Digital Investigation of LISS3 Data around Mangrove Habitat at Lower Reaches of Valapattanam River, Kerala, India

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Abstract

The mangrove vegetation is blessed with enriched biodiversity and plays a crucial role in the existence of coastal and marine ecosystems, which provides essential contribution for socio-economic development of the country. The satellite derived data analysis is highly useful in understanding the distribution and areal extent of vegetation, helpful in conservation activities and planning the management strategy for protecting the coastal and marine biodiversity. Detailed study has been conducted at the lower reaches of Valapattanam river region of Kannur district, Kerala using LISS3 data. Supervised classification techniques have been attempted in delineating the vegetation and non-vegetated regions. The outcome of the study identified the thick vegetal cover particularly around the mangrove belts, which needs to be conserved. The methodology adopted in this study can be employed in managing the vegetation cover.

Keywords: Mangrove; Supervised classification; LISS3; Biodiversity

Introduction

Mangroves represent the salt tolerant vegetation dominantly located at the tropical and subtropical climatic zones. Mangroves are thereby different from that of terrestrial plants on several features, which includes varieties of species of trees and shrubs that grow in the intertidal zones at the coastal areas. Basha (1991) reported the decline of mangroves of Kannur district of Kerala state. An investigation by Forest Survey of India (FSI, 2003) in the state of Kerala found that mangroves are mainly confined to the river mouths, tidal creeks and land forms of similar nature. Large scale human interferences like sand mining causes problems to the existence mangroves (Sunil Kumar, 2002). The structural features of mangroves in Kerala have been attempted by a few workers. Vidyasagaran et al. (2011) analyzed the Phytosociological aspects of mangroves. It is believed that the domination of mangrove communities have affinities to specific environmental and ecological conditions. Ewel and Bourgeois (1998) believed that the influential factors for the species dominance of mangroves at different sites may be due to tolerance level to salinity, soil, adaptations etc. Notable analysis on image processing relevant for the present investigation are seen from the works of Badhwar (1984), Green et al. (1996), Imbrernon (1999), Mohammed-Aslam (2010), Mohammed-Aslam and Abdussalam (2011), Mohammed-Aslam et al.(2011), Manish Sharma at al. (2011).

Study Area and Environment

The area of study (Figure 1) is located in the lower reaches of Valapattanam river basin and lies between east longitude of 75.29E and 75.38E and north latitude of 11.92N and 11.97N (geographic latitude/longitude –WGS84). The area receives a total annual rainfall about 3400 mm. Heavy rainfall is observed during the South

West monsoon season during June to September followed by North East monsoon. The South West monsoon contributes 70 % of the total rainfall received in this area. Geomorphologically, the area of study is located in the coastal low lands. Three types of soils have been observed in the area of study and adjoining areas. They are lateritic soil, brown hydromorphic soil, coastal and river alluvium. The lateritic soil is derived from the process of weathering under humid tropical environment, ranging from sandy loam to red loam. A brown hydromorphic soil varies from sandy loam to clay, which have been generated as a result of transportation and deposition of materials at the hill slopes by action of rivers. The marshy soil, which is composed of recent deposits of marine and fluvial origin in the coastal plain, estuaries and riverside, are noticed by mangrove vegetation.

Figure 1. Location of study area is confined within the round circle shown near Kannur. (The entire stretch of map represents the Kerala state, India)

Results and Discussion

The Resourcesat-1, LISS3 data acquired on 15th December 2009has been used for the present study. Supervised classification was performed on this image for generating the land use/land cover maps. Surveys of India (SOI) topographic sheets and Google Earth resources have also been used to enrich the quality of the analysis.

The land use/land cover characteristics are distinct in this area. Remote sensing method offers an efficient and quick approach as land use/land cover classification is a time consuming and lengthy process. The land use and land cover pattern have been identified by conducting supervised classification using ERDAS Imagine. Maximum likelihood classifier is used in this analysis as it is a successful criterion that is based on a priori probabilities. The classes identified using these procedures are thick vegetation, sparse vegetation, water and other area (Figure 2). Thick vegetation includes those locations which are composed of pixels having dense vegetal cover. Mangrove regions of this area belong to this category. The vegetations are relatively less in case of sparse vegetation, which include partially occupied other land use patterns. Water bodies in the study area include river and sea. Other areas cover the settlements and bare lands. During the classification procedure, the training sites have been properly identified by conducting detailed field investigations. The table 1 shows the relative occurrence of percentages of different land cover classes. The land use/land cover of the area reflects the interrelations to natural vegetation, water bodies, rock and soil interactions and related land transformations. As mangrove belts protect coastal areas from erosion and natural disasters including storm surge and tsunamis, an understanding of spatial spread of mangroves are crucial for its conservation.

Table 1. Land cover / Land use Distribution

Land cover/Land use	Area (%)
Thick vegetation	11.07
Sparse Vegetation	49.63
Water	21.43
Other Area	17.87

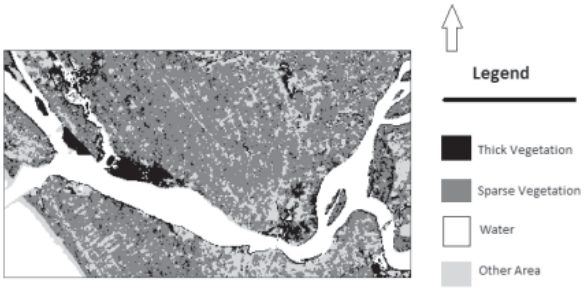

Figure 2. Classified Image of the study area

Acanthus illicifolius, Avicenniamarina, Avicennia officinalis are major types of mangroves observed in the study area. Relatively higher frequency and density of *A. illicifolius* was noticed during the field investigations. Unique ecosystem has been noticed in this coastal tract owing to the intricate network of roots of mangroves. Among the commonly seen faunal diversity around mangroves in the area of study include fishes, mangrove crabs and shrimps. The vegetal density of mangroves is high at the river banks which are very close to the sea. As the fragility of this regions are high, effective conserving strategy need to be followed.

Conclusion

The remotely sensed data analysis provides more holistic and integrated approach to environmental assessment of biodiversity conservation objectives. The lower reaches of Valapattanam river, Kerala near the point of confluence has remarkable mangrove vegetation and associated biodiversity. The supervised classification of LISS3 data has clearly delineated the vegetal cover in this coastal tract. Despite their incredible environmental, economic and ecological significance, these ecosystems are under increasing threat, due to numerous direct and indirect pressures arising from different types of anthropogenic interference and activities related to developmental activities. Therefore, a satellite based spatial analysis and the derived database is highly useful in establishing a proper management strategy for conserving the vegetation, particularly the mangroves systems. The land use/land cover delineation performed in this study provides a vital component in the conservation of mangroves of lower reaches of Valapattanam area, Kerala, India.

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