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A Spatio – Temporal analysis and mapping of Land use Land cover change of Thanjavur block using remote sensing and GIS

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***Abstract*: Land use land cover and its changes in Thanjavur block located in the Cauvery delta region of Tamil Nadu, India, has been the main motivation of the study. Understanding of spatial distribution of land use land cover and its changes for planning, utilization and sustainable management to support the demands made by human. Land use land cover pattern has been carried out with effective tool of ArcGIS using supervised classification. The study has concluded that agriculture area has increased along with built up land, whereas fallow land has been decreasing.**

***Keywords:* Land use, Land cover, Thanjavur, land use land cover change, ArcGIS.**

1. INTRODUCTION

The most significant natural resources available on the earth is - land, it constitute of more components like soil, water, flora and fauna involving the total ecosystem on which most of the living creature survive and all activities of human are based. The growing human population pressure and their activities made a demand for the land resources for their survival. Understanding of spatial distribution of land use land cover and its changes for planning, utilization and sustainable management to support the demands made by human is important. (Shankaranarayanan & Sen, 1977) (Dhinva et al., 1992)(Alphan, 2003) (Muttitanon & Trpathy, 2005). This understanding of land use also provides the present environmental process and problems, as it considered as one of the major global environmental changes for making a decision to leave the present condition and standard as it is or to be improved (Anderson, 1976) (Giri et al., 2005). Land use land cover also provides the information like standard of living of the people and available natural resources in the region. Land use indicates the man's activities and the varied uses which are carried on over land. Land cover refers to natural vegetation, water bodies, artificial cover, rock, soil and other noticed on the land (NRSA, 1989). Combination of Remote sensing data and Geographical information system has been considered as the best platform for identification and mapping of land use land cover of a region (Gautam& narayanan, 1983) (Sharma et al., 1984)(Jain, 1992) (Brahabhatt et al., 2000). Remote sensing provides an excellent source of data from which updated land use land cover information and changes can be extracted, analyzed and simulated efficiently.

Motivation:

The main motivation is to study the land use land cover patterns and its changes for the year 1980, 2000 and 2017 in Thanjavur block of Tamil Nadu.

Objectives:

- To study the land use land cover pattern of Thanjavur block
- To find the land use land cover changes in the Thanjavur block
- To analyze and mapping of land use land cover changes using GIS.

Study area:

Thanjavur block located in the Thanjavur district of Tamil Nadu. The most significant urbanized block in the Thanjavur district is Thanjavur block with total area of 411 Sq. Km.

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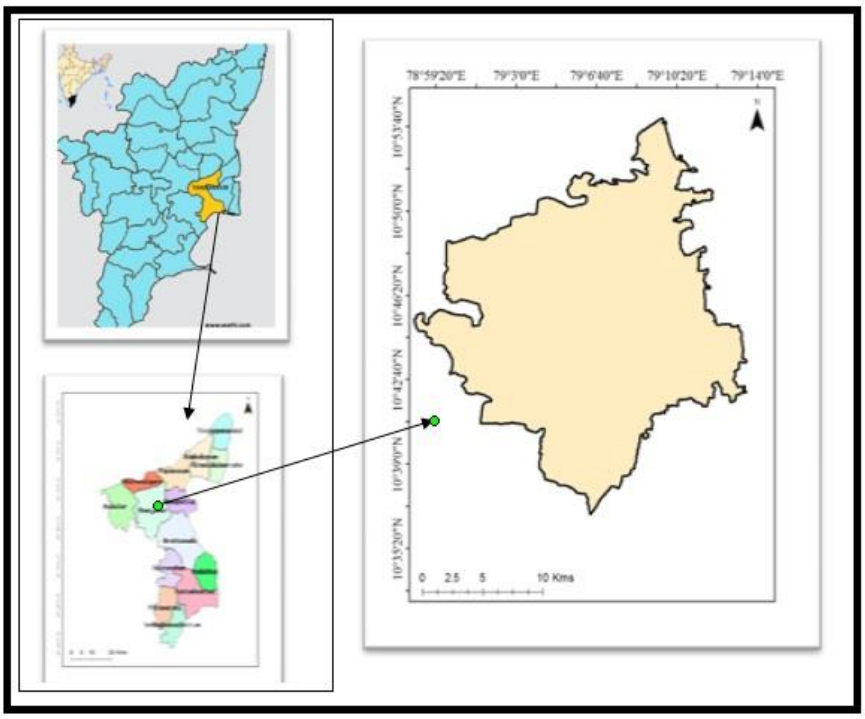
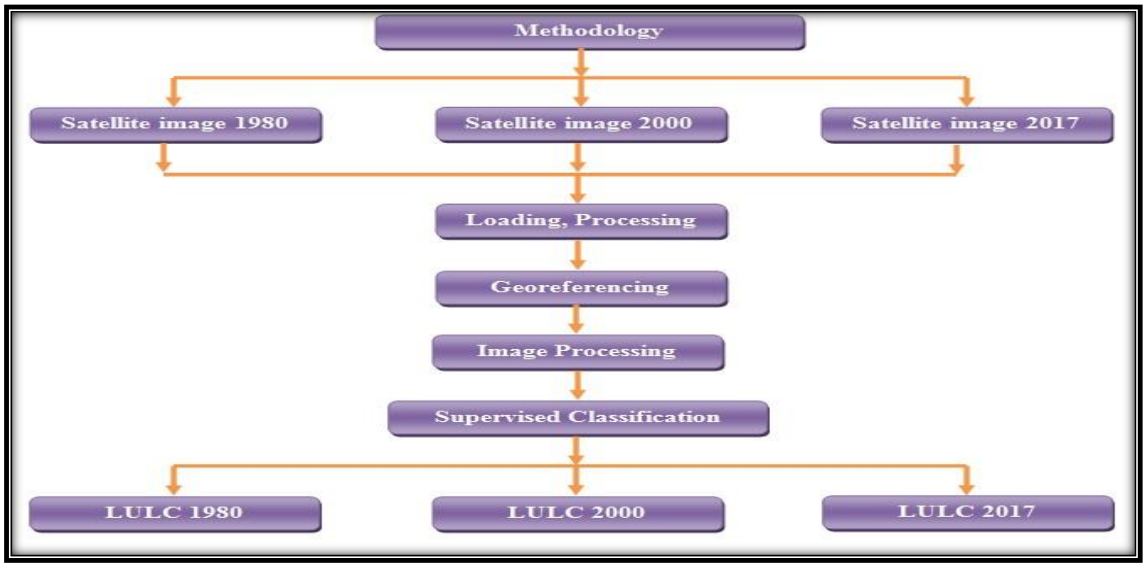


Fig 1: Location map of Thanjavur block

Thanjavur block has 61 villages with bounded by Papanasam, Kumbakonam and Ammapettai block in the East, Budalur block in the west, Orathanadu and Madukkur in the south and Thiruvaiyaru block in the north. Thanjavur block is situated in the Cauvery delta region which supports the agriculture in large extent. The study area lies between the longitude of 79^0 0' 15" E to 79^0 14' 0" E and latitude extension of 10^0 33' 30" N to 10^0 55' 30" N shown in Fig. 01.

2. MATERIAL AND METHODOLOGY

The source of data for the years 1980, 2000 and 2017 has been taken from United States geological survey. USGS satellite images of LANDSAT 3 MSS data for 1980, LANDSAT 7 ETM for the year 2000 and LANDSAT 8 OLI data for 2017 are used for inference. A supervised signature extraction with help of maximum likelihood algorithm is employed to classify the land use land cover using ArcGIS 10.2. The study adopted the NRSC classification of Agriculture land, built up land, current fallow, fallow land and water bodies. Post classification comparison method is used most commonly for estimation of changes in the land use land cover category using two different period of land use land cover map (Jensen, 1996) (Mas, 1999) (Lillesand, 2014)



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3. RESULT AND DISCUSSION

Agriculture land:

Land used for growing of crops like food crops, commercial crops, plantation crops and horticulture crops are categorized as agriculture land use (NRSC, 1989). In our study with help of satellite data this category of agriculture land use land cover are classified up to level II classification which includes crop land, current fallow and fallow land.

a) Agriculture

Crop land in the study area is located only in the northern parts during the year 1980, which slightly extents into central parts during the year 2000 and further extends into southern parts during the year 2017 shown in the Fig. 02, 03 and 04. During the year 1980 the agriculture land in the Thanjavur block is 121.73 sq. km, which is 29.68 percent of the total geographical area. During the year 2000 and 2017 this agriculture land occupied 161.28 sq. km and 190.07 sq. km which shares 39.32 percent and 46.34 percent respectively (Table 1) of the total geographical area shown in the Fig. 03 and 04. This type of land use land cover has been increasing in area that extent from 1980 to 2017 shown in the Fig. 05.

b) Fallow land

An agricultural system is an alteration between a cropping period of several years and a fallow period, this leads to a fallow land. This includes, all land taken up for cultivation but is temporarily out of cultivation for a period of not less than one year and not more than five years. This type of land occupies a total areal extent of 243.44 Sq. Km., which represent 59.36 percent during the year 1980 and this type of land occupies larger area during 1980. During the year 2000 the total area under fallow land is 156.52 Sq. Km which represent 38.16 percent. It becomes 124.47 Sq. Km during the year 2017 which is 30.35 percent of the total geographical area of Thanjavur block shown in the Fig. 02, 03 and 04. Area of fallow land has been decreasing from the year 1980 to 2017 shown in the Fig. 05.

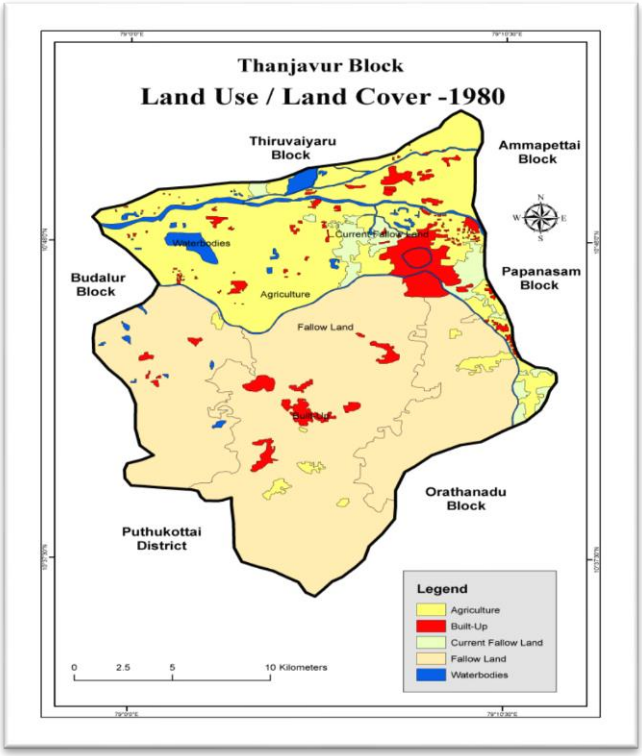

Fig 2: Land use land cover – 1980

c) Current fallow

Agriculture land represents cropped area which is kept fallow during the current year. Table 1 represents the value land use land cover of current fallow. This type of land use land cover category covers 14.22 Sq. Km (3.47 percent) during 1980 shown in the Fig. 02 and it becomes 35.52 Sq. Km which represent 8.66 percent during 2000 shown in the Fig. 03

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and 18.11 Sq.Km (4.42 percent) during 2017 as shown in the Fig. 04. Area of current fallow land has been increased from 1980 to 2000 and started to decrease from 2000 to 2017 shown in the Fig. 05.

d) Built up land

An area of human habitation developed due to non agriculture use and that has a cover of buildings, transport and communication, utilities in association with water vegetation and vacant lands. This built up land consist of three category viz., urban, rural and mining. In our study land use land cover category of built up has been kept as the main focus. Table 1 shows the area and its percentage cover of built up land in the Thanjavur block for the years 1980, 2000 and 2017. Land use land cover category of built up land occupies 16.84 Sq. Km during the year 1980 which is 4.11 percent of the total geographical area of Thanjavur block.

During the year 2000 the build up land use land cover is 46.25 Sq. Km which is 11.28 percent of the total study area. 66.36 Sq. Km area occupy by built up land use land cover during the year 2017 which is 16.18 percent of the total geographical area of Thanjavur block shown in the Table 1 and Fig. 02, 03 and 04. Built up land use land cover has been increasing from 1980 to 2017 shown in the Fig. 05.

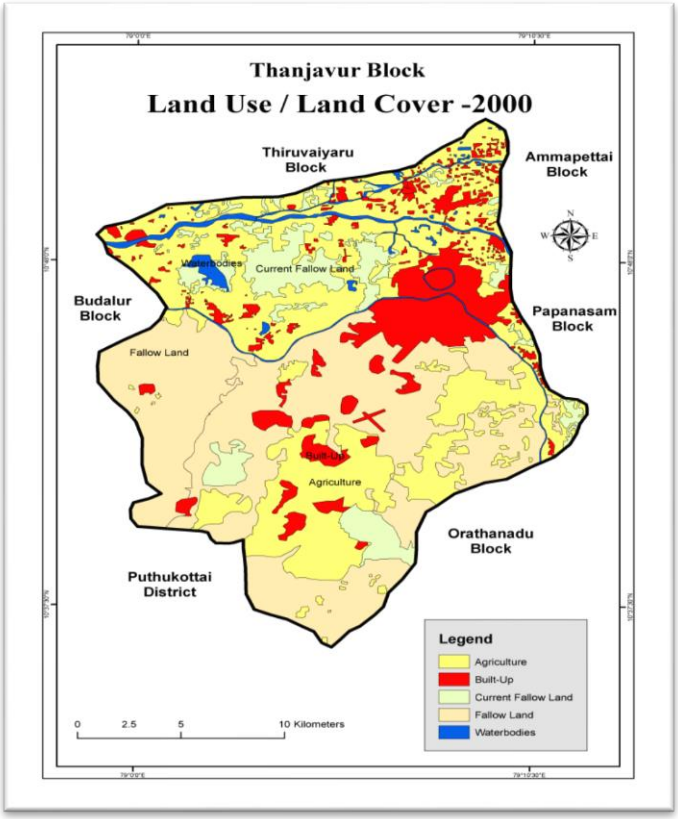

Fig 3: Land use land cover – 2000

Table 1: Land use land cover of Thanjavur block

S.No.	LULC	1980		2000		2017	
		Area (Sq.Km)	%	Area (Sq.Km)	%	Area (Sq.Km)	%
1	Agriculture	121.73	29.68	161.28	39.32	190.07	46.34
2	Built Up	16.84	4.11	46.25	11.28	66.36	16.18
3	Current fallow land	14.22	3.47	35.52	8.66	18.11	4.42
4	Fallow Land	243.44	59.36	156.52	38.16	124.47	30.35
5	water bodies	13.87	3.38	10.56	2.58	11.11	2.71
	Total	410.12	100.00	410.12	100.00	410.12	100.00

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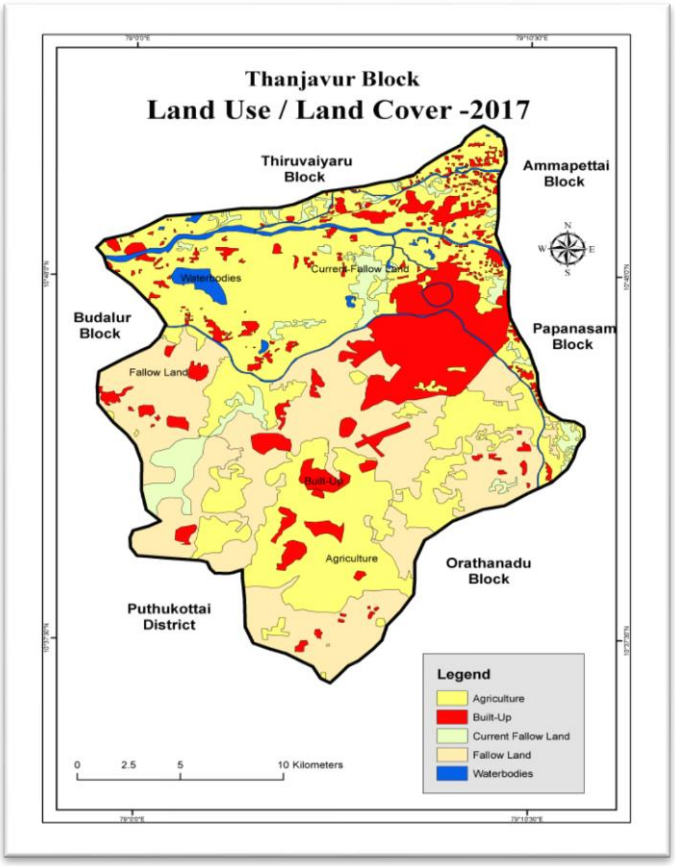

Fig 4: Land use land cover - 2017

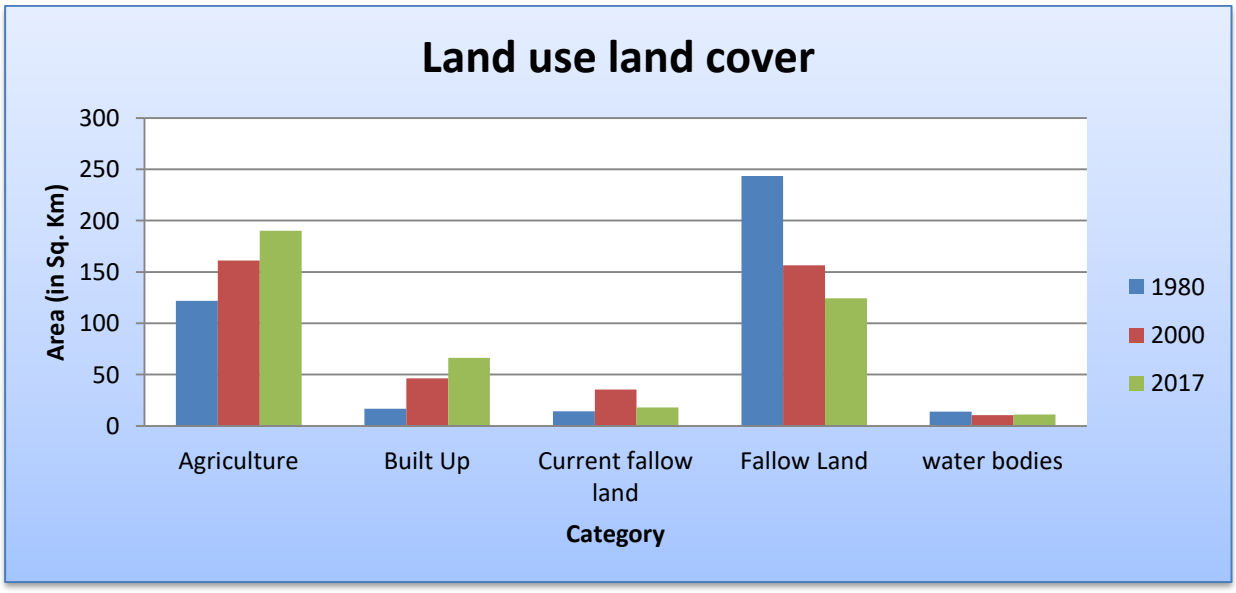

Fig 5: Land use land cover of Thanjavur block

e) Water bodies

Land use land cover category comprises of areas with surface water in the form of ponds, lakes, tanks, reservoirs, streams, canal etc. This type of land use land cover category occupies 13.87 Sq. km which is 3.38 percent of the total geographical area during the year 1980, 10.56 Sq. Km of area during the year 2000, which is 2.58 percent of the total study area. The total area of water bodies during the year 2017 is 11.11 Sq. Km which is 2.71 percent of the total study area shown in the Fig. 02, 03 and 05.

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Tabel 2: Land use land cover change – Thanjavur block

S. No.	LULC	1980 – 2000		2000 - 2017		1980 - 2017	
		Area (Sq. Km)	%	Area (Sq. Km)	%	Area (Sq. Km)	%
1	Agriculture	39.55	9.64	28.79	7.02	68.34	16.66
2	Built Up	29.41	7.17	20.11	4.90	49.52	12.07
3	Current fallow land	21.3	5.19	-17.41	-4.25	3.89	0.95
4	Fallow Land	-86.92	-21.19	-32.05	-7.81	-118.97	-29.01
5	water bodies	-3.31	-0.81	0.55	0.13	-2.76	-0.67

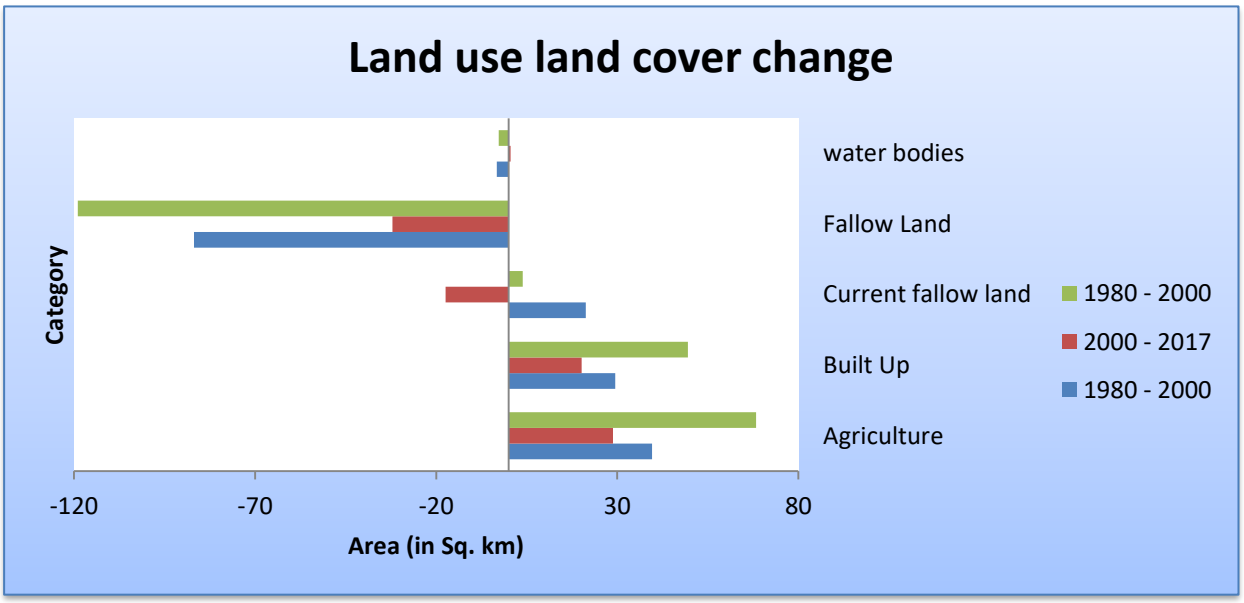

Fig 6: Land use land cover change of Thanjavur Block.

LAND USE LAND COVER CHANGE OF THANJAVUR BLOCK:

There is a continuous change in the area of study from the period 1980 to 2017, since Thanjavur block is located in the Cauvery delta region, agriculture land use land cover has been flourished in large area. Agriculture land use land cover category has been increased 39.55 Sq. Km from 1980 to 2000, 28.79 Sq. Km from 2000 to 2017. Total increase in agriculture area from 1980 to 2017 is 68.34 Sq. km. which is 16.66 percent of increased area from the 1980, which is shown in the Table 2 and Fig. 06. Built up land has also been increased from 1980 to 2017. 29.41 Sq. Km has been increased from 1980 to 2000 and 20.11 Sq. km has been increased from the year 2000 to 2017. The total land use land cover category of Built up land has been increased from 1980 to 2017 is 49.52 Sq. Km, which is an increase of 12.07 percent of the built up land from 1980. Current fallow land has been increased initially at the rate of 5.19 percent from 1980 to 2000 and decreased 17.41 Sq. Km during the period of 2000 to 2017. Therefore, net change from the 1980 to 2017 under built up land use land cover category is 3.89 Sq. Km which is 0.95 percent from 1980. The land use land cover category of fallow land has been decreased at a rate of 21.19 percent from the year 1980 to 2000 and 7.81 percent decrease from 2000 to 2017. It has been noted that nearly 118.97 Sq. Km has been decreased from 1980 to 2017 which is loss of – 29.01 percent. Water bodies have been decreased 3.31 Sq. Km during the period 1980 to 2000 and it increase of 0.55 Sq. Km during the period of 2000 to 2017. The net changes in the areal extent of water bodies in Thanjavur block is decreased to 2.76 Sq. Km from 1980 to 2017 shown in the Table 2 and Fig. 06.

4. CONCLUSION

Thanjavur block is situated in the Cauvery delta region, which supports agriculture in large extent and it is our prime duty to manage the agriculture area in a sustainable way. The present study has identified that agriculture area has been increased in the study area from 1980 to 2017, Land use land cover category of built up has been increased from the year 1980 to 2017. Fallow land has been decreasing since 1980 indicates that it has been converted into built up land and agriculture area. Water bodies decreases from 1980 to 2000 and increased from 2000 to 2017.

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