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RESEARCH ARTICLE

AN ANALYSIS ON LAND USE/LAND COVER USING REMOTE SENSING TECHNIQUES – A CASE STUDY OF TAMBARAM SUB URBAN, KANCHEEPURAM DISTRICT, TAMIL NADU

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ABSTRACT

The present study aims to find out the land use/land cover features of Tambaram Suburban region of Chennai, Tamil Nadu. The total area of the region is 75.25 sq.km. The study has made use of high resolution IRS LISS IV pan merged satellite imagery for identifying the land use/land cover classes. ERDAS and ArcGIS software were used to demarcate the land use/land cover features of Tambaram Suburban region. Remote sensing and GIS provide consistent and accurate base line information than many of the conventional surveys employed for such a task. The land use and land cover analysis on Tambaram Suburban region has been attempted based on thematic mapping of the area consisting of built-up land, agriculture land, water bodies, forest and waste land using the satellite image. The research concludes that there is a rapid expansion of built-up area. 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/Land cover exhibits the physical and economical situation of any region. Land use/Land cover determines the standard of the living people and the natural resources found in a region. The development of human race has started to convert the land cover regions into different land use regions. Man alters the land cover according to his need and necessity. The increase in population growth, increase in consumer demand, land tenure arrangements, customs and urbanization have changed the land cover to intense land use regions. Land use is defined 'as the total of all the arrangements, activities and inputs that people undertake in certain land cover types'. Land use and land cover changes degrade and have an instant impact on the global carbon cycle. Urban planning and development is a continuous process and involves planners, administrators, developers, investors and of course, the residents. In order to achieve sustainable urban planning and to check haphazard development, it is necessary that authorities associated with the urban development generate such planning models so that every bit of the available land is used in most rational and optimal way. This requires the present and past land use/land cover information of the area and pattern of changes with respect to urban settlements and other local resources (Chaurasi*a et al.,* 1996). Remote sensing, the latest advancement in space technology has the capabilities to overcome the shortcomings of conventional methods. Land use and land cover information is important 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. The information may be obtained by visiting sites on the ground and/or extracting it from remotely sensed data. 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. The changes in land use/land cover due to natural and human activities can be observed using current and archived remotely sensed data (Luong, 1993). Land use/land cover change is critically linked to natural and human influences on environment. With the availability of multi-sensor satellite data at very high spatial, spectral and temporal resolutions, it is now possible to prepare up-to-date and accurate land use/land cover map in less time, at lower cost and with better accuracy. The present study describes the various land use/land cover changes and categories of the study area.

Study area

Tambaram Suburban region is situated in the northern portion of Kancheepuram District (south to Chennai City) with an area of 75 sq.km. It lies between the latitudinal extent of 12°50' N - 12°57' N and longitudinal extent of 80°05' E to 80°15' E. Since 1931 onwards Tambaram Suburban is continuously developing after electric train service was commissioned. The

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Tambaram is one of the most important railway junctions of Chennai city. The physiography of this region consists of few small hills in the northwestern portion. The prominent soils in this region are clay and alluvial, found in the eastern and as well as northern Portion; and the western portion was covered by black clay soil with varying stiffness at different depths (Fig. 1).

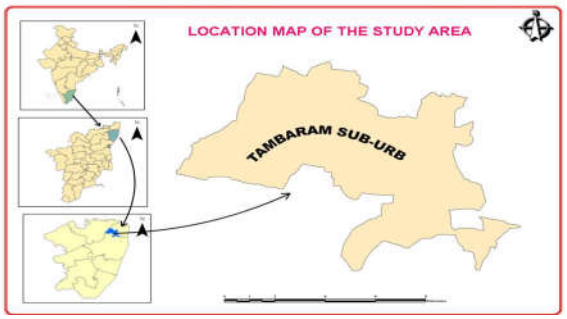

Fig. 1 - Study area – Tambaram Suburban Region

interpreted and after making thorough field check, the map was finalized. The various land use and land cover classes interpreted in the study area include, built-up land, agricultural land (crop land, fallow land and agricultural plantation) forest (scrub forest and dense 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 the areas of human inhabitation, developed due to non-agricultural activities like building, industries and transportation network. In the satellite image 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 randomly distributed. The well developed settlements in this region are Pallavaram, Tambaram, Chitlapakam, Sembakam and Pamal. Many smaller settlements such as Rajkilpakkam, Agaramthen, and New Balaji Nagar are also identified from the satellite image.

Table 1. Land use/Land cover classification of Tambaram Suburban Region

Sl. No.	Level - I	Level - II	Area in sq.km	Percentage of the area (%)
1.	Built-up Lands	Residential Area	18.10	24.05
		Industrial & Commercial Area	12.00	15.95
		Mixed Built-up Area	6.00	7.97
		Total Area	36.10	47.97
2.	Agricultural Lands	Crop Land	6.00	7.97
		Fallow Land	9.15	12.16
		Plantation	5.00	6.64
		Total Area	20.15	26.78
3.	Forest Areas	Dense Forest	1.50	1.99
		Scrub Forest	4.50	5.98
		Total Area	6.00	7.98
4.	Waste Lands	Barren Rocky/ Stony waste	0.30	0.39
		Land with scrub	1.50	1.99
		Land without scrub	0.80	1.06
		Salt affected Land	0.40	0.53
		Total Area	3.00	3.98
5.	Water bodies	River /Canal	2.50	3.32
		Tanks	7.50	9.97
		Total Area	10.00	13.29
		Grand Total	75.25	100.00

MATERIALS AND METHODS

The study has made use of various primary and secondary data. These include Survey of India (SOI) topographic sheets of 66/D1 and 66/D5 of 1:50,000 scale, and satellite image IRS 1D LISS IV geocoded data of 1:50,000 scale for the year 2010. The Indian Remote Sensing Satellite (IRS) data was visually and digitally interpreted by using the image interpretation elements (such as tone, texture, shape, pattern, association etc.) and ArcGIS software was used 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 the land use/land cover changes and categories of the study area.

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 IV data (FCC of bands 2, 3 and 4) of 1:50,000 scale. The satellite data was visually

On both the sides of the Grand Southern Trunk road (G.S.T.), a long stretch of built-up area is noticed. Residential areas noticed in Pallavaram, Tambaram Chitlapakam, Sembakam, Pamal and Thandurai. Industrial and Commercial areas were noticed in Pallavaram, Tambaram, Chrompet, and the surrounding areas of Tambaram. The total area covered by the settlements, network of road and railways and other built-up areas accounts 36.10 sq.km (47.97 per cent) respectively (Fig 2).

B) Agricultural lands: Agricultural lands include land used to raise food crops, commercial crops, plantation crops and horticulture crops. With the help of satellite data, it is possible to identify the various agricultural lands up to level II. The agricultural regions are Agaramthen, Tandurai and Madampakkam. Agricultural land has decreased because of land revoke for industrial zone constructions. The various categories of the agricultural lands identified in the study area are described in detail.

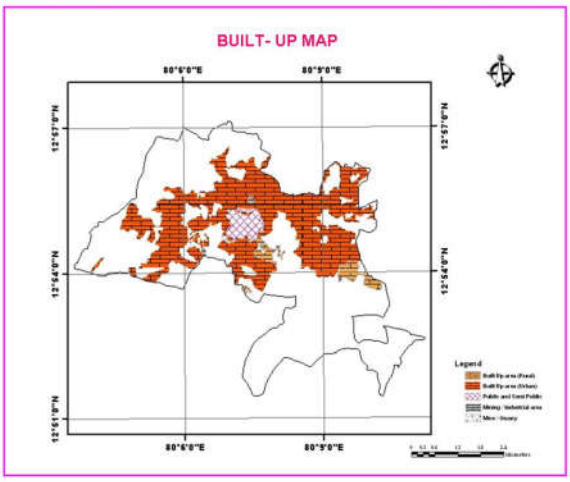

Fig. 2 - Built-up Lands

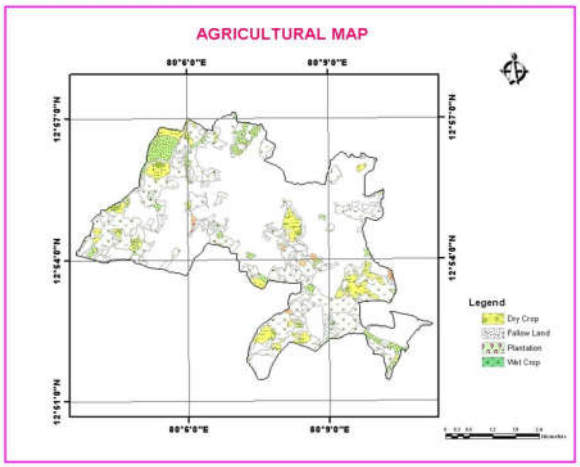

Fig. 3 - Agricultural Lands

i) Crop lands: The crop lands include all the agricultural areas. The agricultural lands are identified by their characteristic like red tone, square or rectangular shape of the agricultural fields, association with the water bodies and topography. Crop lands are distributed in the western and southern part of the study area. The Kharif crops (paddy and groundnut) are cultivated in the month of June, July and August. These crops are cultivated mostly in the central and southern part of the study area. The Rabi crops mostly paddy, maize and millets are cultivated in the months of October, November and December. The crops cultivated during Rabi season are distributed in the southern part of the study area. The crop land covers about 6.00 sq.km (7.97 per cent) of the total land use in the study area.

ii) Fallow lands: 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 southern portions. This type of land occupies a total area of 9.15 sq.km (12.16 per cent).

iii) Agricultural Plantations: The plantation crops include cashew nuts, coconut trees etc. Such areas were found in dark red colour tone in the western part of the region. The plantation cropped area occupies about 6.64 per cent of the agricultural land with an area of 5.00 sq.km.

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 black in 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. 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. Tanks are mostly concentrated in the central part of the study area with few dry tanks scattered around in the northern parts. Water bodies occupy a total areal extent of 10.00 sq.km (13.29 per cent).

D) Forest Areas: Forest, comprises of thick and dense canopy of 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 northwestern and southern part of the study area. The study area covers mostly the dense and scrub forest. The relative concentration of scrubs, bushes and smaller trees are predominant in this category. In the satellite image such forest are identified by yellow tone with smooth texture. The forest areas are Tambaram reserved forest, Kadaperi reserved forest, Pulikoradu reserved forest, part of Vandallur extension reserved forest etc. It covers an area of 6.00 sq.km (7.98 per cent).

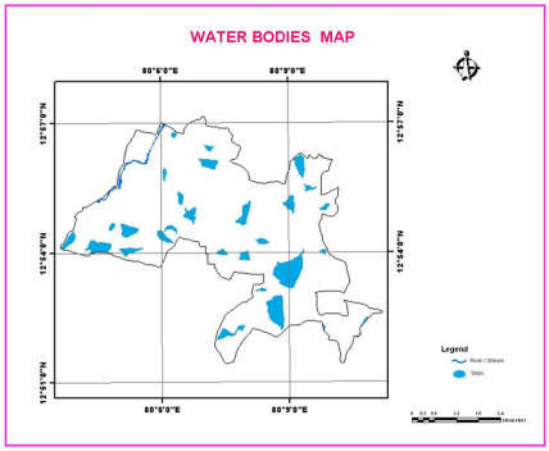

Fig. 4 - Water bodies

E) Waste lands: Land, which does not support any vegetation are known as waste lands. Barren rocky, salt affected land, land with and without scrub, sandy area, sheet rocks and stony regions include in this category. Such lands are formed due to the chemical and physical properties of soil, temperature, rainfall and local environmental conditions. In the study area there are four categories of waste lands, which could be easily identified from the image.

i) Land with scrub: 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. Land with scrub found in the western part of the study area. The total area under this category is about 1.50 sq.km (1.99 per cent).

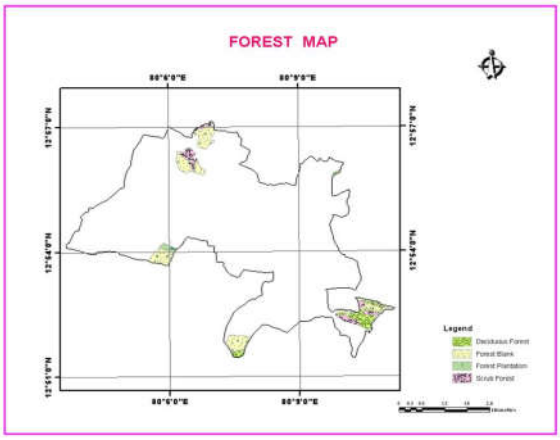

Fig. 5 - Forest Areas

ii) Land without scrub: These lands are found associated with higher topography and are formed by degradation or erosion. It is identified in the satellite data by its yellow tone and association with the higher altitudes. Land without scrub found in the northern part of the study area and it occupies an area of 0.80 sq.km (1.06 per cent).

iii) Barren Rocky: These are rocky exposures of varying lithology often barren and devoid of soil cover and vegetation. They occur amidst hill forest as openings or scattered as isolated exposures or loose fragments of boulders or as sheet rocks on up lands and plains. In the study area, these lands appear in brownish colour and they have irregular shape. The barren rocky region covers 0.30 sq.km (0.39 per cent) of area.

iii) Salt affected areas: The salt affected areas are identified along the coastal side and nearer to Buckingham Canal of the study area. It has an adverse effect on the growth of plants. These areas are identified by white colour tone with smooth texture. Due to aquaculture and salt pans the area is affected by salt and the land becomes a waste land in course of time. About 0.40 sq.km (0.53 per cent) was identified as salt affected regions.

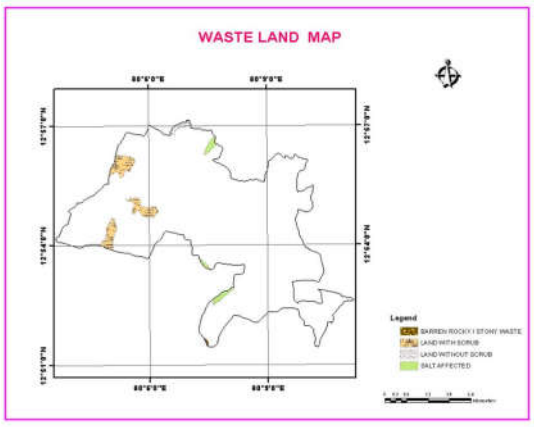

Fig. 6 - Waste Lands

CONCLUSION

The study has classified as per the major land use/land cover types**.** The Indian Remote Sensing Satellite (IRS) data, image processing and Geographical Information System techniques were used to identify the land use categories such as built-up lands, agricultural lands, forests, waste lands and water bodies. Satellite images in combination with predated topographic sheet of Survey of India were used for analyzing land use and land cover change detection. It is helpful for further macro and micro level plannings. With the help of Geographic Information System the various land use and land cover zones are mapped, which in turn helps for decision maker for planning purpose. There was a rapid expansion of built-up land; the area was 36.10 sq.km (47.97 per cent). With the trend of changing agricultural land into non-agricultural land, the extent of agricultural land was reduced into 20.15 sq.km (26.78 per cent). The water bodies were well distributed throughout the study area, and it covers 10.00 sq.km (13.29 per cent). Forest occupies 6.00 sq.km and sharing about 7.98 per cent of the total land use and land cover of the study area. The waste land has occupied around 3.00 sq.km and sharing 3.90 per cent of the total land use and land cover of the study area.

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