

Chapter 5

Land use change analysis

5.1 General

Fragmentation is an intuitive concept and involves dividing something into a number of smaller pieces. Fragmentation is characterised by the number and size distribution of the resulting pieces. Most often fragmentation implies the division of natural ecosystems into smaller patches as the result of human activities, such as the development of agricultural or urban areas in places once supporting forests or wetlands. Landscape indices do not serve as useful indicators of fragmentation effects. While certain indices are useful in specific cases, most indices should only be used to describe landscape pattern. The cross table formulated using GIS intersection analysis detailing the changes of the land uses supplemented with the landscape indices are used for studying the change analysis of the study area in two different taluks:

5.2 Land use change analysis: Tharangambadi taluk

The changes of the various land use categories available in Tharangambadi taluk are analyzed village-wise as shown below:

5.2.1 Sattangudi

The change matrices depicting the detailed transformations for the years 1992 – 1997 and 1997 – 2004 for the different land use categories found in the Sattangudi village are shown in the tables 5.1 and 5.2 and the summary statistics in table 5.3.

The fallow/harvested land dominated in most of the parts of the village during the year 1992 (48.78 % of the total area) has been converted into built-up land to a certain extent in the year 1997 and goes highly down in its area by 8.5 % due to its conversions to built-up land, waterlogged area, scrub lands, croplands and agricultural

Table 5.1 Land use Change Matrix for Sattangudi village from 1992 to 1997

Land use category	Sandy area	Built-up area	Tank	Cropland	Fallow/ harvested land	River	Area for 1992 in m²
Sandy area	1250028	2349	0	0	0	0	1252377
Built-up area	0	372076	0	0	0	0	372076
Tank	0	0	57870	0	0	0	57870
Cropland	0	0	0	56881	0	0	56881
Fallow/harvested land	0	108445	0	0	1753049	0	1861493
River	0	1608	0	0	0	213798	215406
Area for 1997 in m²	1250028	484478	57870	56881	1753048	213798	3816104

Table 5.2 Land use Change Matrix for Sattangudi village from 1997 to 2004

Land use category	Sandy area	Built-up area	Water logged area	Tank	Scrub land	Cropland	Fallow/harvested land	Agricultural plantations	River	Area for 1997 in m²
Sandy area	325587	227029	149869	0	11376	432296	34500	69370	0	1250028
Built-up area	0	484478	0	0	0	0	0	0	0	484478
Water logged area	0	0	0	0	0	0	0	0	0	0
Tank	0	40435	0	2720	0	14715	0	0	0	57870
Scrub land	0	0	0	0	0	0	0	0	0	0
Cropland	0	51193	0	0	0	5688	0	0	0	56881
Fallow/harvested land	0	587977	113020	0	71225	652401	289970	27204	11253	1753048
Agricultural plantations	0	0	0	0	0	0	0	0	0	0
River	12365	48473	9769	0	42166	989	0	0	100036	213798
Area for 2004 in m²	337953	1439585	272658	2720	124767	1106089	324469	96574	111289	3816104

Table 5.3 Land use summary statistics of three time periods-Sattangudi Village

S No	Land use category	Year	No of patches	Area (a) in m ²	Perimeter (p) in m	P=(p/a) in %	S1 (min) in m ²	S2 (max) in m ²	S3 (mean) in m ²
1.	Built-up area	1992	4	372076	4012	1.08	430	351354	93019.0
		1997	4	484478	4862	1.00	430	372187	121119.5
		2004	8	1439585	16473	1.14	430	811036	179948.1
2.	Cropland	1992	2	56881	1428	2.51	25076	31805	28440.5
		1997	2	56881	1428	2.51	25076	31805	28440.5
		2004	2	1106089	10640	0.96	1239	1104850	553044.5
3.	Fallow/harvested land	1992	7	1861493	19864	1.07	11243	1326562	265927.5
		1997	7	1753048	19824	1.13	11243	1235023	250435.4
		2004	9	324469	8599	2.65	2010	133226	36052.1
4.	Agricultural plantations	1992	0	0	0	0.00	0	0	0.0
		1997	0	0	0	0.00	0	0	0.0
		2004	5	96574	4447	4.60	4837	32489	19314.8
5.	Water logged area	1992	0	0	0	0.00	0	0	0.0
		1997	0	0	0	0.00	0	0	0.0
		2004	4	272658	4378	1.61	3243	192171	68164.5
6.	Scrub land	1992	0	0	0	0.00	0	0	0.0
		1997	0	0	0	0.00	0	0	0.0
		2004	5	124767	4978	3.99	15008	31477	24953.4
7.	Sandy area	1992	5	1252377	15952	1.27	322	1158865	250475.4
		1997	5	1250028	15823	1.27	322	1156527	250005.6
		2004	5	337953	7493	2.22	3059	315540	67590.6
8.	River	1992	4	215406	7350	3.41	8015	183197	53851.5
		1997	4	213798	7340	3.43	8015	181475	53449.5
		2004	6	111289	5107	4.59	0	50700	18548.2
9.	Tank	1992	2	57870	1377	2.38	6488	51382	28935.0
		1997	2	57870	1377	2.38	6488	51382	28935.0
		2004	1	2720	232	8.53	2720	2720	2720.0

plantations during the year 2004. Similarly the sandy area also has been reduced from 32.81 % (in the year 1992) to 8.86 % of the total area (in the year 2004) by its transformations to built-up land, waterlogged area, cultivable lands, croplands, fallow/harvested lands and agricultural plantations. The built-up land existed on the southern parts of the village by 9.75 % of the total area in the year 1992 slightly extends towards north during the year 1997 and projected towards all the directions of the village during 2004. The cropland found during the year 1992 (1.49 % of the total area) accumulates its area due conversions from fallow/harvested lands, tanks, etc., to give up 28.98 % of the total area of the village during 2004.

The details of the changes of fractal dimensions for the various categories of this village are shown in the table 5.4. The values of the fractal dimensions of all the categories lie between 1.01 and 1.13, which means the shape of the land use type is simple.

The Landscape diversity and dominance index of this village is shown in table 5.53. The table shows that the landscape diversity index was slightly up from 0.53 in 1992 to 0.55 in 1997 and again up to 0.72 in 2004. Since the values are increased, the land use types are more diversified during 2004. The landscape dominance index shows a slight decrease in 1997 with 22.55 % from 24.34 % in 1992 and again a slight increase in 2004 with 23.65 % from 22.55 % in 1997. Since the values are low, it reflects increase in diversification.

Table 5.4 Fractal dimension of land use category-Sattangudi Village

S No	Land use category	Fractal Dimension		
		1992	1997	2004
1.	Built-up area	1.07	1.06	1.06
2.	Cropland	1.01	1.01	1.13
3.	Fallow/harvested land	1.07	1.07	1.08
4.	Agricultural plantations	---	---	1.10
5.	Water logged area	---	---	1.06
6.	Scrub land	---	---	1.08
7.	Sandy area	1.09	1.09	1.12
8.	River	1.13	1.13	1.11
9.	Tank	1.02	1.02	1.00

5.2.2 Manikkapangu

The change matrices depicting the detailed transformations for the years 1992 – 1997 and 1997 – 2004 for the different land use categories found in the village are shown in the tables 5.5 and 5.6 and the summary statistics in table 5.7.

The fallow/harvested land dominated in most of the parts of the village during the year 1992 (38.90 % of the total area) gave a slight way to built-up land during 1997 and a larger way for conversions to built-up land, sandy area, Salt pan/Aquaculture/Aquaculture, waterlogged area, cropland, plantations and salt affected land but the total area of it was approximately reclaimed to 35.02 % due to conversions from the same categories except built-up land during the year 2004. The cropland, which found not available during 1992, was 18.38 % during 2004. The sandy area consistent through 1992 and 1997 was converted and reduced from 17.17 % (in the year 1992 and 1997) to 10.79 % of the total area (in the year 2004) through transformations. The built-up land existed on the central part of the village as a small hamlet by 0.61 % of the total area in the year 1992 slightly increased during the year 1997 and projected towards all the directions of the village to 17.96 % during 2004. The Salt pan/Aquaculture and salt affected land decreased through years from 1992 to 2004.

The details of the changes of fractal dimensions for the various categories of this village are shown in the table 5.8. The values of the fractal dimensions of all the categories lie between 1.00 and 1.14, which means the shape of the land use type is simple.

The Landscape diversity and dominance index of this village is shown in table 5.53. The table shows that the landscape diversity index is slightly up from 0.62 in

Table 5.5 Land use Change Matrix for Manikkapangu village from 1992 to 1997

Land use category	Sandy area	Built-up area	Salt pan / Aquaculture	Cropland	Fallow/harvested land	Agricultural plantations	Salt affected land	Area for 1992 in m²
Sandy area	1111777	0	0	0	0	0	0	1111777
Built-up area	0	39446	0	0	0	0	0	39446
Salt pan / Aquaculture	0	0	679566	0	0	0	0	679566
Cropland	0	0	0	0	0	0	0	0
Fallow/harvested land	0	3462	0	113267	2401739	0	0	2518469
Agricultural plantations	0	0	0	0	0	307158	0	307158
Salt affected land	0	247	0	0	0	0	1817225	1817472
Area for 1997 in m²	1111777	43155	679566	113267	2401739	307158	1817225	6473887

Table 5.6 Land use Change Matrix for Manikkapangu village from 1997 to 2004

Land use category	Sandy area	Built-up area	Salt pan / Aquaculture	Water logged area	Cropland	Fallow/ harvested land	Agricultural plantations	Salt affected land	Area for 1997 in m²
Sandy area	399033	177939	0	0	37591	402124	11376	83714	1111777
Built-up area	0	43155	0	0	0	0	0	0	43155
Salt pan / Aquaculture	50946	153826	105354	284776	48473	36192	0	0	679566
Water logged area	0	0	0	0	0	0	0	0	0
Cropland	989	23494	1855	0	81241	5688	0	0	113267
Fallow/ harvested land	170396	541730	41795	17930	590079	853710	108569	77531	2401739
Agricultural plantations	60220	55274	0	8161	17806	5441	86434	73822	307158
Salt affected land	16693	167057	0	94719	414984	963762	68505	91504	1817225
Area for 2004 in m²	698276	1162475	149004	405586	1190174	2266917	274884	326571	6473887

Table 5.7 Land use summary statistics of three time periods –Manikkapangu Village

S No	Land use category	Year	No of patches	Area(a) in m ²	Perimeter (p) in m	P=(p/a) in %	S1(min) in m ²	S2(max) in m ²	S3(mean) in m ²
1	Built-up area	1992	1	39446	974	2.47	39446	39446	39446.0
		1997	1	43155	1038	2.41	43155	43155	43155.0
		2004	9	1162475	14549	1.25	9908	310402	129163.8
2	Cropland	1992	0	0	0	0.00	0	0	0.0
		1997	3	113267	2515	2.22	5709	87067	37755.6
		2004	7	1190174	15240	1.28	4634	597711	170024.8
3	Fallow/harvested land	1992	9	2518469	27285	1.08	4775	1718041	279829.8
		1997	9	2401739	28863	1.20	4775	1606964	266859.8
		2004	7	2266917	21110	0.93	154	1237223	323845.3
4	Agricultural plantations	1992	4	307158	5926	1.93	12945	163804	76789.5
		1997	4	307158	5926	1.93	12945	163804	76789.5
		2004	3	274884	5796	2.11	38366	165179	91628.0
5	Water logged area	1992	0	0	0	0.00	0	0	0.0
		1997	0	0	0	0.00	0	0	0.0
		2004	3	405586	4196	1.03	21827	357485	135195.3
6	Salt affected land	1992	2	1817472	18872	1.04	10687	1806785	908736.0
		1997	2	1817225	18888	1.04	10734	1806491	908612.5
		2004	2	326571	4458	1.37	104676	221895	163285.5
7	Sandy area	1992	9	1111777	21301	1.92	5614	357279	123530.7
		1997	9	1111777	21301	1.92	5614	357279	123530.7
		2004	2	698276	12677	1.82	69077	629199	349138.0
8	Salt pan / Aquaculture	1992	1	679566	4656	0.69	679566	679566	679566.0
		1997	1	679566	4656	0.69	679566	679566	679566.0
		2004	2	149004	2830	1.90	35868	97524	74502.0

Table 5.8 Fractal dimension of land use category-Manikkapangu Village

S No	Land use category	Fractal Dimension		
		1992	1997	2004
1.	Sandy area	1.08	1.08	1.14
2.	Built-up area	1.00	1.00	1.03
3.	Salt pan /Aquaculture	1.00	1.00	1.05
4.	Water logged area	---	---	1.03
5.	Scrub land	---	---	---
6.	Cropland	---	1.03	1.07
7.	Fallow/harvested land	1.07	1.08	1.09
8.	Agricultural plantations	1.05	1.05	1.09
9.	Salt affected land	1.13	1.13	1.06

1992 to 0.66 in 1997 and again up to 0.77 in 2004. Since the values are increased, the land use types are more diversified during 2004. The landscape dominance index shows a slight decrease from 1992 with 15.33 % to 18.82 % in 1997 and again a slight decrease from 1997 with 18.82 % to 13.33 % in 2004. This decrease reflects that the area is more diversified.

5.2.3 Pillaiperumanallur

The change matrices depicting the detailed transformations for the years 1992 – 1997 and 1997 – 2004 for the different land use categories found in this village are shown in the tables 5.9 and 5.10 and the summary statistics in table 5.11.

The fallow/harvested land overlooks the other categories by its availability of 56.93 % of total area during 1992 and was converted into different land use categories and only 34.66 % of total area was found as fallow/harvested land during 2004. Many land use categories are converted into cropland accounting to increased area of 38.5 % during 2004 from 4.94 % during 1992 and 1997. The Salt pan/Aquaculture availability increases from 4.30 % of total area in the year 1992 to 9.92 % in the year 2004 through various transformations. The salt affected land decreases from 15.19 % of the total area in the year 1992 to 0.38 % of the total area in the year 2004. Three different hamlets were found on the central, eastern and western parts of the village during 1992 accounting to 2.58 % of the total area. A slight increase in the hamlet was found in the eastern part of the village amounting to 3.82 % of the total area during the year 1997. The central and western hamlets found merged and a settlement has been emerged on the southern part of the village raising to a total of 11 % of the total area during the year 2004.

Table 5.9 Land use Change Matrix for Pillaiperumanallur village from 1992 to 1997

Land use category	Sandy area	Built-up area	Salt pan / Aquaculture	Tank	Cropland	Fallow/ harvested land	Agricultural plantations	Salt affected land	River	Area for 1992 in m²
Sandy area	611100	96574	0	0	0	0	0	0	0	707674
Built-up area	0	224804	0	0	0	0	0	0	0	224804
Salt pan / Aquaculture	0	0	375167	0	0	0	0	0	0	375167
Tank	0	0	0	39075	0	0	0	0	0	39075
Cropland	0	0	0	0	430936	0	0	0	0	430936
Fallow/harvested land	0	11747	0	0	0	4957676	0	0	0	4969423
Agricultural plantations	0	0	0	0	0	0	497585	0	0	497585
Salt affected land	0	0	0	0	0	0	0	1326070	0	1326070
River	0	0	0	0	0	0	0	0	158157	158157
Area for 1997 in m²	611100	333125	375167	39075	430936	4957676	497585	1326070	158157	8728890

Table 5.10 Land use Change Matrix for Pillaiperumanallur village from 1997 to 2004

Land use category	Sandy area	Built-up area	Salt pan / Aquaculture	Tank	Scrub land	Cropland	Fallow / harvested land	Agricultural plantations	Salt affected land	River	Area for 1997 in m²
Sandy area	93854	64053	15457	0	0	90020	331023	16322	371	0	611100
Built-up area	0	333125	0	0	0	0	0	0	0	0	333125
Salt pan / Aquaculture	0	0	313588	0	0	0	61580	0	0	0	375167
Tank	0	0	0	0	0	29182	9892	0	0	0	39075
Scrub land	0	0	0	0	0	0	0	0	0	0	0
Cropland	0	40064	0	0	0	250277	137751	2844	0	0	430936
Fallow/harvested land	0	511682	371829	0	0	2517604	1356489	188944	0	11129	4957676
Agricultural plantations	0	0	63682	0	0	42908	341781	49214	0	0	497585
Salt affected land	0	11253	58983	0	1731	419559	767276	24607	32521	10140	1326070
River	37096	0	42537	0	0	11253	19537	0	0	47733	158157
Area for 2004 in m²	130950	960176	866075	0	1731	3360803	3025329	281932	32892	69002	8728890

Table 5.11 Land use summary statistics of three time periods –Pillaiperumanallur Village

S No	Land use category	Year	No. of patches	Area(a) in m ²	Perimeter (p) in m	P=(p/a) in %	S1(min) in m ²	S2(max) in m ²	S3(mean) in m ²
1	Built-up area	1992	4	224804	5778	2.57	34429	77323	56201.0
		1997	3	333125	5348	1.61	42868	212888	111041.6
		2004	3	960176	10112	1.05	212888	497019	320058.7
2	Cropland	1992	7	430936	8737	2.03	13	142565	61562.3
		1997	7	430936	8737	2.03	13	142565	61562.3
		2004	4	3360803	20740	0.62	7046	3266738	840200.8
3	Fallow/harvested land	1992	3	4969423	44881	0.90	15025	4867225	1656474.3
		1997	3	4957676	44881	0.91	15025	4855476	1652558.7
		2004	4	3025329	26633	0.88	15987	1583844	756332.3
4	Agricultural plantations	1992	5	497585	9100	1.83	379	363266	99517.0
		1997	5	497585	9100	1.83	379	363266	99517.0
		2004	11	281932	8470	3.00	412	55358	25630.2
5	Salt affected land	1992	5	1326070	16142	1.22	213	1108616	265214.0
		1997	5	1326070	16142	1.22	213	1108616	265214.0
		2004	2	32892	1954	5.94	369	32523	16446.0
6	Scrub land	1992	0	0	0	0.00	0	0	0.0
		1997	0	0	0	0.00	0	0	0.0
		2004	1	1731	181	10.47	1731	1731	1731.0
7	Sandy area	1992	9	707674	13946	1.97	1	244548	78630.4
		1997	9	611100	12415	2.03	1	147956	67900.0
		2004	3	130950	3185	2.43	13508	92382	43650.0
8	River	1992	10	158157	7227	4.57	199	48918	15815.7
		1997	10	158157	7275	4.60	50	48918	15815.7
		2004	6	69002	4025	5.83	432	29417	11500.3
9	Tank	1992	4	39075	1528	3.91	3532	21024	9768.8
		1997	4	39075	1528	3.91	3532	21024	9768.8
		2004	0	0	0	0.00	0	0	0.0
10	Salt pan / Aquaculture	1992	2	375167	4274	1.14	77939	297286	187583.5
		1997	2	375167	4274	1.14	77939	297286	187583.5
		2004	4	866075	9578	1.11	418	537293	216518.8

The details of the changes of fractal dimensions for the various categories of this village are shown in the table 5.12. The values of the fractal dimensions of all the categories lie between 1.00 and 1.16, which means the shape of the land use type is simple.

The Landscape diversity and dominance index of this village is shown in table 5.53. The table shows that the landscape diversity index is slightly up from 0.63 in 1992 to 0.64 in 1997 and again up to 0.63 in 2004. Since the values are mostly nearer, the land use types are less diversified during 2004. The landscape dominance index shows a slight decrease from 1992 with 32.50 % to 31.92 % in 1997 and again a slight increase to 32.81 % in 2004. This reflects that the area is less diversified compared to the most of the other villages under study.

5.2.4 Maruthampallam

The change matrices depicting the detailed transformations for the years 1992 – 1997 and 1997 – 2004 for the different land use categories found in the village are shown in the tables 5.13 and 5.14 and the summary statistics in table 5.15.

The fallow/harvested land dominates the other categories by its availability of 72.16 % of total area during 1992 and is converted into different land use categories and only 26.37 % of total area is found as fallow/harvested land during 2004. Many land use categories are converted into cropland accounting to increased area of 28.77 % during 2004 from 4.83 % during 1992. The Salt pan/Aquaculture availability increases from 9.84% of total area in the year 1992 to 14.02 % in the year 2004 with a slight decrease in 1997 through various transformations. The salt affected land increases from 2.80 % of the total area in the year 1992 to 7.63 % of the total area in the year 1997 and then, decreases to 5.13 % of the total area during 2004. Three

Table 5.12 Fractal dimension of land use category-Pillaiperumanallur Village

S No	Land use category	Fractal Dimension		
		1992	1997	2004
1.	Built-up area	1.08	1.05	1.06
2.	Cropland	1.06	1.06	1.08
3.	Fallow/harvested land	1.14	1.10	1.10
4.	Agricultural plantations	1.07	1.07	1.06
5.	Scrub land	---	---	1.00
6.	Salt affected land	1.10	1.10	1.16
7.	Sandy area	1.07	1.07	1.05
8.	River	1.12	1.12	1.12
9.	Tank	1.00	1.00	---
10.	Salt pan /Aquaculture	1.04	1.04	1.06

Table 5.13 Land use Change Matrix for Maruthampallam village from 1992 to 1997

Land use category	Sandy area	Built-up area	Salt pan / Aquaculture	Tank	Cropland	Fallow /harvested land	Agricultural plantations	Salt affected land	River	Area for 1992 in m²
Sandy area	67268	0	37467	0	0	0	76913	0	0	181648
Built-up area	0	151229	0	0	0	0	0	0	0	151229
Salt pan / Aquaculture	0	0	373274	0	0	0	0	135031	0	508304
Tank	0	0	0	21516	0	0	0	0	0	21516
Cropland	0	0	0	0	166562	0	0	82725	0	249287
Fallow /harvested land	50698	19537	23865	21392	117348	3437840	23742	31532	0	3725954
Agricultural plantations	0	0	0	0	0	0	50698	0	0	50698
Salt affected land	0	0	0	0	0	0	0	144676	0	144676
River	0	0	0	0	0	0	0	0	130084	130084
Area for 1997 in m²	117966	170767	434606	42908	283911	3437840	151353	393963	130084	5163398

Table 5.14 Land use Change Matrix for Maruthampallam village from 1997 to 2004

Land used category	Sandy area	Built-up area	Salt pan / Aquaculture	Tank	Cropland	Fallow /harvested land	Agricultural plantations	Salt affected land	River	Area for 1997 in m²
Sandy area	36354	4699	0	0	0	50698	20279	0	5935	117966
Built-up area	0	170767	0	0	0	0	0	0	0	170767
Salt pan / Aquaculture	37467	28317	332097	0		23865	3339	0	9521	434606
Tank	0	14591	0	0	3710	21392	3215	0	0	42908
Cropland	0	117348	0	0	18177	117348	28564	2473	0	283911
Fallow /harvested land	0	297018	246443	2226	1367247	1092734	171632	195127	65413	3437840
Agricultural plantations	0	32150	0	0	0	23742	76913	0	18548	151353
Salt affected land	0	1731	135031	0	82725	31532	25349	67021	50575	393963
River	14839	0	10016	0	13231	0	51811	0	40188	130084
Area for 2004 in m²	88660	666621	723587	2226	1485089	1361311	381103	264620	190180	5163398

Table 5.15 Land use summary statistics of three time periods –Maruthampallam Village

S No	Land use category	Year	No of patches	Area(a) in m ²	Perimeter (p) in m	P=(p/a) in %	S1(min) in m ²	S2(max) in m ²	S3(mean) in m ²
1	Built-up area	1992	5	151229	3114	2.06	121	131981	30245.8
		1997	3	170767	2595	1.52	9594	148676	56922.3
		2004	7	666621	8697	1.31	9594	167565	95231.6
2	Cropland	1992	9	249287	6463	2.59	36	109314	27698.6
		1997	3	283911	4744	1.67	57755	139188	94637.0
		2004	5	1485089	25779	1.74	32186	812741	297017.8
3	Fallow/harvested land	1992	14	3725954	33290	0.89	5	3227515	266139.6
		1997	12	3437840	27600	0.80	5	3053437	286486.7
		2004	13	1361311	24897	1.83	0	841092	104716.2
4	Agricultural plantations	1992	3	50698	2128	4.20	1533	31950	16899.3
		1997	1	151353	2346	1.55	151353	151353	151353.0
		2004	9	381103	7560	1.98	42	188573	42344.8
5	Salt affected land	1992	5	144676	4111	2.84	1791	88533	28935.2
		1997	5	393963	7634	1.95	27520	136892	78792.6
		2004	14	264620	8154	3.08	1880	69147	18901.4
6	Sandy area	1992	4	181648	4476	2.46	42	155411	45412.0
		1997	3	117966	4600	3.90	20265	53398	39322.0
		2004	3	88660	3007	3.39	215	73800	29553.3
7	River	1992	4	130084	4897	3.76	31	89801	32521.0
		1997	4	130084	4897	3.76	31	89801	32521.0
		2004	5	190180	7761	4.08	5894	79664	38036.0
8	Tank	1992	2	21516	806	3.75	3680	17836	10758.0
		1997	2	42908	1261	2.94	18120	24788	21454.0
		2004	1	2226	190	8.53	2226	2226	2226.0
9	Salt pan / Aquaculture	1992	6	508304	6143	1.21	139	378547	84717.3
		1997	2	434606	4617	1.06	86281	348325	217303.0
		2004	5	723587	7877	1.09	9892	490655	144717.4

different hamlets are found on the central, eastern and northern parts of the village during 1992 accounting to 2.93 % of the total area. A slight increase in the hamlet is found in the northern part of the village accounting to 3.31% of the total area during the year 1997. The emergence of new hamlets on central, northern and western parts of the village give rise to a total of 12.91 % of the total area during the year 2004. The agricultural plantations increases from 0.98 % of total area in 1992 to 7.38 % of total area in 2004.

The details of the changes of fractal dimensions for the various categories of this village are shown in the table 5.16. The values of the fractal dimensions of all the categories lie between 1.00 and 1.14, which means the shape of the land use type is simple.

The Landscape diversity and dominance index of this village is shown in table 5.53. The table shows that the landscape diversity index is slightly up from 0.43 in 1992 to 0.51 in 1997 and down to 0.25 in 2004. Hence, the land use types are diversified. The landscape dominance index shows a slight decrease from 1992 with 52.01 % to 44.31 % in 1997 and again a slight increase to 70.26 % in 2004. This reflects that the area is less diversified compared to the other villages under study.

5.2.5 Kalamanallur

The change matrices depicting the detailed transformations for the years 1992 – 1997 and 1997 – 2004 for the different land use categories found in the Kalamanallur village are shown in the tables 5.17 and 5.18 and the summary statistics in table 5.19.

Table 5.16 Fractal dimension of land use category- Maruthampallam Village

S No	Land use category	Fractal Dimension		
		1992	1997	2004
1.	Built-up area	1.00	1.00	1.03
2.	Cropland	1.03	1.03	1.07
3.	Fallow/harvested land	1.07	1.08	1.09
4.	Agricultural plantations	---	---	1.09
5.	Scrub land	---	---	1.21
6.	Salt affected land	1.13	1.13	1.06
7.	Sandy area	1.08	1.08	1.14
9.	River	1.00	1.00	1.01
10.	Tank	1.00	1.00	1.00
11.	Salt pan /Aquaculture	1.00	1.00	1.05

Table 5.17 Land use Change Matrix for Kalamanallur village from 1992 to 1997

Land use category	Sandy area	Built-up area	Salt pan / Aquaculture	Tank	Cropland	Fallow /harvested land	Salt affected land	River	Area for 1992 in m²
Sandy area	155063	0	0	0	0	0	0	0	155063
Built-up area	0	44805	0	0	0	0	0	0	44805
Salt pan / Aquaculture	0	0	376280	0	0	2226	0	0	378506
Tank	0	0	0	43897	0	0	0	0	43897
Cropland	0	0	0	0	115864	0	0	0	115864
Fallow /harvested land	0	9027	0	0	866	1942240	0	0	1952132
Salt affected land	0	0	0	0	0	0	358227	0	358227
River	0	0	0	0	0	0	0	128972	128972
Area for 1997 in m²	155063	53832	376280	43897	116730	1944465	358227	128972	3177466

Table 5.18 Land use Change Matrix for Kalamanallur village from 1997 to 2004

Land use category	Sandy area	Built-up area	Salt pan / Aquaculture	Tan k	Scrub land	Cropland	Fallow /harvested land	Agricultural plantations	Salt affected land	River	Area for 1997 in m²
Sandy area	247	53171	10758	0	84085	0	0	6801	0	0	155063
Built-up area	0	53832	0	0	0	0	0	0	0	0	53832
Salt pan / Aquaculture	126498	0	161616	0	82725	0	0	0	0	5441	376280
Tank	0	4452	0	0	0	39446	0	0	0	0	43897
Scrub land	0	0	0	0	0	0	0	0	0	0	0
Cropland	0	39446	0	866	0	18177	24360	0	33881	0	116730
Fallow /harvested land	0	288609	205266	989	488311	490290	319276	46989	55768	48967	1944465
Agricultural plantations	0	0	0	0	0	0	0	0	0	0	0
Salt affected land	0	45381	40806	0	77160	36849	147767	0	2597	7667	358227
River	27946	0	2102	0	6306	6925	10016	3710	0	71967	128972
Area for 2004 in m²	154692	484892	420549	1855	738588	591686	501419	57499	92246	134041	3177466

Table 5.19 Land use summary statistics of three time periods –Kalamanallur Village

S No	Land use category	Year	No. of patches	Area(a) in m ²	Perimeter (p) in m	P=(p/a) in %	S1 (min) in m ²	S2(max) in m ²	S3(mean) in m ²
1	Built up area	1992	1	44806	926	2.07	44806	44806	44806.0
		1997	1	53832	926	1.72	53832	53832	53832.0
		2004	4	484892	7121	1.47	41099	159524	121223.0
2	Cropland	1992	2	115864	2151	1.86	24386	91478	57932.0
		1997	2	116730	2120	1.82	25252	91478	58365.0
		2004	3	591686	10242	1.73	42764	390159	197228.7
3	Fallow/harvested land	1992	3	1952132	17604	0.90	3417	1885342	650710.7
		1997	3	1944465	17693	0.91	3417	1885342	648155.0
		2004	4	501419	8792	1.75	338	429251	125354.8
4	Agricultural plantations	1992	0	0	0	0.00	0	0	0.0
		1997	0	0	0	0.00	0	0	0.0
		2004	3	57499	2389	4.15	4990	35038	19166.3
5	Salt affected land	1992	4	358227	8025	2.24	35302	171834	89556.8
		1997	5	358227	8025	2.24	35302	171834	71645.4
		2004	1	92246	1787	1.94	92246	92246	92246.0
6	Scrub land	1992	0	0	0	0.00	0	0	0.0
		1997	0	0	0	0.00	0	0	0.0
		2004	3	738588	8807	1.19	32	390417	246196.0
7	Sandy area	1992	1	155063	2143	1.38	155063	155063	155063.0
		1997	1	155063	2143	1.38	155063	155063	155063.0
		2004	5	154692	3869	2.50	246	126434	30938.4
8	River	1992	1	128972	2747	2.13	128972	128972	128972.0
		1997	1	128972	2747	2.13	128972	128972	128972.0
		2004	3	134041	5576	4.16	135	125838	44680.3
9	Tank	1992	2	43897	1174	2.67	4440	39456	21948.5
		1997	2	43897	1174	2.67	4440	39456	21948.5
		2004	1	1855	178	9.58	1855	1855	1855.0
10	Salt pan / Aquaculture	1992	1	378506	2718	0.72	378506	378506	378506.0
		1997	1	376280	2711	0.72	376280	376280	376280.0
		2004	3	420549	5853	1.39	81455	232986	140183.0

The fallow/harvested land dominated in most of the parts of the village during the year 1992 (61.44 % of the total area) gives a slight way to built up land during 1997 and a larger way for conversions to built-up land, sandy area, Salt pan/Aquaculture, waterlogged area, cropland, plantations and salt affected land with the remains of 15.78 % of total area during the year 2004. The plantations, which found not available during 1992, were 1.81 % during 2004. The built-up land existed on the central part of the village as a small hamlet by 1.41 % of the total area in the year 1992 slightly increased during the year 1997 and projected towards the eastern, southern and western directions of the village to 15.26 % during 2004 (Figure 4.28). The Salt pan/Aquaculture maintains almost consistency and salt affected land decreases through years from 1992 to 2004. The cropland increases from 3.65 % of the total area to 18.62 % in 2004. 23.24 % of the land has been converted to scrub land during 2004.

The details of the changes of fractal dimensions for the various categories of this village are shown in the table 5.20. The values of the fractal dimensions of all the categories lie between 1.00 and 1.13, which means the shape of the land use type is simple.

The Landscape diversity and dominance index of this village is shown in table 5.53. The table shows that the landscape diversity index was slightly up from 0.57 in 1992 to 0.58 in 1997 and again up to 0.85 in 2004. Since the values are increased, the land use types are more diversified during 2004. The landscape dominance index shows a slight decrease from 1992 with 33.15 % to 32.71 % in 1997 and again a slight decrease from 1997 with 32.71 % to 14.95 % in 2004. The low values and decrease during years reflects that the area is more diversified.

Table 5.20 Fractal dimension of land use category- Kalamanallur Village

S No	Land use category	Fractal Dimension		
		1992	1997	2004
1.	Built-up area	1.05	1.02	1.01
2.	Cropland	1.08	1.05	1.13
3.	Fallow/ harvested land	1.10	1.10	1.10
4.	Agricultural plantations	1.10	1.00	1.05
5.	Scrub land	---	---	---
6.	Salt affected land	1.06	1.06	1.03
7.	Sandy area	1.08	1.10	1.12
8.	River	1.12	1.13	1.13
9.	Tank	1.01	1.92	1.00
10.	Salt pan /Aquaculture	1.06	1.80	1.05

5.3 Sirkazhi taluk

The changes of the various land use categories available in Sirkazhi taluk are analyzed village-wise as shown below:

5.3.1 Vanagiri

The change matrices depicting the detailed transformations for the years 1992 – 1997 and 1997 – 2004 for the different land use categories found in the Vanagiri village are shown in the tables 5.21 and 5.22 and the summary statistics in table 5.23.

The fallow/harvested land dominated in most of the parts of the village during the year 1992 (59.26 % of the total area) has been converted into built up land to a certain extent in the year 1997 and goes down by its area to 24.45 % due to its conversions to built-up land, scrub lands, croplands, agricultural plantations and salt affected land during the year 2004. The built-up land found on the near boundaries of the western parts of the village by 3.30 % of the total area in the year 1992 slightly extends towards west during the year 1997 and projected linearly towards the eastern side and new hamlets are emerged in the boundaries of northern side of the village during 2004 with a rise to 17.28 % of the total area. The cropland found during the year 1992 (10.51 % of the total area) accumulates its area due conversions to give up 15.46 % of the total area of the village during 2004. A little amount of scrubland found during 1992 (0.85 % of the total area) rises to 5.78 % of the area during 2004. 2.41 % of the area is found converted to salt affected land during 2004. There is a consistent increase found in the area of cropland and Salt pan/Aquaculture during the years. The plantations have increased its area from 0.65 % of the total area during 1992 to 10.85 % of the total area in 2004.

Table 5.21 Land use Change Matrix for Vanagiri village from 1992 to 1997

Land use category	Sandy area	Built-up area	Salt pan / Aquaculture	Tank	Scrub land	Cropland	Fallow /harvested land	Agricultural plantations	River	Area for 1992 in m²
Sandy area	474833	0	0	0	0	0	0	0	0	474833
Built-up area	0	260787	0	0	0	0	0	0	0	260787
Salt pan / Aquaculture	0	0	1083954	0	0	0	0	0	0	1083954
Tank	0	0	0	165944	0	0	0	0	0	165944
Scrub land	0	0	0	0	66897	0	0	0	0	66897
Cropland	0	5812	0	0	0	825243	0	0	0	831055
Fallow /harvested land	7419	4204	0	0	0	66031	4607239	0	0	4684894
Agricultural plantations	0	0	0	0	0	0	45876	5317	0	51193
River	0	495	0	0	0	0	0	0	286013	286507
Area for 1997 in m²	482252	271298	1083954	165944	66897	891275	4653115	5317	286013	7906065

Table 5.22 Land use Change Matrix for Vanagiri village from 1997 to 2004

Land use category	Sandy area	Built-up area	Salt pan / Aquaculture	Tank	Scrub land	Cropland	Fallow /harvested land	Agricultural plantations	Salt affected land	River	Area for 1997 in m²
Sandy area	375538	46247	16446	1731	0	0	2102	38704	0	1484	482252
Built-up area	0	271298	0	0	0	0	0	0	0	0	271298
Salt pan / Aquaculture	161864	0	482499	0	373189	0	1855	64548	0	0	1083954
Tank	0	92246	0	0	0	0	21763	51935	0	0	165944
Scrub land	0	0	0	0	66897	0	0	0	0	0	66897
Cropland	0	382684	0	2349	0	289722	17188	185111	618	13602	891275
Fallow /harvested land	0	537155	606896	29677	16941	907623	1848757	495112	189562	21392	4653115
Agricultural plantations	0	0	0	0	0	0	0	0	0	5317	5317
Salt affected land	0	0	0	0	0	0	0	0	0	0	0
River	4452	36354	26709	0	0	24855	41548	22629	371	129095	286013
Area for 2004 in m²	541854	1365984	1132551	33758	457027	1222200	1933213	858038	190551	170890	7906065

Table 5.23 Land use summary statistics of three time periods –Vanagiri Village

S No	Land use category	Year	No of patches	Area(a) in m ²	Perimeter (p) in m	P=(p/a) in %	S1(min) in m ²	S2(max) in m ²	S3(mean) in m ²
1	Built-up area	1992	2	260787	3446	1.32	78224	182561	130393.5
		1997	2	271298	3367	1.24	78224	193074	135649.0
		2004	5	1365984	13587	0.99	21201	874818	273196.8
2	Cropland	1992	9	831055	16232	1.95	549	317925	92339.4
		1997	10	891275	17517	1.97	549	320329	89127.5
		2004	8	1222200	13914	1.14	1	959038	152775.0
3	Fallow/harvested land	1992	6	4684894	26931	0.57	31	3795871	780815.7
		1997	6	4653115	28289	0.61	31	3717736	775519.2
		2004	9	1933213	16131	0.83	14	1631247	214801.4
4	Agricultural plantations	1992	2	51193	1831	3.58	4722	46471	25596.5
		1997	2	5317	1831	34.44	599	4718	2658.5
		2004	20	858038	18902	2.20	2004	220743	42901.9
5	Salt affected land	1992	0	0	0	0.00	0	0	0.0
		1997	0	0	0	0.00	0	0	0.0
		2004	4	190551	4677	2.45	654	130643	47637.8
6	Scrub land	1992	1	66897	1681	2.51	66897	66897	66897.0
		1997	1	66897	1681	2.51	66897	66897	66897.0
		2004	1	457027	4523	0.99	457027	457027	457027.0
7	Sandy area	1992	2	474833	9779	2.06	27906	446927	237416.5
		1997	2	482252	9808	2.03	27758	454494	241126.0
		2004	2	541854	7806	1.44	3680	538085	270927.0
8	River	1992	2	286507	9771	3.41	35854	250892	143253.5
		1997	2	286013	9771	3.42	35568	250445	143006.5
		2004	6	170890	10932	6.40	553	108593	28481.7
9	Tank	1992	3	165944	2775	1.67	4345	103050	55314.7
		1997	3	165944	2775	1.67	4345	103050	55314.7
		2004	7	33758	1916	5.67	1853	10347	4822.6
10	Salt pan / Aquaculture	1992	1	1083954	4576	0.42	1083954	1083954	1083954.0
		1997	1	1083954	4576	0.42	1083954	1083954	1083954.0
		2004	5	1132551	12791	1.13	10198	531232	226510.2

The details of the changes of fractal dimensions for the various categories of this village are shown in the table 5.24. The values of the fractal dimensions of Salt pan/Aquaculture, tank, cropland, salt affected land and river lies between 1.00 and 1.14 during the years of study stating the shape of the land use type is simple. The values of the fractal dimensions of sandy area, built up area, plantations and river lies between 1.51 and 1.87 during the years 1992 and 1997, which means the shape of the land use type is complex and during the year 2004, it lies between 1.01 and 1.18, which explains the land use type as simple.

The Landscape diversity and dominance index of this village is shown in table 5.53. The table shows that the landscape diversity index is slightly up from 0.60 in 1992 to 0.83 in 1997 and again up to 0.87 in 2004. Since the values are increased, the land use types are more diversified during 2004. The landscape dominance index shows a slight decrease in 1997 with 12.46 % from 35.70 % in 1992 and again a slight increase in 2004 with 13.13 % from 22.55 % in 1997. Since the values are low during 1997 and 2004, it reflects increase in diversification during these years.

5.3.2 Kilaiyur

The change matrices depicting the detailed transformations for the years 1992 – 1997 and 1997 – 2004 for the different land use categories found in the Kilaiyur village are shown in the tables 5.25 and 5.26 and the summary statistics in table 5.27.

The fallow/harvested land spread out over the village during 1992 occupying 46.71 % of the total area, resuming almost the same area (45.29 % of the total area) during 1997 reduced by its conversions to settlement and cropland to 19.69 % of the total area during the year 2004. The settlements found on near central part and southern part of the village are accounting to only 6.63 % of the total area during the

Table 5.24 Fractal dimension of land use category- Vanagiri Village

S No	Land use category	Fractal Dimension		
		1992	1997	2004
1.	Built-up area	1.87	1.87	1.07
2.	Cropland	1.10	1.10	1.09
3.	Fallow/ harvested land	1.14	1.14	1.10
4.	Agricultural plantations	1.68	1.63	1.05
5.	Scrub land	1.00	1.00	1.00
6.	Salt affected land	---	---	1.09
7.	Sandy area	1.51	1.51	1.12
8.	River	1.69	1.69	1.18
9.	Tank	1.02	1.02	1.01
10.	Salt pan /Aquaculture	1.00	1.00	1.06

Table 5.25 Land use Change Matrix for Kilaiyur village from 1992 to 1997

Land use category	Sandy area	Built-up area	Salt pan / Aquaculture	Tank	Cropland	Fallow /harvested land	Salt affected land	Area for 1992 in m²
Sandy area	326819	0	73203	0	0	0	0	400022
Built-up area	0	557681		0	0	0	0	557681
Salt pan / Aquaculture	0	0	2379092	0	0	0	0	2379092
Tank	0	0	0	40064	0	0	0	40064
Cropland	0	10882	0	0	849382	0	0	860264
Fallow /harvested land	0	38209	81241	0	0	3807319	0	3926769
Salt affected land	0	0	0	0	0	0	243105	243105
Area for 1997 in m²	326819	606772	2533537	40064	849382	3807319	243105	8406997

Table 5.26 Land use Change Matrix for Kilaiyur village from 1997 to 2004

Land use category	Sandy area	Built-up area	Salt pan / Aquaculture	Water logged area	Tank	Cropland	Fallow /harvested land	Agricultural plantations	Salt affected land	Area for 1997 in m²
Sandy area	83219	0	4081	196981	0	0	0	42537	0	326819
Built-up area	0	606772	0	0	0	0	0	0	0	606772
Salt pan / Aquaculture	250258	429081	1154685	365028	0	92864	42290	199331	0	2533537
Water logged area	0	0	0	0	0	0	0	0	0	0
Tank	0	21269	0	0	0	9274	6059	3462	0	40064
Cropland	0	480397	0	0	0	229997	1113	108816	29059	849382
Fallow /harvested land	0	441323	97069	38951	14715	1116847	1400015	556568	141832	3807319
Agricultural plantations	0	0	0	0	0	0	0	0	0	0
Salt affected land	0	0	0	0	0	33881	206132	0	3091	243105
Area for 2004 in m²	333478	1978841	1255834	600960	14715	1482864	1655609	910715	173982	8406997

Table 5.27 Land use summary statistics of three time periods –Kilaiyur Village

S No	Land use category	Year	No of patches	Area(a) in m ²	Perimeter (p) in m	P=(p/a) in %	S1(min) in m ²	S2(max) in m ²	S3(mean) in m ²
1	Built-up area	1992	2	557681	7190	1.29	120730	436951	278840.5
		1997	3	606772	7809	1.29	10858	436951	202257.3
		2004	7	1978841	19362	0.98	41995	960597	282691.5
2	Cropland	1992	4	860264	1156	0.13	22721	645972	215066.0
		1997	4	849382	11959	1.41	22721	635114	212345.5
		2004	6	1482864	22396	1.51	63623	823275	247144.0
3	Fallow/harvested land	1992	2	3926769	25844	0.66	63212	3862529	1963384.5
		1997	3	3807319	24760	0.65	424	3743040	1269106.3
		2004	5	1655609	21530	1.30	424	1521581	331121.8
4	Agricultural plantations	1992	0	0	0	0.00	0	0	0.0
		1997	0	0	0	0.00	0	0	0.0
		2004	10	910715	15072	1.65	5553	667878	91071.5
5	Water logged area	1992	0	0	0	0.00	0	0	0.0
		1997	0	0	0	0.00	0	0	0.0
		2004	2	600960	7674	1.28	246059	354901	300480.0
6	Salt affected land	1992	1	243105	3870	1.59	243105	243105	243105.0
		1997	1	243105	3870	1.59	243105	243105	243105.0
		2004	5	173982	5124	2.94	12877	85327	34796.4
7	Sandy area	1992	2	400022	5992	1.50	32774	367248	200011.0
		1997	2	326819	6753	2.07	32691	294128	163409.5
		2004	1	333478	9203	2.76	333478	333478	333478.0
8	Tank	1992	10	40064	2432	6.07	51	8811	4006.4
		1997	10	40064	2432	6.07	51	8811	4006.4
		2004	4	14715	1021	6.94	1315	7895	3678.8
9	Salt pan / Aquaculture	1992	2	2379092	10734	0.45	256	2378836	1189546.0
		1997	1	2533537	11574	0.46	2533537	2533537	2533537.0
		2004	6	1255834	11103	0.88	1324	774269	209305.7

year 1992, with slight increase during the year 1997 constituting 7.22 % of the total area and abruptly increased to 23.54 % of the total area with its extension over most of the parts of the village during the year 2004. There is an appearance of waterlogged area during the year 2004 occupying 7.15 % of the total area of the village with none during 1992 and 1997. The agricultural plantations occupy 10.83 % of the total area during 2004 with none during 1992 and 1997. The area covered by the cropland increased with 10.23 % and 10.10 % of the total area from 1992 and 1997, respectively to 17.64 % of the total area in 2004.

The details of the changes of fractal dimensions for the various categories of this village are shown in the table 5.28. The values of the fractal dimensions of all the categories lies between 1.00 and 1.37 during the years of study stating the shape of the land use type is simple.

The Landscape diversity and dominance index of this village is shown in table 5.53. The table shows that the landscape diversity index remains same during 1992 and 1997 with 0.61 and increases to 0.82 in 2004. Since the values are increased during 2004, the land use types are more diversified during 2004 compared to 1992 and 1997. The landscape dominance index shows a slight increase in 1997 with 23.89 % from 23.76 % in 1992 and a decrease in 2004 with 12.94 %. Since the value is low during 2004, it depicts more fragmentation during 2004.

5.3.3 Perunthottam

The change matrices depicting the detailed transformations for the years 1992 – 1997 and 1997 – 2004 for the different land use categories found in this village are shown in the tables 5.29 and 5.30 and the summary statistics in table 5.31.

Table 5.28 Fractal dimension of land use category- Kilaiyur Village

S No	Land use category	Fractal Dimension		
		1992	1997	2004
1.	Built-up area	1.08	1.06	1.30
2.	Cropland	1.07	1.07	1.35
3.	Fallow/ harvested land	1.12	1.12	1.36
4.	Agricultural plantations	---	---	1.34
5.	Water logged area	---	---	1.31
6.	Salt affected land	1.00	1.00	1.33
7.	Sandy area	1.13	1.16	1.00
8.	Tank	1.01	1.01	1.37
9.	Salt pan /Aquaculture	1.07	1.00	1.32

Table 5.29 Land use Change Matrix for Perunthottam village from 1992 to 1997

Land use category	Sandy area	Built-up area	Salt pan / Aquaculture	Water logged area	Tank	Scrub land	Cropland	Fallow /harvested land	Agricultural plantations	Salt affected land	River	Area for 1992 in m²
Sandy area	780281	0	0	0	0	0	0	29553	0	0	0	809835
Built-up area	0	792872	0	0	0	0	0	0	0	0	0	792872
Salt pan / Aquaculture	0	0	857543	0	0	0	0	0	0	0	0	857543
Water logged area	0	0	315442	0	0	0	0	742421	0	422898	94843	1575604
Tank	0	0	0	0	0	0	0	0	0	0	0	0
Scrub land	0	0	0	0	0	186965	0	0	0	0	0	186965
Cropland	19537	27699	391861	0	130332	0	903048	4149842	0	304066	0	5926384
Fallow /harvested land	13602	0	0	0	0	0	55768	1553718	0	220723	0	1843811
Agricultural plantations	0	0	0	0	0	0	68381	96945	46123	0	0	211449
Salt affected land	0	0	0	0	0	0	23742	83096	0	188573	0	295410
River	0	0	0	0	0	0	0	0	0	0	109929	109929
Area for 1997 in m²	813421	820571	1564846	0	130332	186965	1050939	6655574	46123	1136260	204772	12609803

Table 5.30 Land use Change Matrix for Perunthottam village from 1997 to 2004

Land use category	Sandy area	Built-up area	Salt pan / Aqua culture	Water logged area	Tank	Scrub land	Cropland	Fallow/ harvested land	Agricultural plantations	Salt affected land	River	Area for 1997 in m²
Sandy area	411297	0	40435	57499	0	86558	17683	0	172745	0	27204	813421
Built-up area	0	820571	0	0	0	0	0	0	0	0	0	820571
Salt pan / Aquaculture	80128	127488	598982	521327	0	0	83838	0	71967	7914	73203	1564846
Water logged area	0	0	0	0	0	0	0	0	0	0	0	0
Tank	0	1484	0	0	0	0	88042	0	40806	0		130332
Scrub land	14220	0	0	84456	0	0	0	0	53913	0	34376	1869656
Cropland	0	281561	0	0	120810	15951	93235	40435	456408	42537	0	1050939
Fallow/ harvested land	1855	386049	270061	716577	140719	1007536	2167291	828979	736733	431055	156670	6655574
Agricultural plantations	0	0	0	5564	0	0	0	0	40559	0	0	46123
Salt affected land	0	3586	0	664766	0	0	175837	135278	51564	91504	13726	1136260
River	23989	0	1113	61580	0	0	0	0	7914	0	110176	204772
Area for 2004 in m²	531489	1620738	910591	2111770	261529	1110046	2625925	1004692	1632609	385060	415355	12609803

Table 5.31 Land use summary statistics of three time periods –Perunthottam Village

S No	Land use category	Year	No. of patches	Area(a) in m ²	Perimeter (p) in m	P=(p/a) in %	S1(min) in m ²	S2(max) in m ²	S3(mean) in m ²
1	Built-up area	1992	1	792872	4183	0.53	792872	792872	792872.0
		1997	4	820571	5253	0.64	1994	793139	205142.8
		2004	6	1620738	15095	0.93	1994	1258406	270123.0
2	Cropland	1992	3	5926384	26960	0.45	28054	5747598	1975461.3
		1997	5	1050939	16436	1.56	7385	612761	210187.8
		2004	6	2625925	35056	1.33	5659	1847670	437654.2
3	Fallow/harvested land	1992	9	1843811	22641	1.23	15154	494018	204867.9
		1997	4	6655574	54669	0.82	53924	5614247	1663893.5
		2004	9	1004692	17056	1.70	293	677663	111632.4
4	Agricultural plantations	1992	3	211449	3258	1.54	17785	147258	70483.0
		1997	1	46123	897	1.94	46123	46123	46123.0
		2004	7	1632609	32309	1.98	306	388371	233229.8
5	Water logged area	1992	1	1575604	6953	0.44	1575604	1575604	1575604.0
		1997	0	0	0	0.00	0	0	0.0
		2004	7	2111770	27409	1.3.0	4724	1760729	301681.4
6	Salt affected land	1992	3	295410	4151	1.41	9842	178881	98470.0
		1997	4	1136260	12152	1.07	2732	821794	284065.0
		2004	4	385060	6349	1.65	12284	227311	96265.0
7	Scrub land	1992	1	186965	2816	1.51	186965	186965	186965.0
		1997	1	186965	2816	1.51	186965	186965	186965.0
		2004	1	1110046	11738	1.06	1110046	1110046	1110046.0
8	Sandy area	1992	3	809835	12055	1.49	6980	481623	269945.0
		1997	3	813421	13286	1.63	6980	485113	271140.3
		2004	4	531489	12487	2.39	893	260696	132872.3
9	River	1992	2	109929	3718	3.38	13079	96850	54964.5
		1997	1	204772	5224	2.55	204772	204772	204772.0
		2004	2	415355	16303	3.93	6	415272	207677.5
10	Tank	1992	0	0	0	0.00	0	0	0.0
		1997	9	130332	3933	3.02	16	101016	14481.3
		2004	3	261529	4165	1.59	2486	248934	87176.3
11	Salt pan / Aquaculture	1992	2	857543	8352	0.97	187034	670509	428771.5
		1997	2	1564846	11975	0.77	670115	894731	782423.0
		2004	1	910591	6359	0.70	910591	910591	910591.0

The dominated land use, cropland during 1992 with 47 % of the total area reduces to 8.33 % of the total area during 1997 by conversions to fallow/harvested land and again reclaims its area by giving a toll to an area of 20.82 % of the total area. The fallow/harvested land reclaims most of the land from cropland during 1997 by giving rise to more than half of the total area (52.78 % of total area) and again declines to 7.97 % of total area in 2004 by its conversions to built-up land, scrub land, waterlogged area, plantations, Salt pan/Aquaculture and salt affected area. The built-up land existed as a hamlet in the central portion of the village during 1992 with 6.29 % of the total area increasing to 6.51 % during 1997 with emergence of three new very small hamlets. In 2004, the total built-up land availability rises to 12.85 % of total area due to increase in settlement in the southern parts and increase in existing hamlets. The scrubland shows an increase from 1.48 % of the total area from 1992 and 1997 to 8.8 % of the total area during 2004. There is an abrupt increase in plantations area from 1.68 % in 1992 to 12.95 % in 2004. The salt affected land increases from 1992 to 1997 and again decreased to an area of 3.05 % of total area in 2004. The waterlogged area is found during 1992 and 2004 only.

The details of the changes of fractal dimensions for the various categories of this village are shown in the table 5.32. The values of the fractal dimensions of all the categories lies between 1.02 and 1.40 during the years of study stating the shape of the land use type is simple.

The Landscape diversity and dominance index of this village is shown in table 5.53. The table shows that the landscape diversity index decreases from 0.73 during 1992 to 0.68 during 1997 and increases to 0.95 in 2004. The diversification during 2004 is more compared to 1992 and both the diversifications are more compared to 1997. The landscape dominance index shows an increase in 1997 with 31.73 % from

Table 5.32 Fractal dimension of land use category- Perunthottam Village

S No	Land use category	Fractal Dimension		
		1992	1997	2004
1.	Built-up area	1.08	1.27	1.06
2.	Cropland	1.06	1.35	1.14
3.	Fallow/ harvested land	1.02	1.35	1.09
4.	Agricultural plantations	1.02	1.00	1.06
5.	Water logged area	1.11	---	1.11
6.	Salt affected land	1.03	1.31	1.07
7.	Scrub land	1.00	---	---
8.	Sandy area	1.13	1.33	1.13
9.	River	1.11	1.00	1.29
10.	Tank	---	1.40	1.05
11.	Salt pan /Aquaculture	1.06	1.00	1.21

26.64 % in 1992 and a decrease in 2004 with 12.55 %. Since the value is low during 2004, it depicts more fragmentation during 2004.

5.3.4 Thennampattinam

The change matrices depicting the detailed transformations for the years 1992 – 1997 and 1997 – 2004 for the different land use categories found in this village are shown in the tables 5.33 and 5.34 and the summary statistics in table 5.35.

The dominated land use, cropland during 1992 with 33.40 % of the total area reduces to 7.28 % of the total area during 1997 by conversions to fallow/harvested land and Salt pan/Aquaculture and again reclaims its area by giving a toll to an area of 20.60 % of the total area. The fallow/harvested land reclaims most of the land from cropland during 1997 by giving rise to 36.85 % of total area) and again declines to 12.01 % of total area in 2004 by its conversions to built up land, scrub land, waterlogged area, plantations, Salt pan/Aquaculture and salt affected area. The built-up land found as small hamlets in south-eastern and south-western sides of the village during 1992 with 3.72 %, slightly with addition of one more new hamlet on the northern side of the village gives rise to 4.78 % of total area in 1997. The hamlets found in the south-western part merged and the extent of settlements in south-eastern part increased in 2004 and rises to a toll of 21.82 % of the total area during 2004. The Salt pan/Aquaculture increases from 2.44 % in 1992 to 16.16 % in 2004. The waterlogged area found available only during 1997 and 2004 is with none during 1992. The scrubland got converted from fallow / harvested land and came into emergence during 2004 only with 3.26 %.

Table 5.33 Land use Change Matrix for Thennampattinam village from 1992 to 1997

Land use category	Sandy area	Built-up area	Salt pan / Aquaculture	Water logged area	Tank	Cropland	Fallow/harvested land	Agricultural plantations	Salt affected land	River	Area for 1992 in m²
Sandy area	667981	0	0	0	0	0	0	0	0	41177	709158
Built-up area	0	295163	0	0	0	0	0	0	0	0	295163
Salt pan / Aquaculture	168699	0	0	0	0	0	0	0	0	25226	193925
Water logged area	0	0	0	0	0	0	0	0	0	0	0
Tank	0	0	0	0	0	0	0	0	0	0	0
Cropland	483118	18177	386049	2473	2968	192901	1262140	0	50327	251389	2649543
Fallow/harvested land	780259	53913	49709	14468	495	46618	210831	0	0	168294	1324586
Agricultural plantations	2720	7543	15086	0	0	261653	1066272	0	76295	39817	1469385
Salt affected land	0	0	0	0	0	63187	85940	0	0	30048	179175
River	73080	2226	58859	87918	0	10387	283911	0	71720	522934	1111035
Area for 1997 in m²	2175857	377022	509703	104859	3462	574746	2909093	0	198342	1078885	7931970

Table 5.34 Land use Change Matrix for Thennampattinam village from 1997 to 2004

Land use category	Sandy area	Built-up area	Salt pan / Aquaculture	Water logged area	Tank	Scrub land	Cropland	Fallow/ harvested land	Agricultural plantations	Salt affected land	River	Area for 1997 in m²
Sandy area	246196	55397	333372	232134	0	56634	16941	880172	297142	0	57870	2175857
Built-up area	0	377022	0	0	0	0	0	0	0	0	0	377022
Salt pan / Aquaculture	0	97316	375538	0	0	3091	0	0	27946	0	5812	509703
Water logged area	0	0	43650	0	0	18795	0	0	0	0	42413	104859
Tank	0	0	0	0	0	0	0	3462	0	0	0	3462
Scrub land	0	0	0	0	0	0	0	0	0	0	0	0
Cropland	0	210212	70854	0	0	0	232965	11747	35860	9398	3710	574746
Fallow/ harvested land	0	948306	248793	38457	7419	109558	1258678	23371	80870	89526	104117	2909093
Agricultural plantations	0	0	0	0	0	0	0	0	0	0	0	0
Salt affected land	0	34500	86063	0	0	0	55026	0	0	22752	0	198342
River	120687	38209	117348	16199	0	68999	62693	28935	45258	0	580557	1078885
Area for 2004 in m²	366883	1760962	1275619	286789	7419	257078	1626303	947687	487075	121676	794480	7931970

Table 5.35 Land use summary statistics of three time periods –Thennampattinam Village

S No	Land use category	Year	No of patches	Area(a) in m ²	Perimeter (p) in m	P=(p/a) in %	S1(min) in m ²	S2(max) in m ²	S3(mean) in m ²
1	Built-up area	1992	5	295163	5243	1.78	1825	144756	59032.6
		1997	7	377022	6361	1.69	1825	144756	53860.3
		2004	12	1760962	18473	1.05	190	566229	146746.8
2	Cropland	1992	13	2649543	22319	0.84	314	1744862	203811.0
		1997	15	574746	13577	2.36	4	148242	38316.4
		2004	5	1626303	23256	1.43	4389	1406762	325260.6
3	Fallow/harvested land	1992	10	1324586	14696	1.11	60	899967	132458.6
		1997	9	2909093	35915	1.23	2	1037267	323232.5
		2004	3	947687	6553	0.69	11794	855921	315895.7
4	Agricultural plantations	1992	6	1469385	14913	1.01	428	571491	244897.5
		1997		0	0	0.00	0	0	0.0
		2004	9	487075	12175	2.50	12984	143791	54119.4
5	Water logged area	1992	0	0	0	0.00	0	0	0.0
		1997	1	104859	1862	1.78	104859	104859	104859.0
		2004	1	286789	3715	1.30	286789	286789	286789.0
6	Salt affected land	1992	1	179175	2131	1.19	179175	179175	179175.0
		1997	2	198342	3301	1.66	70166	127810	99171.0
		2004	3	121676	2646	2.17	18964	60253	40558.7
7	Scrub land	1992	0	0	0	0.00	0	0	0.0
		1997	0	0	0	0.00	0	0	0.0
		2004	6	257078	6714	2.61	20410	104457	42846.3
8	Sandy area	1992	1	709158	6400	0.90	709158	709158	709158.0
		1997	6	2175857	14745	0.68	533	1832306	362642.8
		2004	2	366883	8894	2.42	122463	244420	183441.5
9	River	1992	6	1111035	13017	1.17	64	667071	185172.5
		1997	1	1078885	25317	2.43	1078885	1078885	1078885.0
		2004	5	794480	24533	3.09	181	706731	158896.0
10	Tank	1992	0	0	0	0.00	0	0	0.0
		1997	1	3462	234	6.76	3462	3462	3462.0
		2004	3	7419	604	8.14	845	3773	2473.0
11	Salt pan / Aquaculture	1992	1	193925	1801	0.93	193925	193925	193925.0
		1997	1	509703	4547	0.89	509703	509703	509703.0
		2004	7	1275619	15288	1.20	2746	471884	182231.3

The details of the changes of fractal dimensions for the various categories of this village are shown in the table 5.36. The values of the fractal dimensions of all the categories lie between 1.02 and 1.19 during the years of study and hence, the shape of the land use type is simple.

The Landscape diversity and dominance index of this village is shown in table 5.53. The table shows that the landscape diversity index decreases from 0.77 during 1992 to 0.72 during 1997 and again decreases to 0.51 in 2004. The diversification during 2004 is less compared to 1992 and 1997. The landscape dominance index shows an increase in 1997 with 23.48 % from 13.39 % in 1992 and again increases in 2004 with 52.84 %. Since the value is more during 2004, it depicts less fragmentation during 2004.

5.3.5 Thirumullaivasal

The change matrices depicting the detailed transformations for the years 1992 – 1997 and 1997 – 2004 for the different land use categories found in this village are shown in the tables 5.37 and 5.38 and the summary statistics in table 5.39.

The dominated land use, cropland during 1992 with 42.15 % of the total area increases to 45.71 % of the total area during 1997 and reduces to 14.36 % by mostly converted to fallow/harvested land during 2004. The fallow/harvested land with 19.03 % during 1992 got reduced due its conversions to cropland during 1997 to 11.16 % and reclaims 48.80 % in 2004 from the cropland. The built up land found mostly along the banks of the river in the southern and eastern parts of village during 1992 with 13.36 % of total area extends its coverage towards northern and western parts with a toll of 18.92 % and emergence of new hamlets on north-eastern boundary rises

Table 5.36 Fractal dimension of land use category- Thennampattinam Village

S No	Land use category	Fractal Dimension		
		1992	1997	2004
1.	Built-up area	1.04	1.03	1.06
2.	Cropland	1.07	1.07	1.14
3.	Fallow/ harvested land	1.07	1.14	1.04
4.	Agricultural plantations	1.08	---	1.08
5.	Salt affected land	1.00	1.05	1.02
6.	Scrub land	---	---	1.07
7.	Sandy area	1.00	1.08	1.16
8.	River	1.08	1.00	1.19
9.	Tank	---	1.00	1.02
10.	Salt pan /Aquaculture	1.00	1.00	1.06

Table 5.37 Land use Change Matrix for Thirumullaivasal village from 1992 to 1997

Land use category	Sandy area	Built-up area	Water logged area	Cropland	Fallow/harvested land	Agricultural plantations	Salt affected land	River	Area for 1992 in m²
Sandy area	404103	0	0	70112	0	135402	0	120563	730179
Built-up area	0	1852590	0	0	0	0	0	0	1852590
Water logged area	0	38704	0	113886	125015	0	198713	0	476317
Cropland	199578	563617	0	3466033	469639	828855	310620	52306	5890648
Fallow/harvested land	92246	97563	0	1840472	246938	381845	0	0	2659064
Agricultural plantations	631008	0	0	897113	24236	112552	0	0	1664909
Salt affected land	201062	0	0	0	0	101520	0	0	302582
River	0	91504	0	0	0	0	0	307528	399033
Area for 1997 in m²	1527997	2643978	0	6387615	865828	1560174	509332	480397	13975323

Table 5.38 Land use Change Matrix for Thirumullaivasal village from 1997 to 2004

Land use category	Sandy area	Built-up area	Water logged area	Cropland	Fallow/ harvested land	Agricultural plantations	Salt affected land	River	Area for 1997 in m²
Sandy area	247680	393963	6430	26091	658707	182514	0	12613	1527997
Built-up area	0	2643978	0	0	0	0	0	0	2643978
Water logged area	0	0	0	0	0	0	0	0	0
Cropland	0	610976	0	1221335	4374522	180783	0	0	6387615
Fallow/ harvested land	0	42413	0	399033	424258	0	0	124	865828
Agricultural plantations	0	220228	0	188599	1064293	87053	0	0	1560174
Salt affected land	0	39693	0	171261	298254	0	0	124	509332
River	234696	495	14839	0	124	0	0	230244	480397
Area for 2004 in m²	482376	3951747	21269	2006319	6820158	450349	0	243105	13975323

Table 5.39 Land use summary statistics of three time periods –Thirumullaivasal Village

S No	Land use category	Year	No of patches	Area(a) in m ²	Perimeter (p) in m	P=(p/a) in %	S1(min) in m ²	S2(max) in m ²	S3(mean) in m ²
1	Built-up area	1992	1	1852590	12390	0.67	1852590	1852590	1852590.0
		1997	6	2643978	20332	0.77	15163	2315654	440663.0
		2004	6	3951747	27087	0.69	15163	3061627	658624.5
2	Cropland	1992	6	5890648	33569	0.57	6004	3955636	981774.7
		1997	2	6387615	49710	0.78	230180	6157435	3193807.5
		2004	3	2006319	14840	0.74	94460	1646364	668773.0
3	Fallow/harvested land	1992	5	2659064	24097	0.91	21885	1851738	531812.8
		1997	11	865828	17280	2.00	4035	332669	78711.6
		2004	3	6820158	31380	0.46	415605	5681597	2273386.0
4	Agricultural plantations	1992	4	1664909	15380	0.92	73314	860172	416227.3
		1997	12	1560174	25518	1.64	7535	590934	130014.5
		2004	6	450349	6780	1.51	541	211298	75058.2
5	Water logged area	1992	1	476317	4981	1.05	476317	476317	476317.0
		1997	0	0	0	0.00	0	0	0.0
		2004	1	21269	785	3.69	21269	21269	21269.0
6	Salt affected land	1992	1	302582	2214	0.73	302582	302582	302582.0
		1997	1	509332	5421	1.06	509332	509332	509332.0
		2004	0	0	0	0.00	0	0	0.0
7	Sandy area	1992	2	730179	6890	0.94	141226	588953	365089.5
		1997	10	1527997	18698	1.22	1715	1131296	152799.5
		2004	11	482376	13308	2.76	395	163821	43852.4
8	River	1992	1	399033	6331	1.59	399033	399033	399033.0
		1997	1	480397	7387	1.54	480397	480397	480397.0
		2004	4	243105	6262	2.58	8454	163931	60776.3

the total coverage to 28.28 % of the total area. The salt affected area reduces to none during 2004. The plantations and waterlogged area reduces through the years.

The details of the changes of fractal dimensions for the various categories of this village are shown in the table 5.40. The values of the fractal dimensions of all the categories lie between 1.05 and 1.31 during the years of study and hence, the shape of the land use type is simple.

The Landscape diversity and dominance index of this village is shown in table 5.53. The table shows that the landscape diversity index decreases from 0.72 during 1992 to 0.68 during 1997 and again decreases to 0.56 in 2004. The diversification during 2004 is less compared to 1992 and 1997. The landscape dominance index shows decrease in 1997 with 16.39 % from 18.43 % in 1992 and increases in 2004 with 28.35 %. Since the value is more during 2004, it depicts less fragmentation during 2004.

5.3.6 Vettangudi

The change matrices depicting the detailed transformations for the years 1992 – 1997 and 1997 – 2004 for the different land use categories found in this village are shown in the tables 5.41 and 5.42 and the summary statistics in table 5.43.

The dominated land use, cropland during 1992 with 45.37 % of the total area increases to 50.04 % of the total area during 1997 and reduces to 39.04 % by mostly converted to fallow/harvested land during 2004. The fallow/harvested land with 24.85 % during 1992 get reduced due its conversions to cropland during 1997 to 14.28 % and reclaims 35.40 % in 2004 mostly from the cropland. The built-up land, which is available as very small hamlets during 1992 with 1.83 % of the total area, strengthens its area to 2.40 % in 1997 and due to merging of the most of the hamlets available and

Table 5.40 Fractal dimension of land use category- Thirumullaivasal Village

S No	Land use category	Fractal Dimension		
		1992	1997	2004
1.	Built-up area	1.07	1.07	1.07
2.	Cropland	1.29	1.13	1.08
3.	Fallow/ harvested land	1.31	1.08	1.08
4.	Agricultural plantations	1.28	1.06	1.05
5.	Sandy area	1.29	1.08	1.09
6.	River	1.13	1.12	1.11

Table 5.41 Land use Change Matrix for Vettangudi village from 1992 to 1997

Land use category	Sandy area	Built-up area	Cropland	Fallow/ harvested land	Agricultural plantations	Salt affected land	River	Area for 1992 in m²
Sandy area	64177	0	180906	0	114009	22876	0	381968
Built-up area	0	289104	0	0	0	0	0	289104
Cropland	921473	73574	3898441	1224055	895011	62569	92864	7167987
Fallow/harvested land	1282914	17188	1686399	651411	226288	60962	371	3925533
Agricultural plantations	827743	0	1937417	373313	526891	43155	0	3708519
Salt affected land	0	0	85322	0	0	16075	0	101397
River	42537	0	116977	7296	20774	0	35612	223196
Area for 1997 in m²	3138843	379866	7905462	2256075	1782973	205637	128848	15797704

Table 5.42 Land use Change Matrix for Vettangudi village from 1997 to 2004

Land use category	Sandy area	Built-up area	Salt pan / Aquaculture	Scrub land	Cropland	Fallow/ harvested land	Agricultural plantations	Salt affected land	River	Area for 1997 in m²
Sandy area	224309	83714	301593	0	966112	1243592	294050	0	25473	3138843
Built-up area	0	379866	0	0	0	0	0	0	0	379866
Salt pan / Aquaculture	0	0	0	0	0	0	0	0	0	0
Scrub land	0	0	0	0	0	0	0	0	0	0
Cropland	0	827124	47978	130579	3697143	2616392	569058	0	17188	7905462
Fallow/ harvested land	0	64177	20650	268577	760351	1076659	38951	0	26709	2256075
Agricultural plantations	0	0	5688	0	631132	598735	547418	0	0	1782973
Salt affected land	0	42413	0	0	79881	43279	7296	32768	0	205637
River	0	0	22010	0	31779	14468	15333	0	45258	128848
Area for 2004 in m²	224309	1397295	397920	399156	6166398	5593125	1472106	32768	114628	15797704

Table 5.43 Land use summary statistics of three time periods –Vettangudi Village

S No	Land use category	Year	No of patches	Area(a) in m ²	Perimeter (p) in m	P=(p/a) in %	S1(min) in m ²	S2(max) in m ²	S3(mean) in m ²
1	Built-up area	1992	10	289104	7371	2.55	95	65719	28910.4
		1997	7	379866	7372	1.94	11580	105298	54266.6
		2004	6	1397295	16964	1.21	42630	662441	232882.5
2	Cropland	1992	13	7167987	59240	0.83	211	2680196	551383.6
		1997	7	7905462	79938	1.01	40	7625964	1129351.7
		2004	11	6166398	53476	0.87	2740	3621463	560581.6
3	Fallow/harvested land	1992	15	3925533	34782	0.89	1071	3263017	261702.2
		1997	22	2256075	37799	1.68	0	454320	102548.8
		2004	9	5593125	44567	0.8	16666	3646925	621458.3
4	Agricultural plantations	1992	3	3708519	42574	1.15	1	779758	1236173.0
		1997	19	1782973	29108	1.63	6125	293906	93840.7
		2004	21	1472106	28359	1.93	1	360476	70100.3
5	Salt affected land	1992	2	101397	1870	1.84	2269	99128	50698.5
		1997	3	205637	4016	1.95	42287	116400	68545.7
		2004	4	32768	1349	4.12	2634	26431	8192.0
6	Scrub land	1992	0	0	0	0.00	0	0	0.0
		1997	0	0	0	0.00	0	0	0.0
		2004	1	399156	3671	0.92	399156	399156	399156.0
7	Sandy area	1992	3	381968	5931	1.55	4143	215301	127322.7
		1997	29	3138843	42860	1.37	1348	480647	108235.9
		2004	5	224309	6253	2.79	22074	66120	44861.8
8	River	1992	1	223196	7385	3.31	223196	223196	223196.0
		1997	4	128848	5830	4.52	11836	64095	32212.0
		2004	4	114628	5502	4.80	3070	64273	28657.0
9	Salt pan / Aquaculture	1992	0	0	0	0.00	0	0	0.0
		1997	0	0	0	0.00	0	0	0.0
		2004	4	397920	5584	1.40	11972	250504	99480.0

emergence of new hamlets during 2004 shows its area increased to 8.84 %. The plantation goes on decreasing during the years.

The details of the changes of fractal dimensions for the various categories of this village are shown in the table 5.44. The values of the fractal dimensions of all the categories lie between 1.03 and 1.15 during the years of study and hence, the shape of the land use type is simple.

The Landscape diversity and dominance index of this village is shown in table 5.53. The table shows that the landscape diversity index increases from 0.56 during 1992 to 0.60 during 1997 and again increases to 0.64 in 2004. The diversification during 2004 is more compared to 1992 and 1997. The landscape dominance index shows decrease in 1997 with 35.60 % from 38.94 % in 1992 and again decreases in 2004 with 31.80 %. Since the value is less during 2004, it depicts more fragmentation during 2004.

5.3.7 Tandavankulam

The change matrices depicting the detailed transformations for the years 1992 – 1997 and 1997 – 2004 for the different land use categories found in this village are shown in the tables 5.45 and 5.46 and the summary statistics in table 5.47.

The dominated land use, cropland during 1992 with 55.55 % of the total area reduces to 29.02 % of the total area during 1997 and again reduces to 15.05 % of the total area in 2004. The fallow/harvested land, which covered 28.09 % of the total area during 1992, get converted some area from cropland and increased to 29.02 % of the total area during 1997 and due its conversions to plantations, built-up area, salt affected area and Salt pan/Aquaculture during 2004, it gets reduced to 16.65 % of the

Table 5.44 Fractal dimension of land use category- Vettangudi Village

S No	Land use category	Fractal Dimension		
		1992	1997	2004
1.	Built-up area	1.04	1.03	1.05
2.	Cropland	1.09	1.15	1.10
3.	Fallow/ harvested land	1.12	1.08	1.08
4.	Agricultural plantations	1.05	1.04	1.06
5.	Scrub land	---	---	---
6.	Salt affected land	1.05	1.04	1.05
7.	Sandy area	1.08	1.05	1.07
8.	River	1.00	1.14	1.15
9.	Tank	---	---	---
10.	Salt pan /Aquaculture	---	---	1.00

Table 5.45 Land use Change Matrix for Tandavankulam village from 1992 to 1997

Land use category	Sandy area	Built-up area	Salt pan / Aqua culture	Cropland	Fallow/ harvested land	Agricultural plantations	Salt affected land	River	Area for 1992 in m²
Sandy area	380361	0	0	1237	145789	69988	0	0	597374
Built-up area	0	152095	0	0	0	0	0	0	152095
Salt pan / Aquaculture	92741	0	0	7914	178928	0	43279	0	322862
Cropland	956096	64548	0	1791258	2677612	39693	176331	294297	5999835
Fallow/harvested land	801775	0	0	1319116	753674	45258	114628	0	3034449
Agricultural plantations	214540	0	0	0	100902	137256	0	0	452699
Salt affected land	0	0	0	0	0	0	0	0	0
River	0	0	0	14839	32026	0	24978	170025	241868
Area for 1997 in m²	2445513	216643	0	3134362	3888931	292195	359216	464322	10801182

Table 5.46 Land use Change Matrix for Tandavankulam village from 1997 to 2004

Land use category	Sandy area	Built-up area	Salt pan / Aquaculture	Water logged area	Tank	Cropland	Fallow/ harvested land	Agricultural plantations	Salt affected land	River	Area for 1997 in m²
Sandy area	839984	266599	334485	117595	1855	244465	138864	199826	301840	0	2445513
Built-up area	0	216643	0	0	0	0	0	0	0	0	216643
Salt pan / Aquaculture	0	0	0	0	0	0	0	0	0	0	0
Water logged area	0	0	0	0	0	0	0	0	0	0	0
Tank	0	0	0	0	0	0	0	0	0	0	0
Cropland	0	434398	356248	21269	5070	946080	473938	448000	439468	9892	3134362
Fallow/ harvested land	0	506983	333743	341286	0	417210	1168039	845301	229997	46370	3888931
Agricultural plantations	0	18301	0	0	0	17930	0	202299	53666	0	292195
Salt affected land	0	0	108198	39940	0	0	0	60467	141461	9150	359216
River	0	10016	233336	0	0	0	17312	69494	0	134165	464322
Area for 2004 in m²	839984	1452939	1366010	520090	6925	1625684	1798153	1825386	1166432	199578	10801182

Table 5.47 Land use summary statistics of three time periods –Tandavankulam Village

S No	Land use category	year	No of patches	Area(a) in m ²	Perimeter (p) in m	P=(p/a) in %	S1(min) in m ²	S2(max) in m ²	S3(mean) in m ²
1	Built up area	1992	7	152095	4170	2.74	588	66177	21727.9
		1997	6	216643	4315	1.99	588	74576	36107.2
		2004	11	1452939	21834	1.50	588	702963	132085.4
2	crop land	1992	4	5999835	35632	0.59	4305	5654804	1499958.8
		1997	5	3134362	29106	0.93	24433	2770789	626872.4
		2004	10	1625684	22906	1.41	359	727255	162568.4
3	Fallow/harvested land	1992	2	3034449	21560	0.71	68279	2966170	1517224.5
		1997	9	3888931	40437	1.04	422	1761328	432103.4
		2004	14	1798153	31097	1.73	2135	1016500	128439.5
4	Agricultural plantations	1992	2	452699	3991	0.88	122053	330574	226349.5
		1997	4	292195	4928	1.69	27838	103735	73048.8
		2004	12	1825386	27734	1.52	7434	442201	152115.5
5	Water logged area	1992	0	0	0	0.00	0	0	0.0
		1997	0	0	0	0.00	0	0	0.0
		2004	2	520090	5714	1.10	191986	328104	260045.0
6	Salt affected land	1992	0	0	0	0.00	0	0	0.0
		1997	4	359216	6811	1.90	40085	188153	89804.0
		2004	5	1166432	16098	1.38	80406	694360	233286.4
7	Sandy area	1992	2	597374	7721	1.29	41012	556362	298687.0
		1997	13	2445513	29808	1.22	25588	872086	188116.4
		2004	13	839984	15896	1.89	26	301105	64614.2
8	River	1992	3	241868	7342	3.04	1014	183443	80622.7
		1997	2	464322	10382	2.24	41981	422341	232161.0
		2004	9	199578	8346	4.18	4	129718	22175.3
9	Tank	1992	0	0	0	0.00	0	0	0.0
		1997	0	0	0	0.00	0	0	0.0
		2004	1	6925	358	5.17	6925	6925	6925.0
10	Salt pan / Aquaculture	1992	1	322862	3215	1.00	322862	322862	322862.0
		1997	0	0	0	0.00	0	0	0.0
		2004	6	1366010	14662	1.07	530	777107	227668.3

total area. The built up land, found as small hamlets during 1992 with an area of 1.41 % of total area , increased its area to 2.01 % due to merging of some hamlets during 1997. The emergence of new hamlets and extension of the available hamlets in its area reaches a toll of 13.45 % of the total area during 2004. The salt affected land has increased to 10.80 % in 2004 from none in 1992. The Salt pan/Aquaculture and plantations increased in their areas during the years. There is small emergence of scrubland during 2004.

The details of the changes of fractal dimensions for the various categories of this village are shown in the table 5.48. The values of the fractal dimensions of all the categories lie between 1.02 and 1.18 during the years of study and hence, the shape of the land use type is simple.

The Landscape diversity and dominance index of this village is shown in table 5.53. The table shows that the landscape diversity index increases from 0.53 during 1992 to 0.65 during 1997 and again increases to 0.90 in 2004. The diversification during 2004 is more compared to 1992 and 1997. The landscape dominance index shows decrease in 1997 with 19.90 % from 31.25 % in 1992 and again decreases in 2004 with 9.72 %. Since the value is less during 2004, it depicts that the area is highly fragmented during 2004.

5.3.8 Pudupattinam

The change matrices depicting the detailed transformations for the years 1992 – 1997 and 1997 – 2004 for the different land use categories found in this village are shown in the tables 5.49 and 5.50 and the summary statistics in table 5.51.

Table 5.48 Fractal dimension of land use category- Tandavankulam Village

S No	Land use category	Fractal Dimension		
		1992	1997	2004
1.	Built-up area	1.04	1.02	1.05
2.	Cropland	1.11	1.09	1.10
3.	Fallow/ harvested land	1.10	1.10	1.09
4.	Agricultural plantations	1.01	1.03	1.07
5.	Water logged area	---	---	1.06
6.	Scrub land	---	---	---
7.	Salt affected land	---	1.06	1.05
8.	Sandy area	1.06	1.05	1.09
9.	River	1.17	1.17	1.18
10.	Tank	---	---	1.00
11.	Salt pan /Aquaculture	---	---	1.06

Table 5.49 Land use Change Matrix for Pudupattinam village from 1992 to 1997

Land use category	Sandy area	Built-up area	Salt pan / Aquaculture	Water logged area	Cropland	Fallow/ harvested land	Agricultural plantations	Salt affected land	River	Area for 1992 in m²
Sandy area	279335	0	0	0	0	25596	252379	0	74687	631998
Built-up area	0	179917	0	0	0	0	0	0	0	179917
Salt pan / Aquaculture	24484	0	0	0	0	74193	0	0	0	98676
Water logged area	60714	44268	0	219981	125880	317872	76666	315195	77284	1237861
Cropland	48967	640035	0	0	809318	1025095	68752	229132	61580	2882879
Fallow/harvested land	239024	23989	0	0	205885	685911	3462	1059347	11871	2229489
Agricultural plantations	777044	0	0	54655	0	488311	814635	0	106095	2240741
Salt affected land	0	0	0	0	0	0	0	0	0	0
River	11005	23742	0	19166	120934	141832	9645	26709	244094	597127
Area for 1997 in m²	1440574	911951	0	293803	1262017	2758810	1225539	1630383	575611	10098688

Table 5.50 Land use Change Matrix for Pudupattinam village from 1997 to 2004

Land use category	Sandy area	Built-up area	Salt pan / Aquaculture	Water logged area	Tank	Cropland	Fallow/ harvested land	Agricultural plantations	Salt affected land	River	Area for 1997 in m²
Sandy area	216519	13107	93235	489177	0	47978	20650	503644	43774	12489	1440574
Built-up area	0	911951	0	0	0	0	0	0	0	0	911951
Salt pan / Aquaculture	0	0	0	0	0	0	0	0	0	0	0
Water logged area	0	21763	0	202546	0	0	0	8532	0	60962	293803
Tank	0	0	0	0	0	0	0	0	0	0	0
Cropland	0	169530	0	59601	0	634718	50080	170025	98924	79139	1262017
Fallow/ harvested land	0	123531	120563	848968	11253	955230	247061	339926	0	112278	2758810
Agricultural plantations	0	142944	124	157165	0	0	68752	855565	0	989	1225539
Salt affected land	0	102386	501295	556321	14097	23371	279954	127859	0	25102	1630383
River	61580	53913	0	218003	0	55768	0	94348	0	91999	575611
Area for 2004 in m²	278099	1539126	715217	2531780	25349	1717065	666497	2099899	142697	382958	10098688

Table 5.51 Land use summary statistics of three time periods –Pudupattinam Village

S No	Land use category	Year	No of patches	Area(a) m ²	Perimeter (p) in m	P=(p/a) in %	S1(min) in m2	S2(max) in m2	S3(mean) in m2
1	Built-up area	1992	2	179917	2356	1.31	74791	105126	89958.5
		1997	5	911951	9188	1.01	74722	409850	182390.2
		2004	7	1539126	16917	1.10	36875	508511	219875.1
2	Cropland	1992	4	2882879	15416	0.53	0	2880688	720719.8
		1997	2	1262017	13055	1.03	148145	1113872	631008.5
		2004	4	1717065	18504	1.08	12553	1615625	429266.3
3	Fallow/harvested land	1992	3	2229489	15971	0.72	93068	2018920	743163.0
		1997	4	2758810	25175	0.91	18079	1520414	689702.5
		2004	3	666497	6578	0.99	8011	590778	222165.7
4	Agricultural plantations	1992	2	2240741	11790	0.53	60648	2180339	1120370.5
		1997	7	1225539	13428	1.10	25446	458730	175077.0
		2004	8	2099899	17089	0.81	14422	1474881	262487.4
5	Water logged area	1992	3	1237861	12307	0.99	255804	573685	412620.3
		1997	2	293803	4247	1.45	135708	158095	146901.5
		2004	6	2531780	25763	1.02	4602	1109505	421963.3
6	Salt affected land	1992	0	0	0	0.00	0	0	0.0
		1997	2	1630383	12234	0.75	242910	1387475	815191.5
		2004	2	142697	4125	2.89	41678	101019	71348.5
7	Sandy area	1992	4	631998	11069	1.75	5008	286702	157999.5
		1997	7	1440574	15698	1.09	3719	861933	205796.3
		2004	3	278099	7047	2.53	8738	169049	92699.7
8	River	1992	2	597127	14456	2.42	237031	360096	298563.5
		1997	10	575611	17950	3.12	7	237072	57561.1
		2004	5	382958	15753	4.11	17659	213438	76591.6
9	Tank	1992	0	0	0	0.00	0	0	0.0
		1997	0	0	0	0.00	0	0	0.0
		2004	2	25349	1033	4.07	11251	14098	12674.5

The dominated land use, cropland during 1992 with 28.55 % of the total area reduces to 12.50 % of the total area during 1997 and increases to 17.00 % of the total area in 2004. The fallow/harvested land, which covered 22.08 % of the total area during 1992, increased to 27.32 % of the total area during 1997 and due its conversions to plantations, built-up area, salt affected area and Salt pan/Aquaculture during 2004, it gets reduced to 6.60 % of the total area. The built up land, found as two hamlets on the northeastern and southeastern parts of the village with 1.78 % of the total area during 1992, after emergence of three more hamlets during 1997, increased to an area of 9.03 % of the total area during 1997. The merging of available hamlets, emergence of some more new hamlets and extension of the available hamlets rises to a toll of 15.24 % of the total area during 2004. The plantations from 22.19 % during 1992, reduces to 12.14 % during 1997 and reclaims its area to 20.79 % of the total area during 2004. The emergence of salt affected land during 1997 with 16.14 % reduces to 1.41 % in 2004. The waterlogged area gets increased during 2004 to 25.07 % of the total area.

The details of the changes of fractal dimensions for the various categories of this village are shown in the table 5.52. The values of the fractal dimensions of all the categories lie between 1.00 and 1.18 during the years of study and hence, the shape of the land use type is simple.

The Landscape diversity and dominance index of this village is shown in table 5.53. The table shows that the landscape diversity index increases from 0.76 during 1992 to 0.84 during 1997 and 2004. The diversification during 1997 and 2004 is more compared to 1992. The landscape dominance index shows decrease in 1997 with 6.67 % from 14.73 % in 1992 and again increases in 2004 with 16.33 %. Since the value is less during 1997, it depicts that the area is highly fragmented during 1997.

Table 5.52 Fractal dimension of land use category- Pudupattinam Village

S No	Land use category	Fractal Dimension		
		1992	1997	2004
1.	Built-up area	1.00	1.01	1.04
2.	Cropland	1.09	1.11	1.11
3.	Fallow/ harvested land	1.08	1.11	1.06
4.	Agricultural plantations	1.06	1.03	1.05
5.	Water logged area	1.07	1.06	1.10
6.	Scrub land	---	---	---
7.	Salt affected land	---	1.08	1.10
8.	Sandy area	1.10	1.07	1.15
9.	River	1.19	1.14	1.18
10.	Tank	---	---	1.03

Table 5.53 Comparison of Landscape pattern indices

S No	Name of the village	Diversity index H				Dominance index D in %			
		1992	1997	2004	2006	1992	1997	2004	2006
1.	Tharangambadi	0.53	0.55	0.72	0.59	24.34	22.55	23.65	18.94
2.	Manikkapangu	0.62	0.66	0.77	0.65	15.33	18.82	13.33	19.41
3.	Pillaiperumanallur	0.63	0.64	0.63	0.81	32.50	31.92	32.81	9.57
4.	Maruthampallam	0.43	0.51	0.25	0.58	52.01	44.31	70.26	37.65
5.	Kalamanallur	0.57	0.58	0.85	0.78	33.15	32.71	14.95	11.96
6.	Vanagiri	0.60	0.83	0.87	0.71	35.70	12.46	13.13	28.65
7.	Kilaiyur	0.61	0.61	0.82	0.78	23.76	23.89	12.94	16.98
8.	Perunthottam	0.73	0.68	0.95	0.71	26.64	31.73	12.55	13.45
9.	Thennampattinam	0.77	0.72	0.51	0.49	13.39	23.48	52.84	41.57
10.	Thirumullaivasal	0.72	0.68	0.56	0.53	18.43	16.39	28.35	25.56
11.	Vettangudi	0.56	0.60	0.64	0.69	38.94	35.60	31.80	26.57
12.	Tandavankulam	0.53	0.65	0.90	0.75	31.25	19.90	9.72	15.57
13.	Pudupattinam	0.76	0.84	0.84	0.64	14.73	6.67	16.33	20.24

5.4 Discussions

The reasons for the changes were discussed for the study area according to land use category:

5.4.1 Built-up land

The area occupied by settlements has shown an increase throughout the period of study in Tharangambadi taluk. In the years between 1992-97, this increase is marginal ranging between 0.06 % in Manikkapangu and 2.94 % in Sattangudi. But in the period 1997-04, the increase is considerable. This can be attributed to the population increase and industrialization. The village Sattangudi shows highest increase of 25.03 %. This is because of tourism boom as it houses the Tharangambadi fort, one of the prime tourist attractions in this vicinity. Again, the next highest increase of 17.29 % observed in Manikkapangu is because of the overflow in tourist activities, as this is to the north of Sattangudi encompassing the approach route from Nagapattinam. Kalamanallur, with a considerable increase of 13.57 % reinforces the effect of tourist influx and tourism related activities, as it contains Poompuhar of Vanagiri village. The other villages Pillaiperumanallur and Maruthampallam show an increase of 7.18 % and 9.6 % respectively. The inception of power plant in the year 2002 in Pillaiperumanallur has increased the employment potential in this area resulting in settlement expansion. Maruthampallam being adjacent to Kalamanallur and north of Pillaiperumanallur accommodates the overflow settlement expansion showing an increase in the built-up area.

Between the period 1992 and 1997, the built-up land has shown a usual increase in all the villages of the study area in the Sirkazhi Taluk. The key change is observed in Pudupattinam (7.25 % of total area), where the waterlogged area and

agricultural plantations were occupied by settlements. Likewise, Thirumullaivasal and Thennampattinam has also shown an increase of 5.66 % and 1.06 %, respectively of total area, where the agricultural plantations and river were engaged by the Built up land. Villages Tandavankulam, Kilaiyur, Vettangudi, Perunthottam and Vanagiri have undergone a marginal shift of 0.6 %, 0.59 %, 0.57 %, 0.22 % and 0.13 %, respectively of the total area. In these villages, agricultural plantations and river have been bounded by settlements. During the period between 1997 and 2004, Thennampattinam and Kilaiyur has shown a wide increase of 17.42 % and 13.85 % of the total area, respectively, where the agricultural plantations, salt pan / aquaculture and river has been surrounded by the built-up land. A typical increase of 13.85 %, 11.44 % and 9.36 % are observed in Vanagiri, Tandavankulam and Thirumullaivasal. Here, the sandy area, agricultural plantations, tanks and river are transformed to settlements. About 6.44 %, 6.34 % and 6.21 % of increase are observed in Vettangudi, Perunthottam and Pudupattinam, where the built-up land covered the sandy area, salt affected land and river.

The change in population data is shown in table 5.54. This population increase is nominal during the years and it does not necessitate more shelter accommodations. The district is primarily agrarian in nature and throws open good scope for development of industries based on agricultural inputs such as extraction of rice bran oil, straw board, cultivation and extraction of palm oil, cultivation and processing of horticultural products and floriculture. After the setting up of a refinery at Panangudi near Narimanam, there is good scope for gas based industries and petrochemical based downstream industries. Apart from these, the district offers good scope for tourism, handicrafts, etc. and marine based industries in the 147 km long coastline.

Table 5.54 Population Details

S.No.	Village	1991	2001	% Difference
1	Sattangudi	18881	20843	10.39
2	Manikkapangu	4243	4460	5.11
3	Pillaiperumanallur	2593	2966	14.38
4	Maruthampallam	2802	2911	3.89
5	Kalamanallur	2805	2828	0.82
6	Vanagiri	5348	6261	17.07
7	Kilaiyur	6643	8224	23.80
8	Perunthottam	4270	6860	60.66
9	Thennampattinam	4138	3989	-3.60
10	Thirumullaivasal	11551	12594	9.03
11	Vettangudi	4646	4046	-12.91
12	Tandavankulam	4130	4594	11.23
13	Pudupattinam	7444	9316	25.15

The Techno Economic Survey Report of Nagapattinam district states that the number of small scale industries registered increases from 91 during 1991 – 1992 to 1199 in 1996 –1997, which results in more employment of the people in the in and out areas of the district. Such migrated population from other parts of the country created more demand for shelter. ONGC and Chennai Petroleum Corporation Limited located in the Nagapattinam district, attracted more employees from other states of the country, which stayed as the main cause for increase in settlement. Even though the industries are not situated in this area, the lesser rent and cost of land makes more people to move towards this area. Poompuhar (Sirkazhi block), Tharangambadi (Sembanarkoil block), Velankanni (Velankanni block), Nagore (Nagapattinam block) and Point Calimere (Vedaranniyam block) are the main tourist spots in the district. The first 4 tourist spots are visited throughout the year and the tourist spot Point Calimere is visited from August to March. The foreign tourist arrivals have fluctuations and domestic tourist arrivals have been steadily increasing except in the years 1992-93 and the tourist arrivals both domestic and foreign are estimated at 2,99,150 during the years. These five tourist spots are also included in the tourist circuits identified by the Tourism Department. (From Final report of Directorate of Environment, GTN, Nagapattinam District Environment Profile, AIMS Research, Chennai). These tourists spots forms the most important factor for the floating population of the people in the study area, which thereby, leads to construction of hotels, lodges, etc., to increase the built up area of the study area.

5.4.2 Agricultural Land

5.4.2.1 Cropland

During the period between 1992 and 1997, there is no change in the Sattangudi and Pillaiperumanallur while in all the other three villages of

Tharangambadi, there is a marginal increase in the area occupied by cropland. In Manikkapangu, it has increased by 1.75 % of total area being converted into fallow / harvested land, in essence being retained within the agricultural plantations land. In Kalamandalur, the increase is very minimal by 0.02 %, while in Maruthampallam it has increased by 0.67 %. The notable change is that it has been converted into salt affected lands as these areas are close to the coastal belt and spawning aquaculture activities. In the year between 1997 and 2004, it is seen that there is a considerable increase in the area occupied by cropland. It has increased by 27.49 % in Sattangudi where built-up land has occupied cropland area. The other villages Manikkapangu, Pillaiperumanallur, Maruthampallam and Kalamandalur have shown an increase of 16.63 %, 33.56 %, 23.27 %, and 14.95 % of total area, respectively. The key observation is that in all these villages, the cropland has turned into fallow / harvested land again held in the category of agricultural lands which has shown a decrease in all these villages other than being converted to fallow / harvested land, it has also been taken by built-up land in all the villages, by saltpan in Manikkapangu and salt affected land in Maruthampallam and Kalamandalur.

The villages of Sirkazhi taluk, Vanagiri, Thirumullaivasal and Vettangudi shows ascending power of increase during 1992 – 1997 in cropland to 0.76 %, 3.56 % and 4.67 % of the total area, respectively. All these villages show conversion of cropland to built-up land. In the villages Thirumullaivasal and Vettangudi, the cropland has been converted to sandy area, fallow/harvested land, agricultural plantation, salt affected land and river. The villages Perunthottam, Tandavankulam, Thennampattinam and Pudupattinam show a considerable decrease in cropland to 38.67 %, 26.53 %, and 26.05 % of the total area respectively. The cropland has been converted to sandy area, built up land, fallow/ harvested land and salt affected land.

In the villages Perunthottam and Thennampattinam, the cropland is taken up by saltpan / aquaculture and tanks. The cropland is also taken up by river in Thennampattinam, Tandavankulam and Pudupattinam. During the period 1997 – 04, the cropland increased by 13.32 %, 12.49 %, 7.54 %, 4.5 % and 4.19 % of total area, respectively in the villages Thennampattinam, Perunthottam, Kilaiyur, Pudupattinam and Vanagiri. The cropland is converted to built-up land, fallow/harvested land, agricultural plantation and salt affected land in these villages. Tanks in Vanagiri and Perunthottam took up the cropland. It is also converted to saltpan / aquaculture in Thennampattinam village. River occupies cropland in the villages Vanagiri, Thennampattinam and Pudupattinam. The other villages Thirumullaivasal, Tandavankulam and Vettangudi show a decrease of 31.35 %, 13.97 %, and 11 % of total area. In all the three villages, cropland is converted to built-up area, fallow/harvested land, and agricultural plantation. In addition, it is also converted to saltpan / aquaculture, scrub land and river in Vettangudi, whereas to saltpan / aquaculture, water logged area, tank, salt affected land and river in Tandavankulam.

5.4.2.2 Fallow / Harvested land

During 1992 and 1997, fallow/harvested land category of Tharangambadi taluk has declined to a small extent by 2.48%, 1.8%, 0.13%, 5.56% and 0.24% in Sattangudi, Manikkapangu, Pillaiperumanallur, Maruthampallam and Kalamanallur respectively. In all the villages, it has been occupied by built-up land, cropland in Manikkapangu, Pillaiperumanallur and Kalamanallur. Maruthampallam has also shown shift to agricultural plantations, tank, saltpan / aquaculture, sandy area and salt affected land. This category has declined predominantly in all the villages, Sattangudi by 37.44 %, Manikkapangu by 2.08 %, Pillaiperumanallur by 22.14 %, Maruthampallam by 40.23 % and Kalamanallur by 45.42 % in the period between

1997 and 2004. As mentioned above, in all the villages, fallow / harvested land has been converted to cropland and agricultural plantations. In Sattangudi and Manikkapangu, it has turned to built-up and salt affected land in Manikkapangu, Maruthampallam and Kalamanallur, water logged and saltpan in Manikkapangu and saltpan in all villages except Sattangudi.

It shows a decrease trend in four villages of Sirkazhi taluk, Vanagiri, Kilaiyur, Vettangudi and Thirumullaivasal with 0.4 %, 1.42 %, 10.57 %, 12.83 % of the total area, respectively during 1992 – 1997. All these villages show a conversion of fallow/harvested land to built up land. In addition, fallow/harvested land has been converted to sandy area and cropland in Vanagiri, Thirumullaivasal and Vettangudi. This land use category has been converted to plantation in Thirumullaivasal and Vettangudi. In the village Vettangudi, fallow /harvested land has also been transformed to river. The other four villages namely Perunthottam, Thennampattinam, Tandavankulam and Pudupattinam shows an increased trend with 38.16 %, 20.15 %, 7.91 % and 5.24 % of total area, respectively. In these villages, the fallow land is converted to sandy area, cropland and salt affected land. In Pudupattinam, fallow land is given up to built up area and river. In Tandavankulam and Pudupattinam, the fallow land is taken up by agricultural plantation. During the period 1997 – 2004, only two villages Thirumullaivasal and Vettangudi show increase in fallow/ harvested land with 42.6% and 21.12% of the total area, where fallow harvested land is taken up by built up land and cropland. In addition, the fallow/ harvested land is converted to saltpan / aquaculture, scrubland, agriculture plantation and river in Vettangudi. The villages Perunthottam, Vanagiri, Kilaiyur, Thennampattinam, Pudupattinam and Tandavankulam show decrease with 44.81 %, 34.41 %, 25.6 %, 24.84 %, 20.72 % and 19.35 % of total area respectively, where land use category is taken up mostly by

built-up land and crop land. It is also converted to saltpan / aquaculture, scrubland, plantations, water logged area, salt affected land and river.

5.4.2.3 Agricultural Plantations

Between 1992 and 1997, Maruthampallam alone shows an increase of 1.95 % while in all the other villages it remains the same. Here, it has been converted to sandy area and fallow/harvested land. During 1997 – 2004, this category has declined in Manikkapangu and Pillaiperumanallur marginally by 0.49 % and 2.47 % respectively while the other villages has shown an increase 2.53 % in saltpan, 4.45 % in Maruthampallam and 1.81 % in Kalamanallur. In all the villages, agricultural has turned into fallow land and cropland in Manikkapangu and Pillaiperumanallur.

All the villages of Sirkazhi Taluk except Kilaiyur has shown decrease in plantations with 18.52 %, 12.19 %, 10.05 %, 1.48 %, 1.31 %, 0.75 % and 0.58 % of the total area respectively, for villages Thennampattinam, Vettangudi, Pudupattinam, Tandavankulam, Perunthottam, Thirumullaivasal and Vanagiri during the period 1992 – 1997. All the villages show that plantations have been transformed to fallow/harvested land. The village Perunthottam, Thennampattinam, Thirumullaivasal and Vettangudi shows conversion of plantations to cropland. The village Thennampattinam loses some of its plantations area to built up land and saltpan / aquaculture. The plantations have been converted to sandy area in Thirumullaivasal, Vettangudi, Thennampattinam and Pudupattinam. In Vettangudi and Thennampattinam, this category gives up to salt affected land. This category is taken by river in Pudupattinam and Thennampattinam.

During 1997 – 2004, these plantations have shown an increase trend in all the villages except Thirumullaivasal and Vettangudi, where it is decreased by 7.94 % and 1.97 % of total area, respectively. In both the villages it has been converted to

cropland and fallow harvested land, whereas also to built-up land in Thirumullaivasal and saltpan in Vettangudi. The other villages Tandavankulam, Perunthottam, Kilaiyur, Vanagiri, Pudupattinam and Thennampattinam has shown increase in this category with 14.19 %, 12.58 %, 10.83 %, 10.78 %, 8.65 % and 6.17 % of the total area, respectively. The plantation area is taken up by built-up land in Tandavankulam and Pudupattinam, waterlogged in Perunthottam and Pudupattinam. It is also converted to cropland salt affected land in Tandavankulam, saltpan and fallow / harvested land in Pudupattinam. The river has taken up plantations in Vanagiri and Pudupattinam.

The fallow / harvested area has decreased through the years. Canals serve 80 percent of the total net area irrigated and only the river Cauvery alone feeds these canals. The Cauvery Delta system is the most ancient of all irrigation schemes in undivided Thanjavur. This comprises mainly of three important projects - Grand Anicut, the Upper Anicut and the Cauvery Vennar Regulator Project. Tanks and wells are rarely used for irrigation in the study area. Paddy is the main crop of this district and it is grown three times in a year. The first crop is known as 'Kuruvai' (the short-term crop) with duration of three and a half to four months from June-July to October-November. The second crop called the 'Thaladi' has duration of five to six months from October - November to February-March. Third is the 'Samba' (the long-term) crop and has duration of almost six months from August to January. Other cereal crops of the district are cumbu, ragi, maize, korra and varagu. The pulses grown in the district are redgram, greengram and blackgram. Other food crops are condiments and species, sugar crops, fruits and vegetables. Among the non-food crops, cotton/fibre, edible oils crops (groundnuts, coconut and gingelly) non-edible oils crops (castor, miger seeds, though in very small area) are the important ones. Cereals, pulses and oil

seeds are the three important crops produced in the district. The production of cereals, pulses and oil seeds fluctuate for the past five years. The reason for the fluctuation could be using rotation of crops seasonally. According to the VAO's statement, the three periods of paddy growth has been reduced to single period because of water availability. Since the system depends on Cauvery water alone, water release from Grandanaicut decides the paddy cultivation. The water has been released during 18th of June 1992 with 1337 cusecs of water followed by 3591 cusecs on 19th of June 1992 and 3874 cusecs during 20th of June 1992 (table 5.55). The annual rainfall at Sirkazhi rain gauge station during 1992 is 1209 mm and the ground water level is 3.29 m. But the water released during 2004 was with one-month backdrop, 3021 cusecs on 27th July, 4512 cusecs on 28th July and 2529 cusecs on 29th July. The rainfall is normal during the year 2004 with 1646.9 mm. The average ground water level found during this year is 1.90 m (table 5.56). Even though, the rainfall is normal during the years, it doesn't significant much to cultivation.

The aquaculturists get the water from the same source, where agriculturists draw water for their cultivation. This is the reason for the conflicts between the village people and the farm owners in this village. As the date of water release changes during the years, the people pump water for their cultivation, which leads the way for salt-water intrusion. The availability of river water decides the yield of paddy. But during the harvesting season, the water availability goes very less in the river, which in turns makes the matured crops dry and the farmers, suffer a heavy loss during these years. This stimulates the people to sell their land. This increases the extent of the area available for prawn culture in this area. This pollutes the adjoining areas by making the soil unworthy for agricultural and water turns saline.

Table 5.55 Details of Cauvery water release

Year	Date of release of water from Grand Anicut	Capacity of water in cusecs
1992	18.6.1992	1337
	19.6.1992	3591
	20.6.1992	3874
1997	16.6.1997	2478
	17.6.1997	5501
	18.6.1997	3009
2004	27.7.2004	3021
	28.7.2004	4512
	29.7.2004	2529
2006	16.6.2006	4032
	17.6.2006	4598
	16.6.2006	5147

Table 5.56 Rainfall and Groundwater level details

Year	Average Groundwater level in m	Annual rainfall in mm
1991	3.48	1235.8
1992	3.29	1209.0
1996	2.95	1888.5
1997	3.16	2063.8
2003	2.03	878.8
2004	1.90	1646.9
2005	1.98	1786.3
2006	2.10	1905.2

An Extensive water sample analysis carried out in over half-a dozen villages of Sirkazhi taluk, in the aquaculture belt of Nagapattinam district by the Gandigram Rural University as reported in Indian Express dated October 9, 1994 has revealed a disturbing deterioration in the quality of the only source of potable water – ground water. The effluents let out of these farms containing biodegradable wastes are not properly treated in many cases and pollute groundwater in adjoining areas increases, as they need very less quantity of water.

Agriculture fields are situated very next to aqua farms. The effluent discharged enters the receiving waters and the agriculturists also use this water. Conversion of the use of land leads to a marked effect on livelihood of the hitherto agricultural labourers. Agriculture is endangered and food shortages in such areas are a serious possibility, if continuing loss of arable farmlands to aquaculture. Extraction of groundwater for the purposes of shrimp farming threatens the very existence of fresh groundwater in these areas. This leads to the degradation of agricultural land.

It is a general observation that privatization of land creates mechanism for preservation of environmental qualities. When land is divided and held by individuals with clearly defined boundaries and rights, the possibility of internalizing environmental costs is high. Water pollution and degradation of land actually decreases the market value of these lands. Frequent floods during these years also attribute for such changes of land use categories.

5.4.3 Wasteland

5.4.3.1 Salt affected land

Sattangudi of Tharangambadi taluk does not have any salt-affected area between 1992 and 1997. Manikkapangu, Pillaiperumanallur and Kalamanallur show no change in salt- affected area in this period while Maruthampallam alone shows an increase of 4.83 % by occupying the areas from saltpan, croplands and fallow/harvested land. During 1997 – 2004, all the villages show a considerable decreases in the area occupied by the salt-affected land. The area being taken by built-up land and agricultural lands in every village. Similarly in Pillaiperumanallur, Maruthampallam and Kalamanallur saltpan have increased showing a definite shift in the traditional occupation of the people. Scrubs have been noted in Pillaiperumanallur and Kalamanallur, which again reinforces the effect of the rainfall pattern in this period. In Manikkapangu sandy area and waterlogged area have occupied salt-affected land.

The salt affected land is increased in all the villages of Sirkazhi Taluk during 1992 – 1997 except Kilaiyur and Vanagiri. Kilaiyur shows no change and Vanagiri shows the absence of this category 16.14 %, 6.67 %, 3.33 %, 1.47 %, 0.66 % and 0.25 % of total area increase is observed in Pudupattinam, Perunthottam, Tandavankulam, Pudupattinam, Thirumullaivasal, Vettangudi and Thennampattinam, respectively. In Perunthottam, it has been converted to cropland and fallow/harvested land. In Thirumullaivasal, it has been converted to sandy area and plantations. In Vettangudi, this category is transformed to cropland and to plantations and river in Thennampattinam. In the period 1997 – 2004, salt affected land increased by 2.41 %, 7.47 % and 14.73 % of the total area in the villages Vanagiri, Tandavankulam and

Pudupattinam, respectively. In Tandavankulam and Pudupattinam, it has been converted to saltpan, water logged area, agricultural area and river. In addition to this, it has been converted to built up area and tank in Pudupattinam. Kilaiyur, Thennampattinam, Vettangudi, Thirumullaivasal and Perunthottam shows a considerable shift with decrease of 0.82 %, 0.97 %, 1.09 %, 3.64 % and 5.96 % of total area, respectively. Here, it has been converted mostly to built-up land, agricultural area, water logged area and river.

This may be due to seepage of water stagnated for saltpan turning lands adjacent to salt affected areas. Salt affected areas have been reclaimed for agriculture owing to adequate rainfall, higher ground water level and the encouragement from Government in providing agriculture loans. Salt resistant plantations have become dominant occupying the salt-affected area.

5.4.3.2 Waterlogged area

There are no waterlogged areas in the villages of Tharangambadi taluk between the year 1992 and 1997. In the period 1997-04 only, Sattangudi and Manikkapangu have shown a new land use category.

The Sirkazhi villages Vanagiri, Kilaiyur, Vettangudi and Tandavankulam are void of water logged area during the period 1992 – 1997. The other villages Perunthottam, Thirumullaivasal and Pudupattinam shows a decrease in the water logged area respectively 12.5 %, 3.41 % and 9.35 % of the total area. In these villages water logged area has been transformed to agricultural land and salt affected land. In Perunthottam, it has been converted to saltpan / aquaculture and river. This category has been converted to built-up land in Thirumullaivasal and Pudupattinam. In addition to these transformations, there is a shift in this land use category towards

river in Pudupattinam. The only village where the water logged area increased during 1992 – 1997 is Thennampattinam, which sumup to 1.33 % of total area. Even during 1997 – 2004, the villages Vanagiri, Vettangudi and Tandavankulam portray the absence of waterlogged area. All the other villages Pudupattinam, Perunthottam and Kilaiyur shows a considerable shift by increase in waterlogged area accounting to 22.16 %, 16.75 % and 7.15 % of total area, respectively. The waterlogged area in Pudupattinam villages has been transformed to built-up area, agricultural plantation and river. The villages Thennampattinam and Thirumullaivasal shows a very meager increase in water logged are which puts up to 2.3% and 0.15% of the total area respectively. The Thennampattinam villages shows conversation of water logged area to saltpan / aquaculture, scrubland and river.

The pathway constructed by Public Works Department (PWD) has also been encroached to build shrimp farms. This has caused a great problem for people of these villages, to come to the main road. The area occupied by salt pans/aquaculture blocks the natural drainage passage leading to stagnation of water. Due to the nature of the soil, water logged areas are formed.

5.4.3.3 Scrubland

There is no scrubland in the villages of Tharangambadi taluk except in Pillaiperumanallur village, where there is no change during 1992 – 1997. The scrubland is found increased in Kalamanallur with 23.24 % of total area and decreased with 0.043 % in Pillaiperumanallur.

The village Kilaiyur, Thennampattinam, Thirumullaivasal, Vettangudi, Tandavankulam and Pudupattinam shows no signs of presence of scrubland during 1992 – 1997. There is no change in scrubland in other villages Vanagiri and

Perunthottam during 1992 – 1997. The village Kilaiyur, Thirumullaivasal, Vettangudi and Pudupattinam retains the absence of scrubland category in the next study period 1997 – 2004 also. The villages Perunthottam, Vanagiri, Thennampattinam and Tandavankulam shows descending order of increase in scrubland with 7.32 %, 4.93 %, 3.26 % and 0.06 % of the total area, respectively. The scrubland has been converted to sandy area; water logged area, agricultural plantation and river during 1997 – 2004.

The saltwater seepage from shrimp culture pollutes the fresh water and renders the fertile lands into barren ones. Aquaculture involves commercial exploitation of land without due regard to the sustainable modes of resources use. This is because the chemicals used by the aqua farms lead to degradation of land. The land may even become unfit for carrying on agricultural practices due to adverse ecological effects. Artificial inputs like antibiotics; chemical fertilizers, etc., are used in the pond. Since the species that is grown is alien to the land, the land that is used by aquaculture farms will not be fit for growing anything.

5.4.3.4 Sandy area

The villages under Tharangambadi Taluk have shown a predominant decrease trend in the sandy area. The period between 1992 – 97 shows a marginal shift of 0.05 % in Sattangudi and 1.11 % in Pillaiperumanallur, being transformed to built-up area, while 1.23 % in Maruthampallam is occupied by agricultural lands and salt pan / aquaculture. This period between 1992 and 1997 introduced aquaculture as viable, attractive commercial option to coastal areas. The initial impetus and adaptation to this opportunity is evidenced here. The conversion of sandy area into plantation indicates the opening of the community to commercial agriculture. Another point to

note is the conversion of fallow / harvested land into sandy area (1.36 % of fallow / harvested land) which can be attributed to natural wind action and geographic position of the harvested area. Manikkapangu and Kalamallur do not show any change in this period. In the village Manikkapangu, it is seen that there is no shift in the sandy area i.e., no conversion of sandy area into other land use categories. This is due to the fact that the community is basically a fishing community, which limits their interaction with landforms like converting them into plantations or croplands. Population increase is also very limited ruling out the possibility of conversion of sandy area into built-up area which is true for this period. Kalamallur again shows no change in sandy area. The community being agriculture-based community, the bountiful harvest and plentiful rainfall in this period does not warrant dry crop cultivation, which leads to the occupation of sandy areas. Again between 1997 and 2004, the same decrease trend is seen and it is also observed that there is a considerable shift amongst the various land use categories and the net change clearly shows a decrease in sandy area. In all the villages, sandy area has been occupied by built-up area and agricultural lands considerably. The other land use category transformations and net percentage changes are as follows: In Sattangudi, it is 23.9 % being converted to water-logged area while in Manikkapangu it is 6.38 %, which is transformed to salt-affected lands, Pillaiperumanallur with 5.5 % decrease occupied by saltpan / aquaculture and salt affected lands. Maruthampallam and Kalamallur show lesser magnitude of net change to the tune of 0.57 % and 0.01 % respectively. In Maruthampallam the area is occupied by saltpan / aquaculture and river and Kalamallur it is taken up saltpan / aquaculture, scrubland and agricultural lands in addition to the built-up area.

Sandy area has shown an increase in all the villages of the study area under Sirkazhi taluk for the period 1992-1997 except Kilaiyur, which has shown a decrease by 0.87 % of the total area. The net change is much pronounced in Thennampattinam (18.62 %). It is noted that there is a shift from the sandy area, which is occupied by river. Similarly, Vettangudi and Tandavankulam has also shown an increase of 17.45 % and 17.11 % respectively, where sandy area has been occupied by agricultural lands in both villages while in Vettangudi sandy area is converted to salt affected land. Thirumullaivasal and Pudupattinam have shown a net increase of 5.71 % and 8.00 % respectively, where river and agricultural lands occupy sandy area. There is a marginal shift in Vanagiri and Perunthottam of 0.09 % and 0.03 %. In Perunthottam, it is noted that it is converted to fallow harvested land. Between the period 1997 and 2004, sandy area has shown a net increase in Vanagiri (0.75 %) and Kilaiyur (0.08 %), while in other villages it has shown a decrease. In both the villages Vanagiri and Kilaiyur, sandy area has been occupied by agriculture lands and salt pan / aquaculture, while in Vanagiri it is also noted that sandy area is converted to built-up land and river and in Kilaiyur by waterlogged area. Thennampattinam experiences a sharp decrease of 22.91 % in sandy area of the total area, where it is taken up by built-up land, salt pan / aquaculture, waterlogged area, scrubland, agricultural land and river. Similarly in Vettangudi, Tandavankulam and Pudupattinam also there is a considerable decrease of 18.45 %, 14.86 % and 11.51 % respectively. Predominantly, in all these three villages sandy area is occupied by built-up land, saltpan / aquaculture and agricultural land. While in Pudupattinam and Vettangudi it is also taken up by river. Salt - affected land waterlogged areas have also been taken up sandy areas in Tandavankulam and Pudupattinam. Thirumullaivasal and Perunthottam again shows a decrease in sandy area by 7.41 % and 2.24 %

respectively, where sandy area is converted to waterlogged, agricultural land and river. In Perunthottam, it has also been consumed by saltpan and scrub while in Thirumullaivasal by built-up land.

The increase in built-up area and conversion of sandy area into settlement primarily centers on the population increase due to infrastructure development and developmental activities with employment creation potential enabling settlement expansion. In spite of minimal rainfall in 2002 and 2003, agricultural lands has seen an increase in the area due to introduction of dry crops like sesame, maize, etc and plantations like eucalyptus, casurina, etc. Another unique category shift observed in Maruthampallam is that of the sandy area occupied by river, which is attributed to dredging and desilting activities.

5.4.4 Water bodies

5.4.4.1 River

There is no change observed in the river category coming under Pillaiperumanallur, Maruthampallam and Kalamanallur villages of Tharangambadi Taluk during 0.04 % of total area, where the built-up area has occupied it. During the period 1997 – 2004 Pillaiperumanallur, Sattangudi and Manikkapangu show a decrease of 1.02 %, 2.68 % and 23.03 % of total area, respectively. Maruthampallam and Kalamanallur show an increase in water spread area with 1.16 % and 0.16 % respectively. This category has been mostly occupied by Sandy area, built-up land and agricultural land.

Tandavankulam, Perunthottam and Thirumullaivasal of Sirkazhi taluk shows an increase of 2.06 %, 0.75 % and 0.58 % of total area, respectively under the river category during 1992 – 1997. The village Vettangudi, Thennampattinam and

Pudupattinam show a decrease with 0.59 %, 0.41 % and 0.21 % of total area, respectively. The river area remains the same in Vanagiri during this period. During 1997 – 2004 the villages Thennampattinam, Pudupattinam, Tandavankulam, Thirumullaivasal, Vanagiri and Vettangudi shows a decrease trend with a decrease of 3.54 %, 1.91 %, 1.85 %, 1.70 %, 1.46 % and 0.09 % of the total area, respectively. The river area under Perunthottam is increased by 1.67 % of the total area.

In order to accommodate the expanding population in the villages the riverbanks have been used for temporary residence. So, this is a main reason for conversion of river to built-up land. The change in flow of river due to meandering, made the river to either occupy lands from fallow / harvested land, sandy area, agricultural land, etc., or to lose the land to them.

5.4.4.2 Tank

Sattangudi and Kalamanallur villages of Tharangambadi taluk show no change in this category during 1992 – 1997. This category is increased with 0.41 % of the total area in Maruthampallam. During 1997 – 2004 Sattangudi, Kalamanallur and Maruthampallam shows a decrease in tank area with 1.45 %, 1.32 % and 0.79 % of total area respectively, which have been occupied by built up land and agricultural land.

During 1992 – 1997, there is no change in the area covered by the tank of Vanagiri and Kilaiyur of Sirkazhi Taluk and it shows an increase of 1.03 % and 0.04 % of total area, respectively in the villages Perunthottam and Thennampattinam. During the period 1997 – 2004 the area occupied by Tanks in the villages Tandavankulam, Vettangudi, Perunthottam, Pudupattinam and Thennampattinam increased with 4.82 %, 2.53 %, 1.04 %, 0.25 % and 0.05 % of the total area respectively. Tanks are mostly converted to built up land, agricultural land.

5.4.5 Saltpan / Aquaculture

The aquaculture category is not available in Sattangudi village of Tharangambadi taluk. There is no change in this category during 1992 – 1997 in the villages Manikkapangu and Pillaiperumanallur. This is found to decrease in the villages Maruthampallam and Kalamannallur with 1.42 % and 0.07 % of total area. It has been converted to salt affected land in Maruthampallam and fallow / harvested land in Kalamannallur. During the period 1997 – 2004, Pillaiperumanallur, Maruthampallam and Kalamannallur show an increase of 5.62 %, 5.60% and 1.40 % of total area in this category. The only village, which shows a decrease of saltpan / aquaculture by 8.20 % is Manikkapangu. Here, the land is converted to sandy area, built-up area, waterlogged area and agriculture land.

Saltpan / aquaculture has shown an enormous increase in Sirkazhi villages Perunthottam, Thennampattinam, and Kilaiyur, screening about 5.61 %, 4.02 % and 1.84 % of the total study area in Sirkazhi Taluk among the period 1992 –1997. The saltpan has been occupied by sandy area, built-up land and agricultural in these villages. Also the villages, Tandavankulam and Pudupattinam show a decrease of 2.99 % and 0.98 % in the shift of the saltpan, where the change is from sandy area and fallow/harvested land. Thirumullaivasal and Vettangudi do not show any change in this period. During the period 1997 and 2004, saltpan shows a typical increase in the villages except Kilaiyur and Perunthottam in the study area. The net change is observed in Tandavankulam, where 12.65 % of the total area has been shifted to agricultural plantations and study area. Thennampattinam and Pudupattinam also shows a massive increase of 9.7 % and 7.08 % of the total area in the saltpan has converted into built up land and fallow / harvested land. Vettangudi and Vanagiri underwent a marginal shift of 2.52 % and 0.62 % where the saltpan is occupied by

sandy area and scrubland. Kilaiyur and Perunthottam show a regional decrease of 15.2 % and 5.19 % of the total area, respectively. This is due to the shifting of sandy area, built-up land, waterlogged area and agricultural plantations in the area of saltpan / aquaculture. The saltpan / aquaculture area of Thirumullaivasal remains unchanged in this period.

Aquaculture requires large tracts of land. Soil is removed to construct large ponds, where culturing of shrimp takes place. It involves altering of traditional land-use pattern and the natural produce of lands. Many aqua farm owners have bought the land from lower caste people in the village who had been issued wastelands by the government of Tamilnadu in 1970s. According to the Villages Headman, they mainly due to poverty and other reasons that these low caste people in the village have sold their lands to aqua culturists for high prices offer them. Many backward classes have sold their lands, as they are not able to carry on cultivation due to poverty. This has been the cause for them to sell the land for whatever prices offered by the aquaculturists. The salinization of aquaculture land use and the threat of salinity intrusion into the agricultural lands also force agriculturists to sell their lands.