

# LAND USE AND LAND COVER CHANGE DETECTION THROUGH REMOTE SENSING AND GIS APPROACH, A CASE STUDY OF TAMBARAM TALUK, KANCHIPURAM DISTRICT IN TAMIL NADU, INDIA.

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## ABSTRACT

Tambaram taluk is located in Kanchipuram district in Tamil Nadu, latitude is 12.922915 and longitude is 80.127457. The study area is boundary by Sriperubudur taluk on the west direction, Sholinganallur taluk on the north direction, Chengalpet taluk on the south direction and Bay of Bengal on the east direction. This geographical area rather the bounded space within the 10-km buffer zone of Bay of Bengal. The total geographical research area is 24sq.km approximately. Land use and land cover is a significant constituent in appreciative the connection of the human activities with the surroundings and thus it is

necessary to be able to simulate changes. Observed the study revealed a change in land use land cover classification in Tambaram, located in Tamil Nadu state. In this research dissertation an attempt is made to study the changes in land use and land cover changed in Tambaram in excess of 16 years period (2011 and 2016).The study has been done by remote sensing approach, Landsat imageries of May 2001 and April 2016. The land use land cover classification was performed based on the Survey of India study area map and satellite imageries. Arc GIS software 10.2 is used to prepare the thematic maps. The present study has brought to light that settlement area that

occupied about 9.14sq.km of the taluk area in 2016 has increased to 3.36 per cent in the year 2016. Agricultural land, barren land, scrubland also has been decreased. Settlement land has been increased from 0.39 per cent to 0.36 per cent of the total geographical area. The study area is identified as the zoological park and reserved forest, army camp also available in the study area of Kanchipuram district. Proper land use planning is essential for a sustainable development of the study area.

**Keywords: Remote Sensing and GIS,  
Land Use Land Cover, Settlements,  
Water Bodies, Barren Land, Scrub Land.**

## **1. INTRODUCTION**

The study of land use land cover change is very important to understand the natural and manmade resources of the surface of the earth. The knowledge of this can be used to determine their utilization, conservation and sustainable management of land resources. The land use refers to mans activities and the varied uses to which land is put to and land cover which refers to natural vegetation, water bodies, rock/soil, artificial cover and other uses observation on the land (NRSA, 1989). Land use and land

cover change is always caused by multiple interacting factors. The mix of driving forces of land use land cover changes varies in time and space and according to specific physical and human environmental conditions. The increasing population and their socio economic needs create pressure on land use land cover and this pressure result in unplanned and uncontrolled growth. Land use land cover changes are usually caused by the growth of rural and urban land uses, mismanagement of agriculture, forests and water bodies, which lead to several environmental problems.

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. Land use refers to man's activities on land which are directly related to the land. Land use and land cover are dynamic. Changes may involve the nature or intensity of change but may also include spatial (forest abatement at village level, or for a large scale agro industrial plant) and time aspects. Land use/ Land cover changes also involve the modification,

either direct or indirect, of natural habitats and their impact on the ecology of the area. Land degradation results mainly due to population pressure which leads to intense land use without proper management practices. Over population makes people move towards sensitive areas like highlands.

Application of remotely sensed data made possible to study the changes in land cover in less time, at low cost and with better accuracy (Kachhwaha, 1985) in association with geographical information system (GIS) that provide suitable platform for data analysis, update and retrieval (Star et al. 1997; McCracker et al.1998; Chilar 2000). Space borne remotely sensed data may be particularly useful in developing countries where recent and reliable spatial information is lacking (Dong et al. 1997). Remote sensing technology and geographic information system (GIS) provide efficient methods for analysis of land use issues and tools for land use planning and modeling. By understanding the driving forces of land use development in the past, managing the current situation with modern GIS tools and modeling the future, one is able to develop plans for multiple uses of natural resources and nature conservation. The change in any

form of land use is largely related either with the external forces and the pressure built-up within the system (Bisht and Kothiyari, 2001).

Tambaram is one of the most popular road connectivity stations and very famous Aringer Anna zoological park in Chennai. In this study area major covered by settlement areas. Because of nearby the main urban areas is available such as main bus and train terminals to various districts and state and nation, international airport also available in the study area of Tambaram. In the same way land used for agricultural land is also decreasing. But at the same time land under built up area is increased. Recently the functioning of the real estate's people and property promoters are bringing a serious tragedy to barren land and agricultural land. This is an unhealthy situation of land management of this study area. In this context studies on land use land cover change detection are essential to understand the existing situation and plan for the future development.

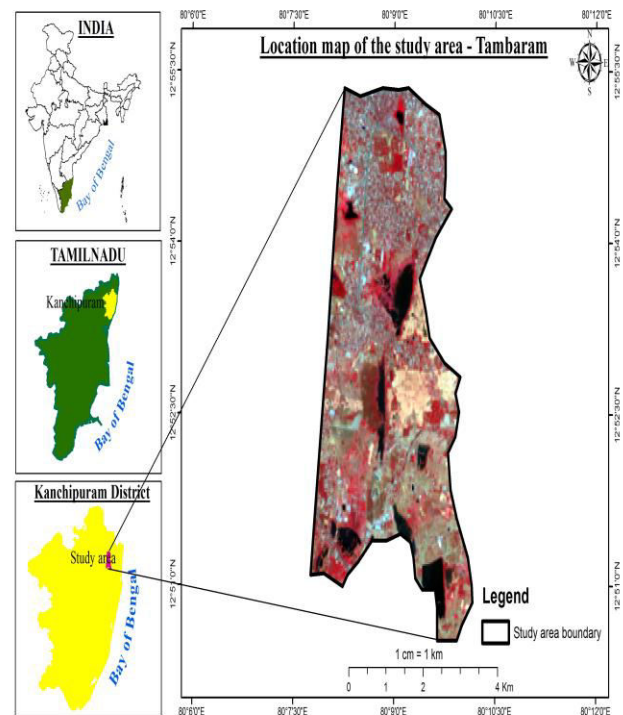
## **2. GEOGRAPHICAL PROFILE OF THE STUDY AREA**

Tambaram taluk is a Kanchipuram district of the Indian state of Tamil Nadu.

The headquarters of the taluk is the town of Tambaram. It comes under the Chennai metropolitan area and it is a suburb of Chennai city. The study located in latitude 12.922915 and longitude is 80.127457. The study area is boundary by Sriperubudur taluk on the west direction, Sholinganallur taluk on the north direction, Chengalpet taluk on the south direction and Bay of Bengal on the east direction. This geographical area rather the bounded space within the 10-km buffer zone of Bay of Bengal. The total geographical research area is 24sq.km approximately within the 10-km buffer zone of study area.

According to the 2011 census, the study area had a population of 3, 90,279 with 1, 98,538 males and 1, 91,741 females. There were 966 women for every 1000 men. The study area had a literacy rate of 84. Child population in the age group below 6 was 19,191 Males and 18,718 Females. In the study area had total no of villages 64, no of towns 6. The maximum and minimum temperatures experienced in the study area during different seasons in summer (April to June) maximum of 36.6 °C in winter (December to January) average minimum of 19.8 °C.

**Figure: 2.1** Location map of Study area in Tambaram Taluk



Most of the precipitation occurs in the form of a cyclonic storm caused due to the depressions in Bay of Bengal chiefly during the southwest monsoon period. The southwest monsoon rainfall is highly erratic and summer rains are negligible.

### 3. Aim

The main aim of the study is to utilize the remote sensing and GIS technology for the land use/land cover changes in Tambaram in Tamil Nadu, the earlier period 16 years 2001 and 2016.

### 3.1 Objectives

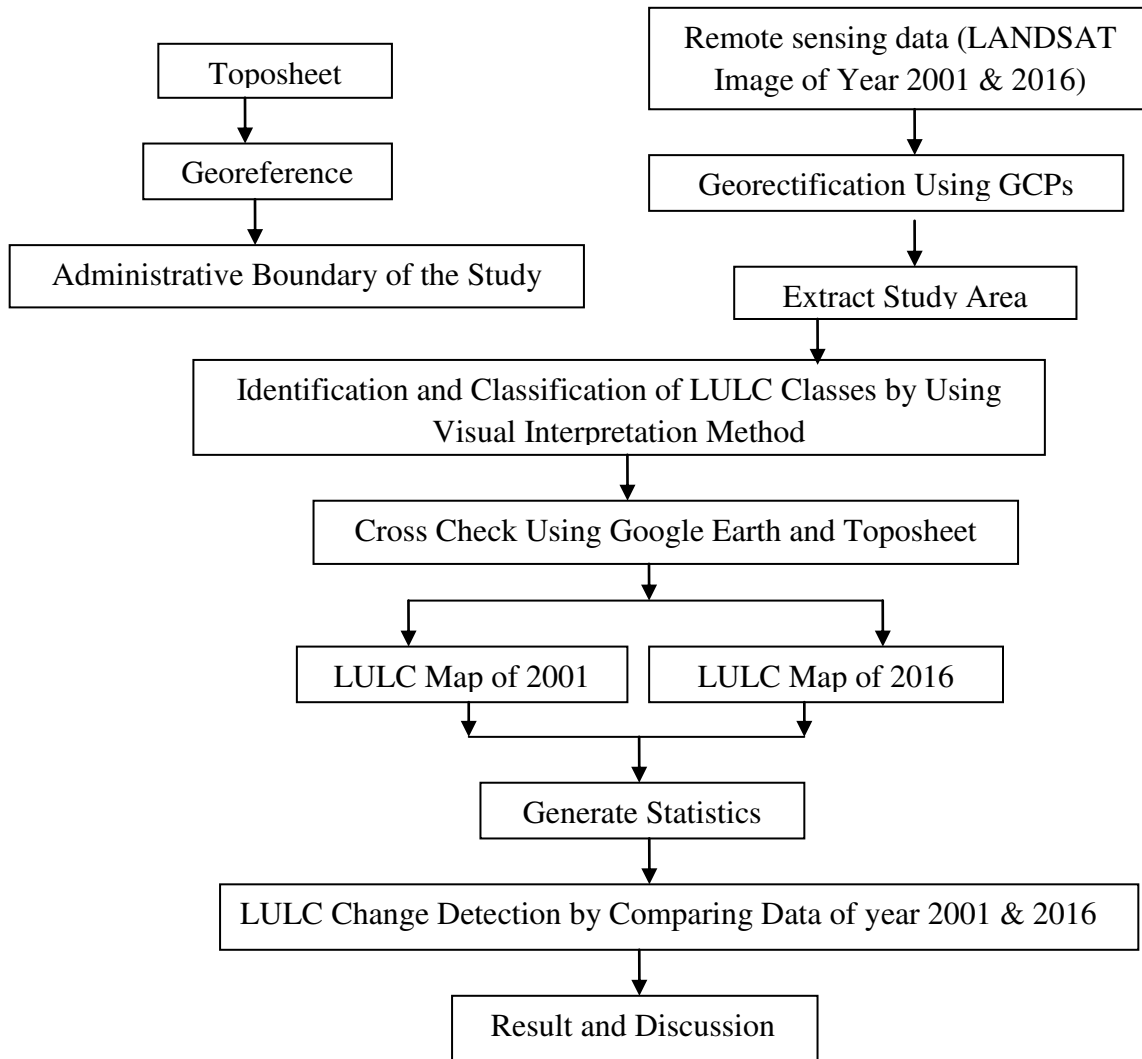
To prepare thematic maps using satellite imageries. To evaluate the various features on the study area. To extract the land use/land cover changes and categories of the study area.

### 4. Materials and methodology

For the purpose of study in land use/land cover changes over the period of 16 years. Arc GIS 10.2 are powerful tools for extracting the land use, land cover layers, from SOI toposheets and satellite imageries. The land use/land cover classes include agriculture land, water bodies, settlements, barren land, scrub land. An analysis has been conducted to understand and assess the existing land use land cover detection changes over a period of 16 years 2001 and 2016, using remote sensing and GIS. Change detection is generally a comparison between themes of multi date satellite for a period of more than a decade. Thematic maps are derived for to the study area can be

facilitated through image interpretation of Landsat data. This classification system designed to use are at four “levels” of information could be drawn from aerial photos and satellite images, depending on the sensor system and image resolution.

The study is based purely on remotely sensed data by visual interpretation technique and by randomly field checked. The spatial themes were classified based on NRSA (National Remote Sensing Agency, 2003) guidelines and derived 6 land use classes (Level I), suitable to the local condition. They are Built-up lands, Agricultural lands, Forests, Barren lands, scrub land and water bodies in the study area. Since the data is of medium resolution, the higher level classification was attempted but in vain due the pixel resolution of the image is of (30m) of Landsat imagery. The main goal of this study is to extract the land use/land cover changes and categories of the study area.



### 5. RESULT AND DISCUSSION

Land use/Land cover change detection is accomplished using the visual interpretation technique and change detection of data for the year 2001 and 2016 was used for finding the transitions from rural to urban, agricultural to non agricultural land uses illustrating the land use land cover changes, with the connivance of the human interpretation in the coastal

stretch of Kanchipuram district through USGS land use land cover classification system. The methods showed the result for high classification accuracy such that the land use land cover change that occurred in the coastal stretch showed significance in spatial changes. However, the thrust is on the corroborations we could find from the results.

## 5.1 LAND USE AND LAND COVER IN THE YEAR 2001

Landsat satellite data pertaining the year of 2001 was used for analyses considering 4 batches (red, blue, green, red and near infrared band). The study area is visualized through the software visual interpretation techniques for used for deriving the thematic layer such as water bodies, settlement, scrub land, forest, barren land and agricultural. Other classes such as Perennial Ice, Range land and tundra are not available in our study area. Image interpretations keys like size, shape, tone, texture, Patten, association are followed by this analysis result of the analysis are detailed below. For the better comprehensive development and management of the Kanchipuram coast and its surrounding areas, it is needed to have proper information on LU/LC and the driving forces that affect the urban ecosystem. Landsat ETM data of 1:50,000 scales for the year 2001 and 2016 were visually interpreted for the delineation of LU/LC categories of the study area.

## 5.2 LAND USE LAND COVERS CLASSIFICATION 2016

Agricultural land is described as the land primarily used for farming and for the production of food, fibre, and other commercial and horticultural crops. It includes land under crops (irrigated and unirrigated, fallow, plantations etc). Tambaram and its environs which are the northern part of the study area have shown that the agricultural land has decreased in the year (2016) because of lands earmarked and set aside for constructions in the industrial zone. With a trend of changing agricultural land into the non agricultural land, the careful extent of agricultural lands were decreased from 726.06sq.km in percent 64.51 in the year 2001 and 417.51sq.km in per cent 37.05 in the year 2016 . A careful study of the spatial urban spread in Kanchipuram district in response to special economic zones for example (Yasodharan Sursh et. al., 2011, Nethaji Mariappan et. al., 2011) has shown that Kanchipuram district is a favourable distance for SEZ considering proximity to Chennai city, harbour, airport and cheap labours. An interesting fact is that the entire district is an agriculturally productive district, as surplus irrigation is

available as a result of rainfall a number of tanks with surplus water a number of tube wells and bore wells. Gross irrigation area and net irrigated area approximate each other.

The implementation of special economic zones (SEZ) by the government has resulted in the conversion of productive agricultural land into infrastructural development, industrial and public housing sectors. To further improve upon the situation, the government should chart new sectors like the agricultural economic zones (AEZ) parallel to special economic zones (SEZ), thereby sustaining agricultural productivity in anticipation of population explosion. The major changes of agricultural land use changes in the study area had decreased between the years 2001 and 2016. Results were exhibited 27.46% decreased in agricultural land between the year 2001 and 2016 in the respectively study area of Tambaram.

## **6. ANALYSIS OF LAND USE/LAND COVER BY USING REMOTE SENSING DATA**

Change detection is an important application of Remote Sensing technology. This gives us the changes of specific

features within a certain time interval. For a given research purpose, when the remotely sensed data and study areas are indentified, selection of an appropriate change detection method has substantial consequence in producing a high quality change detection product. The land use/land cover categories of the study area were mapped using data of 1:50,000 scale. The satellite data was visually interpreted and after making thorough field check, the map was finalized. The a variety of land use and land cover classes interpreted in the study area include Forest land, built-up land, Barren land, Scrub land, water bodies. The comprehensive accounts of these land use /land cover classes of the study area are described in the subsequent segment.

### **6.1 AGRICULTURAL LAND**

Agricultural is the one of the main activities in this study area, approximately 47 % of the peoples engaged in these agricultural activities. Major food crops are such as Paddy, Sugarcane, Cereals, Millets and Pulses etc. All the sophisticated land with or without crops orchards and plantations are considered in this class of agricultural land. In the year 2011 agricultural land was covered by all the four



directions of the study area in Tambaram. Total agricultural land in the study area occupied 19.96sq.km (0.80 per cent) in the year 2001 and 3.75sq.km (0.15 per cent) in the year 2016. Hence the result has been analyses agricultural land had decreased from (0.80 per cent) to (0.15 per cent). The agricultural land was decreased (0.65 per cent) in the year 2016.

## **6.2 BARREN LAND**

Barren land those ecosystems in which less than one third of the area has vegetation or other cover. In general, Barren Land has thin soil, sand, or rocks. Barren lands include deserts, dry salt flats, beaches, sand dunes, exposed rock, strip mines, quarries and gravel pits. It occupies an area of 0.9sq.km (0.03 per cent) in 2011 and 3.37sq.km (0.13 per cent) in the year 2016. The analyses result barren land was increased (0.03 per cent) to (0.13 per cent).

## **6.3 SCRUB LAND**

Scrubland an area of land scattered sparsely with vegetation, such as shrubs (woody plants that are shorter than most trees), bushes and grasses, is known as scrubland, or scrubland. These lands are subject to degradation, erosion or thorny bushes. Such areas are identified from their

pink tone and their association with uplands and their irregular shapes. Scrub land found in the southern part of the study area. The result has been analyses in the year 2001 scrub land were observed in 1.41sq.km, (0.05 per cent) and 6.82sq.km, (0.27 per cent) in the year 2016. The scrub land was increased from 1.41sq.km to 6.82 sq.km in the respectively study area in the year 2016.

## **6.4 SETTLEMENT**

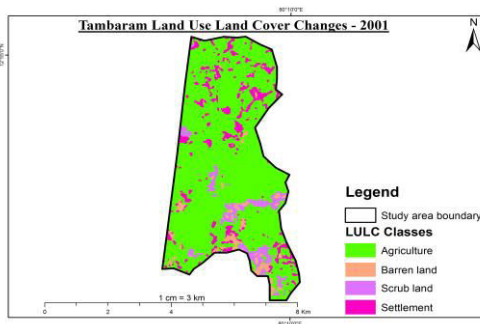
Traditionally, it belongs to cultural geography and is divided into the geography of urban settlements (cities and towns) and rural settlements (e.g. villages and hamlets). Thereby, settlements are mostly seen as elements of the cultural landscape that developed over time.

Built up land is composed of areas of intensive with much of the land covered by structures and it covers an area of 2.39sq.km (0.09 per cent) in the year 2001 and 9.14 sq.km, (0.36 per cent) in the year 2016. The last 16 years the settlement land was increased from 0.09 per cent to 0.36 per cent in the year 2016 the respectively study area. Included in this category are cities, towns, villages, industrial and commercial complexes and institutions. In the study area

major towns or villages are Chrompet, Pallavaram, Pallikaranai, Medavakkam, etc. The transportation facilities in the study area are roads and railway line. The highway roads are present in this study area of

### Tamaram Land Use Land Cover

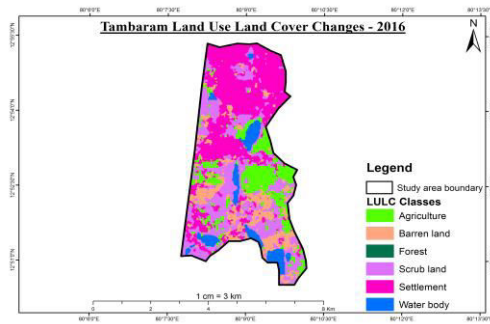
2001



Tamaram. The industrial mining of clay, Iran ore and some other building stones is carried out at some places in the study area showed in Figure 6.1.

### Tamaram Land Use Land Cover

2016



### 6.5 WATER BODIES

The shallow water and deep water features appear in light blue to dark blue in color. Small canals are noticed in the vegetation area. Tanks are mostly determined in the heart part of the study area with few dry tanks spotted around in the southern parts of the study area. The result was observed in the study area of water body are not founded in the year 2001, but at the same time in the year 2016 water body's are newly observed in 1.65sq.km, in (per cent 0.06) in the respectively study area showed in Figure 5.2

### 7. CONCLUSION

The present study shows that satellite remote sensing based land cover mapping is very effective. The high resolution satellite data such as Landsat TM are good source to provide information accurately. Under utilization of potential land, increased population and land adaptation are the major dynamic forces for the change in land use during the earlier period 16 years. The overall accurateness of the present land cover study is 87%. Based on the investigation of changes in land use/land cover some of the counteractive procedures are recommended, which are crucial for most favorable and sustainable exploitation of land possessions and anticipation of

added disagreeable and deteriorated changes in land use.

Results of the study through USGS land use land cover classification has demonstrated that visual interpretation is one of the key tools in delineating land use land cover categories of Landsat (2001) and (2016) for the study area of Tambaram taluk. This study also depicted the usefulness of land use land cover themes for the year 2001 were agricultural class occupied a large area of 19.96sq.km in per cent 0.80. In the year 2016 were observed in the area of (3.75sq.km) in the per cent 0.15 the result was observed agricultural land was decreased from 19.96 in the year 2001 to 3.75 in the year 2016 and decreased per cent 0.65 in the year of 2016. The barren land were increased in 2016 comparatively 2001, the barren land was observed in 0.9 sq.km in per cent 0.03 in the year 2001 and barren land possess an area of 3.37sq.km in percentage of 0.13 in the year 2016.

The result were analysis of area was increased 0.1 per cent in the year 2016, Water bodies' coverage seems to be higher due to 2015 post flood scenario in the percentage increased in the year 2016 comparatively 2001 in this year not founded

any water body in the study area of Tambaram, the increased area 1.65sq.km, in (per cent 0.06) in the year 2016 of the study area. This analysis has proved that build up area has drastically improved in the recent decade; consequently the built-up land was increased in the percentage of 2.39 in the year 2001 to 9.14 in the year 2016, the overall settlement was increased per cent of 0.27 between the year of 2001 and 2016, The scrub land was observed in the year 2001 1.41sq.km, 0.05 percent and 6.82 sq.km, 0.27 per cent in the year 2016. The result was analysed in the study area of scrub land was increased in the per cent of 0.22 in the respectively study area. In my study area was mainly observed in large area of such as settlement and scrub land and second position is water bodies, barren land are observed finally in 2016. At the same time 2016 the geographical area of land use land cover changes was gradually increased such as settlements, water bodies and scrub land also increased in the year 2016.

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