery and faunal farming may provide a base for employment and ancillary industries. This will help in the upliftment of the rural economy in addition to agri-maricultural prosperity of the country. The forest is very rich in biodiversity and supports different species of about 334 plants, 120 fishes, 35 reptiles, 270 birds and 42 mammals.A

total 245 genera and 334 plant species were recorded by Prain (1903).

Being a borderline ecosystem (ecotone) three distinct types of organisms can be found in mangrove areas. The first are the typical species such as the mangrove crab, telescope shell, fiddler crab or the estuarine crocodiles, which are exclusive mangrove dwellers. However, both marine and fresh water species also frequent the mangrove forests. Mangroves throughout the world attract a wide variety of organisms making them a biologically rich habitat. Hidden beauties of Sundarbans are enormous. The beauty of the deep green forests in the early morning and evening, the basking crocodiles along the margins of the creeks and inlets, the quick, delicate movements of the deer at the drinking pools, as well as the beautiful seashore, will quicken the hearts of even the most world-weary traveller.

There are six different seasons, each giving different perspectives of the forest. In the rainy season, the fresh green leaves appear full of youthful vigour. The waterways during this period are full of fishes and provide great sport for the fisherman. Majestic white waves roll in from the Indian Ocean to end their journey on the spectacular shore. Each winter, thousands of guest birds and colourful ducks transform the water body into a bird sanctuary. From the sight of thousands of shorebirds wheeling in perfectly synchronised flight over the water, to the soft calling of myriad's of song-birds as they fly overhead on 6am autumn night, or the ghostly silhouettes of geese seen passing across a full moon, there are few other natural environments that can compete.

Attractions of the Sundarbans Reserved Forests

Description	Comments
Location	On the Bay of Bengal the largest mangrove formation is the largest river delta.
Tropical climate	Cool and dry during the tourist season (October/November to February).
Waterways	Large and small waterways provide opportunities for cruising and jungle boating.
Forests	Unspoiled mangroves; forest ecology.
Wildlife	The largest single population of the Bengal tiger and exceptional populations of spotted dear and wild boar; adequate bird watching, migratory species and raptors in particular.

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Beaches	Unspoiled, wild, unpolluted and totally undeveloped beaches throughout along the Bay of Bengal and around some islands
History/archaeology	Rare sites set in the forest.
Sociology	Fishermen in particular, otter fishermen, also other traditional collectors of forest produce.
Cuisine	Many different species of edible fish, prawns and crabs.
Culture	Annual festivals

Source: de Vere Moss 1993.

Conservation Approaches needed for yielding Sustainable Benefits of Sundarbans

The threats to Indian Sundarbans are mostly site specific in nature and indirectly related to the nature of resource, their exploitation pattern and socio-economic profile of the area. So there is a need of proper conservation approaches for protecting the richest biodiversity of this region. The greatest enemy of the Sundarbans is the poverty of its people. Deprived of any other means of sustenance, the inhabitants earn their livelihood by felling wood, catching fish-spawn in rivers and hunting, all of which destroy the natural resources and threaten the biodiversity of this area. Public awareness campaigns are urgently needed to inculcate environmental consciousness among people. Alternative means of income should be encouraged, replacing traditional methods that harm the ecosystem.

The Forest Departments and Fisheries Departments of Government of West Bengal and various NGOs have already adopted several strategies to conserve the vibrating mangrove ecosystem of Indian Sundarbans. Some of the important approaches are:

- Eco-Development and Joint Forest Management support activities
- Afforestation
- Vocational Training for prawn seed collectors
- Encouragement towards alternative livelihood
- Canal excavation
- Oyster culture
- Crab fattening
- Apiculture
- Pisciculture
- Development of Eco-tourism
- Establishment of Interpretation Centres

For keeping the nature in balance and for getting maximum benefit from these mangrove wetlands, more and more planned conservation approaches are required to develop the sustainable awareness in such estuarine lands on an urgent basis, besides the above mentioned protective measures. In this estuarine wetland ecosystem of the Sundarbans, human influence would cause changes raising alarming conditions. So, the main objective should be to convince the local people that they are the proud inhabitants of this World Heritage Site.

1. TrainingActivities -

In collaboration with the Forest Department other organizations should come forward to train the local people in alternative means of livelihood like:

a) Potential agriculture techniques and procedures; such as - fodder and forage grass cultivation, medicinal plant gardening and the plantation of the selected fruit trees and timber producing plants, fibre yielding trees which may also help to improve the rural economy. By this artificial afforestation programme and by developing the social forestry, the pressure on the mangrove forest trees may be minimized.

b) Economic and sustainable uses of the natural resources of the Sundarbans and other socio-economic implications may be considered.

2. Educational Activities

To generate mass education about this threatened environment some awareness programmes should be arranged in different localities. By arranging such type of programme, people may be made aware about the :

a) causes of degradation of the mangrove environment with special reference to anthropogenic activities.

b) means and methods of preservation of the endangered or threatened mangrove biota and mangrove ecosystem of Sundarbans.

c) effect of tourism development in the mangroves and recreation should be planned in such manner that the ecology is not destroyed.

d) needs for wildlife development and conservation.

3. Other Activities

a) Survey and analysis of eco parameters of this threatened mangrove ecosystem may be done in collaboration with Government departments and various NGOs.

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b) Documentation of the significant faunal diversity followed by statistical data analysis of the scientific investigations is essential for keeping in mind the present status of the environment.

4. Reduction of Man- Animal Conflict

Straying of tigers from the Reserved Forests into the habitations along the Northern and Western fringes of Sundarban Forest occasionally result into death of cattle/human beings as well as tiger. Illegal entry of fishermen into core areas as well as entry of honey-collectors into the forest also leads to killing of a number of people by the tigers. An ex-gratia relief of Rs 30,000/- is paid for human casualty.

In order to prevent straying of tiger into villages, Nylon net as well as Goran chita fencing are being erected along the forest-village interface. Tranquilisation and capture of the straying animal and their subsequent release into the forest, is also frequently resorted to. Training of the staff in use of tranquilizer gun, use of capture cage/net, quick response at the time of straying and generating support of the villagers are part of capacity building initiatives to tackle tiger straying. These efforts, coupled with Eco-development activities are paying dividend. Between 1994-95 and 2001-02, there had been 25 recorded cases of tiger straying, leading to death of 10 tigers whereas during 2002-03 to 2005-06, there were 20 cases of tiger straying with only one tiger getting killed, that too for self-defense.

Environmental Implications of Tourism

The Government of West Bengal has launched several schemes for exploiting the full potential of tourism industry in the state in accordance with the National Action Plan for Tourism, 1992. The environmental implications of the further growth of tourism industry in the state, however, need to be understood.

The most important direct effect that the tourism industry brings on the environment is increased pressure on the carrying capacity of the ecosystem in each tourist locality. Increased transport and construction activities lead to large scale deforestation and destabilization of natural landforms, while increased tourist flow leads to increase in solid waste dumping as well as depletion of water and fuel resources. Flow of tourists to ecologically sensitive areas lead to destruction of rare and endangered species due to trampling, killing, disturbance of breeding habitats. Noise

pollution from vehicles and public address systems, water pollution, vehicular emissions, untreated sewage, etc., also have direct effects on bio-diversity, ambient environment and general profile of tourist spots.

Though no systematic study has been conducted on this subject, glaring examples may be cited from Krushedei Island near Rameswaram. What was once called paradise for marine biologists has been abandoned due to massive destruction of coral and other marine life. Since the growth of the tourism industry does not have a uniform impact on all ecological regions, two distinctly different ecological regions, namely the coastal zone of West Bengal and the Darjeeling hills could be considered to sharply focus the issue of tourism on environment.

Role of tourism in protecting conservation areas

Birding and wilderness exploring is a popular form of eco-tourism, an activity that may ultimately help governments improve their management of natural resources. Ideally, eco-tourists visit sites to observe wildlife and as a result spend money in the area.

Governments and local people have economic incentives to maintain these areas in a natural condition to ensure continued visits by eco-tourists. Ecotourism is therefore being promoted as a tool for bio-diversity conservation and rural development (Aronsson,2000). To achieve these goals, however, careful management and planning is required.

Before promoting eco-tourism activities, authorities should assess and mitigate the potential impacts from eco-tourism.

Tourism in the Sundarbans

In order to realize its idea, the West Bengal government has drawn up plans for developing the beaches lining the Bay of Bengal and also the Sunderbans. The plan also includes the introduction of cruises on mechanized boats in the Sundarbans that has got a number of rivers criss-crossing it. It was further informed by the State Tourism Minister Manab Mukherjee that at Jharkhali near Sundarbans, up to six world class resorts are being developed. The tourist lodge of the state tourism board which is presently in a dilapidated state is also being renovated.

To promote West Bengal as a desirable tourist destination, the State Government has formulated certain plans & policies.

- Promote sustainable development of tourism in the State.

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- Preservation and promotion of local art, tradition, heritage, culture & environment.
- Promotion of Sports tourism, Adventure tourism, River tourism, Rural tourism, Eco-tourism,, Forest & wildlife tourism
- Notification of Special Tourism Areas in the State.
- Public Private Participation in creation of tourism infrastructure.

The impact of tourism on the Sundarbans needs to be critically analysed. With increasing tourist traffic, there is the likelihood of changes in water quality due to accidental or other release of diesel and lubricants from motorised boats. Large number of tourists in small island areas is also likely to disturb the habitat condition of the biota. The present tourist promotion scheme lacks management of solid waste and waste water even from organised hotel sector. Noise level due to small motorised country boats and other vessels is apt to increase and cause disturbance in the habitats of several species.

While the need for promotion of tourism in the Sundarbans cannot be debated, the necessity of having a study on the carrying capacity should be a priority action area. Loss of mangrove in the past, acute scarcity of fresh groundwater, soil salinity, water logging, siltation in the channel courses and adverse climatic conditions (high tides, cyclonic storms) are listed as main hazards which affect the entire Biosphere Reserve. While promoting tourism, these limiting factors are to be considered to assess the carrying capacity. The number and capacity of motorised boats carrying tourist traffic on board, overnight accommodation at selected places with acceptable disposal system of solid waste and wastewater treatment could be the part of such a study.

Promotion of tourism can be made eco-friendly by making available adequate information material, interpretation centre and watch towers at carefully selected spots. Tourism in the Sundarbans can also lead to a profitable activity for local population. Tourist statistics indicate that at present 1,80,000 tourists annually visit Sundarban area. An opinion poll about tourism attraction indicate that most of the participants (100%) are interested in inter island boat trips, besides showing interest in bird watching (50%), turtle nesting (33%) and recreational fishing (17%). The tourism activity can further be augmented by interdicting underwater Plexiglas capsule for watching the marine life. As many as 83% of the tourists have shown interest in this regard (Periodic, State of Conservation of World

Heritage properties, 2006). The local people could therefore be engaged in inter island boat trips, as guides for bird-watching, turtle nesting sites and recreational fishing. The employment of the local people in all other promotional activities should form an important component of management strategy.

The relationship between tourism and conservation can be a symbiotic one. The benefits that a well-managed coastal area can accrue to the tourist industry are clear; however, tourism can also facilitate the protection of coastal areas. If tourism is properly controlled, it can create the conditions necessary to support the process of conservation through productive planning and comprehensive management.

Ecotourism interests can also convince local people that their resources are as, if not more, valuable when intact than when extracted from the ecosystem. When a user fee or visitor admission fee structure is imposed, real economic incentives for protected areas can catalyze their formulation. Ecotourism hopes to change the unequal relationships of conventional tourism. Thus it encourages the use of indigenous guides and local products. It claims to combine environmental education with minimal travel comforts, help protect local flora and fauna and provide local people with economic incentives to safeguard their environment.

Ecotourism has the potential to cause harmful environmental impacts. One issue is the harassment of wildlife. For example, feeding animals can create unnatural behaviour, which can be dangerous for the animals. Some birders can attract birds by whistling or playing a tape- recorded song, which brings them out into the open to confront the intruder. Tourists can set fire to the forest, which if they run out of control, may destroy the vegetation and wildlife habitat. When used too often, however, these tactics may cause birds and other animals undue stress. Another issue is trampling. Tourists often venture off the trail in pursuit of birds and animals, damaging the underlying vegetation and soil in the process. Authorities will need to use caution and expertise in containing such issues.

Conservation tourism or ecotourism may be developed for the Sundarbans without causing undue disturbance to the forest and wildlife. The Royal Bengal Tiger (Panthera tigris) is, in particular, an important and alluring component of the Sundarbans and as such, should be an essential part of conservation and tourism activities. The fishing operation during winter months can also be developed as an interesting tourist spot.

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Tourism has been recently regarded as an important component of the management and development of the Sundarbans. It has been recommended that due to the difficult terrain and the conservation needs of the forest ecosystem, the Sundarbans should be considered a site for low volume high-cost ecotourism rather than for a wider, less affluent mass market (UNDP 1998).

The National Tourism Policy of 1992 identifies the Sundarbans as one of the four key areas for development with an emphasis on wildlife.

Various constraints to developing the tourism potential of these forests have also been noted by the report and include:

1. Seasonal and climatic factors such as monsoon rains, storms etc.
2. Shortage of drinking water.
3. Lack of power and telecommunication facilities.
4. Lack of medical facilities.
5. Distance from airport.
6. Lack of tourism ethic and institutional framework.
7. Lack of infrastructure and staff for wildlife management, and conservation of wilderness values.
8. A fragile environment and difficult terrain.

Despite the difficult terrain and climatic uncertainties of the Sundarbans, the mangroves remain a source of attraction both in terms of aesthetic and wildlife value as well as in terms of research potential and educational value. The conservation of the natural ecosystem is therefore imperative, not only to maintain the productivity of the forests but for the preservation of wildlife and the various services and functions performed by the forests, many of which we have yet to discover.

CONCLUSION

The primary goal of creating sanctuaries is to conserve the mangrove forest and its flora and fauna in a natural state, while providing opportunities for education and recreation. Compared with other types of tourism, eco-tourism has the most potential to meet these goals and it will be able to tackle most of the problems when GIS technology would be used as a tool to minimise the impact.

It has become a matter of immediate urgency to address the integrated management and research needs of the ecosystem. The resources and

functions provided by the mangroves are essential for the coastal communities and for the national economy. In terms of scientific and educational value, and as part of natural heritage, the world's largest block of mangrove forests, straddling across the border of Bangladesh and India, is of both national and international value.

The involvement of local people in tourism is currently limited because the majority of visitors are on all-inclusive package-tours which originate and terminate in distant places. Thus, different modes of tourism and smaller scale operations need to be supported. Also, opening more entry points will help other island villages to avail of tourism opportunities.

Tourism development in the Sundarbans needs to be environmentally sustainable. Currently, there are no restrictions on the number of permits issued to tourists. However, any future plans for tourism must take into account the capacity of the forests in the region to cope with scaled-up tourism. It is clear that eco-tourists are distinct from conventional tourists and have different and often more beneficial environmental, social, and economic impacts on protected areas.

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