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ECOLOGICAL IMPORTANCE OF MANGROVES - A REVIEW

[*1] T.Nedumaran and [2]M.Elamvaluthi

[*1]Department of Plant Biology and Plant Biotechnology,Sir Theagaraya College,Chennai-21, Tamil Nadu, India.

[2]P.G and Research Department of Botany, Pachaiyappas College, Chennai-30, Tamil nadu, India.

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ABSTRACT

Mangrove forests are among the most productive and biologically important ecosystem because they provide goods and services to human society. The mangrove forests help to stabilize shorelines and reduce the devastating impact of natural disaster such as tsunami and hurricanes, the productivity of important estuarine dependent fisheries, water quality regulations, flood reduction and shoreline stability.

Keywords: : Mangroves, Ecological services, Coastal erosion, Sediments, Carbon sequestration.

1.INTRODUCTION

Mangroves are a group of salt-tolerant species occurring in the tropical and sub tropical inter-tidal estuarine regions, lagoons, bay and creeks spreading from the height level of spring tide down almost to mean sea level. The mangrove community as a whole consists of salt tolerant plant of soft and swampy mud, mostly trees and shrubs with broad, leathery, evergreen leaves. Mangroves make special type of vegetation that exists at the boundary of two environments using a variety of survival and reproductive strategies. Till about 1960s, mangroves were largely viewed as economically unproductive areas and were therefore destroyed for reclaiming land for various economic activities. Every ecosystem supports human life by giving direct or indirect benefits and services. Mangrove areas are one among the most productive ecosystems on this planet Mangroves occupy less than 1percent of the world s surface (Saenger, 2002). Mangroves can also be found growing on dandy and rocky shores, coral reefs and oceanic islands. There are instances where islands can be completely coved by mangroves. It is impossible to describe typical mangroves as the variation in height and girth, even for the same species is immense,

depending on the many factors that control growth. Mangroves are wildering and their peculiar be wildering adaptations to the coastal conditions they can penetrate extensively along river banks forming distinctive littoral ecosystem with majestic forest canopy. The circum tropical global distribution of mangroves is restricted to the Indo-pacific and the west Africa- America region. The term mangrove as the intertidal ecosystem or highly adopted plant groups that lies in coastal environment. Though most of the mangrove genera and families are highly diversified but they have developed certain morphological, biological, physiological and ecological common adaptability to thrive in the tidal environment.

Mangrove ecosystems are enriched with many organisms having significant ecological and economical values. The distributed along tropical and sub tropical environments having specific habitats such as shores, estuaries, tidal creeks, back water , lagoons marshes, mudflats and even at upstream points where water remaining saline (Qasim,1998). Mangrove forests are unique functional ecosystems which having much social, economic and biological importance.

Corresponding author: **Dr. T.Nedumaran, Assistant Professor**,** Department of Plant Biology and Plant Biotechnology,*

Sir Theagaraya College,Chennai-21, Tamil Nadu, India.

Ecological uses of Mangrove

Mangrove ecosystems act as the natural barrier to protect the shore line and island areas from various natural hazards (Cyclone, hurricanes and tsunamis). It also prevents the coastal erosion by breaking the force of the waves. They also maintain the water quality by acting as the biological filters, separating sediments and nutrient from polluted coastal water. Mangroves are very significant for maintaining carbon balance in coastal areas as well as for tourism and recreation (Kuenzer *et al*., 2011).

In addition to these services, mangroves economically contribute to the human livelihood by providing nursery for fisheries, aquaculture fuel for the eco community honey traditional medicines. Mangrove forests help to stabilize and reduce the devastating impact of natural disaster such as tsunami and hurricanes. They also serve as breeding and nursing ground for marine fin fishes and shellfishes species of commercial importance. Good mangrove vegetation is an excellent indicator of the health of coastal ecosystem. Mangrove ecosystem traps and cycles various organic materials, chemical elements important nutrients. The roots provide attachment surfaces for many organisms. Many of these attached animals filter water through their bodies and in turn, trap and cycle nutrients may animals find shelter amidst the net work of roots, where fisherman cannot cast his nest not the boatman ferry through it. The ecological values of mangroves in most tropical countries have been qualitatively well documented and recognised. However, there is little quantitative scientific data to back this up.

The general importance of mangroves at many levels is provided, some important use of mangroves

1. Ecological uses
2. Economical uses
3. Social uses

Mangrove tree is halophyte and can grow where no other tree, can significantly contributing to the environment. Mangrove protects the water quality and filters the unwanted material. They dissolved nutrients from the soil and the water. Mangrove are a major part of a food chain and the detrital food cycle as mangrove tree leaves fall in to the water they are surrounded by marine bacteria within a few hours and concede the carbon compounds in to nitrogen rich detritus material. Mangroves act like a barrier between the land and the sea and prevent such assaults on land by the sea.

Mangrove trees take major role in ecological services in mangrove ecosystem. They contribute to the stabilization of the shoreline and prevention of shore erosion. The dense network of support roots, breathing roots and stilt roots give mechanical support to the tree and trap the sediments

Minimizing the Fury of Cyclones and Tsunami

Mangrove forests protect all types of coastal communities from the fury of cyclones and storms. Mangroves mitigate the tsunami effects on human kill and wealth loss, the tsunami of December 26, 2004 has caused economic and ecological disaster in 13 Asian an African countries. The sea waves were generated due to massive undersea earth quake. The tsunami waves were very strong and there were no physical barriers present such as sand dunes, the mangroves and scrub jungle bored the fully fury of the Tsunami. Coastal forests and agriculture lands were destroyed in several tsunami-hit areas. The affected parts of the forests were mostly seedlings, less dense forests, narrow strips of forests and the aerial roots that are clogged with silt deposits.

Controlling the flood

Mangrove systems offer production to the coastline against the flood, which are often caused by tidal waves or due to heavy rainfall associated with storms. The ability of mangroves in flood control is due to the response of their root system to have a larger spread out in areas prone to tidal inundation and their roots to promote sedimentation. Besides flood control, the mangroves prevent the entry of seawater inland and thus protecting the underground water systems, forming a source of drinking water supply to coastal population. Very often very sharp changes have been noticed in salt concentrations of groundwater at the interface between salt flats and modify the salinity of the groundwater by lowering it drastically (Rid & Sam, 1996).

Prevention of the coastal erosion

The mangrove systems minimise the action of waves and thus prevent the coast from erosion. The reduction of waves increases with the density of vegetation and the depth of water. This has been demonstrated in Vietnam. In the tall mangrove forests, the rate of wave reduction per 100m is as large as 20% (Mazda *et al*., 1997). Another work has proved that mangroves from live seawalls and are very cost effective as compared to the concrete seawall and other structures for the production of coastal erosion (Harad *et al.*, 2002).However, the deforestation of mangroves causes erosion problems.

Sediments

One of the important functions of mangroves is trapping of sediment and thus acting as sinks to the suspended sediments (Woodroffe, 1992; Wolanski, 1995; Furukawa *et al.*, 1997). The mangrove trees catch sediments by their complex aerial root systems and thus function as land expanders. In numerous cases, there has been proof of annual sedimentation rate ranging between 1 and 8 mm, in mangrove areas with expansion of land (Bird & Barson, 1977). Woodroffe, (1992) has a different view that the mangrove forests are the result and not the cause of sedimentation in protected coastal areas and that they accelerate the role of sedimentation process. This depends largely on the complexities involved in the exchange process taking place between mangroves and the adjoining coastal areas. The mechanism of sediment5 trapping in mangrove habitats was studied (Furukawa *et al*., 1997; Kathiresan, 2003). The mangrove structures inhibit tidal flows, probably due to the friction force which the trees with their root system provide. The soil particles are carried in suspension in to mangrove forests from seawater by the incoming tide and the soil particles are left behind in the swamps and within the root system by the outgoing tide, probably when the turbulence gets reduced and water velocity at low tide becomes sluggish and low to carry the particles back to the sea. It has been estimated by Kathiresan, (2003) that mangrove help in trapping the sediment up to 25% at low tide as compared to high tide. This efficiency of trapping suspended sediment may be attributed to widespread occurrence of numerous respiratory roots in Avicennia and to compactly arching stilt roots of Rhizophora. The density of mangrove species and their complexity of root system thus constitute most important factors, for determining the sedimentation process.

The sedimentary process varies among the different types of mangrove forests namely riverine basin and fringe types. The process falls in decreasing order: Riverine> Basine> Fringe (Ewel *et al*., 1998). The river dominated system receives an all ochthonous sediment supply and the deposition of the quantity of sediment is a function of the catchment-size. The tide- dominated fringe system contains abundant allochthonous sediment, but the sedimentation gets disturbed by the tides. The interior basin mangroves from sinks for the sediments (Wodroffe, 1992).

Fishes and wildlife populations

Mangrove ecosystems are important for fish production. They serve as nursery, feeding and breeding grounds for many fishes and shellfishes. Nearly 80% of the fish catches are directly or indirectly dependent on mangrove and other coastal ecosystems worldwide (Kjerfve & Macintosh, 1997). To cite a specific case, the Pichavaram mangroves alone nurture 30 species of prawns, 30 species of crabs, 20 species of molluscs and 200 species of fish (Kathiresan, 2000). It is widely believed that the mangrove forests along the coast, there will be either no fishes or fewer fish in the sea and the sea will act like a tree without roots. Besides fish, the mangroves support a variety of wildlife such as the Bengal tiger, crocodiles, deer, pigs, snakes, fishing cat, insects and birds.

The detached parts of the mangrove plants when fall on the floor are called litter-fall. These include leaves, stems, roots, flowers and fruits, Microorganisms found in the soil decompose the fallen parts. During this process, nutrients are released which enrich the surrounding waters. The decomposed organic matter along with microbial biomass is known as detritus. This is an important product produced in the mangrove ecosystems. It is rich in protein and it serves as a nutritious food for a variety of organisms. The organisms feed on detritus or filter the detritus- particles from the water column. Such detritus-feeding fishes are preyed upon by larger carnivorous supports other sensitive habitats like the coral reefs, seaweeds and seagrass beds.

Nutrient Enrichment

Mangrove ecosystems produce large amounts of litter in the form of falling leaves, branches and other debris. Decomposition of the litter contributes to the production of dissolved organic matter and the recycling of nutrients both in the Mangal and in adjacent habitats. The organic detritus and nutrients could potentially enrich the coastal sea and ultimately support fishery resources. The contribution of the mangroves could be particularly important in clear tropical waters where nutrient concentrations are normally low.

The nutrient cycling begins when leaves fall from the mangroves and are subjected to combination of leaching and microbial degradation (Lee *et al.*, 1990; Chale, 1993). Leaching alone remove a number of substances and can produce high levels of dissolved organic matter (Benner *et al.*, 1990). Pottasium is the most thoroughly leached element with up to 95% of the total potassium being removed in a very short time (Steinke *et al*., 1993). Carbohydrates also leach quickly during early decomposition. Mangrove detritus is probably more important as a substrate for microbial activity and nutrient regeneration than it is as a direct food source for detrivores. Wafar *et al*., (1997) analyzed energy and nutrient fluxes between mangroves and estuarine waters and concluded that mangroves contribute significantly to the estuarine carbon budget. However, they contribute little to nitrogen and phosphorous budgets. It is not clear whether any of these substances are exported from the Mangal in sufficient quantities to make significant contributions to energy flow and the ecology of the broder ecosystems (Alongi *et al*.,1992; Alongi., 1998). Mangrove sediments efficiently uptake, retain and recycle nitrogen (Rivera- Monroy *et al*., 1995). Resident bacteria and benthic algae rapidly assimilate available ammonium and prevent its export (Kristensen *et al*., 1995). The mangrove environment may therefore represent a nutrient and carbon sink rather than a source for adjacent habitats. Mangrove ecosystems that occur towards the land prevent soil erosion and also trap soil particles. This process helps in supply of clean and nutrient-rich water for the associated ecosystems like coral reefs, seaweeds and sea grass beds. However, when the mangroves are removed, the sediment becomes loose and gets deposited on those associated ecosystems and destroys them. Thus the mangroves provide protection to other marine ecosystems.

Improving coastal water quality

Mangroves maintain coastal water quality by abiotic and biotic retention, removal and cycling of nutrients, pollutants and particulate matter from land-based sources, filtering these materials from water before they reach seaward coral reef and sea grass habitats (Ewel *et al*., 1998). Mangrove root systems slow water flow, facilitating the deposition of sediment. Toxins and nutrients can be bound to sediment particles or within the molecular lattice of clay particles and removed during sediment deposition. Compared with the expense of constructing a wastewater treatment plant, mangroves are commonly selected as receiving areas of effluent. Increasingly the notion of specifically constructed mangrove wetlands is being adopted and used for treatment of aquaculture and sewage effluents (Saenger and Peter, 2013). Mangroves are functionally linked to neighbouring coastal ecosystem (Mumby *et a*l.,2004) for instance terrigenous sediments and nutrients carried by freshwater runoff are first filtered by coastal forests, then by mangrove wetlands and finally by sea grass beds before reaching coral reefs. The existence and health of coral reefs are dependent on the buffering capacity of these shoreward ecosystem which support the oligotrophic conditions needed by coral reef and sea grass communities sustaining these habitats primary production and general health

Indicator of climate change

Climate change is considered to be a long-term change in the average weather phenomenon. This could be a change in earth's average temperature along with other elements of the atmosphere. In the geological history, earth's climate has gone through warmer and cooler periods, each lasting millions of years. Temperature is the most striking element of the earth's climate change as well as global warming. Its average surface temperature has risen to a hike of 0.8°C during the past 100 years with an average rate of 0.07° C per decade since 1880 (Hansen *et al*., 2006) and at an average rate of o.17°C per decades since 1970 (Dhalman and Linndsey, 2020). Halophytes like mangroves which are growing in the saline soils of tropical coastal margins are the best example of resilience and resistance to climate change. Organisms in earth's ecosystems respond to spatio- temporal patterns with changing climate for survival and thus adapt to other physical portents such as plate tectonics, ocean currents, and land form evolution (Gilman *et al*. 2008).

Carbon Sequestration

Mangrove forests are highly productive, with carbon production rates equivalent to tropical humid forest. Mangrove allocate proportionally more carbon below ground, and have higher below-to- above ground, carbon mass ratios than terrestrial trees. Most mangrove carbon is stored as large pools in soil and dead roots. Mangrove are among the most carbon rich biomass containing an average of 937tc ha^{-1}, facilitating the accumulation of fine particles, and fostering rapid rates of sediments accretion (-5 mm $year)^{-1}$ and carbon burial (174 g cm^{-2} $year^{-1}$). Mangroves account for only approximately 1% (13.5 gt. $year^{-1}$) of carbon sequestration by the world's forests, but as coastal habitats they account for 14% of carbon sequestration by the global ocean (Alongi,2011), if mangrove carbon stocks are distributed resultant gas emission may be very high. Large uncertainties exist in our knowledge of carbon sequestration in mangroves and such a limitations must be factored into the blue print of any payment for ecosystem services. Mangroves are prime ecosystems for reforestation and restoration.

II CONCLUSION

Mangrove forests are among the most productive and biologically important ecosystems because they provide goods and services to human society. The success of mangrove plants growing in intertidal zones is generally ascribed to anatomical adaptations. This article also summarizes the positive impact of mangrove to costal ecosystem, such as protection against floods and hurricanes, reduction of shoreline and river bank erosion, controlling water pollution. Mangrove, including associated soils could sequester approximately 22.8 million metric tons of carbon for each year. They also serve as breeding and nursing grounds for marine finfish and shellfish species of commercial important.

III REFERENCES

Alongi DM, 2011. Carbon payments for mangrove conservation: ecosystem constraints and uncertainties of sequestration potential. Environ.sci.policy 14,462-470.

Alongi, D.M., Boto, K,G and Robertson, A.I. 1992. In: Robertson, A.J. and Alongi, D.M.(Eds). Tropical mangrove Ecosytems, American Geophysical union, Washington, D.C.pp.251-292.

Alogi, D.M. 1998, Coastal Ecosystems processes, CRC press, Boca Raton, Ft, USA.

Benner, R, Hatcher, PG and Hedges, J.I.1990. Early diagenesis of mangrove leaves in a tropical estuary: bulk chemical characterization using solids- state (super 13) CNMR and elemental analysis. Geochemical et cosmochimica Acta 54(7): 2003-2013.

Bird, E.C.F and Barson, M.M, 1997. Measurement of physiographic changes on mangrove-fringed estuaries coast lines. Marine Research Indonesia 18:73-80.

Chale, F.M.M, 1993.Degradation of mangrove leaf litter under aerobic conditions, Hydrobiologia, 257(3), 177-183.

Dahlman, L and Lindsey, R, 2020. Climate News, Stories, Images video, climate eatch Magazine. https//www.climate.gov/news-features/ understanding-climate/ climate-change global-temperature

Ewel, K.C, Twilley, R.R AND Ong, J.E, 1998. Different kinds of mangroves forests provide different goods and services, Global Ecology and Biogeography letters, 7(1), 83-84.

Frukawa, K. Wolanski, E and Mueller,H, 1997. Currents and sediment transport in mangrove forests, Estuarine Coastal and Shelf Science. 44(3): 301-310.

Gilman, E.L., Ellison,J., Duke, N.C and Field,C. 2008. Threats to mangroves from climate change and adaptation options: a review. Aquatic Botany, 89:237-250.

Hansen, J.Sato, M., Ruedy,R., LO., K., Leo, D.W and Medina – Elizade,M. 2006.Global temperature change. Proceedings of the National Academy of Science, 103 (29): 14288-14293.

Kathiresan. K, 2003. How do mangrove forests induce sedimentation? Rev. Biol. Trop.51: 355-360.

Kjerfv, B and Macintosh, D.J. 1997. In: Kjerfve, B, Lacera, L.D and Diop, S. (Eds.): "Mangrove Ecosystem studies in latin America and Africa" UNESCO, Paris, pp1-7.

Kristensen. E, Bouillion, S. Dittmar T et al., 2008. Organic carban dynamics in mangrove ecosystem: a review. Aqu. Bot. 89 : 201-219.

Kuenzer,C. Bluemel A. Gebhardt,S. Quoe TN. Dech.S, 2011. Remote sensing of mangrove ecosystems: a Review: Remote sens.3:878-928.

Lee, H.L, Seleena, P and Winn, Z, 1990. Bacillus thuringiensis senopotype H-14 isolated from mangrove awamp soil in Malaysia. Mosquito Born Diseases Bulletin 7(4): 134-135.

Mazda, Y.,Magi, M.Kogo,M and Hong, P.N.1997. Mangrove on coastal production from Waves in the Tong King Delta , Vietnam, Mangrove and salt marshes 1:127-135.

Mumby,P.J., etal.,2004. Mangroves enhance the biomass of coral reef fish communities in the Caribbean doi:1001038/ Nature, 02231.

Quasim,S.Z, 1998. Mangroves, In: Glimpses of the Indian ocean, University press, Hydrobad, 123-129.

Rid,P.V. and Sam, R. 1996. Profiling ground water salt concentrations in mangrove swamps and tropical salts flats. Estuarine, Coastal and shelf science, 43(5):627-635.

Rivera-Monroy, V.H.and Twilley, R.R.Boustanj, R.G.Day, J.W and Vera Herrera, F, 1995.Direct de nitrification in mangrove sediments in Terminos Lagoon, Mexico. Marine Ecology Prograss series,126(1-30, 97-109.

Saenger, Peter, 2013. Mangrove Ecology, Silviculture and Conservation (https://books.google.com/books?id= WUbrCAAAQBAJ&pg=PRA). Springer. ISBN 978-94-015-9962-7.

Saenger, P, 2002.Mangrove Ecology, Silviculture and conservation. Kluwer, Dordrecht. The Netherlands, 342.

Steinke, T.D., Barnabas, A.D. and Somaru R, 1990. Structural and associated microbial activity accompanying decomposition of mangrove leaves in Mgeni estuary (South Africa). South African Journal of Botany, 56(1):39-48.

Wafer,S. Untawale, A.G. and Wafer,M. 1997. Litter fall and energy flux in mangrove ecosystem, Estuarine Coastal and Shelf Science, 44:111-124.

Wolanski,E. 1995. Transport of sediment in mangrove swamps. Hydrobiologia, 295:31-42.

Wooddroffe, C.D.1992. Mangrove sediments and geomorphology, In: Robertson, A.I. and Alongi, D.M.American Geophysical Union. Washington, DC, USA, pp.7-41.

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