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Original Research Article

Change Detection Analysis Using Geospatial Technology in Salem District, Tamil Nadu, South India

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ABSTRACT

The present study represents the application of geospatial technology for land use land cover, accuracy assessment and change detection with the use of satellite image. A Landsat image has been used in two difference years, which were acquired in USGS website. ERDAS imaging software has been used and the supervised classification method applied to classify the land use land cover pattern. The land use land cover map was prepared the year 1992 and 2015. The study specified that the land use land cover pattern of the Salem district is composed of Deciduous forests, Evergreen and semi evergreen forests, Crop land, Cultivation and Plantation Land, Build up land, Water bodies, Mines and Barren land. Each land use land cover map have examined the accuracy of the classification, which are considered as Overall accuracy, Kappa accuracy, Producers' accuracy and User's accuracy. The changes of land use land cover have assessed from 1992 to 2015. From this investigation, the changes have noticed over a period of 23 years interval, those are, deciduous forests, Crop land, Cultivation and plantation land and water bodies has decreased in 398 Km^2, 250 Km^2, 45 Km^2, 16 Km^2 respectively. In contrast, Evergreen and Semi evergreen forests, Build up land, Mines and Barren land have increased in 288 Km^2, 293 Km^2 and 128 Km^2 respectively.

Key words: Land Use Land Cover, Change detection, Remote sensing, GIS.

INTRODUCTION

Land use land cover changes are most important component in present strategies for managing natural resources and monitoring environmental changes (Rawat et.al. 2013). Urban development leads to the conversion of land use land cover in many areas in the world, mostly in developing countries (Belal and Moghanm.2011, Mukesh Singh Boori et. al., 2015). Land use land cover assists the decision makers to plan the sustainable development and to understand the changes of environment (Muhammad Farooq Iqbal and Iftikahar Ahmad Khan.2014). Remote sensing data has been using for identify the digital change detection of determining and/or describing changes in Land Use Land Cover (Adel Shalaby and Ryutaro Tateishi 2007, Joy Sanyal et.al.,2014). Remote sensing and GIS only can derive the land use land cover with great difficulty and /or cost, be getting information in situ methods (Bjorn Prenzel 2004). Remote sensing science is a critical and worldwide tool for natural resource management and monitoring in many agencies which is being used mostly in change detection analysis (Rober E. Kennedy et.al.2009, Rajitha et.al. 2007). Landsat data has been constituted the longest record of large scale medium spatial resolution earth observation data (Matthew C. Hansen and Thomas R. Loveland 2012). Remote sensing tools provide huge

information which is covered broad areas with both high temporal frequency and spatial resolution (Hasi Bagan and Yoshiki Yamagata 2012). United States Geological Survey USGS -1990 has been defined that the accuracy assessment or justification is an essential step in the processing of remote sensing data which is determines the information result of the data to a user (Abubaker Haroun Mohamed Adam 2013). Examining the quality of a classification result is one of the essential factor in remote sensing since it gives evidence of how the classifier has done the work and extracting the desired objects from the image (Rejaur Rahman and Saha 2008).

Aims and Objectives

The main aim of the present study is to detect the changes of Salem district, South India using Land Use Land Cover classification with the help of remote sensing and GIS applications.

The following three objectives have taken into the present study.

1. To prepare the land use land cover map.
2. To assess the accuracy of the land use land cover classifications.
3. To evaluate the changes from land use land cover map.

Materials and Data Used

Base map preparation: Survey of India Toposheet- 1:50,000 Scale-(1972)

Satellite data: Landsat-7 (1992) and Landsat-8 (2015)

Software: Arc GIS and ERDAS IMAGINE.

Study Area

The study area has chosen in Salem district, South India (Fig.-1). The Salem district geographically lies between 11° 10' and 12° 10' North latitudes and between 77° 35' and 78° 55' East longitudes. It is covered by 5232 Km^2. The average Mean Sea Level is above 278 m (912 ft) and the Shevaroy hills has a highest elevation of 1640 m MSL.

The Salem city is fenced by hills on all sides and marked by isolated hills, North side in Nagaramalai, South Side in Jarugumalai, West side in Kanjamalai, East side in Godumalai, North East side of Shevaroy hills and South west side in Kariyaperumal Hill.

Rivers Cauvery, Sarabanga, Thirumanimuttar, Sweta and Vasista are the major river system draining the Study area. The Cauvery River is the only perennial and Sarabanga and Thirumanimuttar are the tributaries of the river Cauvery. The river course of Cauvery forms the Western margin of study area.

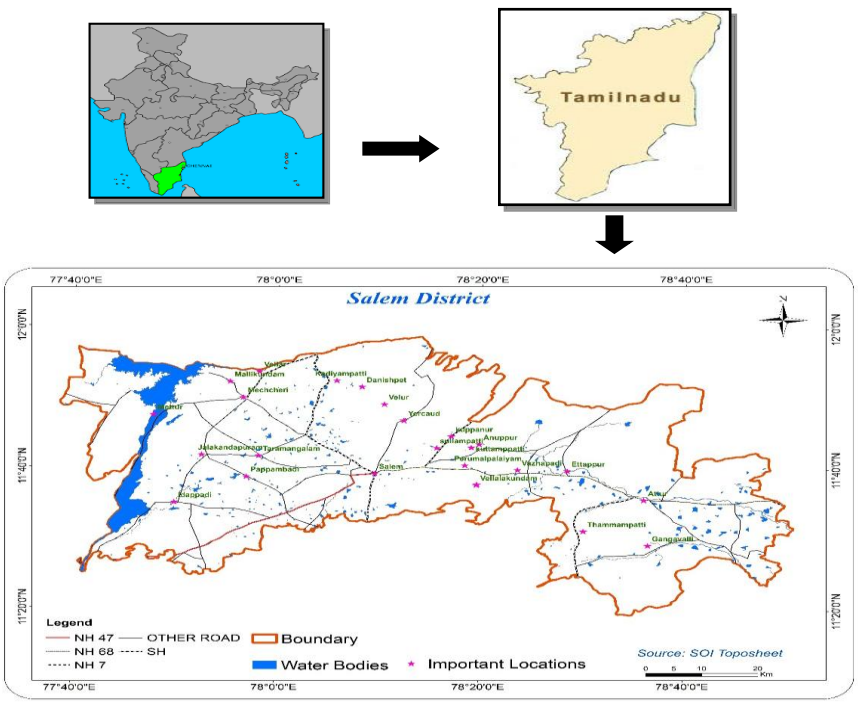

Fig.-1 Study Area Map

METHODOLOGY

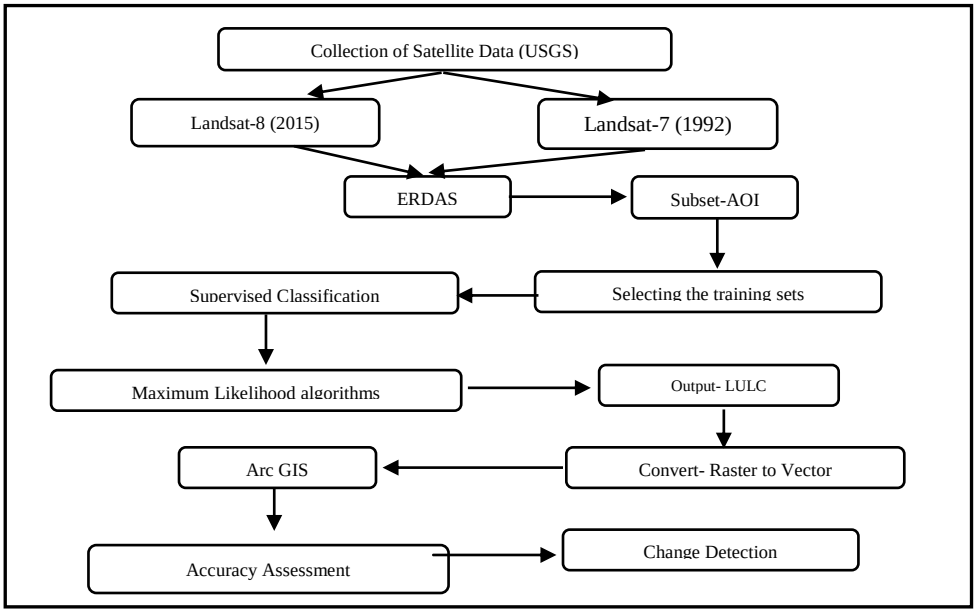

Fig.-2 Flow Chart Methodology

The following flow chart (Fig.-2) illustrating the detailed methods of the present study.

RESULTS AND DISCUSSION

The present study carried out the change detection analysis using satellite data, which has collected the Landsat-7(1992) and Landsat -8 (2015). Land use land cover classification has done by Using these two different years of satellite data.

Land use land cover -1992

Table 1: Results of Land Use Land Cover-1992

S. No	*Classes*	*1992 Area(km²)*	*%*
1	Deciduous Forests	2771	53
2	Evergreen and Semi Evergreen Forests	296	6
3	Crop Land	1110	21
4	Cultivation and Plantation Land	637	12
5	Build up Land	209	4
6	Water Bodies	87	2
7	Mines and Barren Land	122	2
Total		**5232**	

The year 1992 land use land cover has classified and quantified using Landsat-7 MSS data. The land use land cover distribution map of the study area during the year 1992 is shown in figure-3. The map clearly illustrates the spatial distribution of the LULC classification. During the year 1992, the study area had dominant in deciduous forest which was covered 53%, second dominant was crop land which was covered 21%, others classes were occupied very less than deciduous and crop land. Spatial Distribution details have given in Table-1.

Land use land cover -2015

Table 2: Results of Land Use Land Cover-2015

S. No	*Classes*	*2015 Area(km²)*	*%*
1	Deciduous Forests	2373	45
2	Evergreen and Semi Evergreen Forests	584	11
3	Crop Land	860	16
4	Cultivation and Plantation Land	592	11
5	Build up Land	502	10
6	Water Bodies	71	1
7	Mines and Barren Land	250	5
Total		**5232**	

The year 2015 land use land cover has classified and quantified using Landsat-8 data. The land use land cover distribution map of the study area during the year 2015 is shown in figure-6. The map clearly depicting the spatial distribution of the land use land covers classification. During the year 2015, the study area had dominant in deciduous forest which was covered 45%, second dominant was crop land which was covered 16%, others classes were occupied very less than deciduous and crop land. A spatial Distribution detail has given in Table-4.

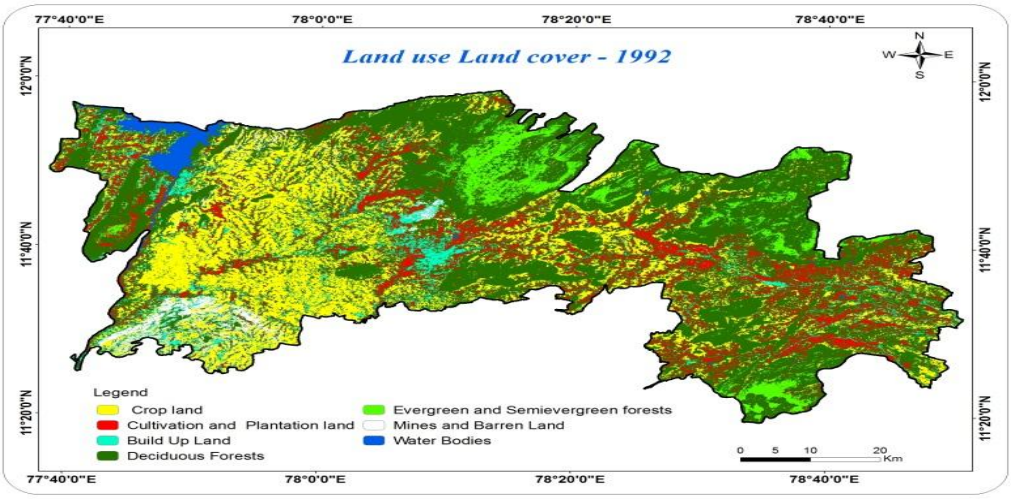

Fig.3: Land Use Land Cover -1992

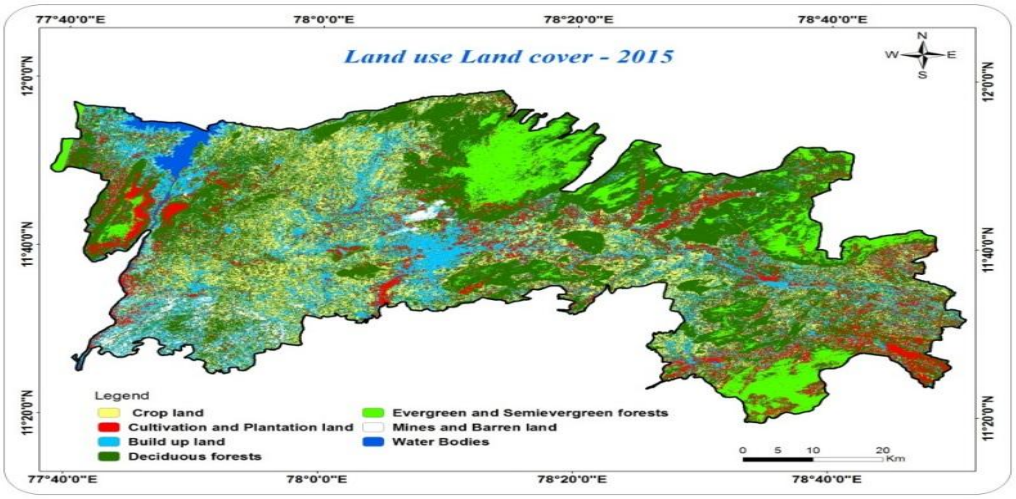

Fig.4: Land use Land cover -2015

Accuracy Assessment

The quality of the land use land cover map of the study area has analyzed by using error matrix methods. The error matrix compares information obtained by ground truth and classified image for a number of sample areas. Totally 50 ground truth samples has been collected at each classes of LULC classification. Accordingly, Producer's accuracy, User's accuracy, Overall accuracy and Kappa statistics were evaluated from the error matrix. The error matrixes were performed for classified images of 1992 and 2015. The accuracy assessment of classified images 1992 and 2015 are representing the table (5) and (6) respectively.

Table 3: Results of Accuracy Assessment-1992

Classes	Mine and Barren land	Deciduous Forests	Built up land	Crop land	Evergreen and Semi-evergreen forests	water bodies	Cultivation and plantation	Row Total	User Accuracy
Mine and Barren land	46	0	2	0	0	2	0	50	92
Deciduous Forests	0	42	2	2	1	2	3	52	81
Built up land	2	2	45	2	0	0	1	52	86
Crop land	1	2	1	43	0	2	2	51	84
Evergreen and Semi-evergreen forests	0	2	0	3	49	3	2	59	83
water bodies	1	0	0	0	0	41	0	42	97
Cultivation and plantation	0	2	0	0	0	0	42	44	95
Column Total	50	50	50	50	50	50	50	350	
Producer Accuracy	92	84	90	86	98	82	84		
Overall Accuracy %	88								
Kappa Accuracy %	86								

Table 4: Results of Accuracy Assessment -2015

Classes	Mine and barren land	water bodies	build up land	deciduous forests	crop land	Evergreen and semi evergreen forests	plantation	Total	User accuracy (%)
Mines and barren land	48	2	1	0	0	0	0	51	94
water bodies	0	47	0	0	0	0	0	47	100
build up land	0	0	47	1	0	0	0	48	98
deciduous forests	1	0	1	40	1	1	0	44	91
crop land	0	1	1	9	49	0	0	60	82
Evergreen and semi evergreen forests	1	0	0	0	0	49	3	53	92
plantation	0	0	0	0	0	0	47	47	100
Total	50	50	50	50	50	50	50	350	
Producer Accuracy (%)	96	94	94	80	98	98	94		
Overall accuracy (%)	93								
Kappa accuracy	92								

Change detection Analysis 1992-2015

Changes has detected from 1992 to 2015 over a period of 23 years by statistical calculations. The changes are given in table-5. Which are deciduous forests decreased in 398 Km2 (-8 %), Crop land decreased in 250 Km2 (-5 %), Water bodies decreased in 16 Km2 (-0%), Evergreen and Semi-evergreen forests increased in 288 Km2 (+6 %), Cultivation and Plantation land decreased in 45 Km2 (-3%), Build up land increased in 293 Km2 (+6 %), Mines and barren lands increased in 128 Km2 (+2%).

Table 5: Results of Change Detection (1992-2015)

S. No	*Classes*	*1992 Area(km^2)*	*2015 Area(km^2)*	*Changes (km^2)*	*%*
1	Deciduous Forests	2771	2373	-398	-8
2	Evergreen and Semi Evergreen Forests	296	584	288	6
3	Crop Land	1110	860	-250	-5
4	Cultivation and Plantation Land	637	592	-45	-3
5	Build up Land	209	502	293	6
6	Water Bodies	87	71	-16	0
7	Mines and Barren Land	122	250	128	2
	Total	5232	5232		

CONCLUSION

The study conducted in most popular city in Tamil Nadu, India. Landsat 7& 8, which has given multiple spatial and temporal satellite data to succeed the present attempt, otherwise which is not imaginable. The land use land cover classification successfully done in the year 1992 and 2015.The study specified that the land use land cover pattern of the Salem district is composed of Deciduous forests, Evergreen and semi evergreen forests, Crop land, Cultivation and Plantation Land, Build up land, Water bodies, Mines and Barren land. Each land use land cover pattern has assessed in separately. The Accuracy of the land use land cover classifications have validated. The overall accuracy and Kappa accuracy of the of the year 1992 classification is 88% and 86% respectively, and the year 2015 classification is 93% and 92% respectively. Among these land use land cover pattern has divided into two categories, those are increasing and decreasing patterns. The first most decreasing category is deciduous forests, which has decreased 398 Km^2, the second most decreasing category Crop land, which has decreased in 250 Km^2, the third most category Cultivation and Plantation land, which has decreased in 45 Km^2, and Water bodies has decreased in 16 Km^2. In contrast, the first most increasing pattern is Build up land, which has increased in 293 Km^2, the second most increasing pattern is Evergreen and Semi-evergreen forests, which are increased in 288 Km^2, the third most increasing pattern is Mines and Barren land, which are increased in 128 Km^2. These were happened over the period of 23 years

intervals. From the result it is clearly noted that, the population encroachment has influenced the major role because the build-up land suddenly increased and degradation of forests are the main factors because of Mines and Barren land also increased.

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