

LAND USE LAND COVER CHANGES IN SWETA NADI BASIN, TAMIL NADU, INDIA USING GEOGRAPHICAL INFORMATION SYSTEM

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Abstract: *This study attempted to expose the impact of changes in land use/land cover of Sweta Nadi of Vellar basin, from 1977 to 2012 by using Geographical Information System (GIS) and remote sensing technology. These studies were employed by using the remote sensing data of Landsat – 2 (MSS), Landsat – 5 (TM), Landsat – 5 (ETM), IRS 1C - Resourcesat-1 LISS III and Resourcesat-2 LISSIII of 1977, 1992, 1999, 2005 and 2012. The study area was classified up to level II classes and delineation of 16 land use/land cover categories based on NRSA technical guidelines. The LU/LC change maps were also produced to document the changes of particular land uses over time. Major changes are seen from 1999 to 2005 for mainly evergreen forest, gullied/ravenous land and wasteland decreased. The results show that the land use and land cover changes great influence on crop land, evergreen forest, fallow agriculture land and wasteland of the basin. The land use activities in and around Kolli hills and Pachamalai evergreen forest were identified uncontrolled degradation and exploitation forest has been converted to other land uses for human livelihoods.*

Key words: Land Use, Land Cover, Geographical Information system and Sweta Nadhi Basin

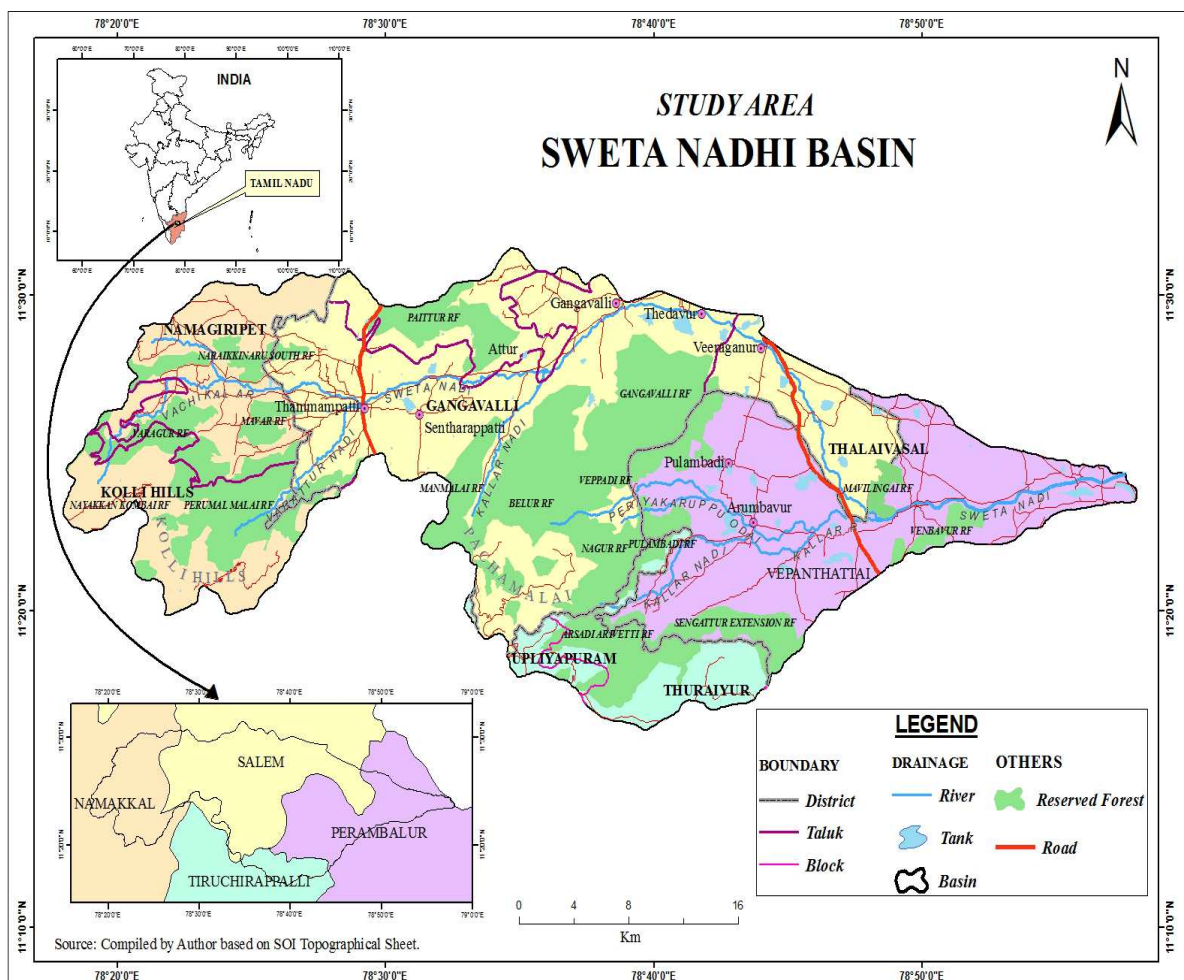
Introduction

A Land use/Land cover is an important component in understanding the interaction of the human activities with the environment and thus it is necessary to be able to simulate changes (Lambin et al. 2001). Underlying causes of LULC changes most important to deforestation and land degradation include speedy economic development, population growth and poverty (Giri et al. 2003, Bolland et al., 2007). Geographic Information System (GIS), which has a strong capacity in data integration, analysis and visualization has become an important tool to support land use planning approaches (Trung et al., 2006). Forests are the important and most valuable ecosystems in the world, containing over 60 per cent of the world's biodiversity. These are the true collective treasure that contributes to the social and economic well-being of our families and communities. Apart from the economic and social value, our forests have high environmental value, viz. production of oxygen, holding rain water, enrichment of soil, checking soil erosion, control of wind and atmospheric temperature (Khanna 2001). Most valuable ecosystems are now disappearing, which is an undesirable phenomenon. Reasons for this loss of forest cover are many and few of them are livestock grazing, conversion of forest land for agriculture, lopping, tree for fodder and firewood withdrawal for local use as well as for sale in neighboring townships (Chaturvedi 2000; Mishra et al. 2004).

Study Area

The Sweta Nadi basin lies in the districts of Namakkal, Salem, Tiruchirappalli and Perambalur of Tamil Nadu State. The Sweta Nadi originates from the northern parts of Kolli hills in Namakkal District. It is located between $11^{\circ} 15' N$ and $11^{\circ} 45' N$ latitudes and $78^{\circ} 15' E$ and $78^{\circ} 58' E$ longitudes (as read from the survey of Indian Topographic sheets 58 I/6,I/7,I/10,I/11,I/14 (Fig.1). The river originates from the northern parts of Kolli hills, a part of Manmalai, adjoining Kolli hills and Palakkadu Malai in Pachamalai. The total geographical area of the basin is 1,034.43 Sq.km (1,03,443 ha) within 82 Revenue villages. The study area is based upon the three major relief orders such as the hills, uplands, and the plains. The river runs over 116 kms from the west to the east, and joins Vellar river, which runs into the Bay of Bengal.

Figure 1: Location Map of the Study Area



Material and Methods

Land use, land cover of the study area was mapped based NRSA classification using multi temporal satellite images. The Land Uses of the study area were brought out from satellite data of Landsat-2(MSS), Landsat-5(TM), Landsat-5 (ETM) satellite images have been used for delineating land use and land cover maps of 1977, 1992 and 1999 images were collected from glovis.usgs.gov website or Earth Explorer (These data are also visible and can be

downloaded using GloVis) and IRS 1C -Resourcesat-1 LISS III, Resourcesat-2 LISSIII images collected from National Remote Sensing Centre, (bhuvan.nrsc.gov.in), Hyderabad, has been analysed to get land use and land cover map of 2005 and 2012. The registration and digitization of the study area were done using ArcGIS 9.3 Software to create land use coverage. Maximum Likelihood Classification technique is applied by ERDAS Imagine software for enhanced and accurate result of the study area. The rate of change per year was calculated by using the following formula (Chebet, C. 2013):

$$R = \frac{Y - X}{T}$$

Where:

- R is the rate of change.
- Y is the area in square kilometers of the study area in the final year.
- X is the area in square kilometers of the study area in the initial year.
- T is the time difference in years.

The study area has been classified up to level II information land use and land cover classes in level I are built-up land, agricultural land, forests, wastelands and water bodies. Level II classes are those of the rural and urban settlements, cropland, agriculture, plantation, Fallow/agriculture, wasteland with scrub, sandy area, Gullied/ravenous land, barren rocky, evergreen forest, deciduous forest, scrub forest river and tank. There are 13 Categories were identified and mapped.

Objectives of the study

To analyze the nature and extent of Land Use/Land Cover Changes of the study area in the past 35 years (1977-2012). Detecting the changes that have occurred. Identifying the nature of the change. Measuring the area extent of the change assessing the spatial pattern of the change over all study area.

Results and Discussion

Land use and Land cover of 1977

The land use and land cover analysis, agricultural land of the basin are primarily used for farming activities. The study area has an area of crop land 34564 ha (33.4 %), fallow land or fallow agriculture 11700 ha (17.1%) and agricultural plantation 981 ha (0.9%) under the agricultural use. It accounts for 53245 ha (51.5%) in the total geographical area. Based on the satellite image of 1977, the basin has a lack of potential land for cultivation, and different types of crops grown under different seasons. The Agricultural activities in the study area, mainly depends upon the southwest and northeast monsoons. They are affected, mostly by the drought due to uncertainty of monsoon rains, soil erosion and physiographical conditions. The crops may be of either kharif (June – September) or rabi (October – March) seasons. They are double cropped (Rabi and Kharif) areas, mainly under the paddy cultivation crop land are equally distributed in the basin, except south and southwest portion of the study area. Because that area occupies the forest land use type. The rain-fed areas, which are seen in the eastern part and the northwestern part of the study area are, due to soil type, topography and absence of tanks and wells. The Plantation is much less during this period, when compared with 1992. The study area has very few but small batches of plantation, seen in the southern parts of Pachamalai, the southwestern parts of Kolli hills (hilly tracts), and only one patch in

the northern parts near the Gangavalli. It is an area under agricultural tree crops such as eucalyptus, tamarind, banana, coconut and other mixed plantation. The following forest types are found in the basin. Evergreen, deciduous forest and scrub forest constitutes about 39.1 % (40489 ha) of the total study area. Especially 28.5 % (29462ha) during this period covers the evergreen forest Pachamalai and Kolli hills reserved forests in the south and southwest part of the study area. The northwest part of the study area stretching from Naraikinaru, Paithur to Kadampur villages are covered by deciduous forest, which has the distribution of 9.7 % (9983 ha). The Wastelands occurred on the uplands and pediment areas, eroded land and infrequently all over the study area (fig.3a). These lands cover as much as 6128 ha (5.9 %) of the total of the basin. The Wasteland with scrub can be seen in Vengalam, Vembavur, Periyavadakarai in the eastern part of the study area, and Kadampur, Kondayampalli, Naigampatti and some small patches seen in the southwestern part of the study area. The Barren rocks could be seen only in village names is Kondayampalli, which is located in the western parts of the study area. During this period, the ravenous land 1.8 % (1877 ha) were found in the villages of Thaluthalai, Vembavur, Periyavadakarai, E. Rajapalayam and Udumbium and in some of the eastern part of the study area. The Sandy areas occurred in small patches in the eastern part of study area were found in Periyavadakarai and V.kalathur villages. It covered an area of about 100 ha (0.1%). These types of lands are essentially tank beds with long deposited down by streams in the catchment. During the rainy season, the gently sloping areas of sandy clay are subjected to soil erosion. As soon as the raindrops strike the ground, the sand particles get separated from the clay. Due to slope condition of the topography, the sands are drained into the stream courses and finally get deposited in these areas. It is a common scenario in the sandy clay. The Water body comprised of rivers and tanks with 1 % (1066 ha) from the total basin area.

Land use and land cover of 1992

The land use, land cover map for the period 1992 month of observation February, Landsat – 5 (TM) satellite image during this period, total agricultural land increased, when compared with 1977, land use had only slight changes within this period, the built –up land (0.6 %) forest (39.2 %), and water body (0.9 %) in their areal extent. During 1977 to 1992, the rural and urban settlements gradually increased from 506 to 577 ha respectively. There was no appropriate change in the forest land use (fig.3b). In the agricultural land areas, which constituted for crop land, fallow agriculture land and plantation totally occupied by 53.4% (55223 ha) in the total study area. The Crop land and plantation also increased as compared with 1977 satellite imagery, plantation activities which were seen in Koneripatti, Kondayampalli, Ulipuram, Narikinaru, and Sentharpatti western middle part of the study area and Gundininadu and Thirupulinadu in along with a Kolli malai rim of the basin, central part of the study area Gangavalli, Veeraganur, Pulambadi, Arumbavur and Vengalam. The villages that occupied this kind of land use activities increased. There was no change in the forest land use during this period. But the evergreen forest reduced, at the same time deciduous forest and scrub forest increased. Hence, the evergreen forest covered 19.5% (20193 ha), deciduous forest covered 16 % (16518 ha) and scrub forest 3.7 % (3869 ha) respectively (table.1). The Rural settlements remained in the same area, since the people primarily carried out agriculture. And most of them were the agricultural laborers. The area constituting lakes

and the river/tank (water bodies) has slightly decreased and occupied 0.9 % (960 ha) of the study area.

Land use and land cover of 1999

The land use and land cover for the year 1999 has been derived from Land sat 5 (ETM) satellite image. During this period, there were no changes in the build up land (0.6 %), waste land (7.96 %), and water bodies (0.9 %) in their areal extent, when compared with 1992. Other land use had slightly changed within them (table.1). During 1992 to 1999, in the rural and urban settlements, there was no appropriate change. The Forest areas were steadily decreased from 40580 ha to 40041 ha km respectively. The proportion of Agricultural land, waste land had decreased in all the categories, except water bodies and forest. The absence of agriculture plantation showed a decreased trend, when compared with 1992 land use and land cover area. The Cropland decreased from 41.6 % to 33.7 % and fallow agriculture land (8.1% to 17.4%) and waste land (5.9 to 8 %) increased during this period, particularly in the eastern part of the study area (fig.3c).

Land use and land cover of 2005

The land use and land cover class for the year 2005 has been derived from IRC 1 C Resource sat – 1 LISS III multi temporal satellite image. When compared with 1999 land use of the study area, the agricultural lands were going towards development, and the crop land from 56.5 % (348.64 Sq.km) to 36.46 % (37705 ha) increased respectively, as well as the plantation also increased in Pachamalai hilly track during this period. The forest area was going towards degradation from 38.7 % (40041 ha) to 37.2 % (38458 ha) respectively. Especially, the evergreen forest and deciduous forest covering 18.2 % (18844 ha) and 16.9 % (17443 ha) of the total forest land use. It should be noted that the area under wasteland was suddenly decreasing, when compared with 1999 satellite imagery (fig.3d). The wasteland with scrub covered 3.7 % (3795 ha) and ravenous land covered 0.7 % (761 ha). At the same time, the sand deposition (sandy area) was steadily increasing, when compared with 1999, which of the total area of the wasteland. There was a rapid increase in the rural and urban settlements from 1999 onwards. The Rural settlements covered an area extent of 0.9 % (951 ha) and urban settlements had 0.2 % (163 ha) in 2005. Water in the tanks was high during this period. Hence, the water bodies were in increasing stage, which occupied about 2.2% (2290 ha) of the total area under the study.

Land use land cover of 2012

In the present study, the land use and land cover map of the basin has been derived for 2012 IRS resource sat -2 LISS III multi temporal satellite image, when compared with 2005 land use of the study area. The total agricultural land decreased, when compared with 2005 land use. But the crop land covering was 42 % (43434 ha). It denotes the development of this period. In the forest land, during this period, there were more changes when compared with 1977, 1992, 999 and 2005 satellite imagery. But steadily increased from 2005 to 2012. When compared with 2005 land use of the study area. The crop lands as well as the forest area were going towards development and also for the degradation evergreen forest. The Evergreen forests like Kolli malai and Pachamalai were covering 17.6% (18194 ha) in their areal extent, respectively. The kolli malai, varagur reserved forest and perumal malai reserved forest in

south western parts degraded, when compared with 1999 satellite imagery. During this period, about 7.1 % (7318 ha) of the study area were under wasteland, including waste with scrub, sandy area Gullied/ ravenous and Barren rocky areas. The Wasteland with scrub engaged 5.5 % (5666 ha) areas respectively. Especially, the sandy area saw a rapid increase since 2012, and the built up land land use increased during this period (fig.3e).The Rural settlements had an area of 1 % (1070 ha) and urban settlements had an area of 0.7 % (712 ha) during this period. Water bodies comprised of tank and river with 2.5 % area coverage, gradually increasing.

LAND USE AND LAND COVER CHANGES DURING 1977 – 2012

The changes in the Land use / land cover in the study area were estimated from 1977 to 2012. Table 2 gives the statistical results of land use / land cover changes. It is evident from the table.2, 3 and figure.2 that the land use/land cover changes where the highest amount of evergreen forest, fallow agriculture, cropland and deciduous forest from 1977 to 2012.

1. AGRICULTURAL LAND

It is defined as the land primarily used for farming and production of food crops, commercial crops and horticultural crops. It includes the land under irrigation and rain-fed crops, which are growing under different seasons, in different farming activities. The Agricultural activities in the basin are mainly dependent on the southwest and northeast monsoons. They are affected, mostly by the natural hazards such as the drought, due to uncertainty of monsoon rains, soils and topography. It covers an area of 51.2 per cent to the total area.

1.1 Agricultural Plantation

The Major agricultural plantation crops cultivated in this study area are coconut, sugarcane, areca nut, eucalyptus and fruit crops like mango, banana, guava, jack and sapota. The area under agricultural plantation was 981 ha in 1977, 3833 ha in 1992, 752 ha in 1999, 1810 ha in 2005, and 1740 ha in 2012 of the total geographical area of the basin. The Overall growth in the agricultural plantation areas between 1977 and 2012 was 759 ha, largely decreased from 1992 to 1999, with total decreases of 3081 ha. A slight decrease from 2005 to 2012 is 70 ha. Hence, the overall rate of changing the value (R) is 22 positively towards development.

1.2 Crop Land

The crop land is used for paddy, tapioca, maize, cholam and other vegetables crops. The study area has an area of 43434 ha, under crop land use. A decrease of 8166 ha was observed during 1992 to 1999. There was an increasing in this land use from 1977 to 2012. The changing rating R value represents 253 positively towards development in overall land use in the study area.

1.3 Fallow/Agriculture

The Fallow land is defined as a cropped area, which is kept unploughed temporarily for one or more seasons, but not less than one year. These lands are particularly devoid of crops during both the seasons. The crops may be of either Kharif or Rabi or both seasons, which are known as the fallow lands. A total of 7742 ha area comes under fallow land which accounts for 7.5 % of the total basin area. The fallow agriculture increased by 9654 ha in the period between

1992 and 1999. 1977-1992, 1999-2005, and 2005-2012 particularly decreased by the 93.40 Sq.km, 8.64 Sq.km 94.14 Sq.km and 99.64 Sq.km. The Overall changing rate R value is 285 negatively changed towards degraded during 1977 to 2012.

Table 1 Area under different Land use land cover changes in Sweta Nadhi basin from 1977 to 2012

Sl. No.	Broad Land use	Land use / Land Cover	1977		1992		1999		2005		2012	
			Area in Ha.	%	Area in Ha.	%	Area in Ha.	%	Area in Ha.	%	Area in Ha.	%
1	Agricultural Land	Agriculture Plantation	981	0.9	3833	3.7	752	0.7	1810	1.7	1740	1.7
		Crop Land	34564	33.4	43030	41.6	34864	33.7	37705	36.5	43434	42.0
		Fallow/Agriculture	17700	17.1	8360	8.1	18014	17.4	17150	16.6	7742	7.5
Total			53245	51.5	55223	53.4	53631	51.8	56665	54.8	52916	51.2
2	Forest	Evergreen Forest	29462	28.5	20193	19.5	29430	28.5	18844	18.2	18194	17.6
		Deciduous Forest	9983	9.7	16518	16.0	9558	9.2	17443	16.9	18582	18.0
		Scrub Forest	1044	1.0	3869	3.7	1052	1.0	2171	2.1	2061	2.0
Total			40489	39.1	40580	39.2	40041	38.7	38458	37.2	38837	37.5
3	Waste Land	Wasteland with Scrub	6128	5.9	5480	5.3	6321	6.1	3795	3.7	5666	5.5
		Sandy Area	100	0.1	66	0.1	209	0.2	328	0.3	1300	1.3
		Guillied/Ravinous Land	1877	1.8	525	0.5	1692	1.6	761	0.7	320	0.3
		Barren Rocky	32	0.03	32	0.03	32	0.03	32	0.03	32	0.03
Total			8137	7.9	6103	5.9	8254	8.0	4916	4.8	7318	7.1
4	Built-Up land	Rural	468	0.5	516	0.5	506	0.5	951	0.9	1070	1.0
		Urban	37	0.0	61	0.1	74	0.1	163	0.2	712	0.7
Total			506	0.5	577	0.6	580	0.6	1114	1.1	1782	1.7
5	Water Body	River & Tank	1066	1.0	960	0.9	938	0.9	2290	2.2	2590	2.5
Grand Total			103443	100	103443	100	103443	100	103443	100	103443	100

Source:Compiled by Author and calculated from satellite images.

2. FOREST

The area of crops rose in the forest and grazing lands or areas open for grazing within the forests should remain included under the forest area. It is an area notified for forest boundary, predominantly with trees and other vegetation capable of producing either timber and other forest produce. In the study area, a hilly terrain has a distinct forest cover with 38837 Sq.km (37.5 %) of the total geographical area.

Figure 2: Temporal land use and land cover changes of Sweta Nadhi basin (1977 to 2012)

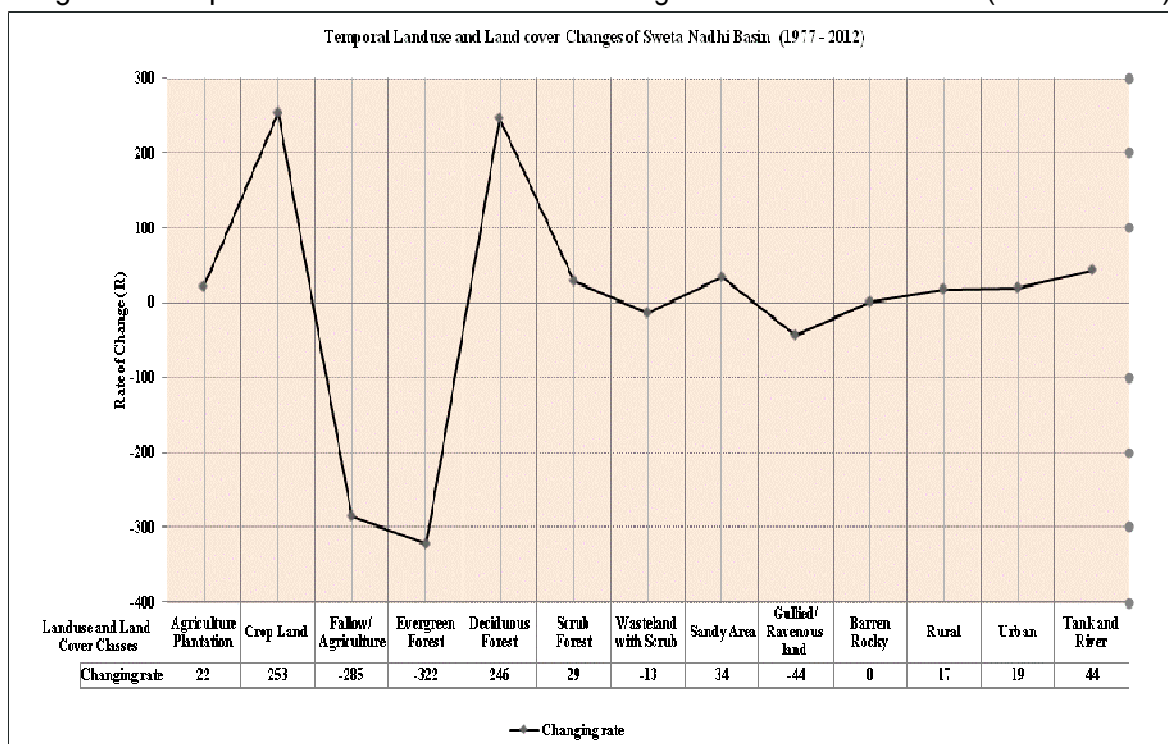


Table 2 Findings of Land use/Land cover changes of Sweta Nadhi Basin (1977 – 2012)

Sl. No.	Broad Land use	Land use / Land Cover	1977 - 1992	1992 - 1999	1999 - 2005	2005 - 2012	1977 - 2012	$R = \frac{Y-X}{T}$
			Area in ha.	Area in ha.	Area in ha.	Area in ha.	Area in ha.	
1	Agricultural Land	Agriculture Plantation	2852	-3081	1058	-70	759	22
		Crop Land	8466	-8166	2841	5729	8870	253
		Fallow/Agriculture	-9340	9654	-864	-9408	-9958	-285
2	Forest	Evergreen Forest	-9269	9237	-10586	-650	-11268	-322
		Deciduous Forest	6535	-6960	7885	1139	8599	246
		Scrub Forest	2825	-2816	1119	-110	1017	29
3	Waste Land	Wasteland with Scrub	-648	841	-2526	1871	-462	-13
		Sandy Area	-34	143	119	972	1200	34
		Gullied/Ravenous land	-1351	1167	-931	-441	-1557	-44
		Barren Rocky	0	0	0	0	0	0
4	Built-up land	Rural	47	-10	445	119	602	17
		Urban	24	13	89	549	675	19
5	Water Body	Tank and River	-106	-22	1352	300	1524	44

Note: Positive sign (+) means an increase while a negative sign (-) means decrease in area.

2.1 Evergreen Forest

About 18194 ha, land comes under evergreen forest which accounts for 17.6 % of the total area. The evergreen forest found here are due to high humidity condition and elevation. . The evergreen forest land use respectively, increased by 9237 ha in the period between 1992 and 1999. The overall changes of the land use with evergreen forest land areas during 1977 to 2012, degraded in the study area. The changing rate value R is 322, which negatively

represents the land use changes of the study area, when compared with other land use/ land cover classes.

2.2 Deciduous Forest

The Deciduous forest occupies a considerable position in its extent. It extends to all along the structural hills in the north and eastern portions, and some batches in the central and southern parts of the basin. The area of 18582 ha (18 %) in the study area is occupied by deciduous forests. This category of land use gradually increased in the period from 1999 to 2012 respectively. And the period from 1992 to 1999, the area has decreased to 6960 ha in the total study area. The overall changing rate R value 246 represents the increase in positively towards the development from 1977 to 2012.

2.3 Scrub Forest

The Dry deciduous forest and degraded forest at moderate and low elevation areas of hills, some evergreen climax forest and semi evergreen climax forest which are degraded, are called as scrub forests, the area of 2061 ha (2 %) in the total study area. The area under scrub forest noticeably increased from 1977 to 1992. Therefore, in this type of land use, there was a gradual increase from 1977 to 2012. The value of R is 29 slightly towards development of this land use system.

3. WASTELAND

The Wastelands, which are described as the degraded land, can be brought under the vegetative cover with reasonable effort. But at present, they are utilized and are deteriorating due to the lack of appropriate land, water and soil management or on account of natural causes. It is described as the degraded land which can be brought under vegetative cover with reasonable effort, and which is currently under-utilized and deteriorates due to lack of appropriate water and soil management due to natural causes (*National Wasteland Development Board, NWDB, 1987*). The wastelands occupied an area of about 7318 ha or 7.1 % of the total area of the basin.

3.1 Wasteland with Scrub

It is one of the wasteland categories which occur throughout the land in different geographical situations. It is generally associated with foothills, highland topography like upland areas of the soil with a thin layer or eroded lands, bad land topography and so on. Especially, the period from 2005 to 2012, there was an increase in the wasteland around 1871 ha, when compared with 1992 and 1999 satellite imagery. About 2526 ha of land were under wasteland, from the period of 1999 to 2005, which denoted that the land with scrub area was decreased. The overall R value 13 is a negative sign; it was slightly decreased in the entire basin.

3.2 Sandy Area

These are the areas, which have stabilized accumulations of sand in-site or transported in the coastal river line or inland (desert) areas. These occur either in the form of sand dunes, beaches, channel (river/stream) islands, etc. (NRSA). The period from 1977 to 1992, the sandy area of land use decreased with an aerial extent of 34 ha of the total study area. During 1992 to 2012, the land use of sandy area gradually increased. Finally, the large amount of

land, increased with this type of categories, from the period of 2005 to 2012 onwards. Finally, the overall changing rate of R value is 34 (1200 ha), which has positively increased.

3.3 Gullied/Ravenous land

The gullies are formed as a result of localized surface runoff, affecting the friable unconsolidated material in the formation of perceptible channels, resulting in undulating terrain. The gullies are the first stage of excessive land dissection followed by their networking, which leads to the development of ravenous land. The word 'ravine' is usually associated not with an isolated gully, but a network of deep gullies formed generally in thick alluvium and entering into the nearby river, flowing much lower than the surrounding high grounds. The ravines are extensive systems of gullies developed along the river courses (NRSA). They cover an area of 320 ha, accounting for 0.3 % (2012) of the total study area. This type of land use occupied an area of 1168 ha of the total area of the basin in the year from 1992 to 1999 was increased. The overall changing rate value R (44) is negatively towards this type of degraded lands.

3.4 Barren Rocky

It is defined as the rock exposures of varying litho logy, which is often barren and devoid of soil cover and vegetation and not suitable for cultivation. They occur amidst of the hill forests as openings or scattered as isolated exposures or loose fragments of boulders or as sheet rocks on plateau and plains. It includes quarry or gravel pit or brick kilns (NRSA). The area under the barren rock was 32 ha, or 0.03 % (2012) of the total geographical area, and has been unvarying from 1977 to 2012. The Isolated barren rocks in the uplands may be used for stone quarrying.

4. BUILT-UP LAND

It is defined as an area of human habitation developed due to non-agricultural lands which covers the buildings, industrial structures, transportation network, etc. The study area, being an agricultural region, the proportion of settlements is very less. Both the rural and urban settlements increased from 1977 to 2012. The changing R value is both the rural and urban increased respectively.

5. WATER BODIES

It is a natural or man-made enclosed water body with a regulated flow of water. It is a natural course of water distributed over the land. It includes ponds, lakes, streams and rivers. It occupies 2590 ha or 2.5 % of the total area of the basin.

5.1 Tank and River

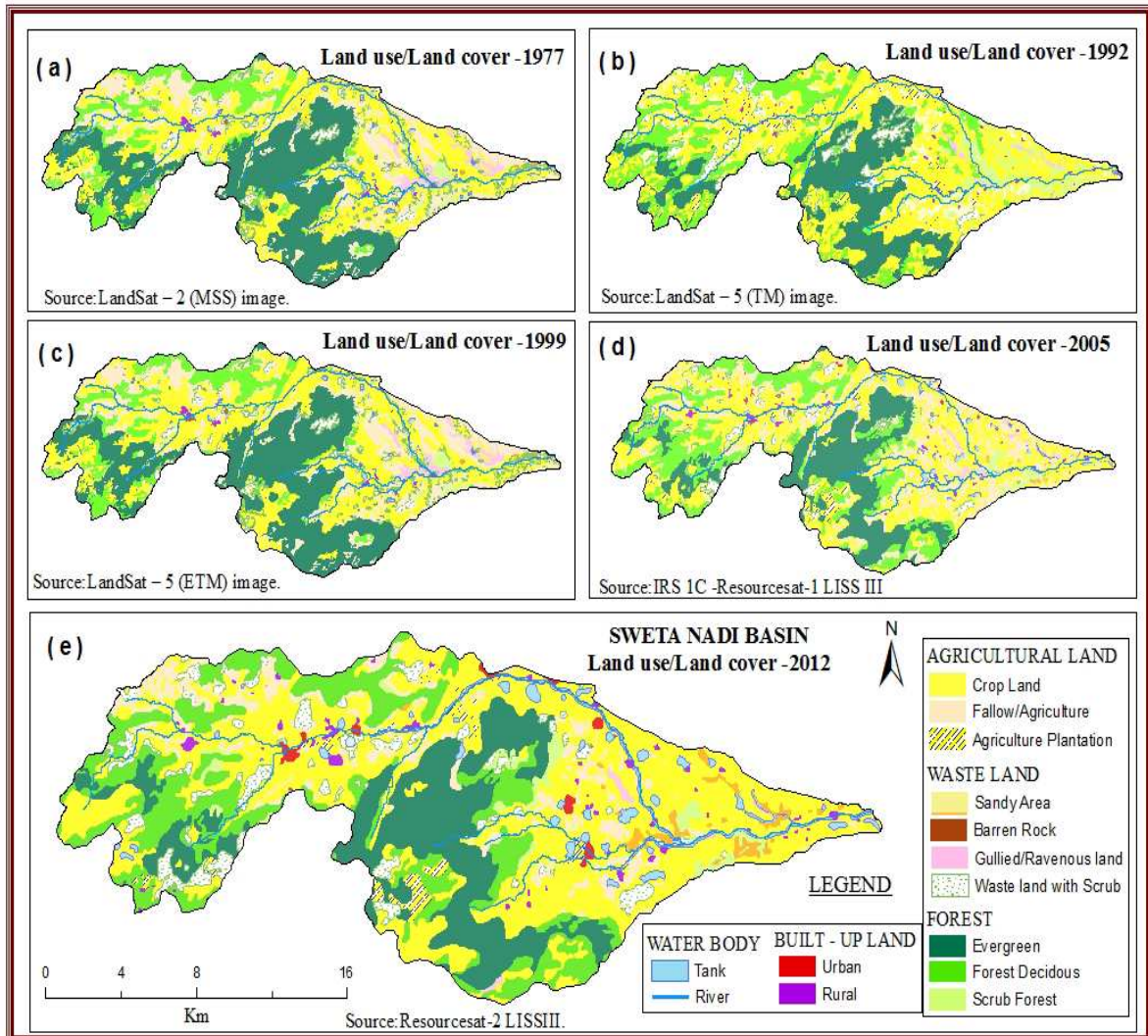
From the period of 1977 to 1999, this type of land use category decreased. When comparing 1999 to 2012, the water body areas were increased, and the R value positively increased in total land use system of this category.

Table 3 Findings of Land use/Land cover changes of Sweta Nadhi Basin (1977 – 2012)

Land use / Land Cover	Changes during 1977 to 2012	Development / Degradation
1. Agricultural Land a) Agriculture Plantation	1992 - 1999 and 2005 - 2012 during that time having decreasing Agricultural plantation	Degradation
	Increasing Agriculture plantation overall in 1977 -2012	Towards development
b) Crop Land	Declined rapid form 1992-1999 during that time having declined the crop land	Degradation
	1977 -2012: Overall, increasing in this land use due to major portions are transformed into dry farming	Towards development
c) Fallow/Agriculture	1992 - 1999: increasing the fallow agriculture during this period	Degradation
	1977 -2012: overall decreasing in this land use because fallow lands converted to dry farming system	Towards development
2. Forest a) Evergreen Forest	1992 - 1999: increasing in this land use	Towards development
	1977 -2012: overall decrease in this land use due to forest plantation	Degradation
b) Deciduous Forest	1992 - 1999: decrease in this land use	Degradation
	1977 -2012: overall increase in this land use major parts of the unirrigated lands converted to dry farming activities	Towards development
c) Scrub Forest	1992 - 1999 and 2005 - 2012 during that time having slightly decreasing because many pockets of scrub land converted to irrigate and dry farming.	Towards development
	1977 -2012: Overall increase in this land use	Towards development
3. Wasteland a) Wasteland with Scrub	2005 - 2012: Most of the areas into irrigated land and dry farming, the foothills are occupied with scrubs	Towards development
	1977 -2012: overall increase in this land use	Towards development
b) Sandy Area	1977 - 1992: Decreased by changing the agricultural activities and rain-fed farming	Towards development
	1992- 2012 and overall increasing this type of land use-some irrigated land and dry forming areas encouraged by sands.	Degradation
c) Gullied/Ravenous land	1992-1999: increasing this type of land use affecting river course nearby agricultural lands	Degradation
	1977-2012: Overall decreasing this type land use, Most of ravenous lands converted to dry farming cultivating suitable crops.	Towards development
d) Barren Rocky	No change from 1977-2012	-----
4. Built-up land	Overall, both rural and urban settlements increased from 1977 to 2012 except 1992 - 1999	Towards development
5. Water Body	No change in the study area, but tank with silt, scrub and encroachment areas are increased slowly.	Degradation

Source: Compiled by Author

Figure 3: Land Use Land Cover Maps from 1977 to 2012



Conclusion

The LU/LC analysis in a GIS system and Remote sensing data, helped in bringing out the maps and statics with useful options for alternate land use plans in the study area. While analysing the status of land use from 1977 to 2012 it is noticed that there is a considerable change. According to a change the increase of the crop land predominates followed by deciduous forest, scrub forest, plantation crops, urban, rural settlement area and sandy areas. At the same time there is a decreasing trend in areal extent of evergreen forest, fallow land, scrub and gullied land. No change in rocky areas in waste land category. Among the various land uses the major changes are seen from 1999 to 2005 notably. in crop land, evergreen forest, gullied/ravenous land and wasteland. The land use activities in and around Kolli hills and Pachamalai evergreen forest were identified uncontrolled degradation and exploitation forest, are converted to other anthropogenic activities. The sandy area is increased in the eastern part of the in the vicinity of, Periyavadakarai, Kaikalathur, Vembavur, Neikuppai, Pasambalur, Bimbalur and V. Kalathur villages during 1977- 2012. Hence, the environmental

conservation groups need to work in collaboration with the government in conducting removal of sands from the farming fields. If it is not controlled, the sandy area may get extended to the surrounding areas. A Proper guidance and training should be provided to the local people, who knowingly or unknowingly deplete the forest resources and land resources.

References

1. Bolland, L. P., Ellis E.A., Gholz H.L. (2007) Land use dynamics and landscape history in La Montana, Campeche, Mexico, *Landscape and Urban Planning*. Vol.82, 198-207.
2. Chaturvedi, A. N (2000) Viability of Joint Forest Planning and Management in Uttar Kannada District, Karnataka, *Indian Forester*. Vol.126, 5, 499-504.
3. Chebet, C. (2013) An Assessment of Land Use and Land Cover in and Around Kakamega Forest in Kanya Using GIS and Remote Sensing, *Journal of Emerging Trends in Engineering and Applied Sciences*. Vol.4, 1, 46-53.
4. Giri, C., Defourny, P., and Shrestha, S. (2003) Land cover characterization and mapping of continental Southeast Asia using multi-resolution satellite sensor data, *International Journal of Remote Sensing*. Vol.24, 21, 4181-4196.
5. Khanna, S. (2001) Mechanisms, Systems and Arrangements in JFM Villages of Gujarat – JFM –cell Geer foundation. 1-52.
6. Lambin, E.F., Turner, B.L., Geist, H.J., Agbola, S.B., Angelsen. A., Bruce, J.W., Coomes, O.T., Dirzo, R., Fischer, G and Folke, C. (2001) the causes of land-use and land-cover change: moving beyond the myths, *Global environmental change*. Vol.11,4, 261-269
7. Mishra, B, P., Tripathi, O.P., Tripathi, R.S and Pandey, H.N. (2004) Effect of anthropogenic disturbance on plant diversity and community structure of a sacred grove in Meghalaya, North East India, *Biodiversity and Conservation*. Vol.13, 2, 421-436.
8. NRSA. (1988-89) Manual of nationwide land use land cover mapping, National Remote Sensing Agency, Hyderabad. (http://mospi.nic.in/Mospi_New/upload/ax0406.htm).
9. Trung, N.H., Le Quang Tri., Mensvoort, M.E.F.Van., Bregt, A.K., (2006) Application of GIS in land-use planning, a case study in the coastal Mekong Delta of Vietnam, In: Proc. International Symposium on Geoinformatics for Spatial Infrastructure Development in Earth and Allied Sciences, Ho Chi Minh, Vietnam. 01-11 November 2006.