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Assessment of Temporal Changes in Land use Pattern over the Kinfra-Vizhinjam Stretch in Thiruvananthapuram City

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Abstract

Metropolitanization is one of the main causes behind the transformations of the coastal segments of Kerala, where new urban settlements have evolved during last decades. Depending on the monetary and administrative roles, various cities speedily changed to territorial junctions. Urbanization causes land use/land cover changes which can lead to deeper social, economic and environmental changes. Remote sensing technology has great potential for acquisition of detailed and accurate land use information for management and planning of urban regions. Our study area was located between 80 22' 45'' North latitude to 760 59' 29'' East longitude (Vizhinjam) and 120 6' 77'' North latitude to 750 24' 38'' East longitude (Kinfra). The main objective of the study was to assess the temporal changes in the landscape spatial pattern to define the growth trends in the area and moreover, to evolve a land use map constructed according to the unsupervised classification technique.

Keywords change detection, vegetation vigor, unsupervised classification, urban landscape
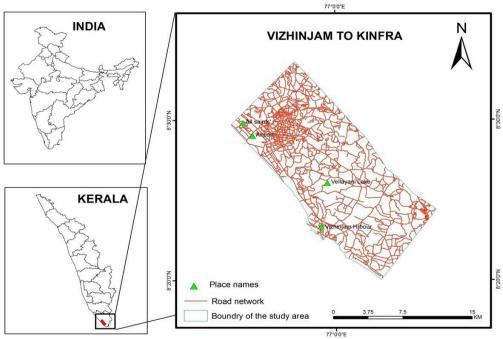
Introduction

Urbanization is an indicator of the fact that how fast the outmoded rural status is changing into contemporary industrial grade one. Additionally, it is defined by an increment in the number of advanced individuals in a region [1]. The factors driving urban expansion can be grouped into economic factors (globalization, rising living standards, land prices, national policies), demographic factors, housing preferences, social aspects, transportation and regulatory frameworks. Urban landscape pattern change is not only the indicator of urban landscape heterogeneity, but also the result of process of human activities. Temporal effects are the factors that change the spectral characteristics of a feature over time. Spatial effects refer to factors that cause the same type of features at a given point in time to have different characteristics at different geographic locations. It is possible to identify the land cover lost as a result of new urban development [2]. Beside the conventional ground data, satellite data (remotely sensed data) can be effectively used to methodically plot, observe and precisely evaluate the three-dimensional outlines of metropolitan extension during dissimilar time phases [3]. Identification of changes in land use/cover is extremely crucial to better understand the dynamics of landscape over an identified duration of time with imperishable management [4]. Application of remotely sensed data make possible to study the changes in land cover in less time, at low cost and with better accuracy in association with GIS that provides a suitable platform for data analysis, update and retrieval. Remote sensing provides spatially consistent data sets that cover large areas with both high spatial detail and high temporal frequency [5].

Study area

The present study was carried out in an area of Trivandrum from Vizhinjam to Kinfra, Kerala. The study area lies between 80 22' 45'' North latitude to 760 59' 29'' East longitudes (Vizhinjam) and 120 6' 77'' North latitude to 750 24' 38'' East longitudes (Kinfra). Kinfra was established in the

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LOCTION MAP OF THE STUDY AREA

Figure 1. Location map of the study area

year 1992-93. The main roadways connecting the two areas are the NH47 bypass road and Salem – Kochi-Kanyakumari highway. The Trivandrum International Airport also lies in this area and the only water body in the area is the Vellayani Lake. The climate is tropical with 26.9 °C average temperature and 1624 mm average annual rainfall. Figure 1 depicts the location of the study area.

Methodology

A land use change analysis was carried out as a part of the present study using Normalized Difference Vegetation Index employing the tools of Remote Sensing and GIS. Multi-temporal satellite data set of Landsat 7 (ETM+ SLC on) and Landsat 8 (OLI/TIRS) and Survey of India Toposheet were used for the analysis. Details of the spatial data sources are given in Table 1. The reflectance of

Table 1 Spatial data sources

Data	Month of Observation
Landsat 7	27th November 2000
Landsat 8	13th January 2015
Survey of India Toposheet	D14, D15, H3

2015 image was corrected and land use / land cover classification was done through unsupervised classification method, based on Google Earth and Toposheet. Arc GIS 9.1 and Erdas Imagine 8.3 are powerful tools for extracting the land use/cover. The vegetation vigor analysis of the area was done through the Normalized Difference Vegetation Index (NDVI) analysis and the vegetation analysis was done with the aid of the ERDAS Imagine 8.3. The identified land use/land cover classes include water body, paddy field, settlement, plantation, quarry and airport.

Results and Discussion

The main land use in the study area was the settlements and vegetation. The spatial analysis from 2000 to 2015 showed drastic changes in the land use features. The areal extent of water body showed a slight decrease and simultaneously, there was a decline in the area occupied by the quarry since 2000 to 2015. Another important change in the land use feature was the increase in the vegetative land cover. There was also a slight increase in the area under cultivation in 2015 as compared to 2000. As for the built up area, a huge increase was observed during the 15 years duration.
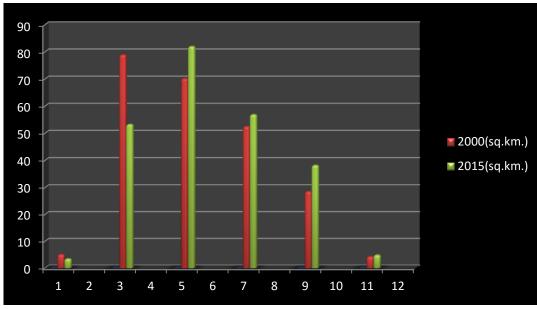
Figure 2. Areal extent of land use classes in the study area in sq. km.

The area of the airport remains almost the same with a small fraction of change. The area of the diverse land use topographies are represented in Figure 2. The map showing land use pattern of two years, 2000 and 2015 are shown in Figure No. 3. Land is one of the most vitally accepted natural resources. Proper growth and organization of a region is basically dependent on an effective land use approach that can be achieved by an outline of land use and its spatial distribution. Land cover

mapping serves as a basic inventory of land resources for all levels of organization, environmental agencies and private industry throughout the world [6].

Conclusion

On the basis of the results obtained in our study, it is clear that there was an increase in the vegetation and built up of the study area, while all the other
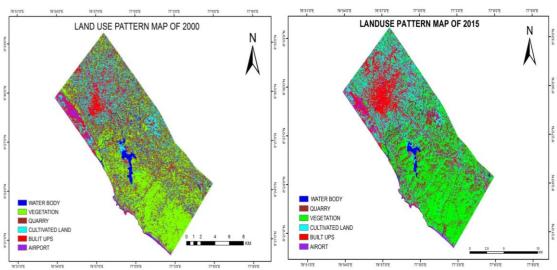

Figure 3. Land use pattern of the study area in 2000 and 2015,

features showed only slight variation over the time period of 2000 to 2015. The area occupied by quarry got drastically reduced, while the area of water body and airport remains almost the same without much change.

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