Mangroves

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1. Mangroves

Mangroves are specialized type of plant (and animal) communities found along the shores of some tropical estuaries and lagoons. They are characterized by certain assemblage of tree species.

2. Distribution of Mangroves

Mangroves are found in the tropics and substropics of both the new world and the old world. They develop in the intertidal zone of sheltered shores where the substratum is not much disturbed by the wave actions.

In Sri Lanka, the mangroves are usually small and the entire island has only about 6,000 ha of mangroves. However, relatively large areas of mangroves are seen in association with the lagoons of Puttalam and Batticaola, and Trincomalee Bay. Most of the other lagoons and estuaries also have at least small areas of mangroves.

In some South-East Asian countries, such as Malaysia and Thailand, there are vast areas of mangroves, and they are usually called mangrove forests or intertidal forests.

3. Mangrove habitat

Mangroves are often swampy areas in which the soil is often a rich mud. This mud is essentially anaerobic, although rich in nutrients. The area is flooded with sea water at each tide, and with freshwater during flooding rains. Thus, ecological conditions present in these habitats are rather harsh, and plants and animals living in the mangroves must be adapted to tolerate wide ranges of salinity, desication, and anoxic conditions. The mean air temperature within Sri Lankan mangroves is about 30° C, and the relative humidity ranges from 60-90%. The salinity varies depending on the land drainage, but in general, wet zone mangroves have a lower salinity than the dry zone mangroves.

4. Mangrove plants

4.1 Species of Macroflora

There are 19 species of woody plants (of which one, Nypa, is a monocot with an underground stem) and one species of herbaceous plant (Acanthus ilicifolius) in Sri Lankan mangroves (see Appendix 1 for a list of mangrove plants). Two genera that are quite common in Sri Lankan mangroves are Rhizophora and Avicennia. Rhizophora can easily be identified by its well branched prop roots. Avicennia has some of its roots jutting out of soil surrounding the tree. These roots are called pneumatophores. These pencil-thick pneumatophores are quite numerous and develop on cable roots

extending out from the tree. Thus, pneumatophores of Avicennia appear in rows radiating from the tree. Sonneratia also develop pneumatophores. However, Sonneratia pneumatophores can easily be disinguished as they are much thicker (often more than one cm in thickness) and longer (often more than 40 cm as opposed to 20-30 cm long Avicennia pneumatophores). Bruguiera, on the other hand, has characteristic knee roots. At some places roots bend upwards grow above soil into thick knotty structures, the knee roots. Other important mangrove trees in Sri Lanka are Ceriops, Lumnitzera, Excoecaria, Aegiceras, and Xylocarpus.

4.2 Adaptations

Pneumatophores and knee roots help the underground root system to obtain oxygen from air. This is important as mangrove mud is often anoxic. Since these plants grow in saline waters they have some mechanism to exclude Na, which in high concentrations is toxic to protoplasm. Some plants like Acanthus, Avicennia and Aegiceras, have special glands in leaves which actively excrete salt. Others like Excoecaria are said to deposit salt in old and disused tissues. The salt water and muddy substratum also create problems for seed dispersal and germination. In many mangrove plants seeds germinate while still on the mother plant. The hypocotyle extends downwards forming a thick root-like

anchoring device. When the seedling drops, the hypocotyl presses into the soft mud keeping the cotyledons and plumule above water. Even when carried by currents, the seedlings can survive for several days until a suitable substratum is found. Rhizophora, Bruguiera and Ceriops show this type of viviparity. Others like Avicennia develop fruits which can float in water for several days while the seeds remain viable. The leaves of mangrove plants show several adaptations to minimize water loss due to evaporation. These are important as obtaining water from saline waters is a problem. Many have succulent leaves (e.g. Rhizophora, Sonneratia, Bruguiera), and some have leaves covered with hairs (e.g. Avicennia). The leaf epidermis is thick-walled and strongly cutinized. In many plants stomata are found only on the lower surface of the leaf.

4.3. Regional differences in distribution

Some species of mangrove trees appear to be present only in certain regions of the country. For instance, Nypa is usually found only in the wet zone. It does not tolerate high salinity conditions present in the dry zone mangroves. Sonneratia alba is found from Negombo to Mannar only; in other regions S. caseolaris is found instead

4.4. Zonation

In large mangroves, such as those that are present in

Malaysia and Thailand, an ecological zonation of plant species is often seen. But, in Sri Lankan mangroves, which are small and narrow, such clear cut ecological zonation is seldom found. The extent of the mangrove depends mainly on the tidal amplitude. In Sri Lanka, the tidal amplitude is very small, seldom exceeding 1.0 m, and often less than 0.5 m. However, the lower region, which is often under water, is occupied by Rhizophora. Sonneratia with its long pneumatophores, also often occur in this region. Sometimes, Avicennia also occurs in the lowermost region. Bruguiera is usually found behind Rhizophora zone. This is followed by a region of mixed mangrove, in which other species occur. Avicennia is sometimes seen in the upper region of the mangrove. In some mangroves, such as those seen in Negombo and Bentota, Acanthus is wide spread, which is probably due to selective felling of mangrove trees by man.

4.5 Mangrove Associates

Behind the mangrove proper, usually there is a region called the back mangrove, in which certain species of trees and herbaceous plants occur. Such plants can occur even in the absence of mangroves. Similarly, in front of the mangrove proper, beds of sea grasses may occur. This region may be called the fore-mangrove. Plant species in the back-, and fore-mangroves are called mangrove associates. Cerbera manghas, Clerodendron inerme, Dolichandrone spathacea and Acrosticum

aureum are some of the back-mangrove plants, whereas Enhalus acoroides, Halophila ovalis, Thalassia hemprichii and Cymodocea serrulata are sea grasses found in the fore-mangrove. Salt marsh plants such as Sueda, Salicornia and Arthrochnemum are seen in the back mangrove of the dry zone and salt marshes.

5. Mangrove Macrofauna

Mangroves provide a wide variety of habitats suitable for various animal species. Some of the animal species found in the mangroves are adapted to a life in the mangroves (true mangrove fauna), whereas others take advantage of the presence of mangroves for obtaining food, shelter etc.(faculative mangrove fauna). Since the mangroves develop in the intertidal zone, most of the mangrove animals are either interdial estuarine animals or species that are derived from them.Since mangroves are also transitional between marine, freshwater and terrestrial habitats, some of the marine, freshwater and terrestrial animals are also found in them.

5.1 Species of Macrofauna

Mangrove substratum provides suitable habitats for polychaetes, molluscs (especially gastropods), and crustaceans (especially decapods). Gastropods and Decapods dominate mangrove macrofauna of Sri Lanka as well as that of many other countries. Among gastropods, Cerithidea is prominent in Sri Lankan mangroves. The gastropods, Littorina and Nerita are also commonly seen on stems and branches of trees. Among bivalves, Anadara and Gelonia are common. The oyster

Crassostrea and the barancle *Balanus* are commonly seen attached to submerged roots of *Rhizophora* etc. Among decapods, grapsid crabs are the commonest. Other epifauna and infauna include ocypodid (fiddler crabs) and portunid crabs, hermit crabs, sedentary animals such as barnacles, penaeid prawns and fish species. The mud loster, *Thalassina* (related to hermit crabs) build quite large mounds within mangroves. The portunid crab, *Scylla serrata*, is commercially important and is exported to Singapore and other countries. The common and commercially important prawns from mangrove areas include *Penaeus indicus*, *P. monodon*, *P. semisulcatus*, *Metapenaeus dobsoni*, and *Macrobarchium rosenbergi*. The common fish species in mangrove waters are mugilids, ambassids, siganids and latids. The mud skipper *Periophthalmus* is quite common on roots of *Rhizophora* and on mudflats.

5.2 Zonation

An ecological zonation of different species of the same genus has often been described in mangroves of countries such as Malaysia and Thailand. However, this type of zonation is seldom found in Sri Lankan mangroves, although different groups of animals are found in different zones in the mangrove. For instance, fiddler crabs and the gastropod *Cerithidea cingulata* are often found on the mudflats. The bivalves are found in the region subjected to daily flooding by tides. The mud lobster *Thalassina* is usually seen above the high tide mark. Grapsid crabs are seen in the intertidal region.

6. Types of Mangroves

Five types of mangroves can be recognized in Sri Lanka depending on the topography, flooding characteristics, and floristic composition.

The riverine mangroves are found on river estuaries, and the fringing mangroves are found on the shores of lagoons and estuaries. The scrub mangrove is a degraded mangrove found in areas in which soil is water-logged, and often becomes hypersaline. Such a mangrove is seen on the shores of Mundel lake. The basin mangrove develops in a shallow depression, in which little exchange of nutrients takes place. Such a mangrove is seen on the shores of Vadamarachchi lagoon in the Jaffna peninsula. Overwash mangroves develop in low-lying areas situated at right angles to the tidal flow, and on small islands. Tides flow over these areas carrying away nutrients etc. Such mangroves are seen on small islands in Puttlam lagoon and Mahaweli estuary and also at Keerimundel and Kovilkudah in the Kalpitiya area.

7. Use of Mangroves

Mangrove trees etc. have been used by man for various purposes for a long time. Mangrove trees are used for charcoal production (not in Sri Lanka) and for firewood. They burn well and leave little ash. They are a good source of timber for building purposes, (eg. to obtain poles and beams in house construction). They are also used for constructing out-riggers in out-rigger boats in Sri Lanka. The wood contains a high percentage of tannins and are resistant to insects decay etc. Tannins from the bark of Rhizophora, Ceriops, Bruguiera etc. are widely used in Latin American countries, but in Sri Lanka only for dying fish nets and fishing lines. Wood-chip and paper are made from mangrove trees in Malaysia. Barks etc. of mangrove trees are used in indigenous medicine. Sonneratia fruit is made into a delicious cream, somewhat similar but better than woodapple cream. Nypa sap is rich in sugar and can be

fermented to a toddy and vinegar, while its leaves are used for weaving mats and baskets. In countries like India and Indonesia, cattle and other domestic animals graze on mangrove trees. Honey production is practised in the mangroves of Bangladesh. Fish and shellfish from mangroves are a major source of income for mangrove dwellers. In Sri Lanka, the pneumatophores of Sonneratia are used to make bottle corks. Use of mangrove tree branches for "brush pile" fishing appears to be peculiar to Sri Lanka.

8. Importance of Mangroves

Mangroves play an extremely important role in the coastal ecosystem. It is unlikely that trees other than mangrove trees can grow successfully in the stressed mangrove habitat. The nutrients and minerals brought in by land drainage are trapped within the mangroves. If not for mangroves these would have dispersed quickly making them less available to other flora and fauna in the estuaries. Mangrove plants entrap solar energy and makes it available to the food web. Detritivores, which start many of the food chains in the mangrove, feed on decaying leaves and other materials. Mangroves provide food and shelter to juveniles of many finfish and shellfish species. Mangroves protect coast lines and river banks from erosion and also act as a barrier against high winds and cyclones. The extensive prop root system of Rhizophora traps silt and mud very effectively and the new seedlings as they grow in shallow waters will make new land.

9. Management and Conservation of Mangroves

Strict measures of management and conservation are urgently required to save our mangroves. Many areas of mangroves in Sri Lanka are cleared completely and even in others larger trees are selectively felled. Crop plantations and human settlements have been established in and around mangrove areas. Strict legislation againstunscientific exploration of mangroves is a necessacity. Replantation of mangrove trees in suitable areas is also very important. But, education of the general public, especially those living in the vicinity of mangroves, as to the importance and necessacity of mangroves to Sri Lanka is of extreme importance. Without such education, other measures are not likely to be very successful.