

Land Use / Land Cover Change Detection of Kuthalam Block, Nagapattinam District, Tamil Nadu Using GIS

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ABSTRACT: A modern nation, as a modern business, must have adequate information on many complex interrelated aspects of its activities in order to make decisions. Land use is only one such aspect, but knowledge about land use and land cover has become increasingly important as the Nation plans to overcome the problems. The proposed system uses the features of existing widely used classification systems that are amenable to data derived from remote sensing sources. The goal of change detection is to discern the areas on digital images that depict change features of interest. The present study area of Kuthalam Block has 198.31sq.km. The area under investigation lies in between the longitudinal extension is from 79°30'45" East to 79°43'45" East and Latitudinal is from 10°54'45" North to 11°11'0".North. The aim of the present study is to analyze the Land use and Land cover changes in Kuthalam Block, Nagapattinam District, Tamil Nadu. The satellite imageries of LANDSAT TM (1991), LANDSAT TM (2000) and LISS III (2012) are used for image analysis. The outputs of map and layout are prepared by using the GIS software.

KEYWORDS: LAND USE, LANDSAT, LISS, GIS, CHANGES, CLASSIFICATION

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. The primary activators like Farmers produce food from the land. The second important basic need of the people home. It takes a very higher priority in its demand land. 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 land cover changes degrade and have an instant impact on the global carbon cycle. The global cycle can add to more 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 scales are used for making development plans.

This block is located in between Mayiladuthurai and Thiruvaidaimaruthur blocks. This block, being Cauvery basin irrigated, with 95% of population engaged in agriculture and allied activities. It is well connected by both rail and road. Some of the items that can be produced here are pappad, straw board, curled and rubberised coir, coir products, cement hollow block, lime powder, cycle seat covers, tyre retreating, roller bushes, groundnut oil extraction. With the recent oil find, there is good scope for power generation, LPG bottling plant and downstream industries.

In our Earth's surface have huge information and data. These are collected using Remote Sensing (RS) and Geographical Information System (GIS) tools. Remote Sensing provides excellent of data from which updated Land Use and Land Cover (LULC) information and changes can be analysed. It should also be noted that LULC mapping using remote sensing has given differentiation of research of various investigations.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 5, May 2017

The patterns of land use and land cover changes and its analysis can be easily identified with remote sensing technology. Remote Sensing technology over the decades have been an indispensable tool in environmental modelling timely and accurate change detection of earth's surface features is extremely important for understanding relationships between human and natural phenomenon of this block.

II. RELATED WORK

The Kuthalam block has an area of 198.31sq.km. The area under investigation lies in between the longitudinal extension is from 79°30'45" East to 79°43'45" East and Latitudinal is from 10°54'45" North to 11°11' 0".North. Kuthalam block is located at the north and east Mayiladuthurai, Tiruvarur district is located in east to south and Thanjavur district is located in the western part of this block.

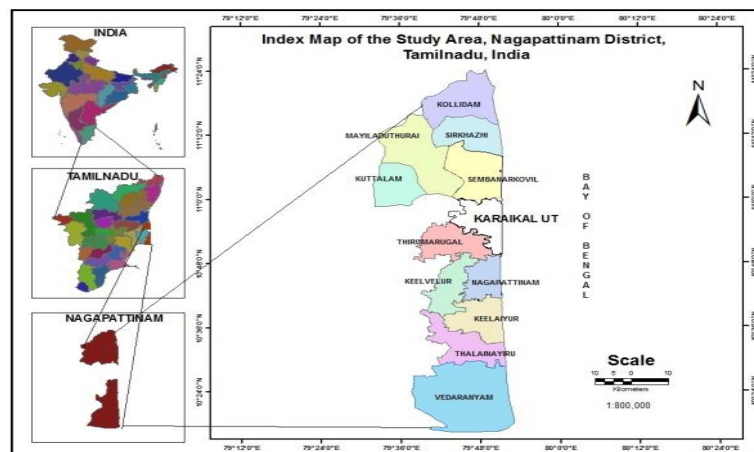


Fig. 1 Study area Location

III. AIM AND OBJECTIVES

The aim of the present study is to analyse the Land use and Land cover changes in Kuthalam block, Nagapattinam district, Tamilnadu. The following objectives are as follows.

1. To understand the general topography of the study area
2. To study the land use category
3. To study the land use changes
4. To use GIS in mapping of land use and land cover changes

IV. METHODOLOGY

The sources of data have been collected from the District collector office, statistical office and soil survey offices in Nagapattinam District. The satellite imageries of LANDSAT TM (1991), LANDSAT TM (2000) and LISS III (2012) are used for image analysis. The simple statistical techniques were applied to present land use and land cover changes of given study area. The supervised method of image classification is followed for image analysis with

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

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Vol. 6, Issue 5, May 2017

accuracy assessment carried out to avoid wrong classification. 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 GIS software.

Totally nine land use and land cover classes were established in this study area as Agricultural land, Barren land, Built-up land, Canal, Fallow land, Plantations, River, Scrub land and Tanks. In the supervised classification techniques, three images with different years are independently classified.

V. RESULT AND DISCUSSION

The study is made in the years 1991, 2000 and 2012. The aerial distribution of the land use and land cover changes has been presented in percentage of in the Table 1. In this period, many land use and land covers have been identified. Each land use and land cover changed positively and negatively in the years 1991, 2000 and 2012. Within every nine or ten years of the selected years, many changes have been observed. Some land use shows strong variation. The changes have been discussed below. Land use and Land cover change detection were analysed and discussed as given below (Table1 and Fig 2, 3, 4).

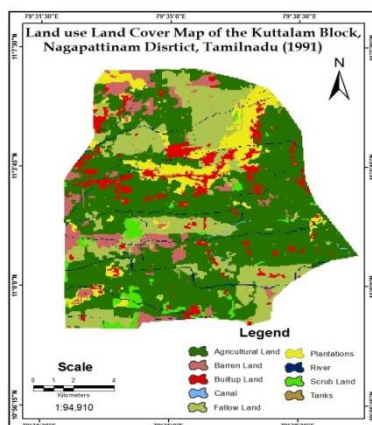


FIG. 2 LAND USE LAND COVER 1991

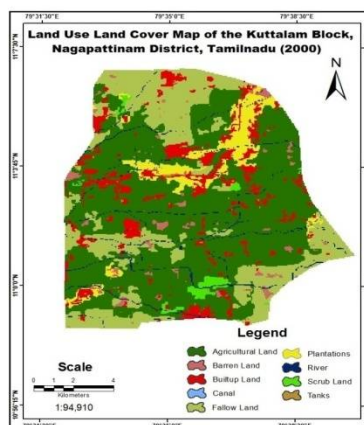


FIG. 3 LAND USE LAND COVER 2000

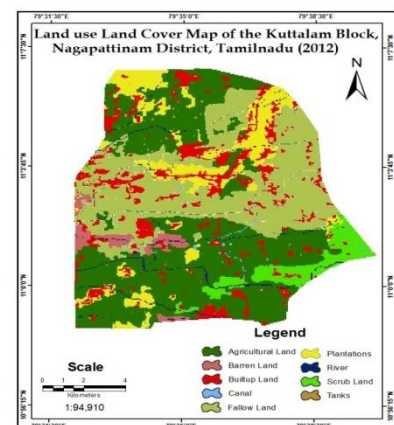


FIG. 4 LAND USE LAND COVER 2012

Agricultural Land

Crop land is the major land use category observed in the study area. The agricultural lands were noted in all the villages. During 1991 the area observed under this category was 81.12sq.km (40.90%). These areas are comparatively higher in carrying out agricultural based activities in 1991 than the year 2000 and 2012. In 2000, the block occupied an area of 66.68sq.km (33.62%) of cropped area. In 2000 compared to 1991 the agricultural land has been decreased i.e. -7.28 per cent.

In 2012, agricultural land occupied an area of 55.02sq.km (27.74%). In 2012 compared to 2000 some agricultural land has been decreased i-e. -5.88 per cent. From 1991 to 2012 in the twenty one years of periods the agricultural land has been decreased i-e.-13.16 per cent. The overall reduction of agricultural land was due to fallow land and construction of real estate's or built-up lands of this block.

Barren Land

The barren lands are under without crops. The barren land is identified as an area of 14.94sq.km (7.53%) in the year 1991. In 2000 the barren land occupied an area of 15.33sq.km (7.73%). In 2000 compared to 1991 the barren land has been increased i-e 0.2 per cent. In 2012 the barren land occupied an area of 18.65sq.km (9.40%). In 2012 compared to 2000, in the twelve years of period the barren land was increased i-e 1.67 per cent. From 1991 to

International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 6, Issue 5, May 2017

2012 in the twenty one years of period the barren land has been increased i-e 1.87 per cent. Because of climatic conditions prevailed in the surrounding of this block.

Built-Up Land

In this block in all villages the built-up land was identified. The towns were identified in many areas of this block. In this block the settlement areas like built-up lands have been increasing day by day. It is observed that in 1991 the built-up land occupied an area of 16.97sq.km (8.55%).

In 2000, the built-up land occupied an area of 17.88sq.km (9.01%). In 2000 compared to 1991 the built-up land has been increased i-e 0.46 per cent. In 2012, the built-up land occupied an area of 19.75sq.km (9.95%). It is observed that in 2012 compared to 2000 the built-up land has been increased i-e 0.94 per cent. From 1991 to 2012, in the twenty one years of period the built-up land has been increased i-e 1.4 per cent. Because of increasing population density and their needs motivate to increase the built-up lands of this block.

Canal

This is one type of water bodies of this block. In this type of water bodies were identified in the west, east and central part of this block. In this block during 1991 the area observed under this category 5.04sq.km (2.54%) and this has increased to 5.06sq.km (2.55%) in the year 2000 and 5.11sq.km (2.57%) in the year 2012. In 1991 compared to 2000 i-e (0.01%). In 2012 compared to 2000 the river sand has been increased i-e 0.02 per cent. From 1991 compared to 2012, in the twenty one years of period it increased to 0.03 per cent.

Fallow Land

The fallow lands are under without cropping pattern temporarily. The fallow land is identified as 45.95sq.km (23.17%) in the year 1991. In 2000 compared to 1991 the fallow lands are increased i.e. 7.48 per cent in the villages. In 2000 the fallow land observed an area of 60.79sq.km (30.65%). In 2012 compared to 2000 the fallow lands are increased i.e. 1.02 per cent. In 2012 the fallow land occupied an area of 62.81sq.km (31.67%). In 2012 compared to 1991 the twenty one years of period the fallow land has been increased (8.5%). The fallow land was increased due to failure of monsoon over a long period. Multi cropping patterns are brought down into a mono crop system in the fields for more than decade.

Plantation Land

The plantations were located in many areas of this block. Generally plantation areas are located near to river course. During 1991 the area observed under this category is 20.44sq.km (10.30%). This area has been comparatively lower than the year of 2000 and 2012.

In 2000 the plantation land was increased i-e 21.70sq.km (10.94%). The plantation lands were increased in the year 2000 compared to 1991 i-e (0.64%) in the villages. In 2012 the plantation lands are located in 23.38sq.km 11.78 per cent. In 2012 compared to 2000 the plantation land was increased i-e 0.84per cent. From 1991 compared to 2012, in the last twenty one years of period the plantation lands are increased i-e 1.48 per cent. Because of poor climatic conditions, poor water resources, nature surface, terrain and population distribution and their needs. So, the plantation lands are converted into built-up lands. Generally the plantation lands were found surrounding agricultural fields and also settlements areas of this block.

River

Rivers are the parts of the hydrological cycle. There are many river system and its tributaries are very helpful for all purposes like agricultural activities, plantation, and built-up lands. In this block during 1991 the area observed under this category 5.25sq.km (2.64%) and the same observed in 2000 and 2012 also. So, there is no change in the river land cover.

Scrub Forest

In 1991 the scrub forest land covered an area of 7.85sq.km (3.95%). The scrub forest land has noticed in the villages are Mayiladuthurai, Pattamgalam, Asaikkadu, Melaiyur, Kokkur, Thiruvalanadu, Karuppur, Onerirajauram, Kilaparuthikkudi, Kothadangi, Palaiyur, Kothangudi, Nathambadi, Ganghadharapuram and Pandaravadai. In 2000

International Journal of Innovative Research in Science, Engineering and Technology

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compared to 1991 the scrub area decreased to -1.54 per cent. In 2000 these category occupied an area of 4.79sq.km (2.41%). In 2012 the scrub forest land occupied an area of 7.45sq.km (3.75%). In this type of forest areas are found in both sides of river system and uncultivable land surface of this block.

Tanks

It is a deltaic region. In 1991 the total area of tanks are 0.75sq.km (0.37). These areas are increased to 0.81sq.km (0.40%) and 0.85sq.km (0.42%) respectively 2000 and 2012.

VI. CONCLUSION

Land is non-renewable resources and has assessment of land use and land cover in temporal sequence is essential for planning and development of land and water resources. The present study was carried out in Kuthalam block. The following land use and land cover changes observed in the year 1991-2000 the categories of agricultural land and scrub land are decreased with 7.28% and 1.54% respectively. The categories of barren land, built-up land, canal, fallow land, plantations and tanks are increased with 0.2%, 0.46%, and 0.01%, 7.48%, 0.64%, and 0.03% respectively. In the year 2000- 2012 the categories of agricultural land were decreased 5.88% and the categories of barren land, built-up land, canal, fallow land, plantations, river area, scrub land and tanks area are increased with 1.67%, 0.94%, 0.02%, 1.02, 0.84%, 0.01%, 1.34% and 0.02% respectively. In the year 1991- 2012 the categories of agricultural land and scrub land were decreased 13.16% and 0.2% respectively. The categories of barren land, built-up land, canal, fallow land, plantations, river area and tanks are increased with 1.87%, 1.4%, 0.03%, 8.5%, 1.48%, 0.02% and 0.05% respectively. Fig.4 shows the overall changes in land use and land cover in the study area.

Mainly a decreasing trend has been identified in the categories of agricultural land and scrub land. The barren land, built-up land, fallow land, plantation land, water bodies like river area and tanks land shows a trend of increase in this study area. It also helps in identifying the status of various land use and land cover categories at a particular time. The study area has rural settlements that have been changed into urban settlements due to the decreasing of agricultural lands of this study area. Because of low rainfall, poor climatic conditions, climatic changes and migration of people rural area to urban area in searching jobs and other infrastructural facilities of this block.

Table No: 1

Land Use and Land Cover Changes in Kuthalam Block

Land use Classification	1991 (Area in sq.kms)	2000 (Area in sq.kms)	2012 (Area in sq.kms)	1991 - 2000	2000 - 2012	1991 - 2012	(%) Changes
Agriculture land	81.12	66.68	55.02	-7.28	-5.88	-13.16	49.26
Barren land	14.94	15.33	18.65	0.2	1.67	1.87	7.00
Built-up land	16.97	17.88	19.75	0.46	0.94	1.4	5.24
Canal	5.04	5.06	5.111	0.01	0.02	0.03	0.11
Fallow land	45.95	60.79	62.81	7.48	1.02	8.5	31.82
Plantations	20.44	21.70	23.38	0.64	0.84	1.48	5.54
River	5.25	5.25	5.25	0.00	0.00	0.00	0.00
Scrub	7.85	4.79	7.45	-1.54	1.34	-0.2	0.74
Tanks	0.75	0.81	0.85	0.03	0.02	0.05	0.18
Total	198.31	198.31	198.31	-	-	-	100

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

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