

Floral Diversity of Mangrove Ecosystem of Pulicat Lake, Andhra Pradesh

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Abstract: Mangrove ecosystem plays an important role in preventing cyclones and tsunamis at estuaries from entering into interior land and in the economic development of local inhabitants. They have peculiar adaptations such as strong supporting interlocking and breathing root system called pneumatophores, vivipary mode of reproduction, salt regulation and nutrient retention. They flourished well in pulicat lake till 18th century. Now mangrove vegetation remains as small patches only in the pulicat lake. They are largely destroyed by human induced activities such as Urbanisation and Agriculture. The present study documents the checklist of true mangroves and their associates present in the pulicat lake which helps to develop the conservative methods to protect leftover patches of Mangroves.

Key words: Pulicat lake-Mangrove flora - True mangroves- Mangrove associates.

Introduction

Mangroves are the plant communities occurring in inter-tidal zones along the coasts of tropical and sub-tropical countries. They are one of the most productive ecosystems. Mangroves represent a rich and diverse living resource and are valuable to both the economy and protection of coastal environments. Mangroves have been variously described as “coastal woodland” and “inter-tidal forest”. Globally mangroves have an estimated cover of 15.2 million hectares and are found in 123 countries world wide. The most extensive is present in Asia 39% (FAO, 2007). Information on Indian mangroves was first documented in 1987 and after one decade a detailed status report on mangroves was reported by KATHIRESAN K., 1998. At present there are about 4,87,100 hectares of Indian mangrove wetlands remains of which 2,75,800 (56.7%) hectares is spread along the east coast and 1,14,700 hectares (23.5%) in the west coast region and the remaining 96,600 hectares (19.8%) is found in Andaman and Nicobar islands. Andhra Pradesh has

42,900 hectares of the total mangrove cover out of 2,75,800 hectares of the mangrove wetlands of east coast (FSI,1999). Atlas of mangrove wetlands of Ap 2004 gives the information about mangroves of Godavari and Krishna deltaic regions and also mentioned about the small patches along the coasts of visakhapatnam, west godavari and prakasam districts. Mangroves of south coastal andhra pradesh studies by NSSR Krishna Rao.

MATERIALS AND METHODS:

Study Area;

The lagoon's boundary limits range between 13.33° to 13.66° N and 80.23° to 80.25°E, with a dried part of the lagoon extending up to 14.0°N.; with about 84% of the lagoon in Andhra Pradesh and 16% in Tamil Nadu. The large spindle-shaped barrier island named Sriharikota separates the lake from Bay of Bengal. The lake spreads over an area of about 620 Km² encompassing numerous islands. Out of total area of 620 Sq Kms of the lake, about 360 Km² in the southern part is active where as the rest of northern part is desiccated. Now it appears more or less like a mudflat. The largest Island being Sriharikota in the Southern Part. The other prominent islands having habitation are Pernadu, Irrakkum and Venadu. Three major Rivers which feed the lagoon are Arani river, Kalangi river and Swarmukhi river. The Buckingham Canal, a renowned navigation Canal is part of the lagoon on its western side. It is connected to the sea through three tidal inlets from north to south respectively, one each at Tupilipalem, Rayadoruvu and Pulilcat villages. The sea mouths are not simply a passage of water into lake but a biocorridor for survival of both aquatic fauna and avian fauna. Its soil varies from sandy, clayey to fine alluvial.

Methodology:

The areas where mangroves and mangrove associated vegetation existing in the vicinity of Pulicat Lake are first identified and documented. For the assessment of present mangrove floral diversity status the true mangroves and their associates were considered for identification. Regular surveys were made along deltaic regions, river channels and the

mouth of estuaries to explore the successful results. Study was undertaken in the Pulicat Lake and data of flora collected by frequent visits during 2012-2014. The Plant specimens were collected and Herbaria was prepared. Plants were identified with the help of Flora of Presidency of Madras (Gamble and Fischer, 1916-1920). During the lab work, the specimens collected were processed according to the methodology adopted by Jain and Rao (1977). The plant species are given in alphabetical sequence with information including botanical name, vernacular name, family, habit. Herbaria-specimens were preserved at Botany Laboratory of N.B.K.R. Medicinal Plant Research Centre, Vidyanagar, Nellore District.

RESULTS AND DISCUSSION

Historical records show that, there were luxurious mangroves of the family Rhizophoraceae, on the north western shores of the Pulicat Lake about 6,650 to 7,000 years ago (Farooque and Vaz 2000). Approximately 10 species of mangroves was recorded on the banks of Buckingham canal in the southern part of Andhra Pradesh. Caratini's discovery of mangrove pollen grains collected from 3.8 to 2.0 metre depth sediments are said to be corresponding to the period between 1450 to 1800AD. The most dominant species (about 80%) was found to be the *Excoecaria agallocha* on the eastern bank of Pulicat Lake by Jayasundaramma, 1987. Some natural regeneration can also be found along eastern banks of the Buckingham Canal, north of Sullurpet-Sriharikota island road, south of the road up to Pulencheri Kuppam and Rattela and in the Sriharikota island by Suryanarayana et.al. In 2010, The Global Nature Fund declared the Pulicat Lake as the "Threatened Lake of the year" (Knannan, 2010) Sriharikota Island, well protected as it is a restricted area under the control of the Indian Space Research Organisation (ISRO), has remnants of the tropical dry evergreen forest of considerable botanical interest. On the other islands in the lake, where protection is negligible, the exotic *Prosopis chilensis* has invaded many areas. In the elevated mudflats, succulent halophytes, such as *Anthrocnemum indicus*, *Sesuvium portulacastrum*, *Salicornia brachiata*, *Suaeda maritima*, *Suaeda monoica* and *Suaeda nudiflora* occur. The average area of water spread is approximately 461 km². Pulicat lake include mud flats, sub littoral and littoral areas, sand dunes, sand bars, sand pan, both human inhabited and uninhabited Islands, sandy and muddy shores, total saline to brackish water to fresh water pools, lake bottom with horizontal spread of submerged water weeds, emergent flora, natural mangroves, plantations of *Casuarina* and community succession by *Prosopis juliflora*.

Mangroves are unique dynamic, multifunctional ecosystem typically inhabiting water logged broad muddy flats in estuaries and river-mouths along inertial zones of tropical and subtropical areas. Andhra Pradesh coast is rich in mangrove diversity from Srikakulam district in the north to Nellore in the Southern end of state. There are extensive mangrove v\wetlands in the estuaries of Nellore district. There are eleven coastal mandals in Nellore district commencing from Kavali Mandal in the north and ending with Tada mandal in the Southern tip of the district. Pulicat lake has its presence in five mandals of the district. Vakadu, Sullurupeta, Tada are three coastal mandals while Chittamoor and DV Satram are two non-coastal mandals associated with Pulicat Lake. Twenty two true mangroves were recorded in different estuaries, river mouths, islands in AP. Present study reveals the presence of six species of mangroves of 5 genera belong to 5 families in the regions of pulicat lake and the list is given in Table.1. Mandal wise distribution of mangroves in the regions of pulicat lake is given in Table:2.

Mangroves are observed in three mandals namely Vakadu, Sullurpet and Tada mandal. Mangroves are not reported in Chittamoor and Doravarisatram mandals. Distribution of different species of mangroves in different mandals of pulicat lake is given in table:3.

VAKADU MANDAL

Four places of Vakadu mandal namely Durgarajapatnam, Kondurupalem, Chinnathota and Peddathota have mangrove swamps.

Durgarajapatnam;

Durgarajapatnam in Vakadu mandal was once a sea port. Now government is planning to develop sea port here by reducing Eco sensitive zone of Pulicat lake which may affect the biodiversity of pulicat lake. Most of the mangrove swamps are now converted into shrimp ponds. *Avicennia marina* is the only mangrove observed here and it shows stunted growth.

Kondurupalem: (Konduru estuary)

It is one of the two mouths of Pulicat lake to Bay of Bengal in Andhra Pradesh region. It has few mudflats with two types true mangroves namely *Avicennia marina* and *Excoecaria agallocha*.

Peddathota:

It is on the northern fringe of pulicat lake in Vakadu mandal. True mangroves like *Aegiceras corniculatum*, *Excoecaria agallocha* and *Avicennia marina* are observed here. *Casuarina* plantations beside the mangrove belt.

Chinnathota:

It also close to a metal road on the northern fringe of Pulicat lake in Vakadu mandal. There is no demarcating line between Peddathota and chinnathota. *Aegiceras corniculatum*, *Excoecaria*

agallacha and *Lumnitzera racemosa* are the true mangroves observed here.

Mangroves are more denser in Chinnathota than in Peddathota. *Aegiceras corniculatum* and *Excoecaria agallacha* are the common true mangroves in both Peddathota and Chinnathota.

Lumnitzera racemosa is the true mangrove recorded only in Chinnathota of Vakadu mandal. *Avicennia marina* is observed in all the three places except in Chinnathota.

SULLURPET MANDAL

Sriharikota island with an area of 180.93 sq.km is a barrier island sandwiched between Pulicat lake and Bay of Bengal. It is located on the southern most part of South coastal Andhra Pradesh. The island is 18 km East of Sullurpeta, the nearest Railway Station connecting Madras-Calcutta trunk line. Four species of Mangroves were listed in Sriharikota island at two sites only namely Chandrasikuppam and Karlabylu by Suryanarayan et.al. NSR Krishna Rao Of Kavali worked on Mangroves of South Coastal Andhra Pradesh mentioned three places of mangrove swamps in COP are (Chandrasekhar Kuppam Out Post) namely Mallpedu Vagu, Cholla dorvu and Chudimoti Kayya.

Mallpeduvagu:

True mangroves are not found in Mallpedu vagu and it shows only mangrove associates.

Cholladoruvu:

It is a brackish water pond with an opening into the Bay of Bengal. It is very important mangrove swamp in SHAR which is adjacent to a blacktop road. It is sustained by flood water and it has a small but thick mangrove forest. Two mangrove species *Avicennia marina* and *Lumnitzera racemosa* are recorded over here.

Chudimoti Kayya:

It is brackish water pond which receives fresh water from upstream during monsoon and is close to the sea with mouth opening into the sea. It has fringe mangroves and is about 50 acres in extent. *Lumnitzera racemosa* and *Excoecaria agallocha* are the true mangroves observed here.

Thick mixed *Lumnitzera* and *Excoecaria* community at COP area. There are *Casuarina* plantations very close to the mangrove communities at Cholladoruvu and Chudimoti kayya. No invasion of *Prosopis* species into the mangrove wetlands in these two places.

Pudirayadoruvu pond;

It is fenced and barricaded area separating SHAR from the adjoining northern area of Pulicat lake. The water in Pudirayadoruvu pond is highly saline, approaching the salinity of sea water. No traces of mangroves reported here. It is one of the two mouths of Pulicat lake to the sea and the other is Kondurupalem on the Andhra Pradesh side of Pulicat Lake. There are thick *Casuarina* plantations on the

northern bank of Pudirayadoruvu, where the coastal village of Mawabpet of Vakadu mandal is located.

Kuruvithittu Island:

It is located in between Irkkam and Sriharikota belt, south east of Irkkam Island. Mangrove area of Kuruvithittu is now under ISRO control. Mangroves of this area are highly affected due to pollution of industries and fly ash of thermal power stations. Local people also cut down some mangroves for the use of fire wood.

TADA MANDAL

Coastal land of Andhra Pradesh is ending with Tada mandal at the southern tip of Nellore District. *Rhizophora mucronata* species is recorded in Venadu island. Rettamala and Pulicherikkuppam, opposite to the Venadu and Irkkam islands, *Avicennia officinalis* and *Avicennia marina* make up about 10% of mangrove vegetation.

CHITTAMURU AND DORAVARISATRAM MANDAL

These are non-coastal mandals of Nellore associated with Pulicat Lake along with adjacent three coastal mandal like Vakadu, Sullurpet and Tada mandals. Mangrove vegetation is not identified in these two mandals.

MANGROVE ASSOCIATES

About 35 mangrove associated floral species belonging to 17 families were identified along the inundated and the adjacent regions of the study area by Basha and Rajyalakshmi 2014. A classified list of mangrove associates identified is presented in Table 4. Salt Marshy areas often inundated by backwaters and are mostly occupied by halophytes. They are: *Aeluropus lagopoides*, *Atriplex repens*, *Cressa cretica*, *Crotalaria retusa*, *Cyperus haspan*, *Fimbristylis ferruginea*, *Salicornia brachiata*, *Sesuvium portulacastrum*, *Suaeda species.*, etc. The halophytes like *Salicornia*, *Sesuvium* and *Suaeda* grow monospecifically in hypersaline areas around Venadu island. Herbs of *Suaeda nudiflora* and *Suaeda maritime* belong to *Chenopodiaceae* family are widely distributed in the lake region observed in two different colours. Younger herbs are in green colour which turns to red when saturated with salt. Hence these plants are tried for use to remove higher amounts of salt from the saline soils. If this is successful we can employ these plants for reclamation of saline soils.

Sand dunes are commonly occupied by dense patches of herbs and shrubs in pure strands or inter mixed state. *Azadirachta indica*, *Borassus flabellifer*, *Lanea corandelilca*, *Pongamia Pinnata*, *Prosopis chilensis*, *Thespesia populnea*, etc., trees are commonly seen scattered here and there. *Prosopis chilensis* is the dominated exotic species invaded in many areas of Pulicat lake and other islands due to lack of protection. (Scott, 1989)

CONCLUSION

Present study of pulicat region will be of immense help not only to the conservation, but also to the planners to take adequate protective measures to safeguard the deteriorating mangrove plant wealth and to utilize the same in a judicious way. Results again highlight the importance of further research in identification of mangrove flora in the remote islands of pulicat lake. It is of great importance to support sustainable use and conservation of mangrove floral diversity of pulicat lake in order to safeguard the livelihoods of those depend on the biodiversity of inland waters. Environmental impact of Pulicat lake studied by Basha et al. in 2010. Protection and conservation of mangrove floral diversity of pulicat region is very important to maintain the balance of nature. The only one measure to protect Pulicat Lake is nothing but recognizing it as a "Ramsar site, for international protection. Farooqui and Vaz (2000) recommend 'some salt tolerant mangrove plants should be planted to function as coastal guards in the buffer zones. This would help in the protection of the present day increasing coastal habitations, from frequent cyclones and storm surges. They also advise that the predominant growth of Prosopis, Casuarina, Eucalyptus and Acacia, through their shallow roots, absorb sub-soil moisture, preventing the growth of pioneered plant communities which help in the accretion of silt, leading to mangrove succession. One of the important suggestion for the conservation of mangrove flora of Pulicat Lake is the declaration of the area between Krishnapatnam in the north and northern part of the pulicat lake as MANGROVE SANCTUARY. Second important suggestion is to develop awareness among fisher folk and other common people about the significance of mangroves in protection from coastal lands from floods and in reducing the soil erosion.

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Table:1 List of Mangrove species found in Pulicat lake region

Name of the Mangrove	Common Name	Family	Order	Habit
<i>Avicennia marina</i>	Tellamada	Avicenniaceae	Lamiales	Tree
<i>Avicennia officinalis</i>	Nallamada	Avicenniaceae	Lamiales	Tree
<i>Aegiceras corniculatum</i>	River Mangrove	Myrsinaceae	Primulales	Shrub
<i>Excoecaria agallocha</i>	Tilla	Euphorbiaceae	Euphorbiales	Tree
<i>Lumnitzera racemosa</i>	Thanduga	Combretaceae	Myrtales	Tree
<i>Rhizophora mucronata</i>	Red Mangrove	Rhizophoraceae	Rhizophorales	Tree

Table: 2. Mandal wise distribution of Mangrove flora in the Pulicat region

Name of the Mandal	Place	True Mangroves
Vakadu	Dugarajapatnam	<i>Avicennia marina</i>
	Kondurupalem	<i>Avicennia marina</i>
		<i>Excoecaria agallocha</i>
	Peddathota	<i>Aegiceras corniculatum</i>
		<i>Excoecaria agallocha</i>
		<i>Avicennia marina</i>
Chinnathota	<i>Lumnitzera racemosa</i>	
	<i>Aegiceras corniculatum</i>	
	<i>Excoecaria agallocha</i>	
Sullurupeta	Sriharikota	
	Malipeduvagu	
	Cholla doruvu	<i>Avicennia marina</i>
	Chudimoti kayya	<i>Lumnitzera racemosa</i>
		<i>Excoecaria agallocha</i>
Tada	Pudirayadoruvu	-
	Venadu	<i>Rhizophora mucronata</i> Poir
	Rettamala	
	Pulincheri kuppam	<i>Avicennia marina</i>
		<i>Avicennia officinalis</i>
Doravarisatram	Kuruvithittu	<i>Avicennia marina</i>
	Nil	Nil
Chittamuru	Nil	Nil

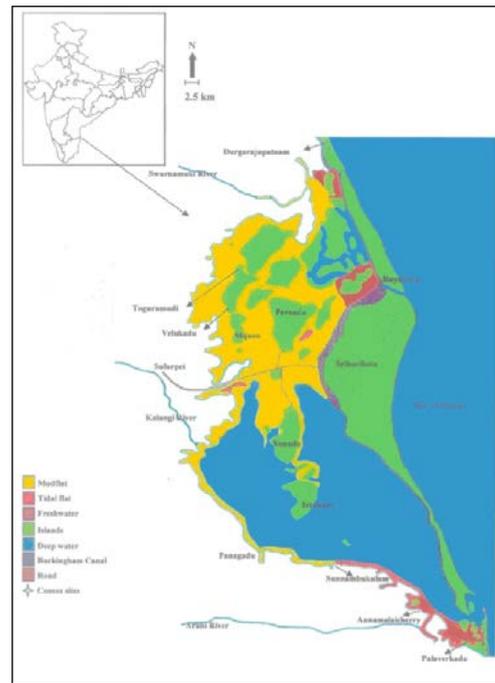


Fig 1. Pulicat Lake and its Islands



Fig 2. View of Pulicat Lake

Mangrove Associates



Fig 3. *Avicennia marina* (Mangrove)



Fig 4. *Pandanus fascicularis*



Fig. 5 *Suaeda species*



Fig.6 *Spiniflex littoreus*