

# **Term Paper- 2**

## **Status of Mangrove Flora and Fauna and Their Impact on Mangrove Ecosystem**

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## **Introduction**

Mangrove is an evergreen, salt tolerant plant community, which grows in inter-tidal coastal zones of tropical and subtropical regions of the world (Rajpar & Zakaria, 2015). Mangrove forests are highly productive, tropical coastal ecosystem encompassing estuaries, creeks, lagoons, backwaters, mud-flats, salt-pans and islands which has both great aquatic and terrestrial biodiversity (Mmom & Arokoyu, 2010) and plays an integral role in coastal ecosystem functions at the interface between terrestrial, freshwater and marine systems (Spalding, Kainuma, & Collins, 2010). Mangrove fauna are animal communities that inhabit or utilize mangrove habitats, such as coastal inter-tidal zones, estuaries and riverine areas where rivers drain into the sea, to fulfill their need for survival and reproduction (Wan Juliana, Damanhuri, Razali, & Norhayati, 2010). The vegetation structure and composition of mangrove areas may vary depending upon soil texture and structure, rainfall pattern, and inflow of freshwater from rivers to the sea (Rajpar & Zakaria, 2015) (Rotaquio, Nakagoshi, & Rotaquio, 2007).

Mangroves occupy less than 1 % of the world's surface and are mainly found between the Tropic of Cancer and the Tropic of Capricorn on all continents covering an estimated 75 percent of the tropical coastline worldwide (Saenger, 2002).

The most extensive and luxurious mangroves extend across the Indo-Pacific regions where they are best developed in the delta systems of major rivers, e.g. the Ganges-Brahmaputra, Irrawady, Mekong and along very sheltered shores protected by large land masses, notably Madagascar, the Malacca Straits, Kalimantan, the Indonesian Archipelago and Papua New Guinea. The largest intact area of mangroves occurs in Bangladesh, where there is almost 600,000 ha of the Sundarbans ecosystem and a mangrove forest area estimated in 1985 to cover 401,600 ha (Chaffey, Miller, & Sandon, 1985). In South America, mangrove forests extend from northern Peru on the Pacific coast and from Brazil's southern state of Rio Grande do Sul on the Atlantic coast (Snedaker, 1986). Large undisturbed forests remain in remote areas, for example the Orinoco Delta in eastern Venezuela (495,200 ha) and the Pacific coast of Colombia (451,300 ha). Similar expanses occur in northern Brazil (Snedaker, 1986). Mangroves also penetrate some temperate zones, but there is a rapid decrease in the number of species with increasing latitude (Tomlinson, 1986). At their latitudinal extremes: 31 N in southern Japan (Hosokawa, 1977); 31 N on the Pacific coast of Mexico; 32 S in Brazil and 38 S in southern Australia (Wells, 1983).

## **Flora of Mangrove**

The distribution of different species of plants and animals in mangrove depends upon the basic ecological factors such as grain size, the type of substrate, tidal period, pH, salinity, the level of the soil and the light. There are more than 18 million ha of global mangroves inhabiting in 112 countries and territories in the tropical and subtropical region. Around 34 major and 20 minor mangrove species belonging to about 20 genera in over 11 families have been recorded globally

(Tomlinson, 1986). Mangroves of South and Southeast Asia form the world's most extensive and diverse mangrove systems comprising 41.4 percent of global mangroves.

In Thailand, especially around the upper Gulf coastline, mangrove forest consists of Avicenia alba as a pioneer species. After Avicenia, the most frequent species is Rhizophora apiculata. Further inland, there is a mixture of different plant species such as Rhizophora mucronata, Xylocarpus moluccensis, Excoecaria agallocha, Bruguiera conjugata, and other Bruguiera spp. Nippa plants are found the innermost parts of mangrove.

On the Andaman coast, in Phang-Nga province, the mangrove forest has about 50% of its total width under the tidal range and the Important Value Index of Rhizophora mucronata, Rhizophora apiculata, and Sonneratia alba at 20m from the sea was found to be more than 50%. About 80 species of true mangrove trees/shrubs are recognised, of which around 50-60 species make a significant contribution to the structure of mangrove forests. Species diversity is much higher in the Southeast Asian region, where approximately two-thirds of all species are found, while approximately 15 species occur in Africa and 10 in the Americas (Zisman, 2005).

Sundarbans have a considerably high floral diversity. A total of 245 genera and 334 plant species were recorded in this forest (IFMP, 1998). Some species growing in the Sundarbans are highly useful and great commercial value (Table 1). The vegetation of the Sundarbans plays an important role in the national economy of the country. It is known that some species are becoming rare in the present time. The Bhat Kati (Bruguiera parviflora), Kala Baen (Avicennia marina) is nowadays a rare plant in the Sundarbans (Hussain & Acharya, 1994). The more prominent and important species found in the Sundarbans are

**Table 1: Important plants of the Sundarbans and their uses**

Scientific Name	Vernacular Name	Family	Types of plant	Main uses
<i>Avicennia officinalis</i>	Baen	Avicenniaceae	Tree	Fuel wood, Anchor logs
<i>Bruguiera sexangula</i>	Kankra	Rhizophoraceae	Tree	Furniture, bridge and house construction
<i>Ceriops decandra</i>	Goran	Rhizophoraceae	Shrub or small tree	Fuel wood, house posts, charcoal
<i>Cynometra</i>	Shinga	Leguminosae	Shrub or	Fuel wood

Scientific Name	Vernacular Name	Family	Types of plant	Main uses
<i>Excoecaria agallocha</i>	Gewa	Euphorbiaceae	Tree	Matchsticks and boxes, newsprint, other papers
<i>Heritiera fomes</i>	Sundari	Sterculiaceae	Tree	House construction, boat building, electric poles, hard boards, fuel wood
<i>Lumnitzera racemosa</i>	Kripa	Combretaceae	Small tree	Fuel wood, posts
<i>Nypa fruticans</i>	Golpata	Palmae	Recumbent palm	Thatching for houses
<i>Phoenix paludosa</i>	Hantal	Palmae	Thorny palm	Posts and rafters for huts
<i>Sonneratia apetala</i>	Keora	Sonneratiaceae	Tree	Packing boxes, construction material
<i>Xylocarpus granatum</i>	Dhundul	Malvaceae	Tree	Furniture
<i>Xylocarpus mekongensis</i>	Passur	Malvaceae	Tree	Furniture, bridge, house construction

### Undergrowth species diversity of Sundarban

48 undergrowth species were recorded in the Sundarbans mangrove forest. On the basis of frequency distribution of undergrowth vegetation data sets six undergrowth species were found to be dominant and widely adapted to the various salinity conditions. Such as *Acanthus ilicifolius*, *Acrostichum aureum*, *Derris trifoliata*, *Vitis trifoliata*, *Sarcolobus globosus* and *Phoenix paludosa*. It is interesting to note that salinity is a vital factor for the development of undergrowth species (S. Harun Rashid et al., 2008).

**Table 2: Most frequent undergrowth species**

Scientific name	Zones
<i>Acanthus ilicifolius</i>	All zones
<i>Acrostichum aureum</i>	All zones

<i>Cynometra ramiflora</i>	Oligohaline zone
<i>Derris trifoliata</i>	All zones
<i>Hibiscus tiliaceus</i>	Oligohaline zone
<i>Nypa fruticans</i>	All zones
<i>Pandanus foetidus</i>	Oligohaline zone
<i>Phoenix paludosa</i>	All zones
<i>Vitis trifoliata</i>	All zones
<i>Porteresia coarctata</i>	Oligohaline zone
<i>Rhizophora mucronata</i>	Oligohaline zone
<i>Sacrobolus globosus</i>	All zones

Source: (S. Harun Rashid et al., 2008)

#### **Climbers of Sundarbans mangrove forest:**

The climbers were comprised of 53 species belonging to 46 genera under 20 families. 44 species were recognized as vines and 9 species were lianas. 25 species of the climbers were non-mangrove, 19 mangrove associates and 9 mangrove species. According to DAFOR scale of frequency classes:

**Table 3: Important plants of the Sundarbans and their uses**

46 species recognized in	Rare category
5 species namely, <i>Dalbergia candentensis</i> , <i>Finlaysonia obovata</i> , <i>Salacia chinensis</i> , <i>Stenochlaena palustris</i> and <i>Vitis trifoliata</i> were recognized in	Occasional category
<i>Sarcolobus globosus</i> recognized in	Abundant category
<i>Derris trifoliata</i> recognized in	Frequent category

Source: (Gazi Mosharof Hossain et al., 2015)

16 climber species were found as aggressive invasive affecting the growth, development and regeneration of many other species. They are

<b>Species</b>	<b>Species</b>	<b>Species</b>	<b>Species</b>
<i>Clerodendrum inerme</i>	<i>Derris trifoliata</i>	<i>Cuscuta reflexa</i>	<i>Entada phaseoloides</i>
<i>Dalbergia candentensis</i>	<i>Finlaysonia maritima</i>	<i>Derris scandens</i>	<i>Flagellaria indica</i>

<i>Hoya parasitica</i>	<i>Sarcolobus globosus</i>	<i>Mikania cordata</i>	<i>Stenochlaena palustris</i>
<i>Mucuna gigantean</i>	<i>Tylophora indica</i>	<i>Salacia chinensis</i>	<i>Vitis trifoliata</i>

Source: (Gazi Mosharof Hossain et al., 2015)

## Fauna

According to Integrated Resources Management Plans for the Sundarbans-2010, there are 1136 species of wildlife which include 315 species of birds (including 84 migratory), 289 terrestrial species of which 49 species are mammals, one of which is the great royal Bengal tiger and 678 aquatic species (of which 210 are fish species), including 59 reptiles, eight amphibians, 11 cetaceans and 16 mollusks which constitute about 35% of the total fauna of Bangladesh. Important mammal species include the spotted deer, barking deer, macaque monkey, wild boar, jackal, Indian fishing cat, civets, small mongoose, common otter, smooth coated otter, bats, Irrawaddy squirrel, crestless Malayan porcupine, large bandicoot rat, etc. Principal reptile species are marsh/estuarine crocodile, python, common cobra, gecko, sea snakes, monitor lizard, turtles, etc. The aquatic birds include storks, herons, egrets, adjutants, little cormorant, etc. Semi-aquatic birds are plovers, red-wattle lapwing, avocet, stint, curlew, sandpiper, common greenshank, gulls, terns, etc. Some raptorial birds include the eagles, falcons, vultures, kites, harriers, etc and some terrestrial birds are doves, kingfishers, woodpeckers, pigeons, flycatcher's oriental magpie robin, red jungle fowls, owls, rose-winged parakeet, etc. There are eight commercially important species of finfish, shrimp and crabs, and at least 11 species of bivalves in estuarine areas. However, seven species have become extinct in the beginning of the last century and 39 species become endangered. Some of them are the Royal Bengal Tiger (*Panthera tigers*), Jungle Cat (*Felis chaus*), Irrawaddy dolphin (*Orcaella brevirostris*), Blyth's Kingfisher (*Alcedo hercules*), Estuarine Crocodile (*Crocodylus porosus*), Yellow Monitor (*Varanus flavescens*), Rock python (*Python molurus*), Green Frog (*Euphlyctis hexadactylus*) and others. (Siddiqi, 2001)

At present 49 mammals species have been recognised, and of these no less than eight spectacular species, namely Javan rhinoceros (*Rhinoceros sondaicus*), Single horned rhinoceros (*Rhinoceros unicornis*) Water buffalo (*Bubalus bubalis*), Swamp deer (*Cervus duvauceli*), Mugger crocodile (*Crocodylus palustris*), Gaur (*Bos frontalis*) and Hog deer (*Axis porcinus*) have become extirpated in the Sundarbans since the last century (Sarker, 1992) (Salter, 1987)

Class	Total number of species in Bangladesh	Existing species in Sundarbans (No)	Sundarbans share with Bangladesh (%)	Extinct species (No)	Endangered species (No)
Mammalia	110	49	45	4	10

Aves	628	261	42	2	11
Reptilia	109	50	46	1	16
Amphibian	22	8	36	-	2

Source: (Rashid, 1994) (Siddiqi, 2001)

### **Aquatic and fisheries resources of Sundarbans:**

The Sundarbans ecosystem supports rich fisheries diversity. Its water-bodies support 27 families and 53 species of pelagic fish, 49 families and 124 species of demersal fish, 5 families and 24 species of shrimps, 3 families and 7 species of crabs, 2 species of gastropods, 6 species of pelecypods, 8 species of locust lobster and 1 family and 3 species of turtles (Acharya & Kamal, 1994).

### **Mangrove Ecosystem**

The mangrove ecosystem is delicate, dynamic and complex and its principal parameters are the environment, the flora, the fauna, and human interference (Choudhury, 1984). Each one of the components of the environment namely, climate, salinity, sweet water supply, siltation, erosion, substrate and nutrients has a first order reaction on the mangrove environment. The second and subsequent order reactions are highly complex and have not been studied in sufficient detail.

The mangrove ecosystem is an open system and the cycles of material transport in the mangrove forests are driven by physical and biological components. The factors in the cycles of material transport include daily tides, run-off, rainfall, decomposition, mineral intake and activities of the fauna in general and fish and wildlife in particular (Hendrichs, 1975). The interaction between biotic and abiotic components in mangrove forest is very complex. As the environment is very different than other ecosystem, the components (flora and fauna) has adapted unique abilities such as, stilt roots, prop roots, pneumatophore, buttress root, waxy leaves, salt tolerance, vivipary germination etc. to survive in this environment. Tidal action is a primary factor that determines mangrove ecology, i.e. ecosystem processes. Once established, roots of mangrove plants provide a habitat for oysters and help to impede water flow, thereby enhancing the deposition of sediment in areas where it is already occurring. Usually, the fine, anoxic sediments under mangroves act as sinks for a variety of heavy (trace) metals which are scavenged from the overlying seawater by colloidal particles in the sediments. Mangroves support unique ecosystems, especially on their intricate root systems. The mesh of mangrove roots produces a quiet marine region for many young organisms. In areas where roots are permanently submerged, they may host a wide variety of organisms, including algae, barnacles, oysters, sponges, and bryozoans, which all require a hard substratum for anchoring while they filter feed. Shrimps and mud lobsters use the muddy bottom as their home. Mangrove crabs improve the nutritional quality of the mangal muds for other bottom feeders by mulching the mangrove leaves. In at least some cases, export of carbon fixed in mangroves is important in coastal food webs. The habitats also host several commercially important species of fish and crustaceans (Khairnar, Solanki, & Junwei, 2004). Human activities have greatly disturbed the balances of components. For development and settlement purpose deforestation in mangrove forest has caused loss of unique habitat (flora) of

fauna. Thus biodiversity has decreased dramatically and many mangrove species (flora and fauna) have faced extinction.

## Conclusion

Mangroves protect the coast from erosion, surge storms (especially during hurricanes), and tsunamis. Their massive root system is efficient at dissipating wave energy. Likewise, they slow down tidal water enough that its sediment is deposited as the tide comes in and are not re-suspended when the tide leaves, except for fine particles. As a result, mangroves build their own environment. Because of the uniqueness of the mangrove ecosystems and their protection against erosion, they are often the object of conservation programs including national Biodiversity Action Plans. Despite their benefits, the protective value of mangroves is sometimes overstated. Wave energy is typically low in areas where mangroves grow, so their effect on erosion can only be measured in the long-term. Their capacity to limit high-energy wave erosion is limited to events like storm surges and tsunamis. Erosion often still occurs on the outer sides of bends in river channels that wind through mangroves, just as new stands of mangroves are appearing on the inner sides where sediment is accreting (Khairnar, Solanki, & Junwei, 2004). It has been proved that the presence of mangrove ecosystems on coastline save lives and property during natural hazards such as cyclones, storm surges and erosion. Therefore to combat deforestation in mangrove forests, extensive mangrove afforestation programmes have been undertaken over the past three decades worldwide.

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