# Estimation of Mangrove Vegetation density in Ernakulam district of Kerala

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**Abstract:**

Mangroves are commonly known as "the protector of shore line", which act as a buffer zone between land and sea. The mangrove forests are increasingly threatened by the population pressure and the pollutants released into backwaters by various industries on the banks of the water bodies. This has caused severe impact on mangrove swamps. In this paper, District of Ernakulum, Kerala was taken as study area for the estimation of vegetation density of mangroves .The district stretches from $9^\circ 58'$ North to $76^\circ 1'$ East. Here, Mangrove vegetation are along the backwater channels and banks of estuarine water bodies, in the form of patches or narrow continuous belt. Specifically they are identified in several places such as the islands of Vypin, Panangad, Kanamali, Kumbalangi,Kumbalam,Nettoor,Mangalavanam,Panambu-kad,Pallipuram,Karumallor,Moothakunnam.
The vegetation density of mangrove forest in this area was evaluated using the remote sensing and GIS techniques, which provided quantitative information on understanding the spatial distribution of mangrove forest. The paper aims at estimating the distribution and density of mangrove in the study area by NDVI methodology. Survey of India (SOI) Toposheet with scale range of 1:50,000 and software packages such as ArcGIS 10 and image processing software were used for processing and mapping the study areas. Visual interpretation technique was followed in order to map the mangrove forest cover using the high resolution LISS III satellite image. LISS III satellite images includes three bands namely Green, Red, and NIR of which Red and NIR bands were used to perform NDVI .Based on the percentage of canopy cover, mangrove forest density was broadly classified as highly dense, moderate, sparse and degraded forest. On the whole, this paper would help to determine the status of mangroves in the district which in turn would help to conserve the fragile mangrove ecosystem.

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## Introduction

Mangroves are the "rainforests by the sea", which have many peculiar features than other terrestrial plants. Mangrove wood serves as a superior kind of charcoal and many trees have been cut down to sustain the local charcoal industries. Mangrove roots are very susceptible to pollutants like clogging of crude oil to their lenticels, and continuous flooding from artificial dikes and sea walls.

Today one of the most threatened habitats in the world are mangrove forests. Over time the stress of the pollutants had adverse effects on large areas of mangroves. Mangrove swamps are being filled in for developments and cut down as a form of mosquito control. The major threat to mangroves is the exploitation of it for timber, firewood, poles and cattle feed by human beings. This leads to a great loss of mangrove biodiversity. In Ernakulam the conversion of mangrove swamps into fish farm causes great ecological damage. Major portion of the vegetation has already been converted for alternate land use like agriculture and aquaculture. Retting of coconut husk is also causing degradation of mangroves. So the present study was conducted to get proper knowledge regarding the mangrove density.

The aim of the paper is to depict accurately current distribution of mangroves using GIS and remote sensing based maps and also estimating the density of mangroves in the study area using NDVI methodology. The study of this nature, using GIS and remote sensing are handy tools for improving the efficiency of mangrove management, thereby expected to pave way for increase of mangroves.

## Study Area

Cochin is often called by the name Ernakulam. Cochin has outgrown its original bounds and is now the general name given to much of the region adjoining the original town, which now includes Cochin, Fort Kochi, Mattanchery, Ernakulam and many other nearby towns and villages. Cochin has one of the best natural harbour in the world. The Cochin backwater extends along the western side of the Cochin area which in turn is the northern part of the Vembanad Lake. The Vembanad Lake is the biggest and most extensive one in Kerala. During flood tides the sea water (Lakshadweep Sea) enters the Cochin estuary via Cochin barmouth (12 m depth) and the flow reverses during the tides. In Cochin backwaters there exist many thickly populated islands. Vembanadu Lake and connected Cochin backwaters are considered to be an example for mangrove estuary. The district stretches from $9^\circ 58'$ North to $76^\circ 1'$ East. Western part of Ernakulam District was chosen as a study area which is shown in the figure 1. LISS III satellite image of the study area shown in figure 2.
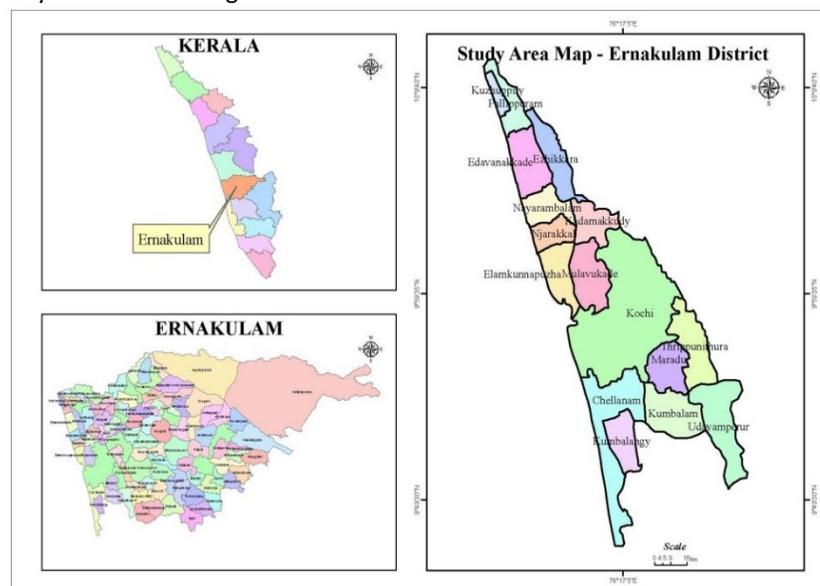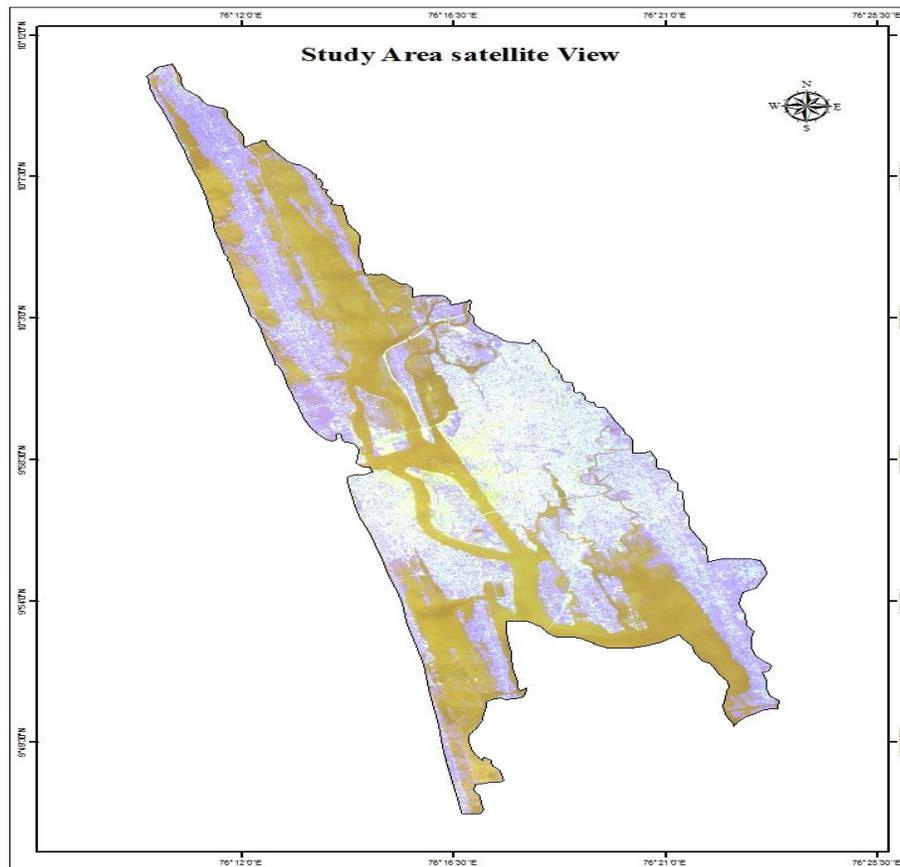


**Fig 1 : Study Area**

The District is endowed with distribution of mangroves in the areas of Vypin, Panangad, Kanamali, Kumbalangi, Kumbalam, Nettoor, Mangalavanam, Panambukad, Pallipuram, Karumallor, Moothakunnam, and Thevara. This rich but fragile ecosystem has undergone serious alterations largely induced by human due to unprecedented destruction, which includes commercial exploitation of raw materials, land reclamation for agriculture, aquaculture and housing. Population increase, mining, and over-exploitation of mangrove forests without replanting are some of the other factors influencing depletion of mangroves in the district. Therefore, need to preserve mangroves in this area is important.



**Fig 2: LISS III image of the Study Area**

## Methodology

Study area was prepared from Survey of India (SOI) Toposheet with scale range of 1:50,000. Processing and geo referencing of the raw satellite image was perfomed using this toposheet. The high resolution LISS III satellite image was used to perform NDVI. Image processing software and ArcGIS 10 were used for processing the image and mapping purposes respectively. Unsupervised classification of the study area were done using image processing software for estimating land use and land cover. This helped in determining the various classes namely waterbodies, estuaries, road, greenery, settlement, shown in figure 4. In order to determine the vegetation density of the area NDVI was performed generated the NDVI map, shown in figure 5.Using visual interpretation techniques by collecting pixel information of mangrove abundant areas calculated the area of mangrove coverage in the study area. Hence, mangrove areas were classified and gridded; output was obtained by generating map in ArcGIS. Figure 3 shows the block diagram explaining the methodology of this work.
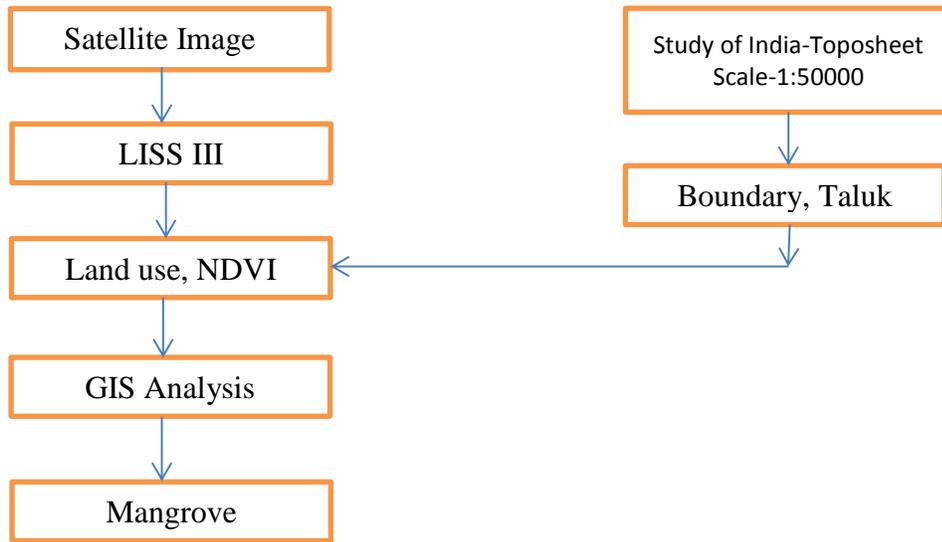
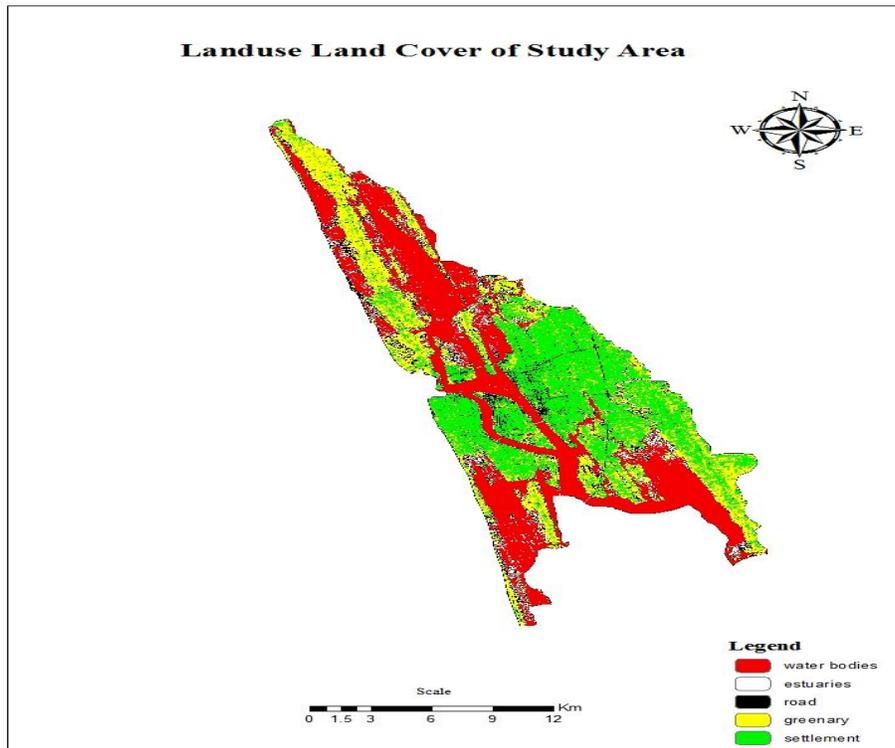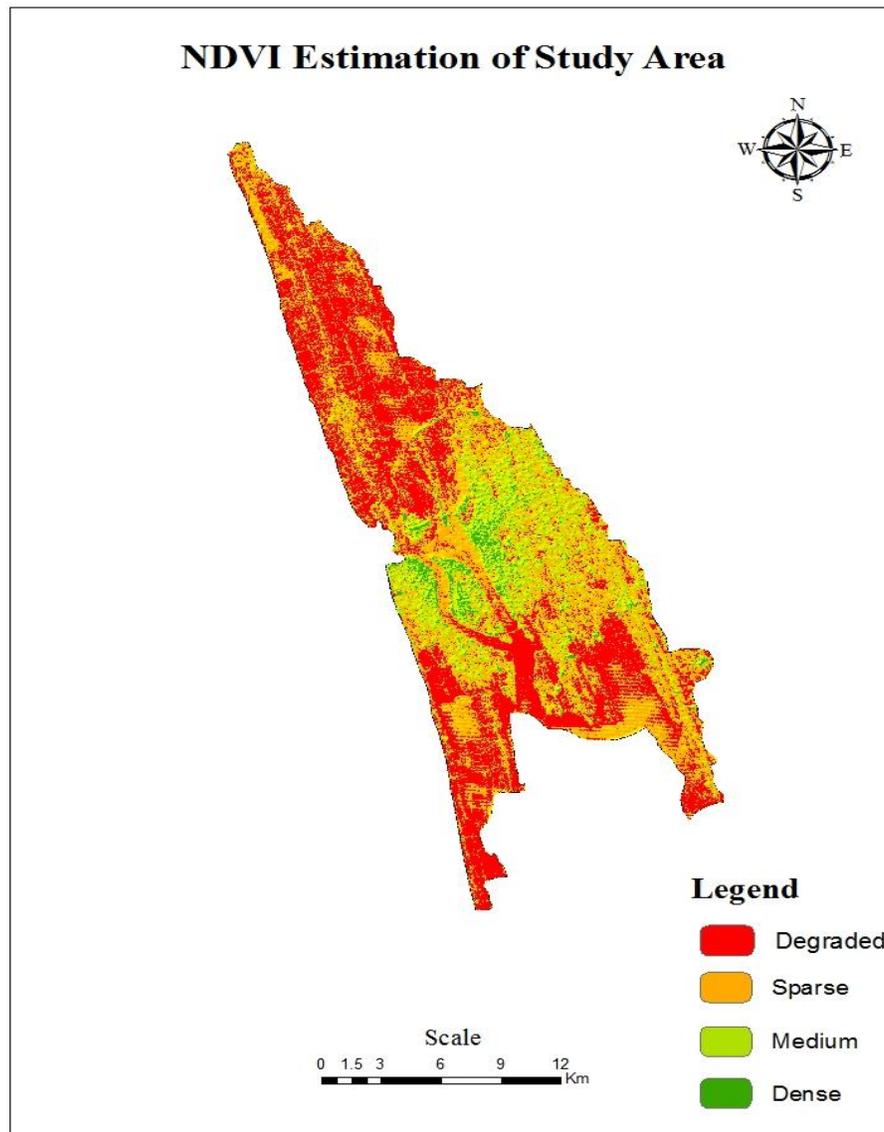**Fig 3 : Block Diagram explaining Methodology**



**Fig 4 : Landuse and Land Cover**

**Fig: 5 – NDVI estimation**

## Results and Discussion

Area under mangroves is relatively smaller, and especially the western part of Ernakulam District .According to the survey of Forestry Information Bureau of the Forest and the wildlife Dept., Government of Kerala, the mangrove vegetation is spread over 260 ha out of total 1650 ha of mangrove forest in the state. Mangroves are now mainly found in Vypin, Panangad, Kumbalangi, Kumbalam, Nettoor, Mangalavanam, Mulavukad, Moothakunnam, Maradu, and Thevara. Mangrove identification done in these areas is shown in figure 6. It was found that mangrove vegetation in Ernakulam is now restrained largely to river mouths and tidal creeks and that there has been no significant mangrove cover when compared to the earlier surveys due to continuing degradation and destruction. The results from this study are important for the conservation and preservation of the mangrove forest in the district.
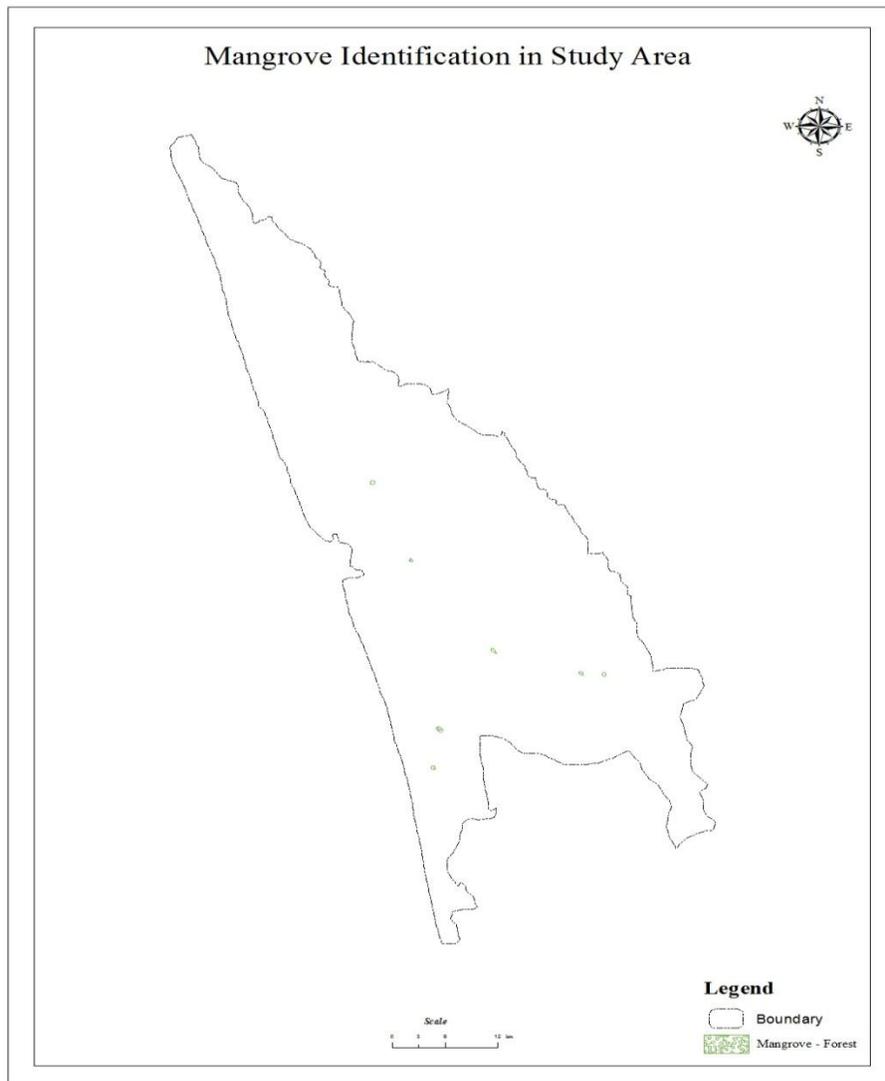
**Fig: 6 – Mangroves Identified in Study Area**

## Conclusion

Investigation was carried out on mangrove distribution and diversity of Ernakulam district to study the present status of mangrove vegetation. In the district mangroves are threatened by the population pressure. Study revealed that mangroves of Ernakulam district are under threat. Immediate actions for the conservation of mangroves of Ernakulam is suggested. Remote sensing and GIS tools have been used to determine the extent of land cover changes. High resolution satellite image was used in this study to evaluate the vegetation density of mangrove forest in Ernakulam District. Visual interpretation techniques were used to map the mangrove forest. NDVI is the valid method used to differentiate the vegetation density of the mangrove forest. The status of mangroves in the each mangrove forest extent elaborates the health status of mangroves in each area. The present information will be useful for the further studies and help to monitor the mangrove ecosystem. It will help to formulate the strategic plans and afforestation of mangroves in the area of study.

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