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RESEARCH ARTICLE

Land use and land cover using remote sensing and GIS techniques - A case study of Thanjavur District, Tamil Nadu, India

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ABSTRACT

The present study aims to find out the land use and land cover in Thanjavur district. The total extention of the area of 3397 sq.km. The district is located in the Eastern coast of Tamil Nadu. The study has been mainly used of satellite imagery for identifying the land use and land cover of the study area. ERDAS and GIS soft were has been used in the study area. Here the researcher followed to the supervise classification and followed the block wise land use and land cover classification in the Thanjavur district. There are 14 blocks in the district such as Ammapettai, Budalur, Kumbakonam, Thanjavur, Papanasam, Thiruvidaimaruthur, Thiruvonam, Thiruppanandal, Orathanadu, Madukkur, Thiruvaiyaru, Pattukkottai, Peravurani, and Sethubhachatram.. The district has been classified into 11 classes in level I to level II. In Thanjavur district total major land use and land cover categories of agriculture land was 1775.4 sq.km, built-up land was 545.12 sq.km, water bodies were 68.29 sq.km, mixed plantation was 424.49 sq.km, scrub land was 131.25 sq.km, without scrub land was 150.99 sq.km, river sand was 45.58 sq.km, mangroves 19.55 sq.km, aquaculture and salt pan 26.9sq.km and marshy land 7.68sq.km. Finally the Rank correlation methods were followed in the district.

INTRODUCTION

Land use and land cover studies could be a ground survey and made by Satellite imagery. These approaches may be used either independently or jointly, each having its own advantages and disadvantages. Generally multi-level approach is a very expensive. The approach, however, will ultimately depend upon the size and nature of the study area and the availability of the data. Careful section of techniques are important as it must suit the satellite data and more over, different changes in the techniques may highlight different types of Land use and Land cover change. The Satellite land cover change information provides an inventory level of data indicating location, nature and extent of change. In order to obtain this information and to contribute effectively to sustain development strategies, it must be integrated into a database in which the process, effects and inter-actions of change with the surrounding environment that can be identified and assessed. Descriptive data on natural and socio-economic components accruing in the study area, including Remotely Sensed data, are collected in a GIS. In many previous investications in land use and land cover related. There is the United States geological survey has devised a land use and land cover classification, as per the report (Anderson *et al.,* 1976).

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Land Cover changes can be identified from Remote Sensing imagery shot in the same area in different times (Shepard 1964). Change detection can be performed manually by means of visual interpretation of the imagery. Satellite imagery in a digital format has become available, and digital change detection techniques have been developed (Jensen et al 1983). Remote sensing and GIS are being increasingly used in resources evaluation and planning (Rajesh et.al 2010). The general land use and land cover pattern of Pudukkottai district (Sumathi *et al.,* 2011).

STUDY AREA

Thanjavur District lies in the East coast of Tamil Nadu. It is situated between $10^0$10' 0"N to 11^0 10' 6" of the Northern latitude and 78^0 45'50" E to 79^0 35'55" Eastern longitude. It extends to an area of 3397 sq.kms. The district is bound on the north by the Tiruchirapalli and Cuddalore districts, on the east by Thiruvarur and Nagapattinam districts, on the south by the Palk Strait and Pudukkottai district and on the west by Pudukkottai and Thiruchirappalli districts. The district can be divided into three District divisions. The Deltaic region covers the whole northern and eastern portions on the district where the Cauvery with its wide network of branches irrigate more than half of the district. It comprises the whole of Kumbakonam Taluk and parts of Thanjavur, Papanasam

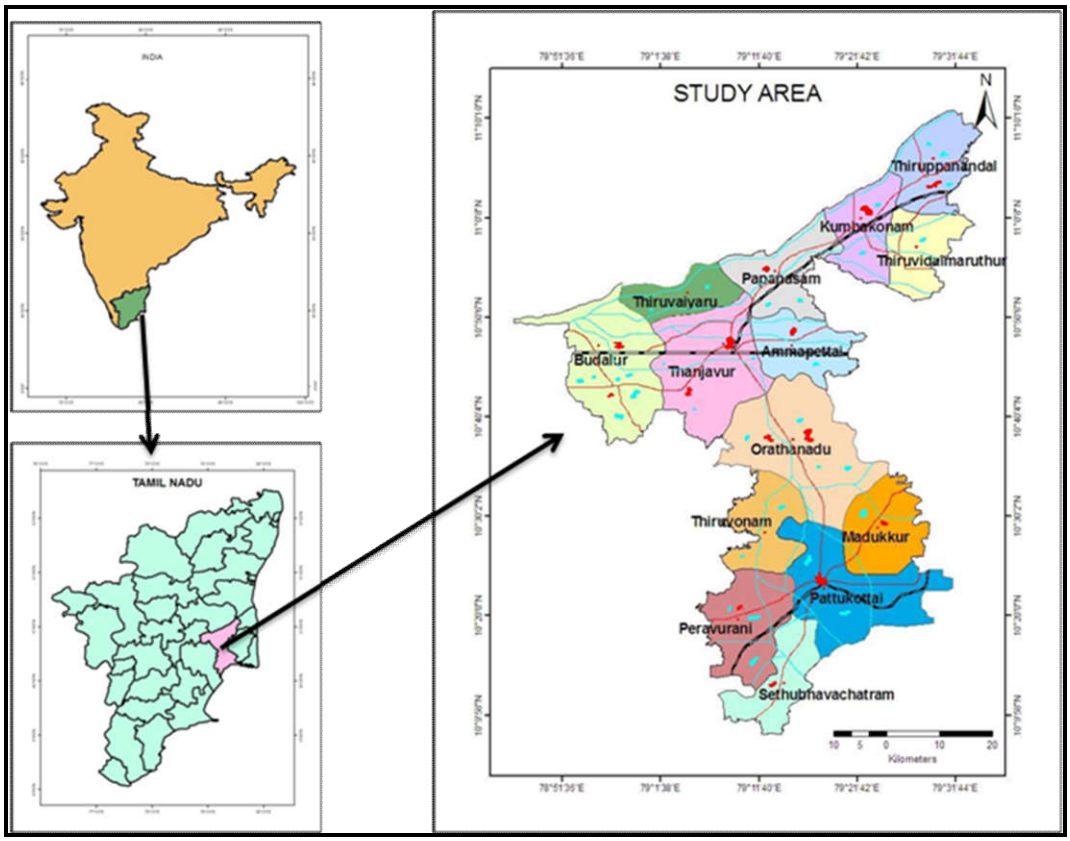


Fig.1. Location map of the study area

Table 1. Image characteristics of land use and land cover classes-visual interpretation keys

S.No	LULC CLASS	Tone	Size	Shape	Texture	Pattern	Association
1.	Built-up land	Bluish green, blue mixed with red and white	small	Irregular	Coarse and fine	Linear to semi-circular	Surrounded by agricultural lands, linear pattern indicating streets and roads
2.	Agri.Crop land	Bright red, pink, Brown	Varying size	Irregular	Medium to smooth or fine	Distinct pattern and canals	Land used for agriculture having patterns of fields and irrigation system
3.	Fallow land	Yellow to greenish blue	Small to large	Irregular	Medium to smooth or fine	Irregular	Amidst crop land as harvested agricultural field etc.
4.	Mixed plantation	Dark red to red	Small to medium	Regular	Coarse to medium	Square shape or irregular	Dry land or unirrigated land amidst cropland, river coarse and on gentle slope.
5.	Scrub land	Yellowish and brown or white	Varying size	Irregular	Rough	Irregular	High relief with slope areas, barren rocky etc., surrounded by scrub agricultural land.
6.	River/Stream/ Tank/well /lake	Medium and light blue grey to dark blue	Small to Long	Linear, circular and irregular	Fine	Linear, circular	Drainage pattern is clearly indicated by vegetation pattern
7.	Without scrub land	Yellowish and brown	Varying size	Irregular	Rough	Irregular	High relief with slope areas, barren rocky etc., surrounded by water surface and uncultivable land or vacant land.
8.	Saltpan	Dark blue to white	Small to large	Square	Smooth	Square	On the land, tidal influx, surrounded by agricultural land
9.	Mangrove	Bright red to red	Small	Irregular	Smooth	Irregular	Surrounded by tanks, agricultural land and roads
10.	Marshy vegetation	Brown to red	Small	Irregular	Smooth	Linear	Depositional coastal areas
11.	Sandy with scrub	White to light yellow	small	Irregular	Smooth	Circular/Irregular	River sand, sand dune, coastal beach and river bed.
12.	River sand	white	small	Linear and irregular	smooth	Linear	Drainage pattern, on both sides of major streams and it dry streams full bed.

Interpretation keys are based on visual interpretation of LANDSAT imagery; Source: Gautham and Narayan (1982) and Referred to by Chaitanya S.Agarwal (2000)

Taluk. The rest of the southern and western areas of the district are non-deltaic region and the agriculture is done with the help of the water resources of the Grand Anaicut canal. Karikala Cholan, one of the famous Chola rulers, and patronised liberally arts and letters and expanded his territory as far as the Himalays. The Grand Anaicut across Cauvery River was his monumental contribution to irrigation and agriculture and Grand Anaicut is hailed as an engineering marvel even today. Cauvery–Mettur project and by extension of the Vadavar region is also derived of hills and slopes

gradually seawards. The district is totally 13 soil series and 3 colours of soil, there are red soil, block soil, and brown soil. The location map of the study areas has been shown are shown in (Fig1). The aim of this study is to produce a block wise land use and land cover map of Thanjavur district at different epochs in order to detect the changes that have taken place particularly in the agriculture and build-up land and subsequently predict likely changes that might take place in the same land areas over a given period. The following specific objectives will be realized in order to achieve the aim stated above.

1. To prepare block level land use and land cover map preparation in the year of 2009 data using satellite imageries.
2. To create the district level land use and land cover map in 1991, 1999 and 2009 using statistical analysis.
3. To create the block level Rank wise of the land use and land cover result in Thanjavur district using Spearman Rank correlation methods.

MATERIALS AND METHODS

The land use and land cover studies involve mapping of different types of land use and land cover features from the satellite imagery. The success met with the land use and land cover mapping from imagery has encouraged the Researcher to rely on satellite imagery for obtaining accurate results. The researcher has been followed to the supervised classifications in block wise. Following this research work, imagery and toposheets are mainly utilized for mapping; together with the supplementary information's obtained from toposheets, district maps, block maps. In the following few pages, various stages of methods adopted in this research work have been reported.

SELECTION OF DATA

The study has been used to various primary and secondary data. These data's are included that toposheets, satellite imagery, and statistics data. A base map was prepared using survey of India toposheets having the index of numbers, 58 N/1, 2, 3, 4, 5, 6, 7, 8, 9, 11 and 58J/13, 14 and 58M/8, 12 on a scale of 1:50,000 as an understanding of this study. Totally 14 toposheets have covered the study area. Land sat images in various forms and formats followed by ground truth verifications. The primary data were collected from the LANDSAT-5TM (1991), LANDSAT-7 ETM (1999) and IRS P6-LISS 111 (2009) data. The LANDSAT data's scale 1:50,000 and LISS-111 data scale 1:250,000 scale. The supplementary data were generated from the Survey of India (SOI) topographical maps on 1:50,000. This ensured the accuracy of results with possibilities of interpretation by overlooking important and prominent features. The SOI Topographical map is identified from the SOI index map. The coordinates of the study area like latitude and longitude were known from the SOI map (1970). This study is mainly based on a visual interpretation of satellite imagery. The visual interpretations are shown in Table 1.

LAND USE AND LAND COVER ANALYSIS

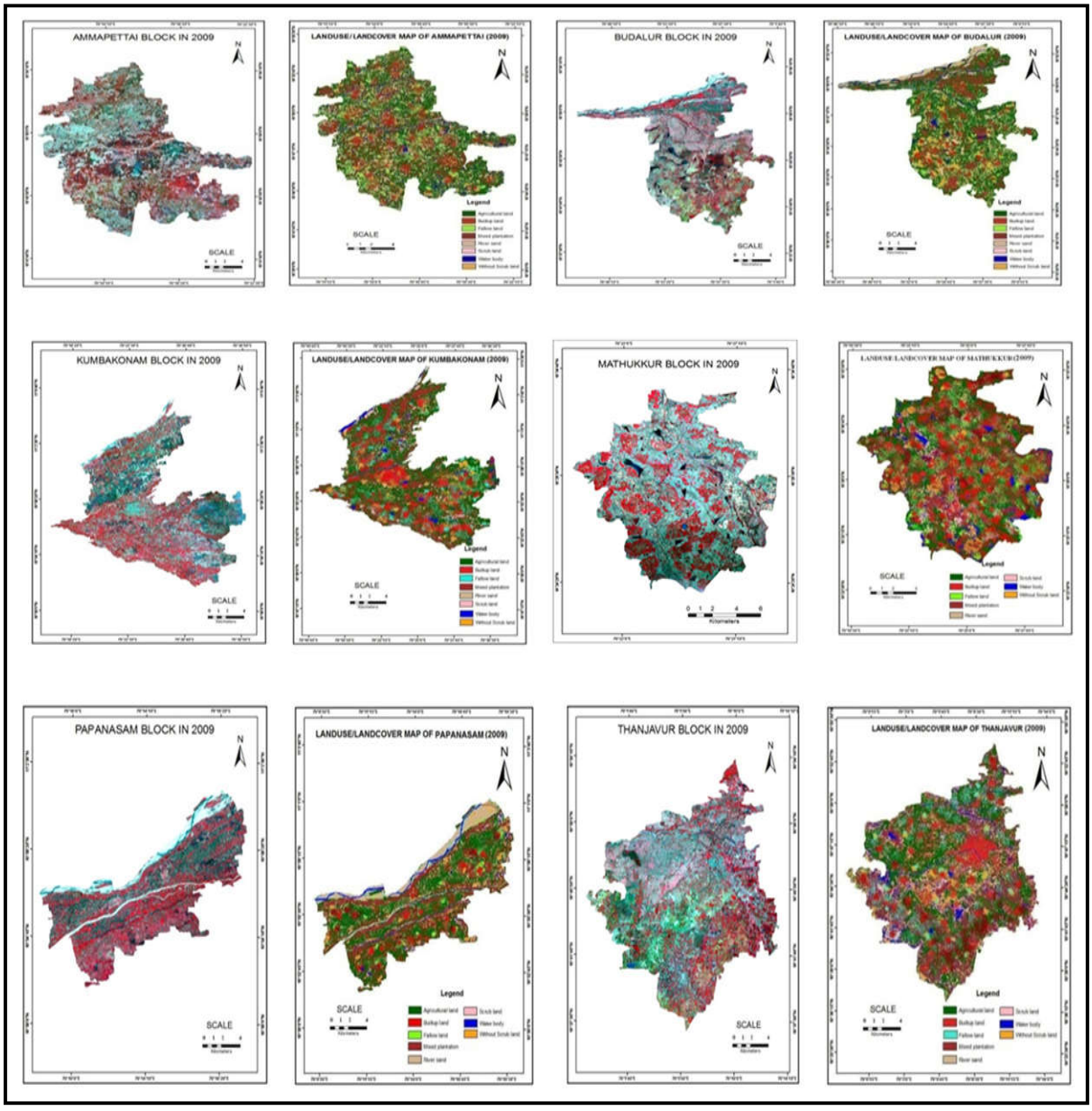
There are 14 blocks in thanjavur district. Here the researcher analyzed to block wise land use and land cover analysis. First the Ammapettai block the imageries for the year 2009 were collected from LISS 111 data. The total area under agricultural land was 10920.54hec (109.21sq.km), built-up land was 3621.59 hec (36.21sq.km), fallow land was 2802 hec (28.02sq.km), mixed plantation was 2257hec (22.57sq.km), river sand was 106.82hec (1.07sq.km), scrub land was 1000.24hec (10sq.km), water bodies were 550.54hec (5.51sq.km), and without scrub land was 2396.47 hec (23.96sq.km) of the total land extent. During 2009 the aerial distribution of the land use land cover have been presented in the Table 2 and Fig 2.1. Budalur block the imageries for the year 2009 based on the classifications taken from the LISS 111 data were considered. In this year the agricultural land was 14455.59hec (144.56sq.km), built-up land was 3485.01hec (34.85sq.km), fallow land was 1649.88hec (16.50sq.km), mixed plantation was 3068.59hec (30.69 sq.km), river sand was 638.88hec (6.39sq.km), scrub land was 1829.17hec (18.29sq.km) water bodies were 1193.28hec (11.93sq.km), and without scrub land was 2026.59 (20.27sq.km) respectively out of the total land extent. During 2009 the aerial distribution of the land use land cover have been presented in the Table 2. and Fig 2. 1. Thiruvaiyaru block the imageries for the year 2009 were collected from LISS 111 data. The agricultural land was 9055.01hec (90.55sq.km), built-up land was 2092.69hec (20.93q.km), fallow land was 1151.66hec (11.52sq.km), mixed plantation was 2395.92hec (23.96sq.km), river sand was 386.06hec (3.86sq.km), scrub land was 690.99hec (6.91sq.km), water bodies were 498.54hec (4.99sq.km), and without scrub land was 659.76hec (6.60sq.km) of the total land extent. During 2009 the aerial distribution of the land use land cover have been presented in the Table 4 and Fig 2.1. Kumbakonam block the imageries meant for the year 2009 were taken into LISS 111 data. The agricultural lands were 16484.02hec (164.84sq.km), built-up land was 5098.62hec 50.99sq.km, fallow land was 801.56hec 8.01sq.km, mixed plantation was 4007.17hec (40.07sq.km), river sand was 388.11hec (3.88sq.km), scrub land was 1014.97hec (10.15sq.km), water bodies were 379.15hec (3.79sq.km), and without scrub land was 854.40hec (8.54sq.km) of the total land extent. During 2009 the aerial distribution of the land use land cover have been presented in the Table 2 and Fig. 2.1.

Papanasam block the imageries for the year 2009 based on the classifications are used in the LISS 111 data were taken into account. The agricultural lands were 8559.58hec (85.60sq.km), built-up land was 1544.90hec (15.45sq.km), fallow land was 935.77hec (9.36sq.km), mixed plantation was 1542.42hec (15.42sq.km), river sand was 679.08hec (6.79sq.km), scrub land was 407.15hec (4.07q.km), water bodies were 402.75hec (4.03sq.km), and without scrub land was 482.34hec (4.82sq.km) respectively out of the total land extent. During 2009 the aerial distribution of the land use land cover have been presented in the Table 3 and Fig. 2.1. Thanjavur block the imageries for the year 2009 based on the LISS 111 data. The agricultural land was 18576.27hec (185.76sq.km), built-up land 11963.80hec (119.64sq.km), fallow land was 2944.12hec (29.44sq.km), mixed plantation was 3542.42hec (35.42sq.km), river sand was 302.10hec (3.02sq.km), scrub land was 2471.83hec (24.72sq.km), water bodies were 417.35hec (4.17sq.km), and without scrub land was 3162.11hec (31.62sq.km) respectively out of the total land extent. During 2009 the aerial distribution of the land use land

Table. 2. Land use and land cover in the year of 2009 in block wise of Thanjavur District

Land use and land cover classes 2009	Ammapettai		Budalur		Kumbakonam		Mathukkur		Orathanadu	
	Area (hec)	Area (sq.km)	Area (hec)	Area (sq.km)	Area (hec)	Area (sq.km)	Area (hec)	Area (sq.km)	Area (hec)	Area (sq.km)
	10920.54	109.21	14455.59	144.56	16484.02	164.84	9052.02	90.52	18495.49	184.95
Built up land	3621.59	36.22	3485.01	34.85	5098.62	50.99	2372.07	23.72	4813.24	48.13
Fallow land	2802.00	28.02	1649.88	16.50	801.56	8.02	876.89	8.77	2881.68	28.82
Mixed plantation	2257.8	22.57	3068.59	30.69	4007.17	40.07	3693.53	36.94	3910.40	39.10
River sand	106.82	1.07	638.88	6.39	388.11	8	356.65	3.57	356.64	3.57
Scrub land	1000.24	10.00	1829.17	18.29	1014.97	10.15	423.43	4.23	786.58	7.87
Water body	550.54	5.51	1193.28	11.93	379.15	3.79	447.14	4.47	262.56	2.63
Without scrub land	2397.47	23.97	2026.59	20.27	854.40	8.54	423.28	4.23	853.40	8.53
Total	23657.00	236.57	28347.47	283.47	29028.00	290.28	17645.01	176.45	32360.00	323.60

Fig. 2.1. Land use land cover block wise details of Thanjavur district - satellite images and maps in 2009



cover have been presented in the Table 3 and Fig. 2.1. Thiruvidaimaruthur block the imageries for the year 2009 were taken from LISS 111 data. The agricultural land was 10196.97hec (101.97sq.km), built-up land was 2498.83hec (24.99sq.km), fallow land was 956.65hec (9.57sq.km), mixed plantation was 2774.74hec (27.75sq.km), scrub land was 289.69hec (2.90sq.km), without scrub land was 209.56hec (2.10sq.km), water bodies were 343.57hec (3.44sq.km) respectively of the total land extent. During 2009 the aerial distribution of the land use land cover have been presented in the Table 4 and Fig 2.2. Thiruppanandal block the imageries for the year 2009 were based on the LISS 111 data. The

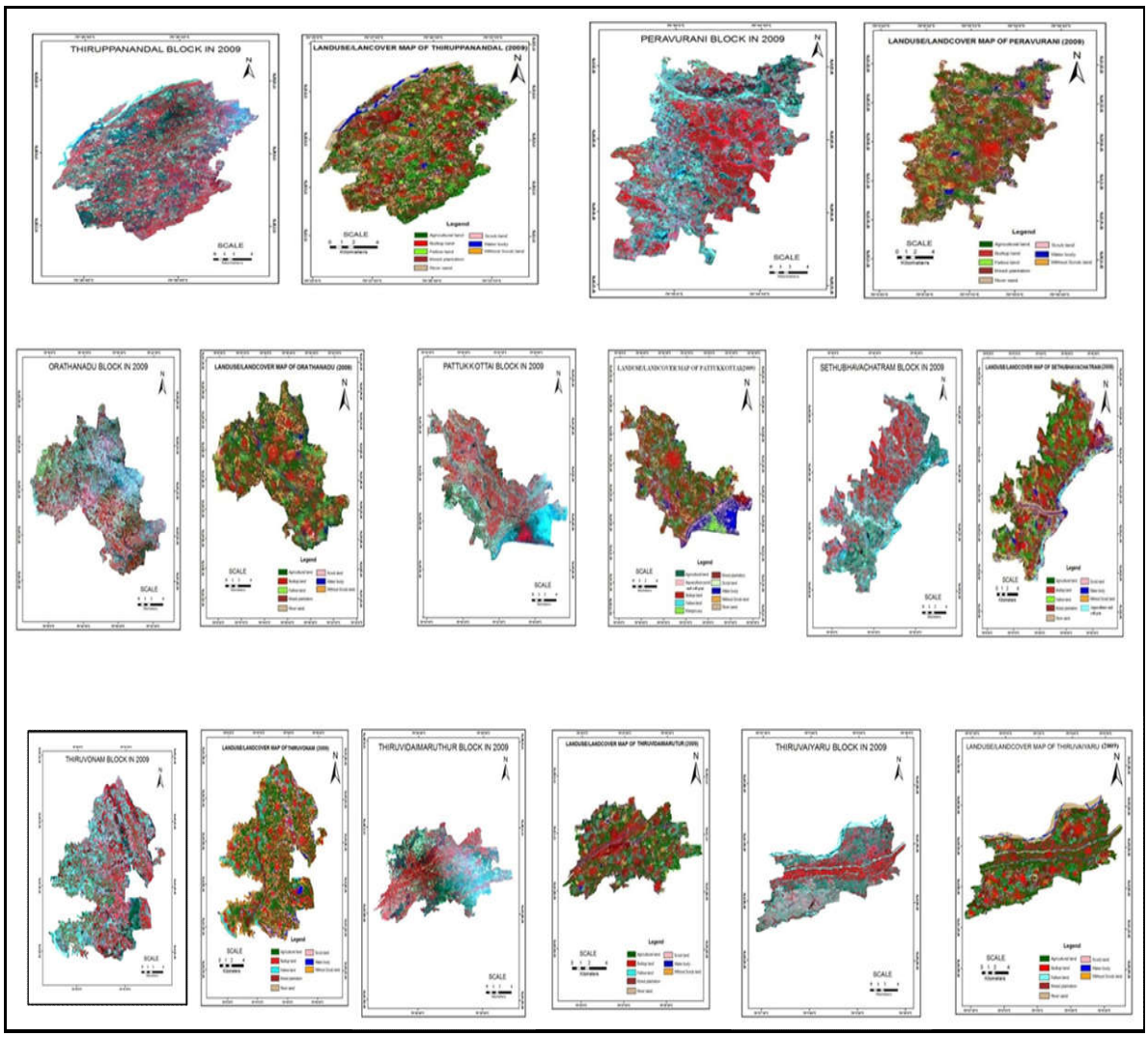


Fig. 2.2. Land use land cover block wise details of Thanjavur district - satellite images and maps in 2009

Table. 3. Land use and land cover in the year of 2009 in block wise of Thanjavur district

Land use and land cover classes 2009	Pattukottai		Sethubhachatram		Papanasam		Peravurani		Thanjavur	
	Area (hec)	Area (sq.km)	Area (hec)	Area (sq.km)	Area (hec)	Area (sq.km)	Area (hec)	Area (sq.km)	Area (hec)	Area (sq.km)
Agricultural land	14800.55	148.01	13028.54	130.28	8559.58	85.60	13806.69	138.07	18576.27	185.76
Aquaculture & Saltpan	2005.37	20.05	1083.00	10.83	Nil	Nil	Nil	Nil	Nil	Nil
Built up land	6418.20	64.18	2445.77	24.46	1544.90	15.45	2877.36	28.77	11963.80	119.64
Fallow land	1039.40	10.40	1822.92	18.23	935.77	9.36	984.01	9.84	2944.12	29.44
Mixed plantation	2786.45	27.86	3420.00	34.20	1542.42	15.42	2520.88	25.21	3542.42	35.42
River sand	287.89	2.88	311.6	3.12	679.08	6.79	396.98	3.97	302.10	3.02
Scrub land	1002.58	10.03	978.89	9.79	407.15	4.07	962.16	9.62	2471.83	24.72
Water body	1014.55	10.15	428.72	4.29	402.75	4.03	245.76	2.46	417.35	4.17
Without scrub land	1094.56	10.95	808.41	8.08	482.34	4.82	918.16	9.18	3162.11	31.62
Mangroves	1719.44	17.19	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Marshy land	290.01	2.90	478.1	4.78	Nil	Nil	Nil	Nil	Nil	Nil
Total area	32559.00	325.59	24805.912	248.05	14554.00	145.54	22713.11	227.12	43380.00	433.80

agricultural land was 8663.33hec (86.63sq.km), built-up land was 2305.71hec (23.06sq.km), fallow land was 530.88hec (5.31sq.km), mixed plantation was 3143.65hec (31.44sq.km), river sand was 346.15hec (3.46sq.km), scrub land was 623.02hec (6.23sq.km), water bodies were 320.15hec (3.20sq.km), and without scrub land was 707.12hec (7.07sq.km) of the total land extent. During 2009 the aerial distribution of the land use land cover have been presented in the Table 4 and Fig. 2.2. Orathanadu block the imageries for the year 2009 based on the classifications were used in the LISS 111 data were taken into account. The agricultural land were 18495.49hec (184.95sq.km), built-up land was 4813.24hec (48.13sq.km), fallow land was 2881.68hec (28.82sq.km), mixed plantation was 3910.40hec (39.10sq.km), river sand was 356.64hec (3.57sq.km), scrub land was

Table.4. Land use and land cover in the year of 2009 in block wise of Thanjavur district

Land use and land cover classes 2009	Thiruppanandal		Thiruvaiyaru		Thiruvidaimaruthur		Thiruvonam	
	Area (hec)	Area (sq.km)	Area (hec)	Area (sq.km)	Area (hec)	Area (sq.km)	Area (hec)	Area (sq.km)
Agricultural land	8663.33	86.63	9055.01	90.55	10196.97	101.97	10983.37	109.83
Built up land	2305.71	23.06	2092.09	20.92	2498.83	24.99	2974.24	29.74
Fallow land	530.88	5.31	1151.63	11.52	956.65	9.57	796.22	7.96
Mixed plantation	3143.65	31.44	2395.92	23.96	2774.74	27.75	3386.28	33.86
River sand	346.15	3.46	386.06	3.86	Nil	Nil	Nil	Nil
Scrub land	623.02	6.23	690.99	6.91	289.69	2.90	644.22	6.44
Water body	320.15	3.20	498.54	4.99	209.56	2.10	457.07	4.57
Without scrub land	707.12	7.07	659.76	6.60	343.57	3.44	568.61	5.69
Total	16640.00	166.40	16930.00	169.30	17270.00	172.70	19810.00	198.10

Table 5. Rankwise land use and land cover details in Thanjavur district

Land use and land cover classes 2009 in %	Agriculture land		Built-up land		Fallow land		Mixed plantation		Water bodies		River sand		Scrub land		Without scrub land		Aquaculture and salt pan		Marshy land		Mangroves	
	%	R_3	%	R_3	%	R_3	%	R_3	%	R_3	%	R_3	%	R_3	%	R_3	%	R_3	%	R_3	%	R_3
Ammapettai	46.16	12	15.31	4	11.84	1	9.54	14	2.3	6	0.45	10	10.13	1	10.1	1	Nil	Nil	Nil	Nil	Nil	Nil
Budalur	51.00	11	12.29	12	5.82	7	10.83	10	4.21	1	2.25	3	7.15	3	7.15	3	Nil	Nil	Nil	Nil	Nil	Nil
Kumbakonam	56.79	5	17.56	3	2.76	14	13.80	6	1.31	10	1.34	7	2.94	10	2.94	10	Nil	Nil	Nil	Nil	Nil	Nil
Papanasam	58.81	3	10.61	13	6.43	6	10.60	11	2.77	4	4.67	1	3.31	8	3.31	8	Nil	Nil	Nil	Nil	Nil	Nil
Thanjavur	42.82	14	27.58	1	6.79	5	8.17	12	0.96	13	0.70	12	7.29	2	7.29	2	Nil	Nil	Nil	Nil	Nil	Nil
Thiruvaiyaru	53.49	8	12.36	11	6.80	4	14.15	5	2.94	3	2.28	2	3.90	6	3.90	6	Nil	Nil	Nil	Nil	Nil	Nil
Thiruvidaimaruthur	59.04	2	14.47	7	5.54	8	16.06	4	1.21	11	-	-	1.99	14	1.99	14	Nil	Nil	Nil	Nil	Nil	Nil
Thiruppanandal	52.06	9	13.86	8	3.21	12	18.88	2	1.92	8	2.08	4	4.25	4	4.25	4	Nil	Nil	Nil	Nil	Nil	Nil
Orathanadu	57.16	4	14.87	6	8.91	1	12.08	8	0.81	14	1.10	9	2.64	12	2.64	12	Nil	Nil	Nil	Nil	Nil	Nil
Thiruvonam	55.44	7	15.01	5	4.02	11	17.09	3	2.31	7	-	-	2.87	11	2.87	11	Nil	Nil	Nil	Nil	Nil	Nil
Mathukkur	51.30	10	13.44	9	4.97	9	20.93	1	2.53	5	2.02	5	2.40	13	2.40	13	Nil	Nil	0.89	2	Nil	Nil
Pattukkottai	45.46	13	19.71	2	3.19	13	8.16	13	3.12	2	0.88	11	3.36	7	3.36	7	6.1	1	1.93	1	5.2	1
Sethubavachatram	52.52	6	9.86	14	7.35	3	13.79	7	1.72	9	1.26	8	3.26	9	3.26	9	4.3	2	Nil	Nil	Nil	Nil
Peravurani	60.79	1	12.67	10	4.33	10	11.10	9	1.08	12	1.75	6	4.04	5	4.04	5	Nil	Nil	Nil	Nil	Nil	Nil

Table 6. Thanjavur district land use and land cover in 2009 (area in sq.km)

S.No	Land use and land cover classes	2009
1	Agricultural land	1775.4
2	Aquaculture and saltpan	26.9
3	Built-up land	545.12
4	Fallow land	201.75
5	Mixed plantation	424.49
6	River sand	45.58
7	Scrub land	131.25
8	Water body	68.29
9	Without scrub land	150.99
10	Marshy lands	7.68
11	Mangroves	19.55
	Total	3397

Table 7. Training samples from Land use and Land cover

Location (village name)	Geographical location		Land use and land cover details
	Latitude	Longitude	
Nanjikottai	N 10 44 58	E79 08 31	Agriculture crop
Marungulam	N 10 40 52	E79 08 36	Agriculture crop
Kurungulam Melpathi	N 10 40 29	E 79 04 62	Buildup land
Thirukanur patti	N 10 43 48	E 79 05 84	Agriculture crop
Madigai	N 10 42 99	E 79 12 26	Mixed plantation
Soorakottai	N 10 44 66	E 79 11 33	Scrub land
Palliyakragaram	N 10 49 62	E 79 08 40	Scrub land
Thittai	N 10 50 33	E 79 10 90	Agriculture crop
Mathur	N 10 52 47	E 79 09 88	Mixed plantation
Manonkorai	N 10 51 45	E 79 09 49	Agriculture crop
Thandangorai	N 10 52 08	E 79 09 91	Buildup land
Ramapuram	N 10 50 80	E 79 09 14	Agriculture crop
Sengipatti	N 10 43 02	E 78 57 28	Scrub land
Budalur	N 10 48 35	E 78 53 57	Agriculture crop
Orathur	N10 48 35	E 78 58 43	River sand
Manaiyeripatti	N10 44 77	E 79 05 36	Agriculture crop
Cholagampatti	N10 46 62	E 78 59 23	Water body
Koviladi	N10 53 74	E 79 32 76	Agriculture crop
Achampatti	N 10 41 22	E 78 51 28	Water body
Melathirupantiruthy	N 10 51 63	E 79 04 74	Agriculture crop
Naducavery	N10 51 66	E 79 03 03	Scrub land
Thiruvaiyaru	N 10 52 74	E 79 06 22	Agriculture crop
Kandiyur	N10 51 69	E 79 06 51	Buildup land
Kulimathur	N 10 51 68	E 79 01 91	Scrub land
Ayyempettai	N 10 53 81	E 79 11 36	Buildup land
Valuthur	N 10 54 34	E 79 12 54	Buildup land
Udayasuriyapuram	N10 24 98	E 79 16 62	Scrub land
Parakalakottai	N10 23 84	E 79 24 79	Without scrub land
Vadakadu	N10 23 20	E 79 21 54	Salt pan
Thuvarankurichy	N 10 24 23	E 79 21 81	Water body
Dalamuthi	N 10 27 66	E 79 17 67	Buildup land
Rajagiri	N 10 55 22	E 79 14 67	Water body
Pandaravadai	N 10 55 05	E 79 14 18	Mixed plantation
Soolamangalam	N 10 55 58	E 79 15 79	Agriculture crop
Manaloor	N 10 52 43	E 79 06 41	Mixed plantation
Thirumangudi	N 10 56 37	E 79 16 81	Mixed plantation
Kabisthalam	N 10 53 18	E 79 18 56	Mixed plantation
Ullikadai	N 10 51 39	E 79 24 59	Buildup land
Sundaraperumal koil	N 10 56 42	E 79 18 42	Without scrub land
Darasuram	N 10 57 96	E 79 21 37	River sand
Kumbakonam	N 10 57 49	E 79 23 28	Buildup land
Ullur	N 10 58 41	E 79 24 32	Agriculture crop
Kovilacheri	N 11 01 50	E 79 24 52	Water body
Cholapuram	N 11 03 42	E 79 24 90	Mixed plantation
Senganur	N 11 04 58	E 11 04 58	Scrub land
Swamimalai	N 10 56 63	E 79 19 76	Water body
Vadapathy	N 10 47 33	E 79 18 34	Mixed plantation
Ukkadai	N 10 47 56	E 79 18 64	Mixed plantation
Kalanjeri	N 10 48 94	E 79 16 23	Water body
Irumbu thalai	N 10 49 56	E 79 16 20	Agriculture crop
Kovirthakudi	N 10 49 56	E 79 16 20	Buildup land
Pulavarnatham	N 10 46 93	E 79 12 82	Buildup land
Saliyamangalam	N 10 46 92	E 78 16 33	Water body
Ammapettai	N 10 50 38	E 79 12 04	Water body
Thittai	N 10 50 33	E 79 10 90	Agriculture crop
Neyithalur	N 10 50 35	E 79 10 97	Agriculture crop
Govindapuram	N 11 01 03	E 79 28 81	Scrub land
Sathanur	N 11 02 82	E 79 28 21	Without scrub land
Suriyanarkoil	N 11 01 60	E 79 28 58	Water body
Thirubhuvanam	N 10 59 32	E 79 28 58	Buildup land
Thiruvidaimarudur	N 10 59 82	E 79 27 12	Water body
Thiruppanandal	N 11 05 67	E 79 27 18	Water body
Kurichi	N 11 06 89	E 79 28 38	Agriculture crop
Athipakam	N 11 07 82	E 79 29 87	Without scrub land
Pattam	N 11 06 31	E 79 27 29	Water body
Kattangarai	N 11 04 46	E 79 27 64	Without scrub land
Pandanallur	N 11 07 93	E 79 30 94	Buildup land
Manikudi	N 11 04 30	E 79 27 69	River sand
Keelasooriyamoolai	N 11 03 34	E 79 28 13	Agriculture crop
Kanjanur	N 11 03 02	E 79 27 82	Agriculture crop
Melkattur	N 1107 01	E 79 29 09	Scrub land
Ullur	N 10 40 92	E 79 14 26	Water body
Thugili	N 10 38 72	E 79 14 26	Agriculture crop
Oratha nadu	N 10 37 25	E 79 14 86	Agriculture crop
Pudur	N 10 35 85	E 79 15 74	Mixed plantation
Kattu kuruchi	N 10 41 31	E 79 12 33	Scrub land
Kokkaraikottai	N 10 36 38	E 79 12 61	Mixed plantation
Vasthasavadi	N 10 45 85	E 79 10 06	Without scrub land
Pappanadu	N 10 33 63	E 79 16 42	Scrub land
Thelungan kudikadu	N 10 33 63	E 79 16 42	Water body
Kovilur	N 10 36 93	E 79 14 08	Water body
Madukkur	N 10 29 04	E 79 23 75	Buildup land

786.58hec (7.87sq.km), water bodies was 262.56hec (2.63sq.km), and without scrub land was 853.40hec (8.53sq.km) respectively out of the total land extent. During 2009 the aerial distribution of the land use land cover have been presented in the Table 2, and Fig, 2.2. Thiruvonam block the imageries for the year 2009 based on the classifications and obtained from LISS 111 data were considered. The agricultural land was 10983.37 hec (109.83sq.km), built-up land was 2974.24hec (29.74sq.km), fallow land was 796.22hec (7.96sq.km), mixed plantation was 3386.28hec (33.86sq.km), scrub land was 644.22hec (6.44sq.km), without scrub land was 568.61hec (5.69sq.km), and water bodies were 457.07hec (4.57sq.km) respectively, out of the total land extent. During 2009 the aerial distribution of the land use land cover have been presented in the Table 4 and Fig. 2.2. Madukkur block the imageries for the year 2009 based on the LISS 111 data were taken into account. The agricultural lands were 9052.02hec (90.52sq.km), built-up land was 2372.07hec (23.72sq.km), fallow land was 876.89hec (8.77sq.km), mixed plantation was 3693.53hec (36.94sq.km), river sand was 356.65hec (3.57sq.km), scrub land was 423.43hec (4.23sq.km), water bodies were 447.14hec (4.47sq.km), and without scrub land was 423.43hec (4.23sq.km) of the total land extent. The detailed changes have been analyzed in the change detection part. During 2009 the aerial distribution of the land use land cover have been presented in the Table 2 and Fig 2.1. Peravurani block the imageries for the year 2009 based on the classifications were made in the LISS 111 data. It was formed the agricultural land covering 13806.69hec (138.07sq.km), built-up land was 2877.36hec (28.77sq.km), fallow land was 984.01hec (9.84sq.km), mixed plantation was 2520.88hec (25.21sq.km), river sand was 396.98hec (3.97sq.km), scrub land was 962.16hec (9.62sq.km), water bodies were 245.76hec (2.46sq.km), and without scrub land was 918.16hec (9.18sq.km) respectively out of the total land extent. During 2009 the aerial distribution of the land use land cover have been presented in the Table 3 and Fig. 2.2. Pattukkottai block the imageries for the year 2009 based on the classifications used in the LISS 111 data structure, were considered. The agricultural land was 17800.55hec (178.01sq.km), built-up land was 3418.20hec (34.18sq.km), fallow land was 1039.60hec (10.40sq.km), mixed plantation was 2786.45hec (27.86sq.km), river sand was 287.89 hec (2.88sq.km), scrub land was 1002.58hec (10.03sq.km), water bodies were 1014.55hec (10.15sq.km), without scrub land was 1094.56hec (10.95sq.km), aquaculture pond and salt pan 2005.37hec (20.05sq.km) mangroves were 1719.44hec (17.19sq.km), and marshy land was 290.01hec (2.90 sq.km). During 2009 the aerial distribution of the land use land cover have been presented in the Table 3 and Fig 2.2. Sethubavachatram block the imageries meant for the year 2009 based on the classifications used in the LISS 111 data were taken into account. The agricultural lands were 130.28hec (130.28sq.km), aquaculture and salt pan was 1083hec (10.83sq.km), built-up land was 2445.77hec (24.46sq.km), fallow land was 311.6hec (18.23sq.km), mixed plantation was 3420hec (34.20sq.km), river sand was 311.6hec (3.12sq.km), scrub land was 978.89hec (9.79sq.km), water bodies were 428.72hec (4.29sq.km), without scrub land was 808.41hec (8.08sq.km), and marshy land 478.72hec (4.78sq.km) respectively out of the total land extent. During

2009 the aerial distribution of the land use land cover have been presented in the Table 3 and Fig. 2.2.

RANK CORRELATION

The researcher followed to block wise land use and land cover classification, so the importance of Spearmen's (1904) rank correlation methods. This method is based on rank. Here the researcher followed to the rank wise result has been followed, not followed to correlation method. This measure is useful in dealing with qualitative characteristics, such as intelligence, beauty, mortality, character, etc. It could not be measured quantitatively, as in the case of Sperarson's coefficient of correlation; but it is based on the ranks given to the observations. Rank correlation is applicable only to individual observations. The result arrived from this method is only an approximate one, because under ranking method original value was not taken into account. All rank wise land use and land cover categories of mention to Table 5.

RESULT AND DISCUSSION

The total Thanjavur district land use and land cover categories of agricultural land was 1775.4sq.km, aquaculture and salt pan was 26.9sq.km, built-up land was 545.12sq.km, fallow land was 201.75sq.km, mixed plantation was 424.49sq.km, river sand was 45.58sq.km, scrub land was 131.25sq.km, water bodies were 68.29sq.km, without scrub land was 150.99sq.km, marshy land was 7.68sq.km, and mangroves 19.55sq.km. The district wise details are given to Table 6. The Rank wise land use and land cover categories of the agriculture land was the first rank of the block of Peravurani, the built-up land was the first rank of the block of Thanjavur,the fallow land was the first rank of the block of Orathanadu, the mixed plantation was the first rank of the block of Mathukkur, the water bodies were the first rank of the block of Budalur, the river sand was the first rank of the block of Papanasam, the scrub land was the first rank of the block of Ammapettai, the without scrub land was the first rank of the block of Ammapettai, the Aquaculture land was the first rank of the block of Pattukottai, the marshy land was the first rank of the block of Pattukottai, the mangroves were the first rank of the block of Pattukottai. The blocks of the rank wise details are given to the table. Mainly the land use and land cover changes of identified in the 14 blocks of agriculture land was high level because of Thanjavur district is the Rice bowl of Tamil Nadu, so the agricultural productions and agricultural land has been high, second land use category of mixed plantations and third category of built-up land and fallow land has been concentrated. In this district southern side is coastal region so the aquaculture, salt pan, mangroves and marshy lands are highly concentration. These are the land use and land cover details have been in Thanjavur district. The researcher followed to the field check reading of GPS points mention to Table 7.

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REFERENCES

Anderson, J.R., Hardy, E.E., Reach, J.T. and Witmer, R.E. 1976. A Land use and Land cover classification system for use with Remote sensor data, US Geological Survey Professional paper 964. U.S. Department of interior, U.S.government printing office, Washington, D.C., 28pp.

Chaitanya S.Agarwal, Pradeep K. Garg, 2000. Remote sensing in Natural Resources monitoring and management. Pp.114-116.

Gautham N.C. and Narayan L.R.A. 1982. Suggested national land use/land cover classification system for India using remote sensing techniques', Mathura: Pink Publishing House.

Jensen, J. R., and Toll, D. L., 1983, Detecting residential land use development at the urban fringe. *Photogrammetric Engineering and Remote Sensing,* 48, 629–643.

Rajesh,Y. , Divya, P. and Chandrashekara, S. 2010. Land use Land cover change detection of Hemavathi watershed in Cauvery Basin in Karnataka state using Remote sensing and GIS. Proceeding of the National seminar on trends in Geospatial Data analysis for Resources and Environmental management, Madurai Kamarajar university, Madurai pp. 208-209.

Sumathi, M, *et al.,* 2011. An analysis on land use / land cover using remote sensing Techniques- A case study of Pudukkottai district, Tamil Nadu, Iindia, *International Journal of Current Research,* Vol. 33, Issue, 6, pp.304-307, June, 2011.

Spearman, 1907. Statistics Book, ISBN.81-219-0431-5.Pp. 363-392.

Singh, A., and Harrison, A., 1985. Standardized principal components. *International Journal of Remote Sensing*, 6: 883–896.

Singh, A. 1986. Change detection in the tropical forest environment of Northeastern India using Landsat. In Remote Sensing and Tropical Land Management, edited by M. J. Eden and J. T. Parry (New York: J. Wiley), pp 237–254.

Santhi Devi, R. and Victor Rajamanickam, G. 2004. Application of Remote sensing and GIS Techniques for land use / land cover change analysis in Vedaranyam, *Indian Jour. of Geomorphology*, vol,9, (1&2), pp.53-58.

Sandhi devi, R., Victor Rajamanickam, and Uma sabitha, A., 2005. Geomorphology of the coast between Devipattinam to Sethubhavachattram, Tamil Nadu. *Indian Journal of Geomorphology*, Vol.10 (1&2).

Shepard, J. R. 1964. A concept of change detection. *Photogrammetric Engineering*, 30, pp. 648-651.

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