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# LAND USE AND LAND COVER CHANGE DETECTION USING REMOTE SENSING AND GIS IN PARTS OF COIMBATORE AND TIRUPPUR DISTRICTS, TAMIL NADU, INDIA

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## Abstract

Land use/ land cover is an important component in understanding the interactions of the human activities with the environment and thus it is necessary to monitor and detect the changes to maintain a sustainable environment. In this paper an attempt has been made to study the changes in land use and land cover parts of Coimbatore and Tiruppur districts. The study was carried out through Remote Sensing and GIS approach using SOI toposheets, LANDSAT imagery of 2000 and IRS-P6-LISS-III 2009. The land use/land cover classification was performed based on the Survey of India toposheets and Satellite imageries. GIS software is used to prepare the thematic maps and ground truth observations were also performed to check the accuracy of the classification. The ten year time period of 2000 -2009 shows the major type of land use change.Agricultural activities were decreased from 33.9% to 26.3%, alternately fallow land was increased 43.9% to 54.5% and built-up-land was increased 0.1 % to 0.3% The reasons for this change detection have beendiscussed. However plantation, land with scrub, wet logged, barren rocky, tanks and reservoirs have also experienced the change. Coimbatore and Tiruppur district are identified as one of the industrialized areas in India. It is necessary to closely monitor the land use/land cover changes for maintaining a sustainable environment for a proper development.

**Keywords:**Landuse, Landcover, change detection, Remote sensing, GIS

## Introduction

Land use/land cover (LULC) changes are major issues of global environment change. The satellite remote sensing data with their repetitive nature have proved to be quite useful in mapping land use/land cover patterns and changes with time. Quantification of such changes is possible through GIS techniques even if the resultant spatial datasets are of different scales/ resolutions (Sarma et al., 2001).Such studies have helped in understanding the dynamics of human activities in space and time. Land use refers to man's activities. During the past millennium, humans have taken an increasingly large role in the modification of the global environment. With increasing numbers and developing technologies, man has emerged as the major, most powerful, and universal instrument of environmental change in the biosphere today.

Land use refers to man's activities and the varied uses which are carried on over land and land cover refers to natural vegetation, water bodies, rock/soil, artificial cover and others noticed on the land (NRSA, 1989). Land Cover, defined as the assemblage of biotic and a biotic components on the earth's surface is one of the most crucial properties of the earth system. Land cover is that which covers the surface of the earth and land use describes how the land cover is modified. Land cover includes: water, snow, grassland, forest, and bare Soil. Land Use includes agricultural land, built up land, recreation area, wildlife management area etc.Moreover thistype of analysis provides a valuable tool to increase the efficiency of land use and land cover, and to diminish the negative environmental and societal impacts related to LULC. Over the years, remote sensing has been used for land use/land cover mapping in different parts of India (Gautam and Narayanan, 1983: Sharma et al, 1984: Jain, 1992; Brahabhatt et al, 2000).Application of remotely sensed data made possible to study the changes in land cover in less time, at low cost and with better accuracy. Remote sensing and Geographic Information System (GIS) provide efficient methods for analysis of land use issues and tools for land use planning and modeling. In this present study, an investigation has been carried out in Parts of Coimbatore and Tiruppur district of Tamil Nadu to detect the land use land cover changes. This area is known for extensive development of industrial growth activity in recent decades. It is believed that this aggressive human activity might have influenced on the land use/land cover patterns resulting in a possible impact on the environment. This work is taken up to better understand this aspect.

# Study Area

The study area is located in and around the southern parts of Coimbatore and Tiruppur district, Tamil Nadu. The area covered in this investigation is about 3953.3 sq.km lying in between 76° 50' 00"to 77° 30' 00"E longitude and 11°10' 00" to 10°20' 00" N latitude. The study area is in between the southern part regions of the Noyyal, Aliyar, Tirumoorthy and Amravati rivers.

*Coimbatore district*

The total population in (2001) – 2916620 and (2011) – 3472578

Temperature – maximum 34.9°c, minimum 18.4°c

*Tiruppur district*

The total population (2001) – 1917033 and (2011) - 2479052

*Rainfall (in mm)*

Normal - North East Monsoon- 328.9, South West Monsoon- 189.8, Actual - North East Monsoon- 410.7, South West Monsoon - 252.9

# Aim & Objectives

The aim of this study is to produce a land use/land cover map of Coimbatore and Tiruppur districts in order to detect the changes that have taken place over a given period using changedetection method. The following specific objectives are pursued in order to achieve the aim.

- The main objective of the present paper is to analyse nature and extent of land use land cover changes in parts of Coimbatore and Tiruppur district of Tamil Nadu in the past 10 years.
- To Creation of land use / land cover classification scheme.
- To determine the nature, rate, location and magnitude of land use / land cover change for the period 2000 to 2009.

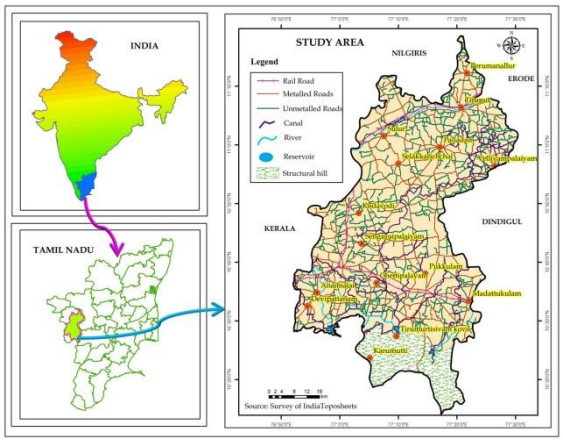


**Fig.1: location map of the study area**

# Methodology

The base map of the study area is prepared from the Survey of India 1:50,000 scale topographical sheets (58 B/13, 58 B/14, 58 B/15, 58 E/4, 58 E/7, 58 E/8, 58 F/1, 58 F/2, 58 F/3, 58 F/5, 58 F/6, 58 F/7 and 58 F/8). To make the change analysis of the study area, two images from the satellite LANDSAT MSS and IRS P6-LISS III 2000 and 2009. Data has been extracted from the multitemporal satellite images and toposheets. Key for interpreting satellite imagery elements is shown (table: 1).

**Table: 1.** Interpretation Key for Understanding Satellite Imagery Elements

| Elements | *Interpretation technique | Description |
|---|---|---|
| Water bodies | Water bodies include those pixels reflecting dark blue to light blue and cyan colour in standard FCC. | This category comprises areas with surface water in the form of ponds, lakes, drains and canals etc. |
| River | It appears light blue to dark blue in colour. | This is a natural course of water following a linear contiguous pattern. |
| Agricultural land | Pixel reflection varies from light red to bright red and green in colour. Area under this category follows regular shape with scattered to continuous pattern. | This category involves land under crops, fallow, plantations and aquaculture/ pisciculture. |
| Plantation | It exhibits bright red to dark red colour, smooth to medium texture and contiguous to non- | This is categorized as scattered plants and protected forest with the help of |

| | | |
|---|---|---|
| | contiguous pattern. | Survey of India Toposheets. |
| wet logged | Distinguished from other waterbodies with the help of Survey of India Toposheets. | It is permanent or seasonally water saturated land. |
| Barren rocky | It appears in greenish blue and brown in colour with varying size and irregular to discontinuous shape. | It is a bare exposed land devoid of vegetation. |
| Built-up land | It is having regular pattern and appears in cyan colour. | This category includes urban and rural settlements, transportation,communication and recreational utilities. |

* Characteristics of colour reflection of pixels are with reference to standard False Colour Composition (FCC).

Area statistics of each land use category is calculated in Sq.kmin attribute table. The land use/land cover classes include crop land, fallow land, settlements, rivers, drains, plantation, tanks etc. the feature classes were identified based on the visual interpretation of the satellite imagery coupled with filed checks. These datasets were digitized and analyzed to obtain land use/land cover statistics for the areas under each of these categories for both the years.

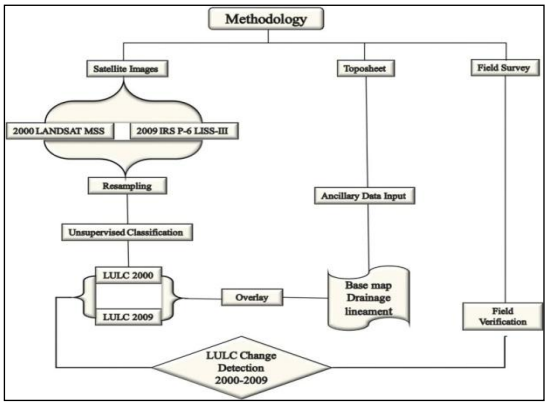


**Figure1. Flow chart of methodology for LU/LC change detection**

# Result &Discussion

The general land use of an area depicts an idea of overall areal utilization of resources, natural or cultural. In this paper, changes in the land use and land cover of Coimbatore and Tiruppur districts are evaluated from the differences between ten years of period (2000-2009) in figure-3 and figure-4. The findings of the present investigation are presented in table 1. Agriculture activities were decreased from 33.9% to 26.3%, alternately fallow land was increased 43.9% to 54.5% and built-up-land was increased 0.1 % to 0.3% The reasons for this change detection have been discussed. However plantation, land with scrub, wet logged, barren rocky, tanks and reservoirs have also experienced the change. The Landsat and IRS P6 –LISS III satellite datasets used in the current study yielded the following comparisons with respect to land use / land cover change detection. From the current study it is evident that there is considerable decrease in the study area for the period of 2000 to 2009. Fallow land, plantation and Built-up land class is showing an increasing trend and thereby resulting to the inference that the population pressure is playing a very active role towards diminishing forest cover. This is very much evident from the Table.3 and Figure.5 depicting the overall trend inthe land use / land covers change for the period 2000 – 2009.Coimbatore and Tiruppur district are identified as one of the industrialized area in India. It is necessary to closely monitor the land use/land cover changes for maintaining a sustainable environment for a proper development.

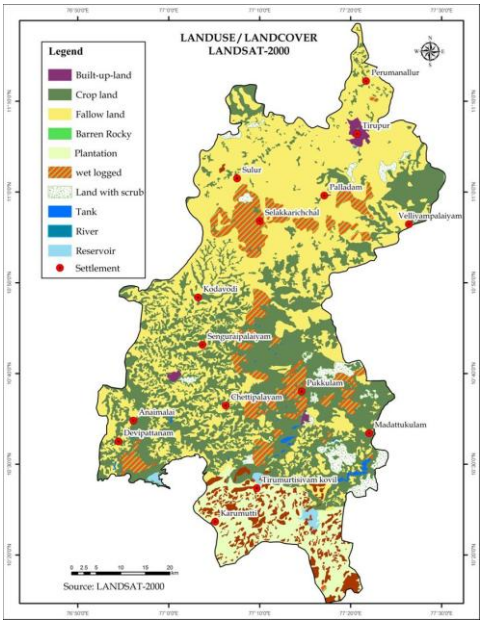


**Figure3. Land use / Land cover map 2000**

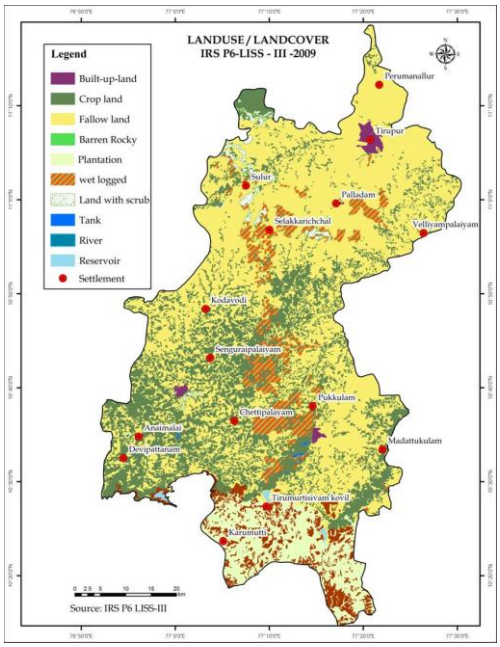


**Figure4. Land use / Land cover map 2009**

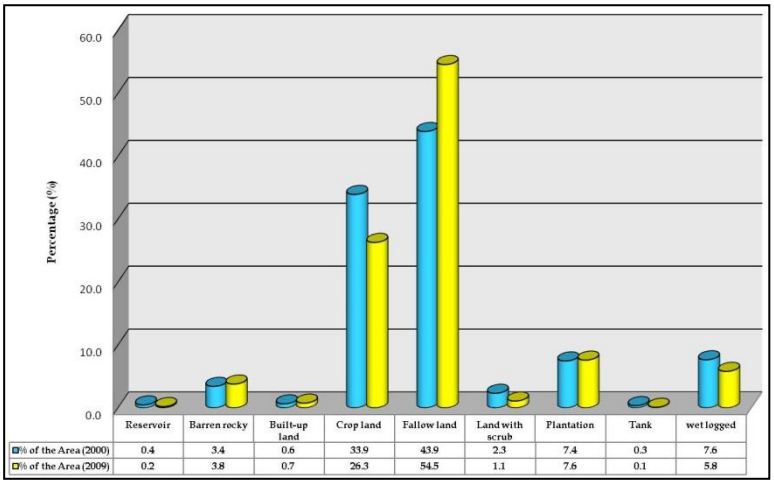


**Figure5. Landuse / Landcover change, 2000-2009**

**Table1. Land use / Land cover change analysis, 2000-2009**

| Land use/Land cover Feature | Area in (sq.km) 2000 | % of the Area (2000) | Area in (sq.km) 2009 | % of the Area (2009) | Change rate between (2000-2009) in Sq. km |
|---|---|---|---|---|---|
| Reservoir | 17.6 | 0.4 | 7.3 | 0.2 | 10.3 |
| Barren rocky | 132.8 | 3.4 | 148.9 | 3.8 | -16.1 |
| Built-up land | 24.3 | 0.6 | 29.2 | 0.7 | -4.9 |
| Crop land | 1341.9 | 33.9 | 1038.6 | 26.3 | 303.3 |
| Fallow land | 1738.6 | 43.9 | 2156.4 | 54.5 | -417.8 |
| Land with scrub | 90.6 | 2.3 | 42.3 | 1.1 | 48.4 |
| Plantation | 293.2 | 7.4 | 299.1 | 7.6 | -5.9 |
| Tank | 13.2 | 0.3 | 2.9 | 0.1 | 10.3 |
| wet logged | 301.0 | 7.6 | 228.6 | 5.8 | 72.4 |
| **Total** | **3953.3** | **100%** | **3953.3** | **100%** | |

# Conclusion

The study was carried out in the southern parts of Coimbatore and Tiruppur districts. The study clearly established that the satellite remote sensing coupled with GIS can be a powerful tool for mapping and evaluation of land use/land cover changes of a given area. The significant changes in the land use/land cover during the study period between the years 2000 to 2009 recorded some interesting observations. The study revealed that the major changes occurred in cropland, wet logged and fallow land. The features namely crop land, Reservoir and tanks indicated a decreasing trend where as the features like fallow land and areas under wet logged, plantations and settlements indicated an increasing trend. The reasons attributed for this are due to the changes in the pattern of agricultural activity and increased activity of urbanization.In general the land use/land cover data during the study period (2000-2009) of the study area indicated certain significant changes which may not show any significant environmental impact. However, these trends need to be closely monitored for the sustainability of environment in future.

Residential / Commercial / Industrial areas were found to occupy the highest area compared to other land use categories. Mixed urban and crop lands were noticed in all parts of the study area. Change detection analysis brings out the actual land loss and land gain on Residential / Commercial / Industrial, Mixed urban, Crop land, Plantation and Land with scrub. Of course, the aerial extent of waterbody such as river and tank has been maintained without neither any loss nor gain during 2000 and 2009. It was also observed that the increase in population has caused the major change of crop land, land with scrub and plantation into Residential / Commercial / Industrial area, mixed urban and other urban areas in Coimbatore and Tiruppur districts. This was verified in the field through personal inspection.

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