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CURRENT STATUS OF MANGROVE BIODIVERSITY IN INDIA: A REVIEW#

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Abstract

Present review describes the current status of Mangrove cover in India. In India, 4975 sq.km of Mangrove cover is present, which is 2.7% of world Mangroves. Mangroves in India are present in the twelve different states and united territories. Sundarbans consist of the highest cover of mangroves, followed by Gujarat, Andaman and Nicobar Island. 44 true mangroves with 86 species of mangrove associates present all over India. There are a 54 sq. km significant increase mangrove cover in between 2017 to 2019. Gujarat is the state where 37 sq.km of mangrove forest shown advancement. Mangroves of Sundarban shows a yearly decrease of 2 sq. km. In West Bengal, two Mangroves species, *Sonneratia griffithii* and *Heritiera fomes* reported as threatened in the IUCN red list categories.

Keywords: Biodiversity, Current status, Mangroves

#Review Article

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Introduction

The land and water join together to form a different environment, specifically in terms of structure, diversity and flow of energy, i.e. a particular ecosystem called a coastal ecosystem. The coastal ecosystem consists of salt marshes, mangroves, coral reefs, seagrass, etc. Out of these, mangrove ecosystems are considered the most significant in terms of ecological and economic views. The monetary value is about 0.5 million rupees per hectare per year. Monetary value is greater than that of coral reefs, continental shelves and the open sea (Kathiresan and Bingham, 2001; Kathiresan and Qasim, 2005). Mangroves are defined differently. According to the Oxford dictionary (1613), tropical trees or shrubs found in coastal swamps with tangled roots that grow above the ground. Whereas the term 'Mangle' and 'Mangue' meaning trees or shrubs of the genus *Rhizophora* used by the Americans, the Spanish and the Portuguese (Mepham & Mepham, 1984). According to Kathiresan (2010), Mangroves are 'tidal forests' or 'coastal woodlands', specially adapted to survive in the harsh interface between land and sea and high salinity conditions, extreme tides, strong winds, high temperatures, low oxygen and muddy soil.

World Scenario

There are about 1 59, 041.5 km² of mangrove forests which are less than 1% of all tropical forest throughout the world and less than 0.4% of the total global forest estate (Lavieren et al. 2012). Mangroves are distributed in 121 countries (Sanraj, et al., 2015), while out of all mangroves, 90% of mangroves are present in developing countries, and nearly 26 countries mangroves are present at the risk of extinction (Kathiresan, 2010). Approximately 75% of the world's mangroves found in just 15 countries, and only 6.9% protected under the existing protected areas network (IUCN I-IV) (Giri et al., 2011) and estimated that 12.3% smaller than the most recent estimate by the Food and Agriculture Organization (FAO) of the United Nations.

Kerry (2017) reported over 74 valid mangrove plant species within 27 genera, which belongs to 20 families dispersed through the world. Out of all Mangroves present in the worlds, 22.6% mangroves are present in Indonesia (Giri et al. 2011).

Indian Scenario

India is a country with about 7516.6 km, including the island territories (Singh, 2012), with about 2.7% of the world's total mangroves (Giri et al. 2011). These mangrove habitats (69°E-89.5°E longitude and 7°N-23°N latitude) comprise three distinct zones: East coast habitats having a coastline of about 2700 km, facing Bay of Bengal, West coast habitats with a coastline of about 3000 km, facing the Arabian Sea, and Island Territories with about 1816.6 km coastline. Due to large estuaries with more enormous deltas and runoffs on the east coast than funnel-shaped estuaries with an absence of delta formation, there is a differential distribution of Mangroves on two strands of India. That is why 60% of total Mangroves in India are present on the east coast along the Bay of Bengal, and 27% is on the west coast, while 13% on the shores of Andaman and Nicobar Islands. The most striking Mangroves are present at Sundarbans in West Bengal, with the highest cover in India of 46.39%, followed by 22.55% in Gujarat and 13.26% in Andaman Nicobar Islands (Kathiresan, 2011).

Table: 1. Percentage of Global Total in the Fifteen Significant Countries of the World

Sr. no.	Country	Area (ha)	% of The Global Total	Region
1	Indonesia	3,112,989	22.6	Asia
2	Australia	977,975	7.1	Oceania
3	Brazil	962,683	7.0	South America
4	Mexico	741,917	5.4	North and Central America
5	Nigeria	653,669	4.7	Africa
6	Malaysia	505,386	3.7	Asia
7	Myanmar (Burma)	494,584	3.6	Asia
8	Papua New Guinea	480,121	3.5	Oceania
9	Bangladesh	436,570	3.2	Asia
10	Cuba	421,538	3.1	North and Central America
11	India	368,276	2.7	Asia
12	Guinea Bissau	338,652	2.5	Africa
13	Mozambique	318,851	2.3	Africa
14	Madagascar	278,078	2.0	Africa
15	Philippines	263,137	1.9	Asia

Source:- Giri et al. *Global Ecology and Biogeography*, (*Global Ecol. Biogeogr.*) (2011) 20, 154–159

Table 2:- Mangrove Cover Area in sq km in India (2019)

Sr. No.	State/UT	Very Dense Mangrove	Moderately Dense Mangrove	Open Mangrove	Total	Change concerning ISFR 2017
1	Andhra Pradesh	0.00	213.00	198.00	404.00	0.00
2	Goa	0.00	20.00	6.00	26.00	0.00
3	Gujarat	0.00	169.00	1008.00	1177.00	37.00
4	Karnataka	0.00	2.00	8.00	10.00	0.00
5	Kerala	0.00	5.00	4.00	9.00	0.00
6	Maharashtra	0.00	88.00	232.00	320.00	16.00
7	Odisha	81.00	94.00	76.00	251.00	8.00
8	Taminadu	1.00	27.00	17.00	45.00	-4.00
9	West Bengal	996.00	692.00	224.00	2112.00	-2.00
10	A &N Islands	398.00	169.00	49.00	616.00	-1.00
11	Daman and Diu	0.00	0.00	3.00	3.00	0.00
12	Pondicherry	0.00	0.00	2.00	2.00	0.00
Total		1476.00	1479.00	2020.00	4975.00	54.00

Source- *India State Forest Report, 2019.*

Mangrove cover in India is present in twelve states and union territories, differentiated into three types: Very Dense Mangrove, Moderately dense Mangroves and Open Mangroves. According to the Indian State Forest Report (2019), very lush mangroves are 1476.0 Km² (29.66%), moderately dense mangroves 1479.00 Km² (29.72%) and 2020.00 Km² (40.60%) open mangrove forests out of 4975 sq. km of total Mangrove forests. However, there is a 54 sq. km net increase in entire mangroves from 2017 to 2019. This increase was mainly because of Gujarat, Maharashtra and Odisha, which showed a rise of 37 km², 16 km² and 8 km² respectively in mangrove cover due to plantations and protection. However, Tamilnadu, West Bengal and Andaman and Nicobar Island showed the loss of 4 km², 2 km² and 1Km² respectively during these two years.

Mangrove Biodiversity In India

Today, the term 'mangrove' and the number of mangrove species assigned very remarkably among different workers. The species growing in the same region are designated differentially; some consider them as mangroves, but others do not (Mandal, 2008). According to Kathiresan (2018), there are 44 species of true Mangroves, 86 species of mangrove associates. There are 11 species of seagrass vegetation, while phytoplankton and seaweed species 557, 69 bacterial species, 103 fungal species, 23 actinomycetes and 32 Lichens. A total of 82 mangrove species, distributed in 52 genera and 36 families, has been recorded by different workers (Mandal et al. 2008).

Mangroves of West Bengal and Sundarbans

Sundarbans Biosphere Reserve (SBR) is the world's largest continuous mangrove ecosystem shared by India (40%) and Bangladesh (60%), with its unique halophytic flora (Choudhary et al., 2016). The mangrove forest of Indian Sundarban covers about 2,400 sq km, estimated to be 62 % of the total Indian mangrove forest (Mandal *et al.*, 2010). The term 'Sundarban' probably coined from the dominant mangrove tree 'Sundari' (*Heritiera fomes*) (Giri *et al.*, 2014). About 30 valid mangrove species occur in the Indian Sundarbans (Kathiresan and Bingham, 2001). Debnath and Naskar (1999) identified 36 species as true mangroves. The Mangrove forest of Sundarbans in India is vast and has tremendous biodiversity. Many species like *Heritiera fomes*, *Nypa fruticans*, *Aegiceras corniculatum*, *Kandelia candel*, *Rhizophora sp.*, *Sonneratia acida*, *Sonneratia apetala* and *Sonneratia caseolaris* also require conservation measures (Gopal & Chouhan, 2006).

Gujarat

Historically Gujarat is a state with an extensive and diverse mangrove ecosystem, which degraded over time due to different developmental activities. With a coastline of 1650 sq. km, approximately 960 sq. km of Mangrove cover is present in Gujarat, the second-largest mangrove cover in India. The Mangroves of Gujarat are distinctly present in three different zones, viz. Gulf of Katch, Gulf of Khambhat and Kori creek. Kori creek is the site with a 775 sq. km. Mangrove cover is present (Saroj et al., 2018). In Gujarat, 15 different valid mangroves species are present; the *Avicennia marina* is the most dominant species. (Saroj, 2018; Devi & Pathak, 2016). *C.tagal*, *R.mucronata*, *A.corniculatum*, *A.illicifolius*, *S.apetala* shows the localised abundance.

Maharashtra

Maharashtra is one of India's vital coastal states with unique mangrove diversity spread all along the 720 km coastline, distributed in about 55 estuaries in five districts (Kulkarni, 2009). According to Jagtap et al. (1994), Maharashtra's mangrove coverage estimated in the year 1987 was 210.17 sq. km, while according to the FSI report (2019), mangrove forest cover in Maharashtra is 320 sq.km. The West Coast of Maharashtra comprises 20 different mangrove species belonging to 15 genera and 11 families. Mangroves distributed in seven coastal districts of Maharashtra. *Avicennia marina* (Forssk.) Vierh., *Avicennia officinalis* L. *Bruguiera cylindrica* (L.) Blume, *Bruguiera gymnorhiza* (L.) Lam., *Ceriops tagal* C. B. Rob. *Kandelia candel* Druce, *Rhizophora apiculata* Blume, *Rhizophora mucronata* Lam. *Sonneratia alba* Griff., *Sonneratia apetala* Buch.-Ham., *Sonneratia caseolaris* (L.) Engl. *Aegiceras corniculatum* (L.) Blanco, *Xylocarpus granatum* J. Koenig, *Cynometra iripa* Kostel., *Hertiera littoralis* Aiton., *Excoecaria agallocha* L., *Dolichandrone spathacea* (L.F.) K. Schum, *Lumnitzera racemosa* Willd., *Achrosticum aureum* L., *Acanthus ilicifolius* L. (Mangrove cell, Government of Maharashtra).

Andhra Pradesh

According to the FSI (2019), mangrove cover in Andhra Pradesh has distributed over the 404.14 sq. km area and distributed in six different parts as East Godavari, Guntur, Krishna, Nellore, Prakasham and West Godavari. East Godavari consist of nearly 188 sq. km area and Krishna second highest 137 sq. km area. According to Rao (2015), 23 species of mangroves observed in the Krishna river. Out of these all the 23 recorded species, *Avicennia marina*, *A. officinalis* was found to be the dominant species in the North-West part of the swamp while *A. marina* noticed to be prevalent in the South-East part of the swamp, followed by *B. cylindrical* and *Rhizophora* sps. in order of relative abundance. The Ponnepudi habitat is dominated by *A. marina*, followed by *R. mucronata* and *Sonneratia apetala*. Interestingly the landward species, *Excoecaria agallocha*, is very sparsely distributed. *S. apetala* is found only in this habitat in the Nellore district (Rao, 2013).

Odisha

In Odisha, mangroves spread over an area of 221 sq. km (FSI, 2007), while according to a report of FSI (2019), the mangrove cover in Odisha is 251 sq. km, indicates the 30 sq. km net increase in area in the twelve years. Upadhyay (2014) reported 29 different species from four various sites Odisha state. *Hertiera littoralis* and *Tamarix troupii* were found only at the Dangmal site, *Instiga bijuga* only at Bhitarkanika and *Avicennia marina* at the Thakurdia site.

The mangroves all along the Odisha coast are threatened due to the high population density in these areas and competing demand for land for agriculture and prawn farming. The mangrove belt in the Kendrapada district is well known and called the Bhitarkanika mangrove forests, comprising areas between the Dhamara mouth to Barunei on the coast, has been notified as Bhitarkanika Sanctuary (672 Sq.km.) (Odisha Wildlife Organisation).

Andaman & Nikobar Islands

As per FSI reports (2019) , Andaman & Nikobar Islands comprises about 616 sq. km area. About 36 species reported by Kathiresan (2008) in Andaman & Nikobar Islands. *Acanthus ebracteatus*, *Acrostichum speciosum*, *Aegialitis rotundifolia*, *Bruguiera cylindrica*, *Bruguiera sexangula*, *Ceriops decandra*, *Cynometra iripa*, *Cynometra ramiflora*, *Kandelia candel*, *Lumnitzera racemosa*, *Rhizophora lamarckii*, *Sonneratia alba*, *Sonneratia apetala*, *Sonneratia griffithii* and *Xylocarpus mekongensis* these fifteen species are rare species present in Andaman & Nikobar Islands (Ragavan et al., 2014). *Acrostichum*, usually called mangrove fern, *A. aureum* L. is common species while *A. speciosum* is rare species. According to Nehru (2018), the tsunami in the Indian ocean in the year 2004 make a significant disturbance to mangrove forest cover in Andaman & Nikobar Islands. Due to this natural disaster, near about 97% loss of mangroves occurs compared to the record.

Tamilnadu

As per the FSI report (2019) Mangrove cover in Tamilnadu is only 46 sq. km. Mangroves in Tamil Nadu exist in the Cauvery deltaic areas. Pichavaram has a well-developed mangrove forest dominant with *Rhizophora* spp., *Avicennia marina*, *Excoecaria agallocha*, *Bruguiera cylindrica*, *Lumnitzera racemosa*, *Ceriops decandra* and *Aegiceras corniculatum* as the dominant flora. Mangroves also occur near places like Vedaranyam, Kodiakarai (Point Calimere), Muthupet, Chatram and Tuticorin (TNAU Agritechportal).

Goa

In Goa state of India, only 26 sq. km of Mangrove cover is present (FSI, 2019). D'Souza and Rodrigues (2013) reported 17 mangrove species in Goa that include 14 valid and three associated mangrove species (Sandhe et al., 2016). Silva (2011) reported *R. mucronata* ,*R. apiculata*, *S. alba*, *S. caseolaris*,*A. marina* *A. officinalis*, *A. alba* ,*B. gymnorrhiza*, *B. cylindrical*, *Bruguiera* spp., *E. corniculatum*, *A. illicifolius* ,*E. agallocha*, *K. candel*, *C. tagal* ,*B. cylindrical* L. *recemosa* species of mangroves.

Karnataka

Mangrove cover in Karnataka is ten sq. km (FSI, 2019). Uppanakadru, Heridri, Jaladi, and hemmakadu wholly dominated by *Rhizophora mucronata* with good growth, followed by *Sonneratia alba*, *Acanthus illicifolius*, *Kandelia candel*, *Avicennia officinalis*, *Excoecaria agallocha*, *Bruguiera gymnorrhiza* and *Aegicerus corniculatum* (Vijaya Kumar , 2012).

Kerala

According to BSI report (2019), Mangrove cover in Kerala 9 sq. km. According to ENVIS, Kerala, (2019) Kannur is a district with 80% of Kerala's total mangrove forest. The floristic diversity of mangroves in Kerala represented by 18 species of true mangroves, *Sonneratia alba*, *Avicennia alba* and *Ceriops tagal* rare in the State (Srilaksmi et al., 2021).

Daman Deu

This territory of India constitutes only three sq. km of mangrove cover (FSI, 2019). In Diu & Daman, mangroves are present on the Chasi river estuary banks and four mangrove species viz., *Avicennia marina*, *Acanthus ilicifolius*, *Aegiceras corniculatum* and *Sonneratia apetala* have recorded (Ragwan, 2016).

Pondicherry

This Union Territory of India covers only two sq. km of Mangrove cover (FSI-2019). Bhalchandran et al.(2009) reported *Acanthus ebracteatus*, *Acanthus ilicifolius*, *Avicennia alba*, *Avicennia marina*, *Avicennia officinalis*, *Lumnitzera racemosa*, *Excoecaria agallocha*, *L. Dalbergia Spinosa*, *Derris trifoliata*, *Xylocarpus mekongensis*, *Aegiceros corniculatum*, *Myriostachya wightiana*, *Bruguiera cylindrica*, *Bruguiera gymnorrhiza*, *Ceriops tagal*, *Rhizophora apiculata*, *Rhizophora mucronata*, *Sonneratia apetala* from Pondicherry.

Threatened Species of Mangroves in India

Very recently, assessments of mangrove species were made by 24 global mangrove workers in two workshops, one in 2007 in Dominica and the other in 2008 in the Philippines. The results published in PLoS ONE reveal that 11 of the 70 mangrove species in the world (16%) are at an elevated threat of extinction; of which only two species, namely *Sonneratia griffithii* (critically endangered) and *Heritiera fomes* (endangered), exist in India (Kathiresan 2010). Their habitat continued to disappear globally at a rate of 0.66% per year during the 2000–2005 period. This habitat loss has put at least 40% of the animal species restricted to mangrove habitat at an elevated risk of extinction under the International Union for Conservation of Nature (IUCN) categories and criteria.

Conclusion

Mangrove cover in India is 4975 sq. km which is 2.7% of the worlds total Mangrove cover. There is a net increase in the 54 sq. km area. However, it is a net increase in the Mangrove cover the species like *Sonneratia griffithii* (critically endangered) and *Heritiera fomes* (endangered). States & Union territories like Kerala, Karnataka, Tamilnadu and Daman & Diu shows very few Mangrove covers. The species like the *Avicennia marina* offers the dominant presence throughout the country. In the future, the reintroduction of mangroves in many areas need to implement.

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