

Land Use and Land Cover Change Detection in Tiruchirappalli District Using Remote Sensing and GIS

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ABSTRACT

Land use and land cover is dominant role in the part of urbanization. As the rapid urbanization led various activities in a region and these changes generally takes place in the agricultural land and caused decrease of arable land .The satellite imageries LANDSAT 5TM (1990), LANDSAT 7ETM (2000) AND LISS 111 (2010) data's are used. The scales are 1:50,000. 1990, 2000 and 2010 covering a period of 19 years the aerial distribution of the land use and land cover changes has been observed. The changes were identified ,in which the decrease of Agricultural land, Natural vegetation , Scrub land and Water body and increase of Built up land, Fallow land, River sand and Without scrub land. The land use and land cover maps are prepared by using GIS software to evaluate the changes and it is showed strong variation.

Key words: Land use and land cover changes in Tiruchirappalli district and GIS.

I. INTRODUCTION

Land is the basic resources of human society. It is the most significant among the natural resources of the country and most of its inhabitants depend on agriculture for their livelihood. Land is being used by people for various purposes. The basic requirement of human society is food. Farmers produce food from the land. The second important basic need of the people is home. It takes a very higher priority in its demand of land. Land use / Land cover exhibits the physical and economical situation of any region. Land use / Land cover determines the standard of living of the people and the natural resources found in a region. The development of human race started to develop from when man started to convert the land cover region to land use. Land use and land cover changes degrade and have an instant impact on the global carbon cycle. The global cycle can add or remove carbon di- oxide from the atmosphere, contributing to climate changes which lead to global warming. The information on land use/land cover patterns, their spatial distribution and changes over a time scale are prerequisite for making development plans.

Tiruchirappalli district is an important region in the State and had been a Centre of activities for many historical events from the days of the early Cholas. Rock Fort, Thayumana Swamy, Pillaiyar Temple, Teppakulam, the Nawab's palace, the Nadir Shah Mosque, Sri Rangam Temple, Thiruvanai Koil, Subramanyaswami Temple, Upper Anicut and Grand Anicut are some of the important monuments and

temples reflecting the history, culture and traditions of the district. Tiruchirappalli district is one of the important districts in Tamil Nadu and had a population of 27 lakhs as per 2011 census. In terms of urbanization level, according to the composition of urban and rural population, Tiruchirappalli district ranked 10th among the other districts in Tamil Nadu.

II. STUDY AREA

Tiruchirappalli district is located at the Central part of Tamil Nadu surrounded by Perambalur district in the north, Pudukottai district in the south, Karur and Dindigul districts in the west and Thanjavur district in the east. It lies between 10° 10' and 11° 20' of the Northern latitudes and 78° 10' and 79° 0' of Eastern latitudes in the centre part of the Tamil Nadu. The general slope of the district is towards east. It has a number of detached hills, among which Pachamalai Hill is an important one, which has a peak up to 1015m, located at Sengattupatti Rain Forest.

Tiruchirappalli district comprised of eight taluks viz. Thuraiyur, Lalgudi, Musri, Tiruchirappalli, Thottiyam Manachanallur, Srirangam and Manapparai, which included 14 blocks, 408 Village Panchayats and 1590 Villages. This district consists of four municipalities namely Ponmalai, Srirangam, Thuraiyur and Manapparai. Tiruchirappalli is the only Municipal Corporation which is also the Head Quarters of the District.

III. AIMS AND OBJECTIVES.

The aim of the present study is to analyze the land use and Land cover changes in Tiruchirappalli district. The following Objectives are as follows.

1. To understand the general topography of the study area.
2. To study the land use categories.
3. To study the land use changes.
4. To use GIS in mapping of Land use land cover changes.
5. Interpretation of land use and land cover changes based on the image analysis.

IV. METHODOLOGY

The sources of data have been collected from the statistical offices, agricultural offices and soil survey offices in Tiruchirappalli district. The NRSA satellite imageries of LANDSAT 5TM (1990), LANDSAT 7 ETM (2000) and LISSIII (2010) are used for image analysis. The simple statistical techniques were applied to present land use land cover changes of given study area. The satellite imagery scales are 1:50,000 (1990, 2000 and 2010). The supervised method of image classification is followed for image analysis is carried out to avoid misclassification. The study area maps are prepared by using Indian Toposheets with the scale of 1:50,000. The change maps are prepared by using the ERDAS and GIS software.

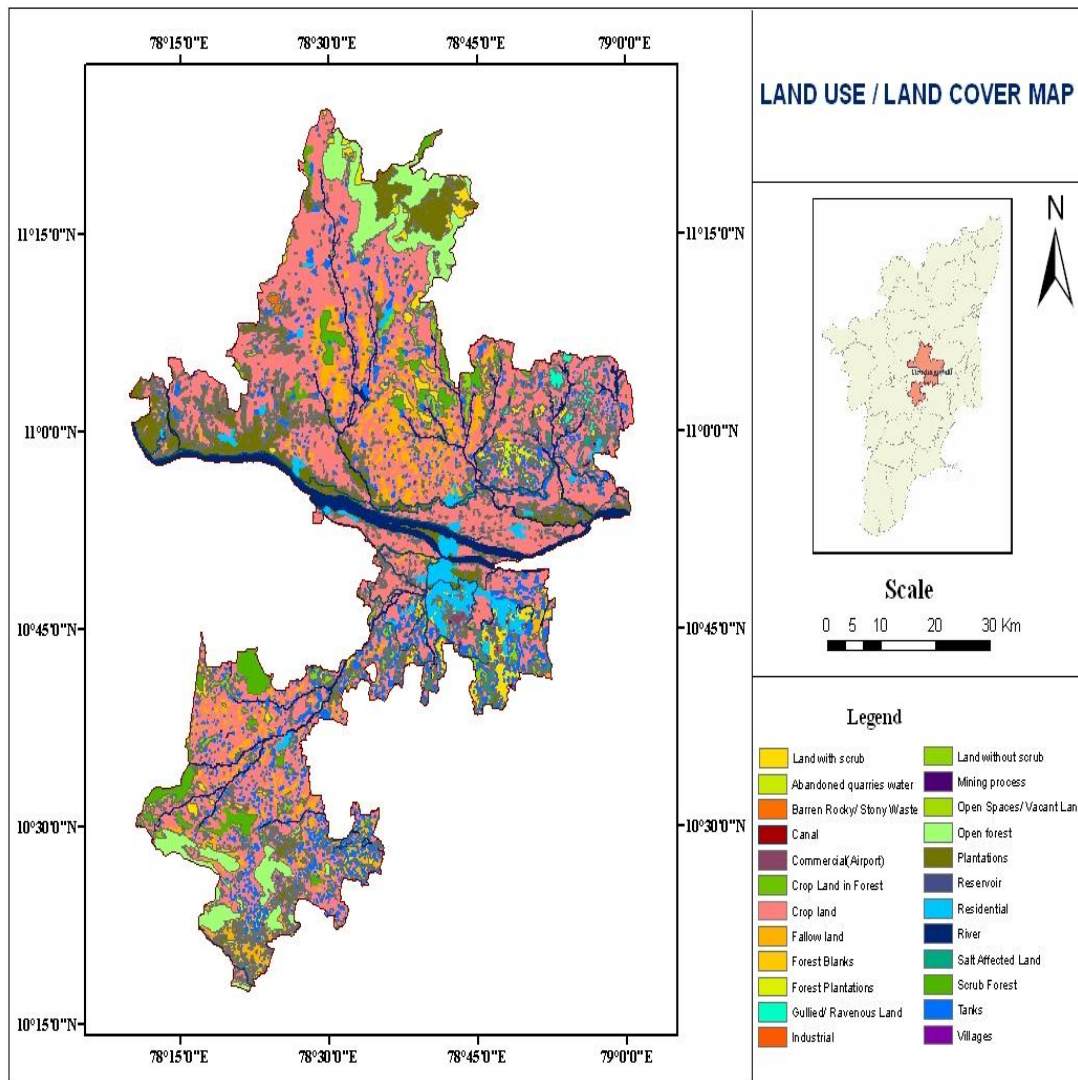


FIG NO 1.1 LOCATION MAP OF THE STUDY AREA

LAND USE AND LAND COVER CHANGE DETECTION IN TIRUCHIRAPPALLI DISTRICT – 1990, 2000 AND 2010

In 1990, 2000, and 2010 the aerial distribution of the land use and land cover changes have been presented in percentage of distribution of the table 1.1 and fig 1.1. In these years many land use and land cover features were identified. Each land use and land cover map positively and negatively was changed in the years 1990, 2000, and 2010. Within every 9 or 10 years of the selected years, many changes have been observed. Some land use has showed strong variation. The different land use and land cover details have been discussed in the earlier chapter. The land use and land cover maps have been generated and analyzed for identifying the changes and its impact on the regional environment. Primarily there has been the land use and land cover category of agricultural land, built-up land, fallow land, Natural vegetation, river sand Scrub without scrub land and Water bodies. The detailed interpretations have been given below. Tiruchirappalli district entire land use land cover from the imageries for the years 1990, 2000, and 2010 the percent changes that have taken place in each category is as follows.

V. AGRICULTURE LAND

Agriculture lands show a remarkable decrease in area. In 1990 compare to 2000 the nine years period the agriculture land has been decreased (-63.74%) Agriculture land was highly concentrated in Eastern and Western side of the district. The agriculture lands occupied an area of Andanallur, Thottiyam, Musiri, Thiruverambur, Manachanallur, Manapparai, Marungapuri, Pullambadi and Vaiyampatti Thathaiyanganpettai, Thuraiyur, Lalgudi and Manikandam in this blocks. From 2000 to 2010 the agriculture land shows another decrease of (104.89%). In 1990 compare to 2010 the years of the agriculture land has a total decrease of (168.63%) Over all agriculture land decrease in this district 24.13%. From the interpretation it was found out that from 1990 to 2010 erosion occurred in some place. It resulted in the increase of fallow land and built-up lands.

In Tiruchirappalli district for the past ten years the deceleration in growth agriculture was noticed. However, it is not uniform and there are regions that still hold promise for stimulating the growth. Studies confirmed that the sharp erosion of total factor productivity in agriculture in Tiruchirappalli district on account of multiple factor relating to technology fatigue, soil fatigue, declining fertilizer response rate depleting capital stock and agro-climatic aberrations.

Based upon the analysis of issues problems and opportunities, relevant and feasible strategic plans have been worked out for agricultural development of Tiruchirappalli district

VI. BUILT-UP LAND

Built –up land was highly concentrated in this district. The built-up land was identified in entire study area. In this center portion was of urban areas which were highly developed. In this district some agriculture land fields were converted in to fallow land and after few days the land was converted to Real Estate land and industrial areas were newly created in National high way lines. This district has well developed transportation facilities. The built-up lands were not only settlements but also Govt offices, Education Institutions and Pharm productions and industries were identified in this district. Such places were identified in the blocks Andanallur, Musiri, Manachanallur, Pullambadi, Thiruverambur, Thottiyam, Uppiliyapuram, Vaiyampatti, Marungapuri, Manikandam, and Manapparai. Built –up lands show a considerable increase in area. In 1990 compare to 2000 the years of built-up land I (-23.03) and built-up II land (- 22.27%) has been increased. In 2000 to 2010 the ten year period the built-up land I (- 24.04%) and built –up land II (-21.55%) show an increased in this district. In 1990 compare to 2010 the built –up land I (-45.07%) and built –up land II (-43.82%) has a total increased. Over all built-up lands increase 34.82% in this district. So many agriculture lands were transformed to fallow lands. The fallow lands were converted to build up lands real estate lands and industries areas. The village people need to infrastructural facilities so people move in rural to urban. These are reasons built –up land was increased in this district.

VII. FALLOW LAND

In 1990 the fallow land occupied an area of 298.22 sq.km. Fallow land was identified in the blocks of Uppiliyapuram, Thuraiyur, Thathaiyanganpettai, Pullambadi, Manapparai, Vaiyampatti, Marungapuri and Thiruverambur. Show an increasing trend in the area. In 1990 compare to 2000 the nine years period the fallow land increase to (-23.26%). In 2000 the fallow land was found in 321.58 sq.km. In 2000, fallow land has been increased highly. In 2000 to 2010 the ten years period the fallow land increased to (-24.93%). The fallow lands were identified in Manapparai, Vaiyampatti, Marungapuri, Manikandam, Pullambadi, and Thuraiyur. In 1990 compare to 2010 the years of fallow land increase in its total (-48.19%). Over all changes in fallow lands 12.46% in this district. Because of failure of monsoon for long period, an active

agriculture delta has registered with the high order of the fallow land. Two crop fields have been brought down into single crop fields for more than a decade. It has must have been the reason to have higher order of fallow land in this region. In this year 2010, it has shown a rise. These fallows must have been the area southern side for settlement and house plots in the vicinity of the major developing town like Vaiyampatti, Uppiliyapuram, Pullambadi, Thottiyam, Thiruverambur. These are the regions were many fallow lands were identified and converted in to built-up land and industries area.

VIII. NATURAL VEGETATION

The plantations were located into all blocks and villages. Mostly in this district coconut plantations, cashew plantation, plantain, tamarind, palm trees banana plantation, are high level concentration. During 1990 the area observed under this category was 522.81 sq.km. Natural vegetation lands show a decreasing trend in the study area. In 1990 compare to 2000 the nine years period the natural vegetation land decrease (-15.87%). During 2000 the plantation land occupied an area of 506.91 sq.km. In 2000 to 2010 the ten years of period the natural vegetation land decrease to (-14.28%) During 2010 the land occupied an area of 492.52sq.km. In 1990 compare to 2010 the nineteen years the natural vegetation land decreases in the (-30.15%) In 2010 year Natural vegetation was converted in to built-up land. Over all changes in the Natural vegetation in all blocks. In this district located in northern and southern side of particular name located in Uppiliyapuram, Thuraiyur, Thathaiyanganpettai, Vaiyampatti, Manapparai, and Marungapuri.

IX. WATER BODY

The Cauvery river is the most important river in the district and the tributaries of Cauvery, i.e. Coleroon river, Koraiyar river, Ariyar, Malattar channel, Uyyakondan channel also drain in this district. Cauvery is one of the major rivers in South India and Tamil Nadu, which flows towards east. The Cauvery Basin extends over an area of 81155 Sq.km, which spread across the States of Kerala, Karnataka and Tamil Nadu. In Tiruchirappalli district, the river splits into two branches, the northern branch being called the Coleroon (Kollidam) and the southern branch is called river Cauvery. The total length of the river in this district is about 125 Kms, and the area of river basin extends about 17,200 hectares of land. Ponnaniar, Uppamodai and Siddhayalli reservoir are mainly used for irrigation purpose.

Water bodies show a decreasing trend in the area. During 1990 the total an area was of 283.15sq.km. In 1990 compare to 2000 the nine years period the water bodies' decrease to (19.66%). During 2000 the land occupied an area of 263.49sq.km was found. In 2000 to 2010 the ten years period the water bodies by another (19.46%). In 1990 compare to 2010 the water bodies has been decrease in its total (36.12%). Because of in this river system was of mainly for perennial and non Perennial River. So the flow of water level in winter season was only increased. Summer season decreased. The rivers aligned with mixed plantations in some places. Small tanks aligned with the settlement of blocks and villages in this district.

X. SCRUB WITHOUT SCRUB LAND

In 1990 the scrub without scrub land occupied an area of 316.74sq.km. The land is a type of waste land or salt affected land and small hills area. In land was in all blocks and villages in this district was found. Observed Scrub without scrub lands show a increasing trend in the area. In 1990compare to 2000 the nine years period the scrub without scrub land increase to (12.48%) scrub without scrub land was identified in the area northern side Uppiliyapuram, Thuraiyur Thathaiyanganpettai, Thottiyam, Manachanallur, Musiri, Thiruverambur, Lalgudi Pullambadi covers in these blocks. Scrub without scrub land was identified in this blocks Andanallur, Manikandam, Manapparai, and Marungapuri Vaiyampatti. During 2000 the scrub without scrub land occupied an area of 338.26sq.km. In 2000 to 2010 the ten years period the scrub without scrub land has been increases to (29.16%). In 2010 the scrub without scrub land was founded in 367.42sq.km. In 1990 compare to 2010 the nineteen years period scrub without scrub lands has been increase to be (50.64%). This district had some of the scrub without scrub land that has been transformed to land in future might be converted into built-up land. So the built-up land day- by- day was increasing, because of increasing population and migration of people Rural to urban area. The built-up land was not only having settlements but also include that all other category of Industries, Govt offices, and education centres.

XI. SAND AREA

The river sand was noticed in Cauvery river basin and Grand Anicut canal small river areas. Sandy areas show an increase trend in the area. During 1990 the area observed under this category was 139.15sq.km. In 1990 compare to 2000 the nine years period the river sand area increase by (11.52%). During 2000 the year observed under this category was 150.67sq.km. In

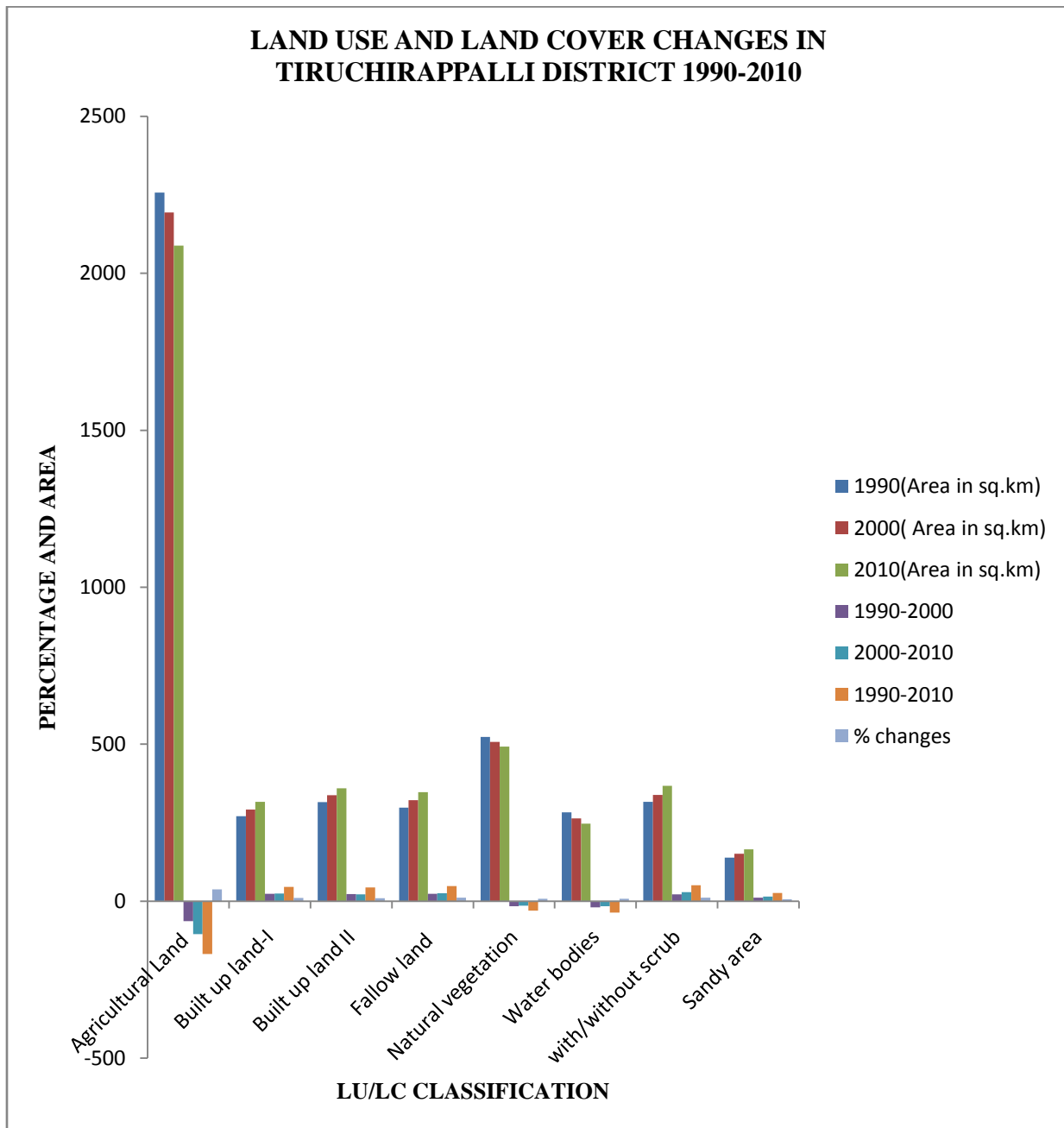
2000 to 2010 the ten years period the river sand increases to (14.56%). In 2010 the river sand land was founded in 165.23sq.km. In 1990 compare to 2010 the nineteen years period the river sand area decrease in the

(26.08%). The reason was water level has been decreased, so the river sand has been increased. The river sand was identified in river basin area.

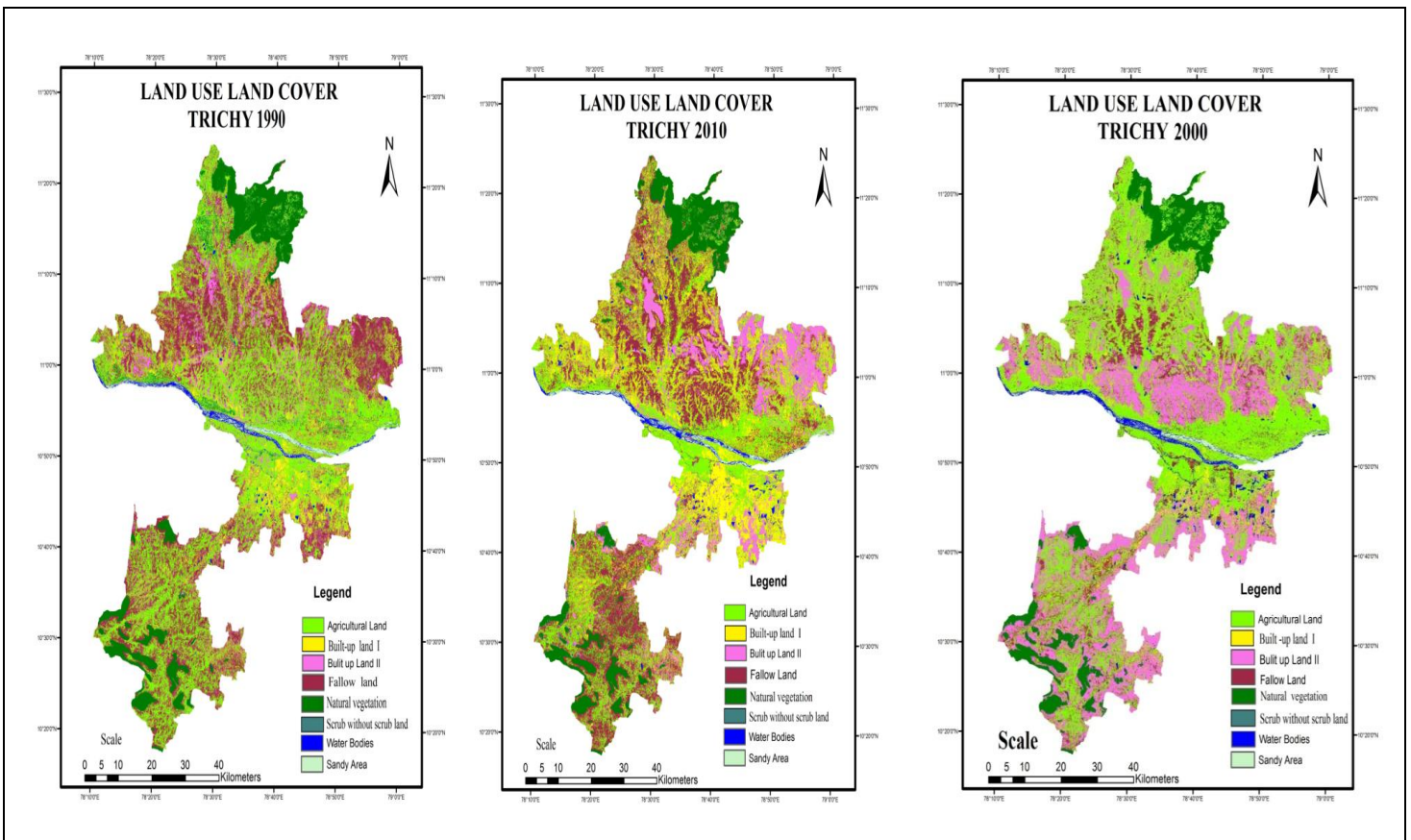
TABLE 1.1 LAND USE LAND COVER CHANGES IN TIRUCHIRAPPALLI DISTRICT

Land Use classification	1990(Area in sq.km)	2000(Area in sq.km)	2010(Area in sq.km)	1990-2000	2000-2010	1990-2010	% changes
Agricultural Land	2257.31	2193.57	2088.48	63.74	104.89	168.63	37.58
Built up land-I	271.09	292.12	316.16	-23.03	-24.04	-45.07	10.04
Built up land II	315.65	337.52	359.37	-22.27	-21.55	-43.82	9.76
Fallow land	298.22	321.58	346.91	-23.26	-24.93	-48.19	10.73
Natural vegetation	522.81	506.91	492.52	15.87	14.28	30.15	7.71
Water bodies	283.15	263.49	247.03	19.66	16.46	36.12	8.04
with/without scrub	316.74	338.26	367.42	-21.48	-29.16	-50.64	11.28
Sandy area	139.15	150.67	165.23	-11.52	-14.56	-26.08	5.81
Total	4404.12	4404.12	4404.12	-	-	-	100

FIG 2.2 LAND USE LAND COVER CHANGES IN TIRUCHIRAPPALLI DISTRICT



FIGS 1.1 LAND USE AND LAND COVER IN TIRUCHIRAPPALLI DISTRICT



XII. CONCLUSION

The present study of Land Use and Land Cover change detection in Tiruchirappalli District, Tamil Nadu, India using remote sensing and GIS has been undertaken primary and secondary to appreciate the type of land use land cover and nature of changes taking place in the chosen area period of study.

Land use and land cover change is a phenomenon, which is of serious concern and needs immediately attention in all the growing rural and urban around solid areas. The nineteen years period shows many drastic changes in agriculture lands. Particularly these lands were converted to real estate land and built-up lands. The built-up lands include Govt offices, private offices, Educational institution, different type of industries and settlements. The pressure of the needs of increasing population is the major reason for this change. The agriculture land, water bodies and Natural vegetation have been decreased in all blocks. The built-up land has increased at the cost of crop land, fallow land, and

scrub without scrub land. All these lands have been converted in to settlements and more industries. The study reveals that remote sensing and GIS techniques have a unique capability to detect the changes that have occurred in land use and land cover over a period of time.

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