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Land Use Land Cover Mapping of Laxmi and Sheri Nala Basin (KR 40 watershed) Around Sangli, Maharashtra Using Remote Sensing Technique

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ABSTRACT

The land use/land cover pattern of the any area is result of natural, socio-economic factors and their application to man in time and space. Land use/land cover is a significant part of the human beings life and their behaviour with the situation and hence it is necessary to imitate changes. Land use is usage of landscape for different purposes like development, conservation or mixed such as crops, forests, mining, transport, housing, entertaining, manufacturing and cost-effective. Land cover is natural or planted vegetation and manmade construction. The unused lands may be unproductive, waste, rocky, barren or fallow land. From surveying and data collection it is not always possible to generate all the information of land use/land cover. In this thought the objective of the present paper is to mapping the general land use/land cover pattern of Laxmi and Sheri Nala basin (KR 40 Watershed) around Sangli, Maharashtra. This study area comes in rain shadow zone i.e. in DPAP (Drought prone area project as per GSDA data), which receives the rainfall about 500 mm and accordingly the area faces scarcity of water. Hence the scenario of groundwater availability and requirement with respect to land use and land cover becomes important factor. To achieve this objective, the secondary data is obtained from Landsat 5 and Sentinal 2 remote sensing satellite imageries for period 1997 and 2017 respectively. From the analysis it can be conclude, there is much scope is in the field of utilization of open rocky land and replacing by agriculture pattern for groundwater management.

KEYWORDS: *Land use/ land cover, Remote Sensing, KR 40 Watershed, Landsat 5, Sentinal 2, Drought Prone Area Project (DPAP)*

INTRODUCTION

Land is necessary for human survival, because it is easily available for human with living space (Bhagawat R., 2011). It is always fulfill all mandatory needs of human kind like food and other raw materials which are used in the day to day life. The land factor is essential for human development;

therefore role of man is become very important in education and development of his physical environment. Land utilities like climate, water, soil, topography are not equal on the earth; therefore various agricultural activities of human kind are restricted. It is essential to shift from generalities to particularities in country like India or even in study area where agriculture is the main means of livelihood for majority of people (Gajbhiye et. al. 2012). Such studies are fundamental for future planning. The main objective is to highlight the spatio-temporal pattern of land use in the study area. The Laxmi and Sheri nala basin is considered as a study unit and land use categories are based on the census classification (Ramotra K.C. et al., 2012). The idea of depicting the use of land in a map was first conceived by Saucer in 1919. Stamp in Britain is given a contribution regarding land use mapping study. The concept of land use has been defined by Stamp in 1962. The land should fulfill all the necessary and legitimate needs of nation (Stamp L.D., 1930). Land is used for the purposes such as crops, forests, pastures, mining, and transportation, residential, recreational, industrial and commercial. The unused lands are uncultivable waste and i.e. rocky, barren and fallow land. According to Nanavati conservation of land is also related with land use (Nanavati et. al. 1951). Freeman given the idea about surface utilization of all developed and available lands for a specific point at a given time and space is described as land use (Freeman T.W., 1968). The land use and land cover classification were carried out in Sangamner area, a part of Pravara basin (Deshmukh et.al 2014). Multiple advance digital database are supporting for digital land cover mapping after the Geo-referencing of satellite data (Aher et. al. 2011). Strategies role of land use study is very important in the settlement of economic, social and cultural progress of human kind. Day by day pressure of population is making impact on land because growing population needs more food and other necessary materials. Therefore we need to use each and every piece of available land. This needs strong scientific, rational and economic preparation to use available resource of land, on another side we have to maintain ecological and socio-economic balance (Mohammad N. 1980). The development in the remote sensing environment now a day support for change detection and monitoring of earth surface resources (Aher et al., 2012). The land use study in its spatial context is essential to understand the regionalization of the area of optimum land use, degraded areas etc. The land use is the result of a combination of both natural genesis and human influences which have been brought to bear on it in the past and of those which are still active in the present (Vink A.P.A., 1975). Satellite remote sensing imagery and it's coupled in GIS environment for land use/land cover analysis is a key to many diverse applications such as environment, forestry, hydrology and agriculture (Pralhad et al., 2010). Any areas natural resource management, watershed management, planning and monitoring depend on accurate information about the land cover in a region (Deshmukh et al., 2012). Methods for land use change detection from intensive field sampling with plot inventories is a complex. However, the extensive analysis using the remotely sensed data has proven to be more cost effective for large regions land use / land cover analysis. In this view the general land use / land cover pattern of Laxmi and Sheri nala basin were identified using remote sensing database.

Study Area

Present study area is the part of Krishna river basin in Sangli district of Maharashtra. The study area is bounded between latitude 16°48'00'' to 17°05'00'' N and longitude 74°30'00'' to 74° 47'00'' E in Survey of India (SOI) toposheets numbers 47K/12, 47K/16,47L/9 and 47L/13 with area about 359 sq.km figure 1. As per GSDA this study area falls in drought prone area project (DPAP) which receives rainfall less than 500 mm. The average temperature of study area is 31^{0}C. The maximum height of study area is 880 m. whereas minimum height is 535 m. from actual sea level. Geologically, the study area is part of Mahabaleshwar formation of Wai subgroup. There is large diversity in rainfall pattern due to physical setting of study area which is responsible for generation of different land cover. Study area situated along bank of Krishna River even though it is facing the water scarcity. The main reason is mismanagement of surface water and at places the over exploitation of groundwater. Study area is also rapidly altering their land cover, especially toward agriculture and built up are (Gatade et. al., 2013) (Thorat et. al., 2012) due to availability of water from Krishna River (Saymote et. al., 2012). Krishna river is important river in this study area and responsible for changing the land use / land cover. In the study area land use are noted by agriculture land, open rocky land, settlement/built up land and water bodies.

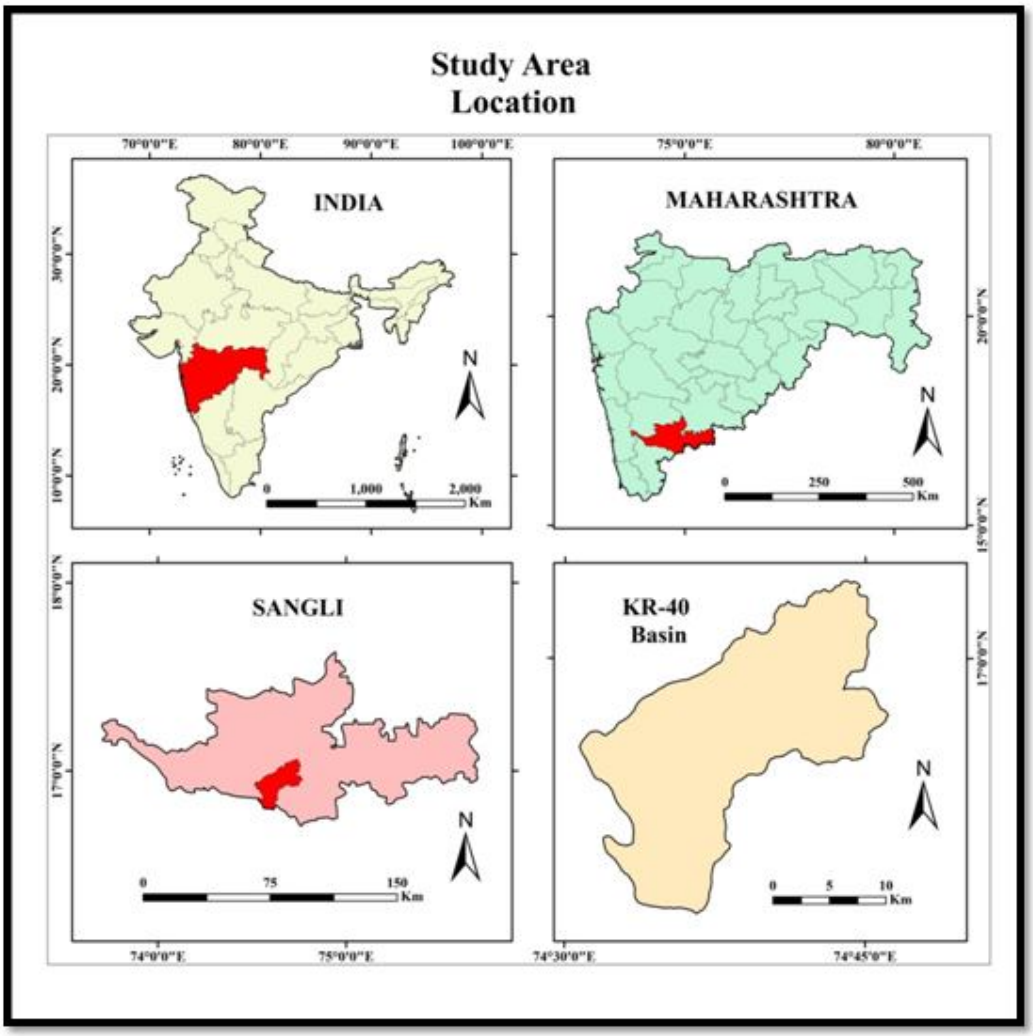

Figure 1: Location map of study area

METHODOLOGY

Pre – Processing of Satellite Imageries:

For analyzing the land use and land cover pattern of study area, the two satellite imageries of 20 years span (December 1997 and January 2017) have been considered. This giving good comparative view to understand the betterment of study area. The used satellite imageries are:

1. *Landsat 5 imagery:*

The Landsat 5 imagery is obtained from USGS (United States Geological Survey) for year 1997, on a scale of 1:80,000 representing synoptic view of Earth's surface at 30mX30m ground resolution in three spectral bands have been procured. The data product is standard FCC (False colour composite) composed of bands 2,3 and 4 in the range of 0.45 – 0.51 micrometer (blue), 0.53 – 0.59 micrometer (green) and 0.67 – 0.67 (near infra red) micrometer respectively.

2. *Sentinal 2 imagery:*

The Sentinal 2 imagery is obtained from ESA (European Space Agency) for the year 2017, with the scale of 1:50000. It has 10mX10m ground resolution with three spectral bands. For generation of the FCC the bandwidth numbers 3, 4 and 8 has been considered in the range of 36 nm (blue), 3nm (green) and 106 nm (near infra-red). For generation of land use and land cover map from imageries

supervised classification has been implemented. The entire process of classification of satellite imageries is performed in Arc-info 10.2 software.

RESULT AND DISCUSSION

Land use and Land cover pattern for year 1997:

The land use pattern of study area for the year 1997 is studied and statistical details are shown in table 1and figure 2. It is observed that out of 359.00 sq. Km. of study area, the area about 258.32 sq. Km is used for agriculture which comprises to 72%. Percentage wise this category uses more land area. This followed by open rocky land is about 64.54 sq. km. with the 18% of extent. About 9% of area is covered by settlement having 33.92 sq km. In the study area water body occupies only 1.97 sq. Km. which is 1.00%. There is no forest cover in the study area figure 3.

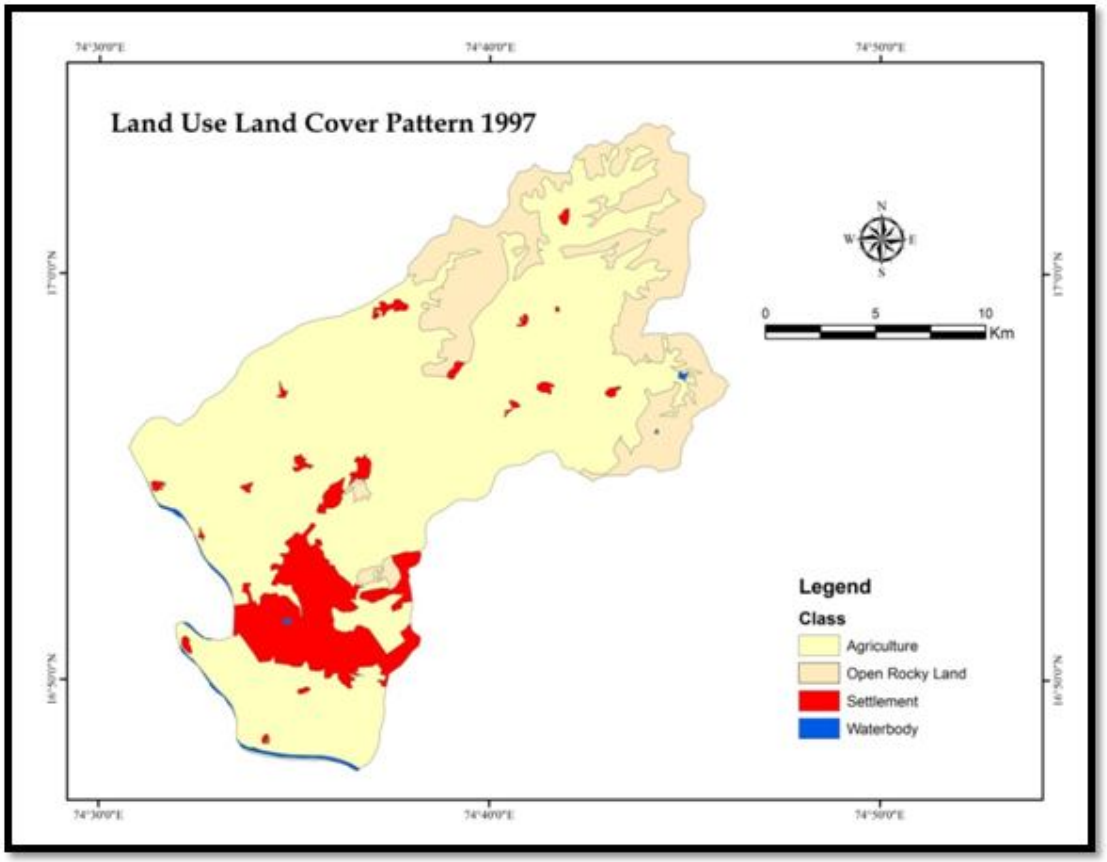

Figure 2: Land use and Land cover pattern for year 1997

Table 1: Land use statistics of study area 1997 (Landsat 5 data)

Sr. No.	Land use category	Area in sq. Km.	Percentage (%)
1	Agriculture	258.32	72
2	Open rocky land	64.54	18
3	Settlement / built up land	33.92	9
4	Water body	1.97	1
	Total	358.76	100.00

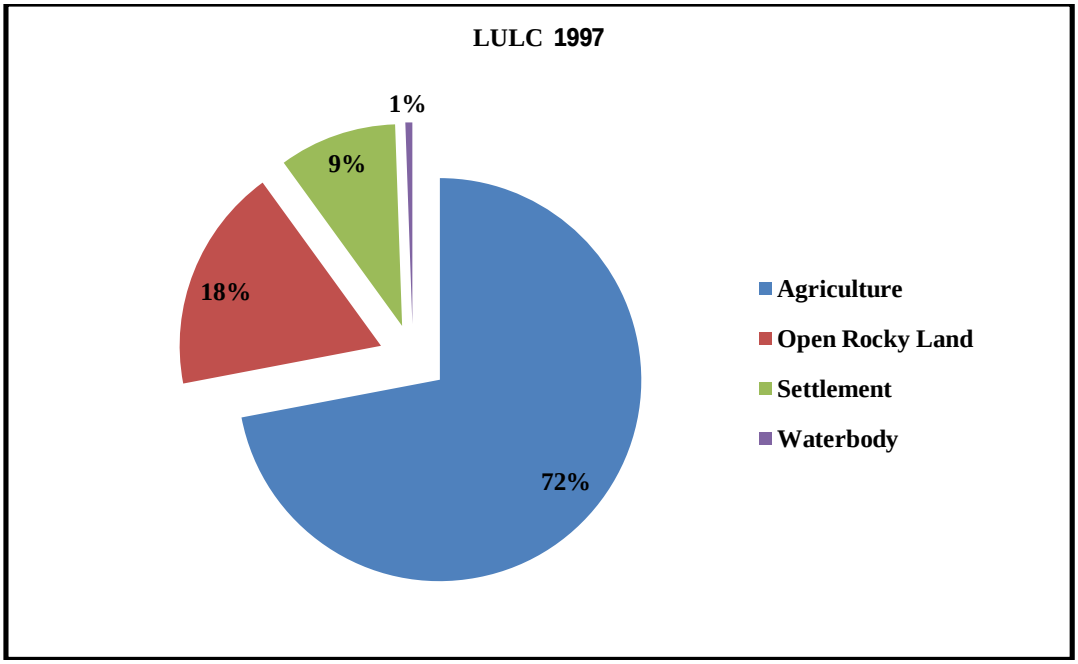

Figure 3: Statistical distribution of Land use and land cover pattern 1997

Land use and Land cover pattern for year 2017:

Land use pattern of study area is shown in table 2 and figure 4. It is observed that out of 359.00 sq. Km. area Agriculture is spread over 278.20 sq. Km comprising 77.00% area of the study area. Followed by settlement with 12% comprising 42.68 sq km. Open rocky land covers 35.65 sq. Km. constituting 10.00% and water body covers only 2.19 sq. Km with 1% of extent. There is no forest cover in the watershed figure 5.

Comparison of LULC of 1997 and 2017 year:

To understand the changes occurred in twenty years span the LULC data are compared. As Fig. 6.5 it has clear that the open rocky land about 18% in 1997 has been reduced in to 10% from 64.54 sq. km. to 35.65 sq.km of area. The maximum land has been converted in to agricultural and settlement land in 2017 of this open rocky land. The water body extent of study area also been increased with 2.19 sq.km but the percentage is remain same as in year 1997 i.e. 1%. Hence ultimately this change triggered the more water requirement, therefore the study area is become water demanding zone figure 6

Table 2: Land use statistics of study area 2017 (Sentinal 2 data)

Sr. No.	Land use category	Area in sq. Km.	Percentage (%)
1	Agriculture	278.20	77
2	Open rocky land	35.65	10
3	Settlement / built up land	42.68	12
4	Water body	2.19	1
	Total	358.72	100.00

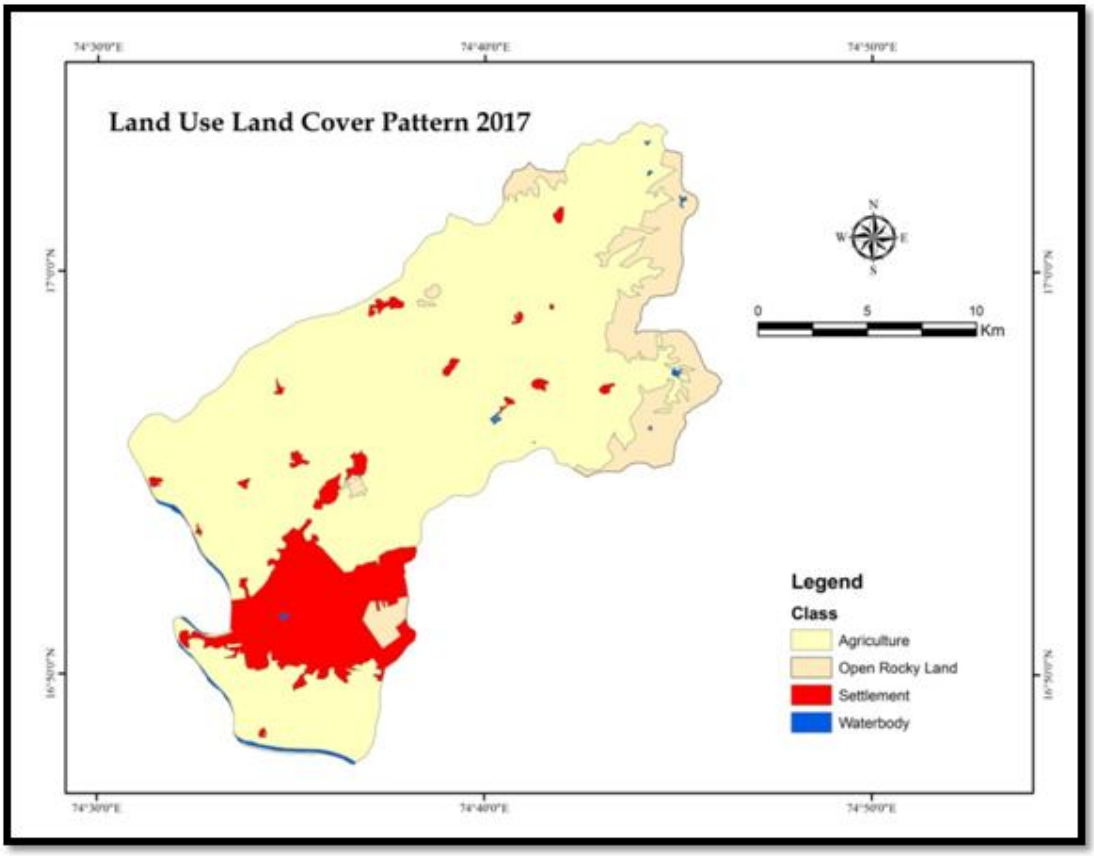

Figure 4: Land use and Land cover pattern for year 2017

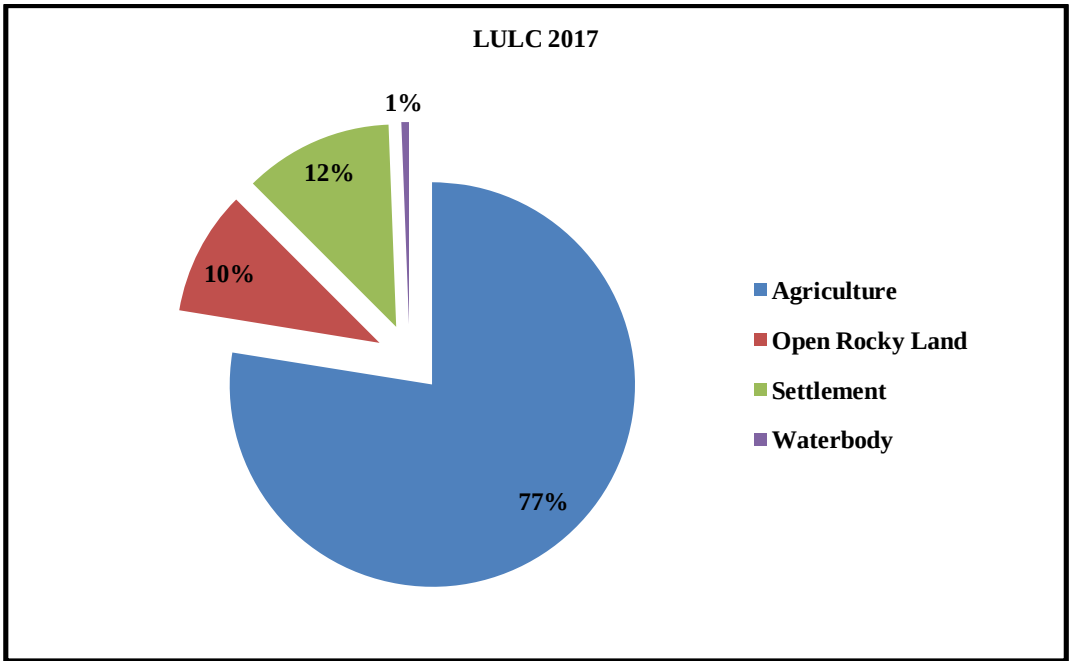

Figure 5: Statistical distribution of Land use and land cover pattern 2017

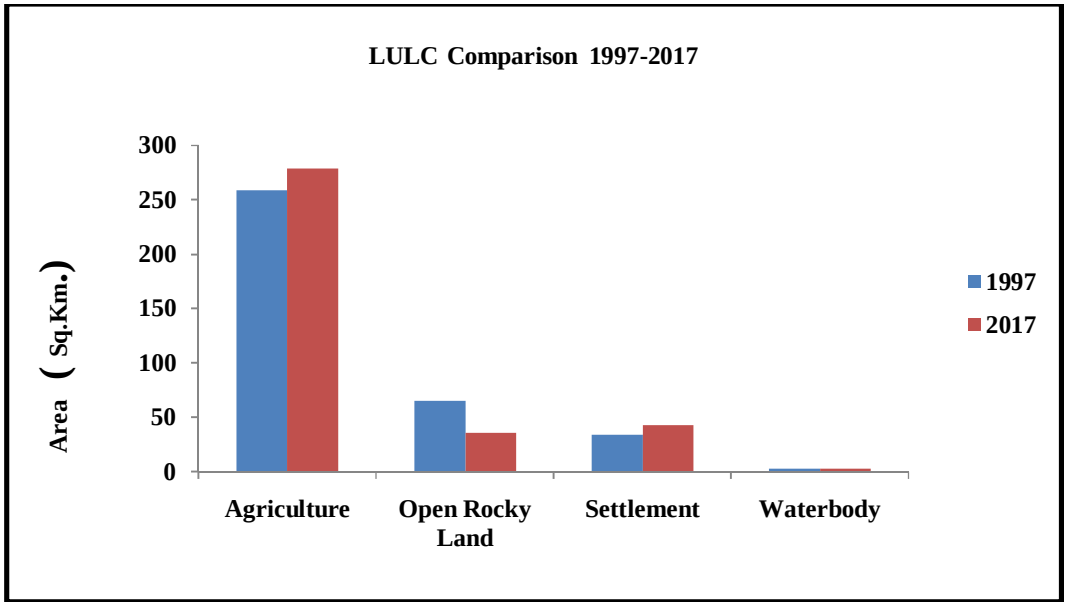

Figure 6: Comparison of Land use and land cover pattern 1997 – 2017

Table 3: Changes in Land use/Land cover pattern 1997 to 2017

Sr. No.	Land use category	1997		2017		Volume change Sq.Km
		Area in sq. Km.	Percentage (%)	Area in sq. Km.	Percentage (%)	
1	Agriculture	258.32	72	278.20	77	5.0
2	Open rocky land	64.54	18	35.65	10	-8.0
3	Settlement / built up land	33.92	9	42.68	12	3.0
4	Water body	1.97	1	2.19	1	-
	Total	359.0	100.00	359.0	100.00	

CONCLUSION

The land use/ land cover change detection is the supportive techniques for any further planning. Remote sensing data has wide range of application in land use/ land cover mapping and change detection also. The remote sensing data such as Landsat 5 and Sentinal 2 are the potential data for identification of land use and land cover in any diverse area. Spectral reflection structures of plains have helped to know of landforms (Wawale 2012). The total geographical extent of study area is 359 sq.km. Land utilization is classified in four categories like agriculture land, open rocky land, settlement and water body in study area. Table 3 clearly shows that the agricultural, built up areas are increased in 2017 than 1997 and open rocky land is reduced. These changes occurred may be due to changing population, and related socioeconomic environment alteration. Hence, ultimately the area covered by water body is insufficient as per these mass changes occurred. Finely, identification of land use/land cover from remote sensing data can be help for the further land planning and decision support system (Wawale 2015).

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