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**RESEARCH ARTICLE**

# LAND USE/LAND COVER CHANGE DETECTION THROUGH USING REMOTE SENSING AND GIS TECHNOLOGY – A CASE STUDY OF ST.THOMAS MOUNT BLOCK, KANCHEEPURAM DISTRICT, TAMIL NADU

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**ABSTRACT**

The present study aims to find out the land use/land cover change detection between the year 1998 and 2008 in St. Thomas Mount Block of Kancheepuram District, Tamil Nadu. The total area of the Block is 243 sq.km. The study has made use of IRS LISS III and high resolution IRS LISS IV pan merged satellite imageries for the year 1998 and 2008 to identify the land use/land cover categories in St. Thomas Mount Block. ERDAS image processing and ArcGIS software were used to demarcate the land use/land cover divisions in St. Thomas Mount Block. Remote Sensing and GIS provide consistent and accurate base line information than many of the conventional surveys employed for such tasks. The land use and land cover analysis has been attempted based on thematic features of the area consisting of built-up land, agriculture land, water bodies, forest and waste land. The research concludes that there is a rapid expansion of built-up area; a perceptible change in transportation network especially on metalled and unmetalled road; and decrease of agricultural area from the year 1998 to 2008. Land use and land cover information, when used along with information on other natural resources, like water, soil, hydro-geomorphology, etc. will help in the optimal land use planning at the macro and micro level.



## INTRODUCTION

Land use change is always being an interesting fact to geoscientists. Land use change is one of the important areas in geographic research to identify, locate and map the available classes over any region. Land use and land cover information is always significant in providing an updated inventory of the existing land resources that are being used by human beings. Using this information on change, the interaction among the forces and the effects of land use change on associated attributes such as land quality, land value and tenure can be studied in comprehensive manner. To prepare a land use map using satellite data, image classification is a powerful method of information extraction (Karteris, 1990). Successful use of satellite remote sensing for land use/land cover change detection depends upon an adequate understanding of landscape features, imaging systems and information extraction methodology employed with relevant to the aim of analysis.

The information may be obtained by visiting sites on the ground and / or extracting it from remotely sensed data. Change detected from different temporal images usually reflects natural and human activity impacts. Many studies have demonstrated the effectiveness of using remotely sensed data as a powerful tool to detect land use change for critical environmental areas, vegetation dynamics and urban expansion. Remote sensing makes a major technological breakthrough in the method of acquiring information on land resources, agriculture, forestry, ocean resources and other studies (Rao, 1991).

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### STUDY AREA

St. Thomas Mount Block is situated in the northern portion of Kancheepuram District (southern side of Chennai) with an area of 243 sq.km. It lies between the latitudinal extent of 12°50' N - 13°05' N and longitudinal extent of 80°05' E to 80°20' E. Twenty five Panchayat villages, three Taluks namely Tambaram Taluk (62 sq.km.), Sholinganallur Taluk (119 sq.km.), and Alandur Taluk (62 sq.km), lies under St. Thomas Mount Block. The physiography of this Block consists of few small hills namely Ladacheri malai, Periya malai, Pullikoradu usimalai and Pacha malai. The prominent soils in this Block are clay and alluvial, found in the eastern and northern portions; and the black clay soil was found in the western portions of the block with varying stiffness at different depths (Fig. 1).

## MATERIALS AND METHODS

The study has made use of various primary and secondary data. These include Survey of India (SOI) topographic sheets

(66/C4, D1 and D5) of 1:50,000 scale; and satellite images IRS LISS III (for the year 1998) and IRS LISS – IV geocoded data (for the year 2008). The Indian Remote Sensing Satellite (IRS) data were visually and digitally interpreted by using the ERDAS (for classifying the image) and ArcGIS software (for processing, analysis and integration of spatial data) to reach the objectives of the study. Adequate field checks were made before finalization of the thematic maps. The main goal of this study is to extract land use/land cover changes using multi-temporal satellite data.

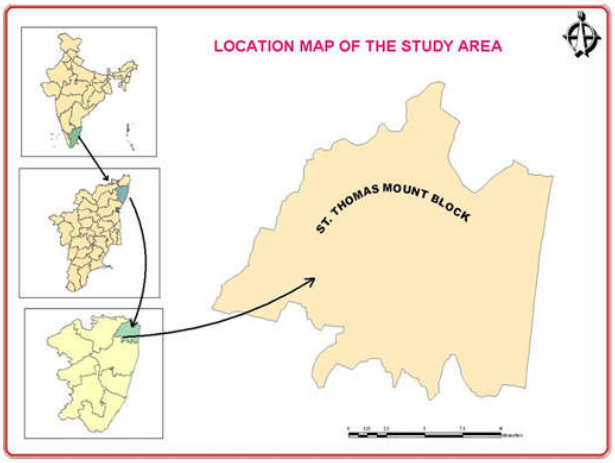


**Fig.1 - Study area map**

## RESULTS AND DISCUSSION

### *Analysis of Land use /Land cover by using Remote Sensing Data*

The land use/land cover categories of the study area were mapped using IRS 1D LISS III data (FCC of bands 2, 3 and 4) and IRS ID LISS IV data (FCC of bands 2, 3 and 4) of 1:50,000 scale. The satellite data was visually interpreted and after making thorough field check, the map was finalized. The various land use/land cover classes interpreted in the study area include, built-up land, agricultural land (crop land, fallow land and agricultural plantation) forest (dense and degraded forest), waste lands, (land with scrub, land without scrub and barren rocky areas) and water bodies, which are shown in Table 1. Detailed accounts of these land use/land cover classes of the study area are described in the following section.

### *A) Built-up lands*

The built-up lands are areas of human inhabitation developed due to non-agricultural activities like building, industries and transportation network. In satellite imagery, these features are identified with their dark bluish green tone in the centre and bluish tone on the periphery. These features have a coarse texture. In the study area the settlements are distributed along the sides of Grand Southern Trunk Road (G.S.T). In 1998, built-up area was seen near the Grand Southern Trunk road. The total area covered was 54.52 sq.km (22.44 per cent). In the year 2008, it increased to 135.76 sq.km (55.87 per cent). Residential area noticed in Alandur, Pallavaram, Tambaram, Ullagram, Pullitihivakam, Kottivakam, Chitlapakam, Sembakam, and Pallavakam in the south, Pallikaranai, Pamal and Thandurai in the east. Commercial area was noticed in Alandur, Pallavaram, and in Tambaram. Industries are located in Pallavaram, Chrompet, Tambaram and the surrounding areas of Tambaram (Fig. 2).

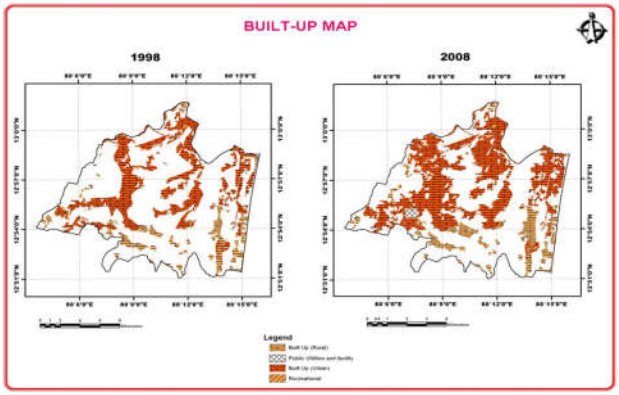


**Fig. 2. Built-up lands**

### *B) Agricultural lands*

Agriculture crops include land used to raise food crops, commercial crops, plantation crops and horticulture crops. The crop land includes all the agricultural areas. The agriculture lands are identified by their characteristic like red tone, square or rectangular shape of the agricultural fields, association with the water bodies, and topography. Fallow lands remain vacant without crops. The fallow lands are identified by their dark greenish tone, smaller size and medium texture. In the study area, such fallow lands are found in the western and central portions. Plantation areas were found in dark red colour tone in the eastern part of the block. The agriculture regions are Kottivakam, Palavakkam, Uthandi, and Arsangalani etc. In the year 1998, the agricultural land in the study area was 76.35 sq.km (31.42 per cent) but where as in the year 2008 it was reduced and total area covered was 38.49 sq.km (15.84 per cent). Agricultural land has decreased because of land revoke for industrial zones construction. With trend of changing agricultural land into non-agricultural land

**Table 1. Analysis of Land use / Land cover changes**

| Sl.No. | Land Use Categories | Area in sq.km. | | Difference in area (sq.km.) | Percentage | | Difference in Percentage (%) |
|---|---|---|---|---|---|---|---|
| | | 1998 | 2008 | | 1998 | 2008 | |
| 1. | Built-up lands | 54.52 | 135.76 | 81.24 | 22.44 | 55.87 | 33.43 |
| 2. | Agricultural lands | 76.35 | 38.49 | -37.86 | 31.42 | 15.84 | -15.58 |
| 3. | Water bodies | 42.97 | 33.53 | -9.44 | 17.68 | 13.80 | -3.88 |
| 4. | Forest lands | 30.36 | 23.05 | -7.31 | 12.49 | 9.49 | -3.00 |
| 5. | Waste lands | 38.80 | 12.17 | -26.63 | 15.97 | 5.00 | -10.97 |
| | Total | 243.00 | 243.00 | | 100.00 | 100.00 | |

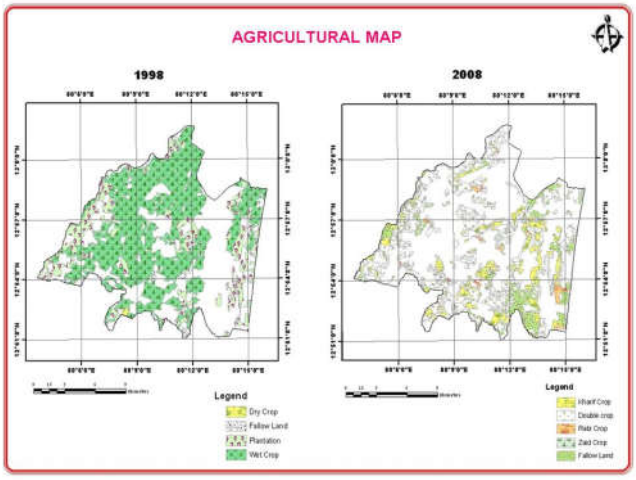


**Fig. 3. Agricultural lands**

### *C) Water bodies*

The water bodies include both natural and man-made water features namely rivers / streams / lakes / tanks and reservoirs. The water features appear in black tone in the satellite image. The shallow water and deep water features appear in light blue to dark blue in colour. Tanks with plantation are identified by the square / rectangle shape and red colour tone. Tanks without plantation are recognized by the shape and light blue to dark blue tone. In 1998, the total area covered under water bodies was 42.97 sq.km (17.68 per cent). Embankments are noticed in Moolecheri, Mudichur, Perungalathur, and Madambakam etc. Buckingham canal runs parallel to east coastal road. Small canals are noticed in the vegetation area. In 1998 the tanks were mostly concentrated in the southern parts of the study area and few dry tanks were located as isolated parcels in the northern parts. The water is most valuable commodity in this area because of low and insufficient rainfall and the non-perennial rivers. In the year 2008, the total area covered was 33.53 sq.km (13.80 per cent).

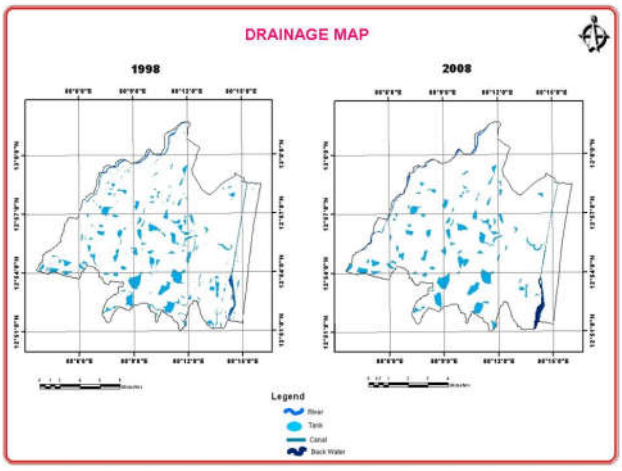


**Fig. 4. Water bodies**

### *D) Forest Areas*

Forest, comprises of thick and dense canopy of tall trees. These lands are identified by their red to dark red tone and varying in size. They are irregular in shape with smooth texture. The forests are found on the central and western side of the Block. Dense forests depict dark red tone with smooth texture and irregular shape on the satellite image. Open Reserved Forests are found in the central and western area of the study area. The relative concentration of scrubs, bushes and smaller trees are predominant in this category. Taller trees are also identified in this group. In the satellite image such forest are identified by yellow tone with smooth texture. In 1998, the forest covers have a total area of 30.36 sq.km (12.49 per cent). The identified forest areas are Tambaram reserved forest, Kadaperi reserved forest, Pulikoradu reserved forest, part of Vandallur extension reserved forest etc. In 2008, it covers an area of 23.05 sq.km (9.49 per cent) due to deforestation.

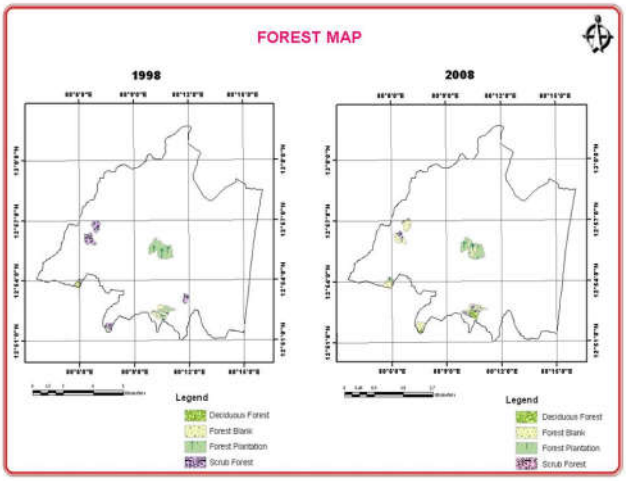


**Fig. 5. Forest areas**

### *E) Waste lands*

Land, which does not support any vegetation are known as wasteland. Barren rocky, salt affected land, land with and without scrub, sandy area, sheet rocks and stony regions include this category. Such lands are formed due to the chemical and physical properties of soil, temperature, rainfall and local environmental conditions. These lands are subject to degradation, erosion or thorny bushes. Such areas are identified from their yellowish tone and their association with uplands, and their irregular shapes. In the year 1998, it was covered with an area of 38.80 sq.km (15.97 per cent) but where as in the year 2008, it was identified with an area of 12.17 sq.km (5.0 per cent)

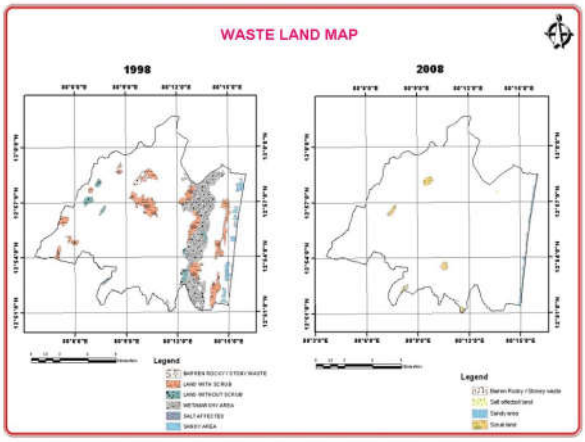


**Fig.6. Waste lands**

## CONCLUSION

The present study of land use and land cover classification establishes the fact that accurate land use data can be obtained from the satellite imagery more efficiently and economically than by traditional method. By using image processing (ERDAS) and Geographic Information System (ArcGIS) techniques the different land use classes are analyze and mapped easily. Satellite images in combination with predated topographic sheet of Survey of India could be used for analyzing land use and land cover change detection. It is helpful for further macro and micro level planning. With the help of Geographical Information System the various land use and land cover zones are mapped, which in turn helps for decision maker for planning purpose. The land use categories compared with 1998 and 2008, there was a rapid expansion of built-up land in the year 2008; the aerial difference was 81.24 sq.km (33.43 per cent). Agricultural land has decreased because of land revoke for industrial zones construction. With trend of changing agricultural land into non-agricultural land, the aerial difference was 37.86 sq.km (15.58 per cent). Because of low and insufficient rainfall and the non- perennial rivers, there was an aerial difference in water bodies 9.44 sq.km (3.88 per cent). Due to deforestation the aerial difference in the forest land was 31 sq.km (3 per cent). Some of the waste lands were converted into built-up land, so due to that the aerial difference was 26.63 sq.km (10.97 per cent). There is a change in transportation from 1998 and 2008, especially on metalled roads and unmetalled roads.

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