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Promoting the Recovery of a True Mangrove- *Avicennia Marina* in Ecogeographic Area of Puthuvypeen, Kochi, Kerala

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Abstract

A study was conducted in a disturbed mangrove forest that had been gazetted as a site under governmental area. This study provides information regarding the status of disturbed mangroves and can be used as baseline data to support decision making in managing mangrove forests. The study were to determine the tree species exploited in mangrove forest. This recovery study was carried out in the upcoming industrial area of Puthuvypeen. Puthuvypeen ecogeographic area is clearly categorized as a mangrove forest that has a uniform single-layered canopy with trees reaching up to an average 15-25cm GBH and 25-30m in height. Generally there are mixed-mangrove forests of *Avicennia marina* and *Avicennia officinalis*. This ecogeographic area of Puthuvypeen may now also be known as "vanishing mangroves." Even under severe degradation, *Avicennia marina* species still shows its adaptation capacity under stressful condition with re-sprouting from in and around the destroyed trees. In general, the species composition of Puthuvypeen geographic area is rich and the regeneration status is good for the recovery of the species.

Keywords: Mangrove, Kerala, Puthuvypeen, Mixed-mangroves, *Avicennia marina* and *Avicennia officinalis*

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Introduction

Mangroves in India are distinctive in terms of their extent, variability and biodiversity. There has been a continuous decline in mangrove forests caused by conversion of land for other alternate uses (Upadhyay et al., 2002; Sahu et al., 2015). As per the Government of India report (Govt. of India, 1987), India lost 40% of its mangrove area during the last century (Kumar, 2000). In Kerala, mangrove forests that once occupied about 700 km^2, have now diminished to 17 km^2. As in many other parts of the world, the vegetation has drastically declined in its extent and has acquired a 'threatened' status in Kerala (Basha, 1991, 1992). In Kerala state, mangroves are spread over ten districts. Kannur district has the highest extent under mangroves (755 ha), followed by Kozhikode (293 ha) and Ernakulum (260 ha). In Ernakulum district the major mangrove areas are concentrated in Puthuvypeen (Muraleedharan *et al*, 2009). Mangroves in and around Ernakulam backwaters have beenindiscriminately destroyed. The remaining scattered patches of mangroves are now found in Puthuvypeen, Vallarpadam, Malippuram, and Mangalavanam in the north zone and Kumbalam, Panangad, Chellanam and Kumbalangi in the south. The major species recorded in these areas are *Avicennia officinalis*, *Rhizophora mucronata*, *Excoecaria agallocha*, *Acanthus ilicifolius*, *Bruguiera gymnorrhiza* (Badaruddin, 1992). The distribution of mangroves in each geograhic loactions are discontinous and are in patches of varying extent, the maximum being 100ha at Puthuvypeen is under Government land (Basha, 1992). Once this geographic zone of mangrove areas in Puthuvypeen is categorized under pure fully grown potential mangroves (Basha, 1992). Basha (1992) categorised the true mangrove *Avicennia marina* as rare species seen in Travancore coast when compared to Malabar Coast of Kerala. Puthuvypeen (Puthu vype–New Vypeen) is an upcoming major Industrial area in Kochi in the Indian state of Kerala. It borders Vembanad Lake to the east,Arabian Sea to the west and South and Njarakkal to the North. The main thoroughfares in the area are Vypin-Munambam Road and LNG Terminal Road. Presently, the potential mangrove trees have been cleared for landuse activities and still the mangrove vegetation persists escaping all the odd on either sides of the road. For the area to

continue providing ecological and commercial benefits, mangrove forests must remain intact with minimal or no disturbance. Dumping of wastes and rapid development in the vicinity certainly has an impact on the vegetation due to the increase in clearing of mangroves for urbanization. However, information regarding the natural vegetation affected by the continued mangrove extraction is scarce. Comprehensive species-specific data is essential for implementing conservation initiatives, including regulation of resource extraction and clearing (Polidoro *et al*., 2010). The objectives of this study were to determine tree species composition and structure of an exploited mangrove forest. The data can serve as a baseline in managing this geographic area.

Methodology

The methodology adopted here for the survey study of Puthuvypeen geographical area of Kochi district in Kerala is based on the physical appearance of mangrove ecosystem. The assessment of the community structure was done regarding density and dominance, a total of five regions from the periphery of plots (10x10 m^2) were non-randomly taken at each site on either sides of the LNG terminal road. The morphological characters like Girth at breast height (GBH): the tree circumference measured at a point 1.37m above average soil level and height of tree: the vertical distance between ground level and tip of the tree were measured. All mangrove species encountered here were recorded at species level using the method of Tomlinson (1986). The identification was based on bark, slash and leaf characteristics. However, if the species of the tree could not be identified, it was sufficient to identify the plant up to genus level. Trees with a diameter of five cm and below were classed as saplings and were recorded. Tree diameters at breast height were measured over bark to the nearest cm using a diameter tape. Total tree heights were estimated using Suunto Clinometer.

Results and Discussion

The results obtained from the survey study of Puthuvypeen ecogeographic area clearly state that this mangrove forest has a

uniform single-layered canopy with trees reaching up to average 15-25cm GBH and 25-30m in height. This mangrove area can be classified as Avicennnia mangrove forest. Currently, the dominant mangrove species seen in Puthuvypeen area are *Avicennia marina* and *Avicennia officinalis* of Avicennecia family that forms dense stand on either side of the road. *Avicennia marina* is a significant species because it can withstand varying soil conditions, high levels of salinity, lack of fresh water inflow for considerable periods of time and pollution of varying form (Balakrishnan, 1992).

Thus, the loss of mangrove forests will lead to a loss of indigenous species like Avicennia marina from the Travancore coast of Kerala, making it too late to save this precious population. Destruction of large tracts of mangroves was one of the biggest ecological disasters that people encounter near the LNG terminal in Kochi, Kerala. The whole area might look green and healthy from outside and be called as potential mangroves (Basha, 1992), but the present scenario of fringe mangrove population in this ecogeographic zone started wilting with no canopy. The severe utilization of mangrove forests, drastically reduced the abundance of trees with preferred stems sizes and species, leaving the forest dominated by juvenile, stunted and old Avicennia trees. Here the tree stumps look as if a massive fire damaged them. There is a similar scene on both sides of the road with dead, black trees with patches of unhealthy trees at the centre. Migratory birds sit on top of these stumps, looking confused at what was once home to their parents. Mangroves of this area are systematically destructed by dumping mixtures of slurry and chemicals. Even now, mangroves are being destroyed along the sides. This ecogeographic area of Puthuvypeen may be now known as "vanishing mangroves."Earlier, a large section of the mangroves weredestroyed for the construction of the LNG road right through them, and now it is the turn of the fragmented mangroves on both the sides of the road (Mini et al., 2012). Even after this severe degradation, Avicennia marina species still shows its adaptation capacity under stressful condition with re-sprouting from in and around the destroyed trees. Genetic diversity represents the biological variation or capacity for variation within each species. It is critically important as it allows organisms to adapt to changing environmental conditions and consequently to evolve into new life forms. Soil erosion and sedimentation,

retention and soil formation, nutrient cycling, waste treatment, pollination and hence control various biological processes is well recognized (Turner et.al. 2000)

Scientific studies need to be initiated in this regard to extract the particular gene of Avicennia sp. which enables the adaptation and salt tolerance capability. These genes may be inculcated into crop plants to make them adapt to the stressful conditions. In traditional medicine, these mangrove plants have proven to work against human, animal and plant pathogens but only limited investigations have been carried out to identify the metabolites responsible for their bioactive potential. Little investigations have been carried out in research areas like pharmacology and toxicology of thesemangroves.

Avicennia species are fast growing mangroves and regeneration capacity is achieved quickly from monoculture (Polidoro *et al*., 2010). Avicennia species has got an incredible application in water purification services in the Muthurajawela Marsh, Sri Lanka are valued at more than $US 1.8 million per year (Polidoro*et al*., 2010). Ecologically *Avicennia marina* species are very important as they exhibit a wide physiological tolerance and provide a conducive environment for other mangroves species to become established (Jusoh and Aziz, 2014). The medicinal and economic use of four mangrove species viz. *Sonneratiaacida, Kandeliarheedii*, *Avicenniatomentosa* and *Lumnitzeraracemosa* that was found in Kerala coast was investigated. Presently none of the above species were found in Kerala coast. A few species like *Excoecariaindica* and *Bruguieraparviflora* are very rare and show restricted distribution along the coasts indicated fast disappearance of the species due to speedy conversion of land for alternate use (Basha, 1992).*Ceriops tagal*, believed to be extinct in Kerala coast was being rediscovered from Vincent Island of Kollam district (Vimal Raj *et al*., 2014).

Mangrove areas may be able to be rehabilitated in some regions, but species and ecosystems cannot be effectively restored. Puthuvypeen mangroves are pole-size with GBH between 15–25cm indicating a healthy mangrove forest due to good regeneration capacity of the species. Despite great threat to the survival of *Avicennia marina* in this mangrove patch, there is no care protection of this species. Climate change and the related rise in sea level

could be particularly harmful to mangroves and vital action is needed to protect them. The need of the hour is to safeguard not only these patches of mangrove forests but also, attract the attention of global scientists from Central and State government organizations, non-government organizations, private organizations in order to protect the areas that are ecologically sensitive such as entire mangrove areas close to breeding and spawning ground of fish and other marine life areas so as to conserve them for sustainable use in the future. One way of estimating the loss of mangrove forests due to deforestation, is to extrapolate the knowledge of present genetic structure and other scientific investigations of these available *Avicennia marina* population rather than converting the land for alternate land use.

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