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RESEARCH ARTICLE

**ANALYSIS OF LAND USE / LAND COVER USING REMOTE SENSING TECHNIQUES –
A CASE STUDY OF KARUR DISTRICT, TAMIL NADU, INDIA**

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ABSTRACT

The present study was aimed to find out the land use / land cover categories of Karur District. The total area of the District is 2,896 sq.km. The District located in the central part of Tamil Nadu. The study has made use of satellite imagery to identify the land use/land cover status of the study area during 2008. The image has been classified using ERDAS image processing software by employing supervised classification techniques. The District has been classified into five land use categories such as built-upland, agricultural land, forest, waste lands and water bodies on the basis of NRSA classifications. Among all classes, agriculture land is predominant in the study area, which has about 2,595.25 sq.km (89.63%), other waste lands occupies around 20.33 sq.km (4.15%), forest lands covers 98.88 sq.km (3.41%), water bodies possess 70.34 sq.km (2.43%) and built-upland covers 10.77 sq.km (0.37%) respectively.

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INTRODUCTION

Land use and Land cover change, is one of main driving forces of global environmental changes, and central to the sustainable development debate. Land use and land cover changes have impacts on a wide ranges of environmental and landscape attributes including the quality of water, land and air resources, ecosystem processes and function and the climate system itself through greenhouse gas fluxes and surface albedo effects. The land use and land cover changes is scalar dynamic. The change in land cover occurs even in the absence of human activities through natural processes. Where as land use changes is the manipulation of land cover by human being for multiple purposes – food, fuel wood, timber, fodder, leaf, litter, medicine, raw materials and recreation. The terms ‘Land use’ and ‘Land cover’ are often confused. Land use is ‘the total of all arrangements, activities and inputs that people undertake in a certain land cover type’. In contrast, land cover is the observed physical and biological cover of the earth’s surface as vegetation, rocks, water body or man-made features (U.N.F.A.O. 1997). However, land use is obviously determined by environmental factors such as soil characteristics, climate, topography, vegetation and water body etc, but also reflects the land’s importance as fundamental factor of production. So, understanding the past changes in land use and projecting the future land use

trajectories require understanding the interaction of the basic human forces that motivate production and consumption. High population growth of increasing consumer demand, combined with varied land –tenure arrangements, and degree of access to financial capital, local inheritance, customs and laws produce unique land uses. Research like this, on how such human factors interact in driving land use will improve projection of land use/land cover and our comprehension of human responses to environmental changes (Turner *et al.*, 2006). Land use and land cover changes leading to degradation have impact on the global carbon cycle and as such this can add or remove carbon di-oxide from the atmosphere, contributing to climate changes, which can lead to global warming. The Inter-governmental Panel on Climate Change (I.P.C.C., 1998). The information on land use/land cover patterns, their spatial distribution and changes over a time scale are prerequisite for making development plans (Gautam and Narayan, 1982 & 1985; Dhinwa *et al.*, 1992; Ibrahim and Loulou, 1994). Remote sensing, the latest advancement in space technology has the capabilities to overcome the shortcomings of the conventional methods. It makes a major technological breakthrough in the method of acquiring information on land resources, agriculture, forestry, ocean resources and other studies (NRSA, 1989; Rao, 1991). The present study describes the various land use/land cover changes and categories of the study area.

Study Area

Karur is the centrally located District in Tamil Nadu State. It is bounded on the north by Namakkal District and Tiruchirappalli District, on the east by Tiruchirappalli and Pudukkottai Districts, on the south by Sivagangai, Madurai and Dindigul Districts and on the west by Dindigul and Erode Districts. The administrative headquarter of this District is located at Karur town. In September 1995, Tiruchirappalli District was divided into three Districts namely Tiruchirappalli, Karur and Perambalur Districts. According to the said trifurcating, Karur revenue division of 1981 census, which comprised of three taluks namely Karur, Manapparai and Kulithalai were detached from the erstwhile Tiruchirappalli District to form this District.

The District lies between 10° 63' - 11° 14' North latitude and 77° 90' - 78° 61' East longitudes. The District covers a total geographical area of about 2,896 sq.km accounting for 2.2 per cent of the geographical area of Tamil Nadu State. A Cauvery and Amaravathi rivers flow in the District and normally found to be dry during the summer season. Broken and isolated masses of crystalline rocks are found in the Vellimalai (silver hills) in the south of Kulithalai taluk, Rangamalai hills (945 metres) in the extreme south of Karur taluk, the golden rock and the great fort. The soil found in the Karur taluk is very poor in quality. The soil is best suited for raising dry farming crops. Karur District consists of four taluks, namely Karur, Aravakurichi, Kulithalai and Krishnarayapuram (Fig. 1).

MATERIALS AND METHODS

The study has made use of various primary and secondary data. These includes Survey of India (SOI) topographic maps (58 E/16, 58 I/4, 58 F/13, 14 and 58 J/1, 2, 6, 9, 10 of 1: 50,000 scale) and IRS LISS – III geocoded data of 1: 50,000 scale for July 2008. The Indian Remote Sensing Satellite (IRS) data were visually and digitally interpreted by using the image interpretation elements (such as tone, texture, shape, pattern, association etc) and by using supervised classification techniques available in ERDAS image processing software. Adequate field checks were made before finalization of the thematic maps.

RESULTS AND DISCUSSION

Analysis of Land use / Land cover by Remote Sensing Data

The land use / land cover categories of the study area were mapped using IRS ID LISS III data (FCC of bands 2, 3 and 4) of 1: 50, 000 scales. The satellite data was visually interpreted and after making thorough field check, the map was finalized.

The various land use / land cover classes were interpreted further. Five categories of land use / land cover classes were identified by this study. The land use classes in the study area include built – up land, agricultural land (crop land, kharif land, rabi land, fallow land and double/triple), forest (deciduous forest, evergreen forest and degraded forest), waste land (scrub land and other waste land) and water bodies. Detailed accounts of these land use / land cover classes of the study area are described in the following section (Fig. 2).

i) Built-up land

Built-up land include educational, health and socio-economic facilities like: games/sport viewing centers and shops etc. These features are identified with their dark bluish green tone

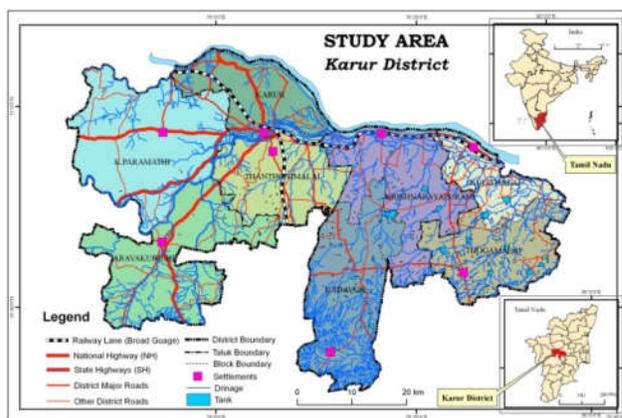


Fig. 1: Study Area – Karur District

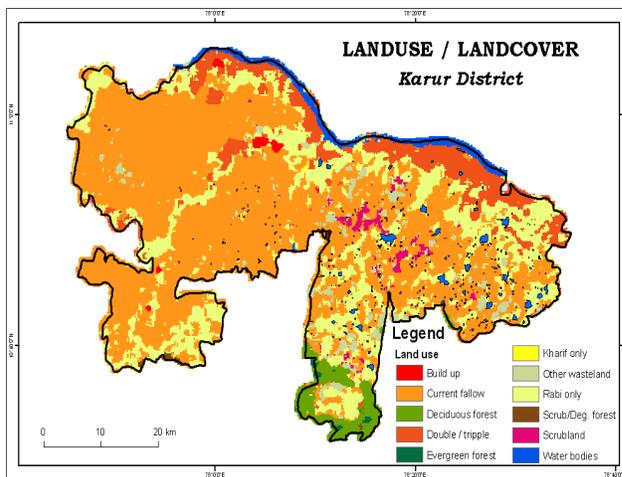


Fig. 2: Land use/Land cover of Karur District

Table. 1. Land Use and Land Cover Classification of Karur District

Sl. No.	Level I	Level II	Area in sq. km	Percentage of Area
1	Built-up land	Built-up land	10.77	0.37
2	Agricultural land	Crop land	-	-
		Kharif land	1.32	0.04
		Rabi land	677.55	23.39
		Fallow land	1667.29	57.58
		Double/Triple	249.07	8.60
3	Forest	Deciduous forest	87.80	3.03
		Evergreen forest	5.76	0.19
		Deg. Forest	5.31	0.18
4	Waste lands	Scrub land	34.65	1.19
		Other waste lands	85.67	2.95

in the core and bluish tone on the periphery. They have a typical coarse and molted texture. These areas are also associated with the network of canals, roads and railway lines. In the study area, Karur town is an urban centre, found in the central part of the study area, Aravakurichi found in southern part of the study area, K. Paramathi in northern part and Kulithalai in the eastern part of the District. Some smaller settlements and tiny towns are found in the study area. The total area covered by the major and minor settlements in the study area constitutes 10.774 sq.km or 0.372 per cent of the study area respectively (Table 1).

ii) Agriculture Land

This encompasses both cultivated and irrigated lands. These are the lands mainly used for farming and for production of food and other commercial and horticultural crops. The help of satellite data, it is possible to identify various agricultural land uses up to level -III. The different types of agriculture lands are identified in the study area and described below in detail. These include the agricultural areas identified by their characteristic red tone, regular shaped agricultural fields and in associated with settlements, water bodies, etc. Crop lands are well distributed throughout the foot hills zones, along the river side and plain regions of the study area.

a) Kharif land

The kharif crops (paddy, groundnut and sugarcane) are cultivated in the months of June, July and August. It is interested to note that such crops are totally distributed in the central part and eastern part of the study area. These kharif crops occupy 1.32 sq.km (0.04 per cent) of the study area.

b) Rabi land

The rabi crops mostly paddy, cholam, cumbu and maize are cultivated in the months of October, November and December. The crops cultivated during these seasons are distributed all over the study area. These crops found in plain regions, along the river side and near to the water bodies. These crops occupy 677.55 sq.km (23.39 per cent) of the total study area.

c) Fallow land

These are the lands, which remain vacant without crop. These were identified by their dark greenish tone, smaller size, regular shape and medium texture. These lands dominated other land use classification of the study area. The fallow land, in the study area distributed maximum amount of the classification. These lands evenly distributed all over the study area. These occupy 1667.29 sq.km (57.58 per cent) of the total study area.

d) Double / Triple

The double / triple is another one more classification of the agricultural land. This was found in the northern part of the study area and exactly found along the Cauvery river of the study area. The regions of the northern parts of Karur, Krishnarayapuram and northern and eastern part of the Kulithalai blocks falls under this land use type. This

classification shares about 249.07 sq.km (8.60 per cent) of the total study area.

iii) Forest

Forest, comprise of thick and dense canopy of all trees. These lands are discerned by their red to red tone and varying in size. They show irregular shape and smooth texture. These forest areas are found in the southern part of Kadavur block. Based on the tonal and textural variations, the forests of the study area are divided in to three categories as deciduous, evergreen and degraded forests.

a) Deciduous forest

The forest of this category occupies an area of 87.804 sq.km or 3.032 per cent. This forest characteristic was found with dark red tone, smooth texture and irregular shaped on the satellite images. In the study area, such deciduous forest areas are found in the southern part of the Kadavur block and southern part of the Thogamalai block. The forest is found confined to the higher and medium altitudinal areas.

b) Evergreen forest

This forest occupies an area of 5.76 sq.km (0.12 per cent) of the total study area. This also found southern part of the Kadavur, Thogamalai, Kulithalai and some pockets of Krishnarayapuram blocks. Such kind of forest is found, where the average annual rainfall is more.

c) Degraded forest

This forest shares about 5.31 sq.km (0.18 per cent) of the total study area. The relative concentration of scrubs, bushes and smaller trees are predominant while taller trees are limited in areal extent. In remotely sensed data, such forest was identified by yellow tone and their proximity to the above mentioned forest areas. These forests are found in lower altitudes of the hill area and found associated with other forests.

iv) Waste land

Land, which in its present state does not or only possesses limited ability to support vegetation, is called wasteland (Dudley Stamp, 1954). Ravenous, rock, mining, stony and active depositional features are included in this category. These may result from inherent/imposed constrains such as location, environment, chemical and physical properties of the soil. In the study area, there are two categories of wastelands, which could be easily identified from the satellite image. These are scrub and other waste lands.

a) Scrub land

These include the uplands or high grounds with scrub. These lands are subjected to degradation or erosion and consist mainly of thorny bushes. Such areas are identified from their yellowish tone and their association with uplands and their irregular shapes. These scrub lands are found in the southern portion of Krishnarayapuram, Thanthonimalai, Thogamalai, Kadavur and some pockets of the Kulithalai blocks. These

scrub land occupies 34.654 sq.km or 1.196 per cent of the total area.

b) Other waste land

These lands are found in association with higher topography. These areas are identified in the satellite images from its light yellowish tone and its associate with higher altitudes. The absence of vegetation distinguishes this category from the earlier described class. Such category is found in almost all the blocks of the study area with some percentage. They are Krishnarayapuram, Kadavur, K. Paramathi, Karur, Thanthonimalai, Thogamalai, Kulithalai and Aravakuruchi blocks and occupied with an area of 85.67 sq.km (2.95 per cent) of the total study area.

v) Water bodies

Both man-made and natural water features are included in this category; they are rivers, streams, lakes, tanks and reservoirs. The deep water features appear in black tone in the satellite imagery. The shallow water and deep water feature appear in light blue to dark blue in colour. Cauvery and Amaravathi are the major rivers of the study area. The numerous major and minor tanks, lakes and canals are identified. The lakes are found in the eastern part of the study area such as Krishnarayapuram, Kadavur, Thogamalai and Kulithalai blocks. The water bodies share about 70.33 sq.km (2.42 per cent) of the total study area.

Conclusion

The study has shown the major land use/land cover types. The Indian Remote Sensing Satellite (IRS) data was used for visual interpretation by using the image interpretation elements such as tone, texture, shape, pattern, association etc. The land use categories were built-up lands, agricultural lands, forests, waste lands and water bodies. The agricultural land was predominant in the present study, which is about 2595.25 sq.km. (89.63%) (Table 1). The agriculture land is well distributed throughout the District, for that reason why the most of people are engaged in agricultural activities. The agriculture land includes crop land, kharif land, rabi land, fallow land and double/triple.

The waste land is occupied by 120.33 sq.km and sharing 4.15% of the total land use and land cover of the District. The waste land includes scrub land and other waste lands. The forests occupy 98.88 sq.km, sharing about 3.41% of the total land use / land cover of the District. The three categories of forest are identified such as deciduous forest, evergreen forest and degraded forest. These forests are indentified in the hill slopes of southern part of the Kadavur block. In water bodies, features such as rivers, streams, tanks and reservoirs are identified and included.

In the District, Cauvery, Amaravathi, Nunganji and Kodavanar are the rivers identified and the tanks were found throughout the District. In overall, water bodies occupies with the area of 70.34 sq.km (2.43%). With all these evaluations, this study concludes that the agricultural activities are the dominant land use / land cover types of the District as it covers with the area of 2595.23 sq.km (89.61%).

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