ABSTRACT

Study and analysis of coastal ecological features is paramount in understanding the ecosystem prevailing in a coastal environment. Various wetland ecological features such as tidal flats, salt marsh, marsh, mudflat, dune sand, beach, spit, sand bars apart from backwaters such as estuary and lagoon provide ambient shelter for many flora and fauna. These features encourage the bloom of primary producers in the form of micro-flora such as algae and phytoplanktons, which in turn nurture many smaller organisms and slowly building up the food chain to attract larger preying fishes and birds thereby maintaining a balanced coastal ecosystem. The brackish water in the lagoon and estuary because of tidal variations due to both diurnal and seasonal changes provide warm and effective environment for breeding as well nurseries for many fauna. This necessitates a holistic view and knowledge of the pattern and trend of wetland features in an ecosystem, which is adequately provided by remote sensing satellite data.

The advent of remote sensing satellite technology has made a tremendous impact on the studies related to natural resources, especially in the field of coastal ecosystem. In the present study, the advantage of remote sensing satellite data with its synoptic view is well utilized to understand the pattern and presence of various ecologically sensitive wetland features around Pulicat lagoon and Yedyanthittu lagoon – Kalveli lake along the coastline of Tamilnadu, India. Among these two study sites, ecosystem around Pulicat lagoon is vastly influenced by diurnal tidal influx developing many classical wetland features that support many micro-organisms to varieties of flora and fauna. The second study site around Kalveli, typically exhibits a thriving interactive ecosystem with active tidal influence into the fresh water Kalveli lake through Yedyanthittu lagoon. The spatial extent and pattern of various ecological wetland features in both the study sites are analysed using information derived from temporal satellite data of two periods (2002 and 2006) and compared for their temporal changes using spatial GIS (Geographic Information System) techniques.

The analysis of the data carried out in two broader segments – image analysis and spatial GIS analysis. In the former, an elaborate spectral analysis of remote sensing
satellite image has showed that each features depending upon their natural inherent character has definite reflectance or digital number (DN) values and spectral pattern. It also showed that these values under different physico-chemical condition though showed different reflectance values have not deviated from its inherent reflectance pattern adhering to spectral properties of individual matter. In this way, waterbody under different condition such as sea water, turbid water along the near-shore, lagoon water, water away from lagoon and fresh water in the lake could be individually identified by their typical DN values influenced by their chemical constituents and physical condition. Similarly, sand patches such as barren soil, beach sand, spit and sand bar adhering to their spectral reflectance pattern showed different spectral DN values. In the same way, agriculture crop such as paddy showed different DN value than that of other plants such as casuarina plantation, scrub vegetation like prosopis and to some extent water spread area under algal coverage. Such analysis has proved its significance in generating knowledge data of various wetland features under different condition and form baseline information for classification of features using image processing techniques.

Classification techniques - both unsupervised and supervised - applied on remote sensing data has brought out significant information regarding the pattern and boundary condition or spatial extent of various features. Image analysis such as edge enhancement, PCA and NDVI has brought out information such as soil moisture, vegetation pattern and alignment of similar coastal wetland features highlighting interaction between land and sea and assisted in delineating the tidal extent into the land.

The delineated coastal wetland features are geo-referenced and transformed into GIS for further analysis with respect to spatial changes in area and pattern using temporal satellite data. The analysis revealed that wetland ecological features such as mudflat, salt marsh, and tidal flat vary dynamically due to variations in tidal level. The spatial pattern of various types of tidal flat in Pulicat – sub-tidal, intermediate and high tidal flat – changes dynamically with changes in tidal variations and also influenced by climatic condition such as sun shine hours and temperature. The area thus estimated from temporal observation of wetland features as extracted from satellite data in GIS.
environment revealed area in these categories varies dynamically including their pattern. But at the same time, they are confined within the high tidal area. Much of brackish water flora and dependant fauna especially fish and prawns thrive within this area thus reiterating the significance of studying wetland features of coastal ecosystem – especially near Pulicat area and Yedayanthittu – Kalveli area – along the coastline of the study sites.