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REVIEW ARTICLE

MANGROVES – A REVIEW

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ABSTRACT

Mangroves are one among the most productive and biologically important ecosystem on this planet, providing vital ecosystem goods and services. Consolidation of data pertaining to the extent and diversity of mangroves is a pre requisite for the selection of any strategy for the conservation of existing or the introduction of newer population. This paper is chiefly a review work on the extent and diversity of mangroves, and is based on published and technical reports. Earlier reports stated that besides all these imperative services provided, these fragile ecosystems are under tremendous pressure.

INTRODUCTION

Mangroves are considered as one of the most specialized ecological assemblages of halophytic plants acting as a transient zone between land and ocean. They comprise of taxonomically diverse shrubs and trees, distributed along tropical and sub tropical environments having specific habitats such as shores, estuaries, tidal creeks, backwaters, lagoons, marshes, mudflats and even at upstream points where water remains saline (Qasim, 1998). Mangrove forests are unique functional ecosystems having much social, economic and biological importance. They are among one of the most productive ecosystems of the world as they provide important ecosystem supplies and services to human society as well as coastal and marine systems (Bouillon 2003; FAO, 2007). These habitats interact with a wide array of aquatic or terrestrial flora and fauna, enabling their growth and establishment. Considering their value for the environment and coastal communities, mangrove conservation should become a priority and efforts must be invested to find new and successful methods for conserving mangrove ecosystems (Bosold, 2012). Advanced research with respect to earlier and current reports on diversity, distribution, growth sustaining attributes of mangroves may aid in the process of formulating proper afforestation strategies along diverse shoreline environments.

MATERIALS AND METHODS

This paper is chiefly a review work on the extent and diversity of mangroves, and is based on published and technical reports.

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RESULTS

Numerous attempts have been carried out worldwide on the extent and diversity of mangroves. Some of the most important ones on a global, national and regional context are summarized below. The greatest extent of mangrove species is found in the Indo-Malaysian region (Chapman, 1975) and thus, it can be considered as the cradle of evolution of mangrove vegetation. There are about 60-100 species of mangroves totally present in the world coming under 30 genera and more than 20 different families (Singh *et al.*, 1987). Studies on their status and distribution in Asia reports that they are distributed mainly in Bangladesh, Indonesia, Pakistan, Srilanka, Philippines and India (Naskar and Mandal, 1999). Earlier reports reveal that globally mangroves cover an area of 12 to 20 million hectares, of which, about one-third is found in Asia (42%), followed by Africa (21%), North and Central America (15%), Oceania (12%) and South America (10%). It has also been reported that 15 countries behold one third of the total global mangroves (FAO, 2007). Later, the total area of mangroves in the year 2000 was estimated to be 1, 37,760 km² in 118 countries in the tropical and subtropical regions of the world (Giri *et al.*, 2011). Spalding *et al.* (2010) revealed the World Atlas of Mangroves, covering 123 countries, constituting a total area of 1, 52,000 km². The lists included both true mangroves and mangrove associates. Distribution status by Hamilton and Casey (2016) showed that mangroves are found in 105 nations globally; of which 10 nations possess approximately 52%. Higher percentage of global mangrove cover was noted in Indonesia (26-29%). The Sundarbans National Park in India and the Sundarbans Mangrove Forests in Bangladesh have been known to possess the world's largest continuous stretch of mangrove forest (UNESCO, 2016). India has been reported for holding the fourth largest mangrove cover in the world. 60 species of

mangroves belonging to 41 genera and 29 families have been reported (Blasco, 1975). Blasco (1977) reported 58 mangrove species in the Indian territories, while Rao (1986) listed 60 species from 41 genera and 29 families. Studies have reported that the country occupies an area of about 7% of the world mangroves (Krishnamurthy, 1987) and 8% of the Indian coastline (Untawale, 1987). Status report on mangroves of India in 1987 and report of the Inter alia Forest Survey of India stated that, within the 7,500 km coastal line, India supports 4, 87,100 ha of mangrove wetlands, in that nearly 56.7% is spread along the east coast, 23.5% along the west coast and the remaining 19.8% in Andaman and Nicobar islands (MoEF, 1987). The report has also stated that Sundarbans of West Bengal and Andaman and Nicobar Islands together occupy 80% of the total Indian mangroves. Rest of the mangrove flora have been distributed along some of the coastal states such as Maharashtra, Gujarat, Orissa, Goa, Andhra Pradesh, Tamil Nadu, Karnataka and Kerala (MoEF, 1987). Banerjee et al. (1989) reported 59 species including true mangroves and associates belonging to 41 genera and 29 families. Comprehensive studies reported the existence of 32 true mangrove species in India (Singh *et al.*, 2012; Singh and Garge, 1993). Dagar et al. (1993) and Jagtap et al. (1993) reported 36 and 50 species of true mangroves from India. Later in 1999 it has reported that including the island territories, India has a total of 7,516.6 km coastline. Of these, 6,749 km² areas were occupied by mangrove forest (Naskar and Mandal, 1999). Studies with respect to species distribution revealed varied statistics as some of them included true mangroves whereas others included both true mangroves and mangrove associates. Naskar (2004) has reported 85 species of mangroves / mangrove associates that were common to the Indian coasts. Studies have also reported that, there are 55 species of true mangroves in India and majority are coming under the families Acanthaceae, Avicenniaceae, Meliaceae and Rhizophoraceae (Vidyasagar and Gopikumar, 2006). Detailed account on the diversity of Indian mangroves has been given by Mandal and Naskar (2008). The total extent of mangroves has been classified in to 3 groups as 'Major mangroves,' Mangrove associates,' and 'Back mangal'. From a total of 12 habitats, 82 species of mangroves belonging to 52 genera and 36 families have been reported. Using the total number of families, genera and species, relative mangrove diversity has also been calculated. Among different habitats studied, maximum value for relative mangrove diversity has been reported from Sundarbans and minimum from Lakshadweep Atoll (Mandal and Naskar, 2008).

According to a status report of the Government of India publication, the total area of the mangroves in India was reckoned at about 6,740 km². Of the total area of mangroves, about 60% is along the east coast (Bay of Bengal), 27% is along the west coast (Arabian Sea) and the remaining 13% is in the Andaman and Nicobar Islands (FSI, 2009). An overview on the status of biodiversity and distribution of Indian mangroves revealed that there are 59 species in 41 genera and 29 families. 34 species belonging to 21 families have been noticed as unique species along the west coast and the east coast comprised of 25 species. The most important species distributed along west coast were *Sonneratia caseolaris*, *Suaeda fruticosa*, *Urochondra setulose* etc. Distribution status with respect to different states revealed 16 species from Gujarat, 20 species from Maharashtra, 14 species from Goa and 10 species from Karnataka (Singh *et al.*, 2012). Based on preliminary surveys, an updated checklist of true mangrove species falling

along Andaman and Nicobar Islands has been reported (Goutham-Bharathi *et al.*, 2014). Visits to selected locations during the period 2009 to 2013 revealed the occurrence of 25 true mangrove species belonging to 10 families and 14 genera. The study also highlighted the need for periodic evaluation of the extent and status of mangroves towards their better management and conservation (Goutham *et al.*, 2014). Mangrove forests have been considerably diminishing as most of the areas are taken for various agricultural and developmental purposes. It was reported that during the last century, Indian coastline has lost 40% of its mangrove cover (Brahma and Mukherjee, 2016). In this background, studies have been conducted to assess the extent of mangroves in India with special reference to Lothian Island Wildlife Sanctuary in Sundarbans. Including 16 true mangrove species and 14 mangrove associates a total of 30 species have been reported from the area. The study has pointed out the need for conserving mangrove ecosystems in terms of effective governance structures, better education and awareness building in local communities (Brahma and Mukherjee, 2016). The preceding literature presented a scattered idea regarding the extent and diversity of mangroves from different districts of Kerala. Bourdillon (1908) reported *Brugueira gymnorhiza* and *Rhizophora* species from Kollam district. Rao and Sastry (1974) and Thomas (1962) reported 5 mangrove species such as *Acanthus ilicifolius*, *Avicennia officinalis*, *Bruguiera gymnorhiza*, *Rhizophora apiculata* and *R. mucronata* under 4 genera and 3 families from Veli backwaters, Trivandrum. The species *Acanthus ilicifolius* has been reported from Kollam district (Blasco, 1975). The total extent of mangrove cover in Kerala has undergone drastic changes over a period of time. Kerala once had a total mangrove cover of 700 km² and has dwindled to 16.71 km² (Basha, 1991). According to him, the entire mangrove flora of the state has been distributed among different districts like Trivandrum (23 ha), Kollam (58 ha), Alleppey (90 ha), Kottayam (80 ha), Ernakulam (260ha), Thrissur (21 ha), Malappuram (12 ha), Kozhikkode (293 ha), Kannur (755 ha) and Kasaragod (79 ha).

Later on Kurien, *et al.*, (1994) has reported that the mangrove cover of the state is only 1,095 ha. Studies by Suma (1995) revealed that the major patches of mangroves in Kerala are distributed in places like Veli, Asraamam, Ashtamudi, Keeryad Island, Chetwai, Vypeen Island, Mallikkad, Kumarakom, Pathiramanal, Edakkad, Pappinissery, Kunhimangalam and Chittarai and in several other small patches across the State. Reports by Mohanan (1997) revealed that the total extent of mangroves in Kerala has been distributed along the upper reaches of estuaries, lagoons, backwaters and creeks were coming to a tune of 4200 ha. Sunil (2000) reported the most important mangroves species of Alleppey district as *Acanthus ilicifolius*, *Aegiceras corniculatum*, *Avicennia marina*, *A. officinalis*, *Bruguiera cylindrica*, *B. gymnorhiza*, *Excoecaria agallocha*, *E. indica*, *Kandelia candel*, *Lumnitzera racemosa*, *Rhizophora apiculata*, *R. mucronata* and *Sonneratia apetalae*, coming under 9 genera and 7 families. Detailed descriptions on the mangroves of Kerala have been furnished by Anupama and Sivadasan (2004). The study as a whole reported 15 true mangroves and 49 mangrove associates from the entire Kerala coast. The true mangrove species were coming under 9 genera and 7 families. The study revealed detailed notes on all the true mangrove species along with their updated nomenclature and distribution (Anupama and Sivadasan, 2004). Radhakrishnan et al. (2006) reported the occurrence of 7 species of mangroves from Kozhikkode district such as *Acanthus ilicifolius*, *Aegiceras*

corniculatum, *Avicennia marina*, *Excoecaria agallocha*, *Kandelia candel*, *Rhizophora mucronata* and *Sonneratia caseolaris*. Thekkumbad island of Kannur district has been studied for the total area covered diversity and population structure of mangroves. Using plot quadrat method, a total of 11 true mangroves and 6 associates have been reported. The most dominant species recorded from the area were *Rhizophora mucronata*, *Bruguiera cylindrica*, *Sonneratia alba* and *Excoecaria agallocha* (Sreeja and Khaleel, 2010).

Compared to other districts, floristic diversity of mangroves in Kannur is very high. Diversity studies from Kannur district revealed 12 species of mangroves under 9 genera, belonging to 7 families. The most important family reported was Rhizophoraceae with four species (Vidyasagaran *et al.*, 2011). Diversity, distribution and abundance of mangroves from Poyya backwaters of Thrissur district reported a total of 9 species; of which 4 were true mangroves and remaining 5 were associates. The true mangrove species reported were *Aegiceras corniculatum*, *Avicennia officinalis*, *Acanthus ilicifolius*, and *Excoecaria agallocha*. The mangrove associates reported were *Derris uliginosa*, *Clerodendron inerme*, *Sphaeranthus indicus*, *Achrostichum aureum*, *Mariscus javanicus* and *Cyperus* species (Saritha and Tessy, 2011). Studies conducted at Kumbalam Island of Ernakulam district revealed the status of mangroves in the area from the year 2010. A total of 17 species including 7 true mangroves, 2 semi mangroves and 8 mangrove associates have been reported from the area (Ram and Shaji, 2013). It has been reported that the extent of mangroves of Kerala is 2,502 ha, out of which, 1,189 ha belongs to the state and 1,313 ha is under private ownership (Vidyasagaran and Madhusoodanan, 2014). Kannur district occupies maximum extent of mangroves (1,100 ha), followed by Ernakulam (600 ha) and Kasaragod (315 ha) and minimum extent was represented by three districts namely Thrissur (30 ha), Thiruvanthapuram (28 ha) and Malappuram (26 ha). A total of 15 pure mangrove species and about 33 semi mangrove species were recorded from different parts of the state. The important species found were *Aegiceras corniculatum*, *Avicennia marina*, *Avicennia officinalis*, *Bruguiera cylindrica*, *B. gymnorhiza*, *B. sexangula*, *Ceriops tagal*, *Excoecaria agallocha*, *E. indica*, *Kandelia candel*, *Lumnitzera racemosa*, *Rhizophora apiculata*, *R. mucronata*, *Sonneratia alba* and *S. caseolaris* (Vidyasagaran and Madhusoodanan, 2014).

Studies at Kadalundi- Vallikkunnu community reserve of Malappuram- Kozhikode districts revealed the occurrence of 7 species of mangroves under 5 families. The most important species recorded from the area was *Avicennia officinalis* followed by *Rhizophora mucronata*, *Excoecaria agallocha* and *Sonneratia alba* (Rahees *et al.*, 2014). A total of 11 species of true mangroves and 6 mangrove associates have been reported from the Ashtamudi estuary of Kollam district (Sumesh *et al.*, 2014). Survey pertaining to the distribution, abundance and plant diversity of the left over mangroves along the 10 coastal districts of Kerala has been carried out. The results revealed a total of 24 species of mangroves belonging to 15 genera and 9 families (Mini *et al.*, 2014). 8 species have been reported from the family Rhizophoraceae. The other families and number of species reported were Acanthaceae (4 species), Myrsinaceae (1 species), Combretaceae (1 species), Malvaceae (1 species), Pteridaceae (1 species), Euphorbiaceae (2 species), Lythraceae (3 species) and Arecaceae (3 species). The study highlights the significance and services of the ecosystem as a whole and suggests the urgent need for protecting them in terms of

massive afforestation practices (Mini *et al.*, 2014). Diversity and phyto-sociological characteristics of mangroves from six locations of Kollam district has been reported. The study revealed 12 species of mangroves belonging to 8 genera and 6 families in which Rhizophoraceae and Avicenniaceae were the most predominant families. Results of the density and other diversity indices revealed that the most common species recorded was *Avicennia officinalis* followed by *A. marina* (Vijayan *et al.*, 2015). The diversity and distribution of mangroves from Kannur district for the period of 2015-16 have been reported by Vaiga and Sincy (2016). From Vellikkeel, 7 species of true mangroves, 4 species of semi mangroves and 7 species of mangrove associates have been reported. 10 species of true mangroves, 3 semi mangroves and 7 mangrove associates have also been reported from Ezhome area. The study concluded that most of the mangrove area within the district has been facing tremendous threats from the public.

Conclusion

A review of the literature revealed that studies pertaining to the extent and diversity of mangroves confining to the coast of Kerala is either fragmentary or outdated in nature. The comprehensive information on diversity in mangroves provided here will help in the long term supervision of mangrove species in the country and formulating species specific conservation strategies.

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