

Land Use / Land Cover Change detection by Using Geo-Spatial Techniques of Hisar city Haryana (India)

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Abstract—The Land use/ land cover is an important component in understanding the interactions of the human activities with the environment. So, it is very necessary to monitor and detect the changes to maintain a sustainable environment of any particular area. In this paper an attempt has been made to study the changes in land use and land cover of Hisar city of Hisar district of Haryana state. The study was carried out through Geo- Spatial techniques using SOI toposheets, LISS III imagery of 1999 and 2014. GIS software is used to prepare the thematic maps. Though there are some changes detected in land use/land cover analysis for the period 1999-2014 but it does not indicate any significant environmental impact on the study area. The urban change detection is happening in Hisar city due to the good trade links with the adjoining areas and its dominance in the field of medical care, education, seed production, horticulture and automobile repair and because of spare parts market. Migration of people from surrounding areas for better employment purposes is also one of the main reason for development of the city. Hisar city acts like a magnet city for the surrounding areas of this Hisar District. It has been identified as a counter magnet city of NCR to attract migrants and develop as an alternative centre of growth to Delhi. It is also known as “The City of Steel” covering an area of 92.78 sq. kms. The population of the city is 3, 01,249 in 2011 as per census expected to have a population of 10.00 Lacks by the year 2021 AD. The rapid growth of population has created an extraordinary rise in the Built-up area of the city. The total residential cum commercial area which comes in developed area has changed from 13.32 sq. kms. to 17.31 sq.kms. and developing area has changed from 7.49 sq.kms. to 12.90 sq.kms. Scrub Land is decreased from 13.83 sq.kms. to 7.19 sq.kms. and water logged area is decreased drastically from 12.53 sq. kms. to 0.10 sq.kms.

Key Words — R.S & GIS, Land Use/ Land Cover, Change Detection, LISS III.

I. INTRODUCTION

Land use and land cover (LULC) change is a major issue of global environment change. The land use/land cover pattern of any region is an outcome of natural and socio – economic factors and their utilization by man in time and space. Land is becoming a scarce resource due to immense agricultural and demographic pressure (Sundara, 2012). Hence, information on land use / land cover and possibilities for their optimal use is essential for the selection, planning and implementation of

land use schemes to meet the increasing demands for basic human needs and welfare. This information also assists in monitoring the dynamics of land use resulting out of changing demands of increasing population. Land use and land cover change has become a central component in current strategies for managing natural resources and monitoring environmental changes.(1) Land Use refers to man’s activities which are carried over on land by human beings and Land Cover refers to natural vegetation, water bodies, rock/soil cover or in other words which are naturally occupied by nature. Application of remotely sensed data made possible to study the changes in land use and land cover in less time, at low cost and with better accuracy (Kachhwaha, 1985) in association with Geographical Information System (GIS) that provide suitable platform for data analysis, update and retrieval (Star et al. 1997; Mc Cracker et al.1998; Chilar 2000). The satellite remote sensing data with their repetitive nature have proved to be quite useful in mapping land use/ land cover patterns and changes with the passage of time. Land Use Change is the modification in the purpose and usage of the land, which is not necessarily the only change in land cover it also includes the changes in intensity and management. Information about land use change is necessary to update the land cover maps and for effective management and planning of the resources for future growth and development of any area. Over the years, remote sensing has been used for land use/land cover mapping in different parts of India (Gautam and Narayanan, 1983; Sharma et al. 1984; Jain, 1992; Brahabhatt et al., 2000). In order to explore this technique, a case study of urban LU/LC change detection of Hisar city is taken. Once a major centre of the Harrapan Culture Modern Hisar is known specially for its medical treatment and good education. Small scale industries, agriculture, automobile and animal husbandry help in proper economic distribution to a large extent.

II.OBJECTIVES

The aim of this study is to produce a land use/land cover map of Hisar city of Hisar district of Haryana state in order to detect the changes that have taken place over a given period ie 1999- 2014 using change detection method. The following specific objectives are pursued in order to achieve the aim.

- To find out various land use changes on the Scale 1:50,000 of the Hisar city.
- To compare various land use changes of different years.
- To determine the trend, nature, rate, location and magnitude of land use / land cover changes.

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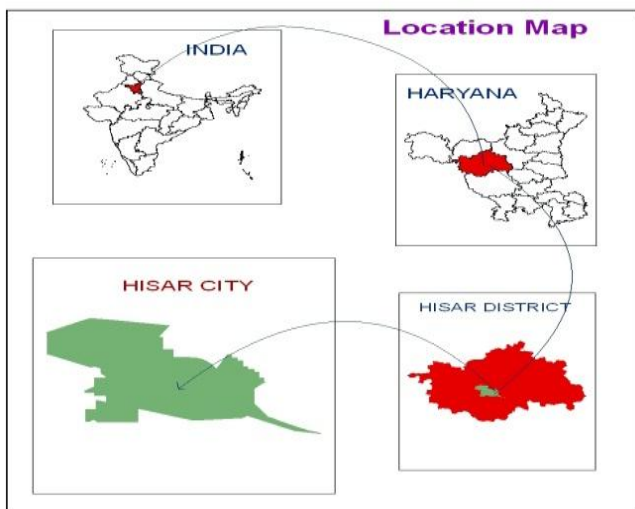
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III. STUDY AREA

Hisar is the third largest city in Haryana. It is located at 28° 53' 45" to 29° 49' 15" N to 75° 13' 15" to 76° 18' 15" E in the NW part of the state Haryana. It is connected to the National Capital Delhi by broad gauge railway line and National Highway No.10 and with the state capital by NH-65 and NH-22. It also has good rail and road links with all important towns of Haryana and neighboring states of Punjab, Rajasthan U.P. and Himachal Pradesh. The climate of Hisar city is very hot summer and very cold winters. It has an average altitude of 234 meters above mean sea level. The maximum day temperature during the summer varies between 40° to 43° Celsius. The winds are strong and frequent from May to July. Normally, the south westerly current of the summer monsoon brings rain during the July to September. Intermittent dust storms are also common. The normal annual rainfall is 350 to 400 mm.



Map1: Location map of Hisar City

IV. DATA PRODUCTS USED IN THE STUDY

- Satellite data of IRS Geocoded Product LISS III of 17 Feb. 1999 and LISS III Path 94 and Row 51 for 24 Sep. 2014.
- Information available in HARSAC, Hisar
- Survey of India Topographical Map of Hisar

4.1 Software used in the study

Arc GIS 9.3: For digitization, preparation of land use/land covers layer, composition and generation of maps
Microsoft Office 2007: For database preparation
Eardas Imagine 9.3: For importing, image rectification and geo-referencing

V. METHODOLOGY

To detect the land use changes over a period of time we required multi- temporal data. The data used for the study consist of land use maps of different time periods. The study is based on both primary and secondary data sources. General methodology adopted to carry out this research work is given in figure 1.1. Interpretation keys like size (small, medium, big), shape, tone ,texture pattern and association are used to prepare land use map of Hisar city with the help of GIS software. Structure features i.e. buildings, roads, railway are main representation information extracted from satellite imagery directly.

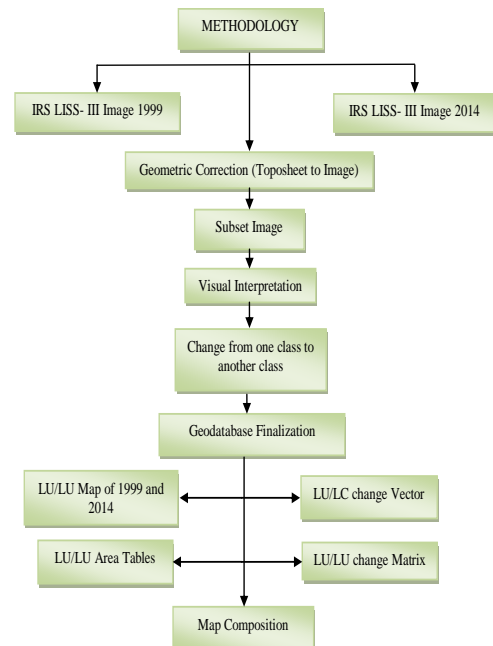
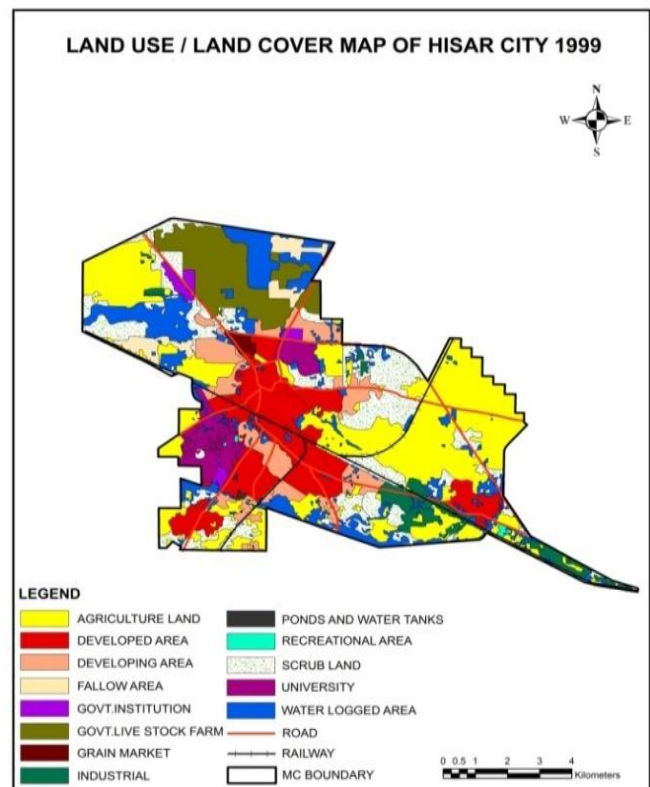


Fig 1: Methodology flow chart for land use/ land cover and change detection.

VI. RESULTS AND DISCUSSIONS

Following results have been concluded on the basis of the land use/land cover maps prepared for the two different years Using LISS-II satellite data i.e. 1999 and 2014. The distribution of land use/ land cover maps of Hisar city are represented in map 4 and 7. Table 1 & 2 shows the estimated land use and land cover transitions based on the comparison of the image interpretation results for the 1999 and 2014 images.



Map 2 : LULC Map of Hisar City during 1999.

LAND USE CLASS 1999	AREA (Sq. Km.)
Agriculture Land	26.72
Developed Area	13.32
Developing Area	7.49
Fallow Land	2.19
Govt. Institution	1.06
Govt. Live Stocks Farm	7.66
Grain Market	0.44
Industrial	3.20
Ponds and Water Tanks	0.08
Recreational Area	0.15
Scrub Land	13.83
University	4.11
Water Logged Area	12.53
Total	92.78

Table 1- Statistics of LULC Hisar City during 1999.

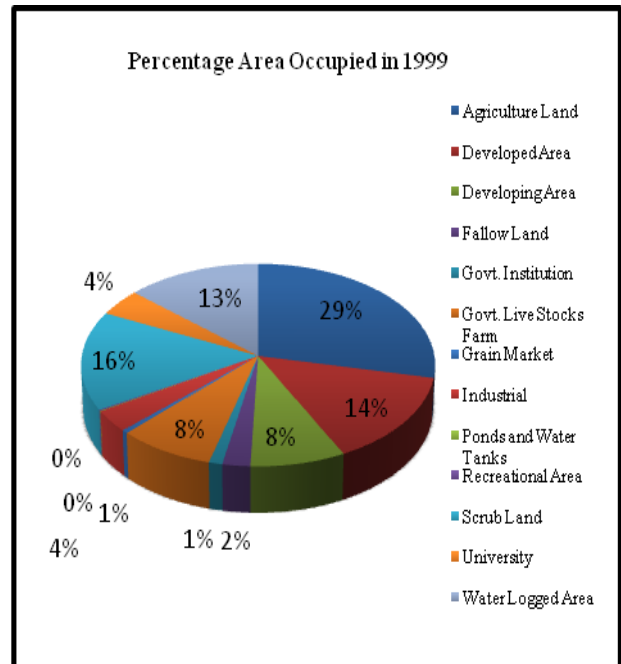
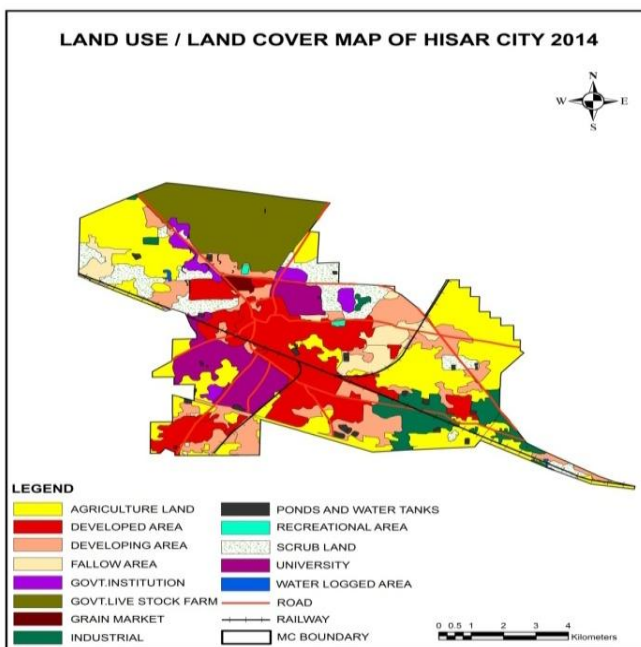


Fig 2: Pictorial Representation of LU/LC 1999.



Map 3: LULC Map of Hisar City during 2014.

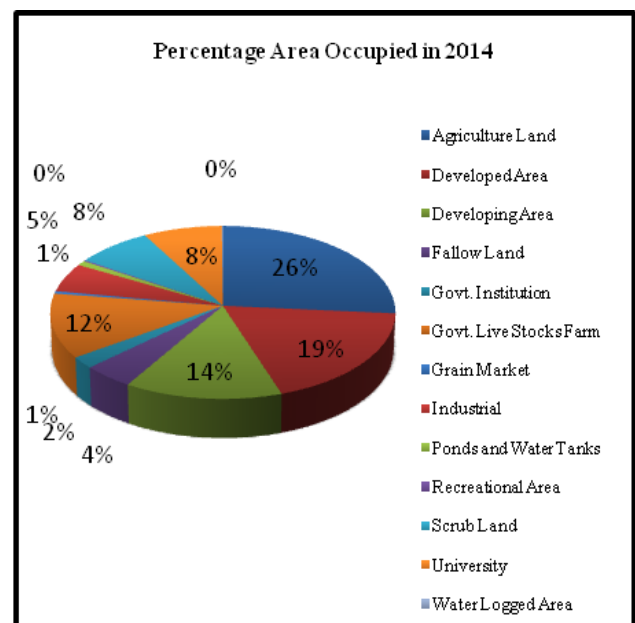


Fig 3: Pictorial Representation of LU/LC 2014.

LAND USE CLASS 2014	AREA (Sq. Km.)
Agriculture Land	24.75
Developed Area	17.31
Developing Area	12.90
Fallow Land	4.18
Govt. Institution	2.02
Govt. Live Stocks Farm	10.29
Grain Market	0.44
Industrial	5.09
Ponds and Water Tanks	0.85
Recreational Area	0.20
Scrub Land	7.19
University	7.46
Water Logged Area	0.10
Total	92.78

Table 2: Statistics of LULC Hisar City during 2014.

VII. CHANGE DETECTION ANALYSIS

Change detection is an important application of Remote Sensing technology. This gives us the changes of specific features within a certain time interval. For a given research purpose, when the remotely sensed data and study areas are identified, selection of an appropriate change detection method has considerable significance in producing a high-quality change detection product. Now after obtaining detailed land use/land cover information, change detection analysis is done by using two data sets to find out the changes that have taken place between the years 1999 to year 2014. Detailed attribute information of the feature classes, that has been changed between the two data sets are given below.

LU/LC Classes	LISS-III 2014		LISS-III 1999		% Difference
	Area Occupied in Sq. Km.	% age of Occupied Area	Area Occupied in Sq. Km.	% age of Occupied Area	
Agriculture Land	24.75	26.68	26.72	28.80	-1.97
Developed Area	17.31	18.47	13.32	14.05	3.99
Developing Area	12.90	13.76	7.49	7.90	5.41
Fallow Land	4.18	4.46	2.19	2.31	1.99
Govt. Institution	2.02	2.16	1.06	1.12	0.96
Govt. Live Stocks Farm	10.29	12.05	7.66	8.08	2.63
Grain Market	0.44	0.47	0.44	0.51	0.00
Industrial	5.09	5.43	3.20	3.38	1.89
Ponds and Water Tanks	0.85	0.89	0.08	0.08	0.77
Recreational Area	0.20	0.21	0.15	0.16	0.05
Scrub Land	7.19	7.67	13.83	15.64	-6.64
University	7.46	7.94	4.11	4.34	3.35
Water Logged Area	0.10	0.11	12.53	13.22	-12.43

Table 3 : Shows Percentage Difference for Years 1999 to 2014.

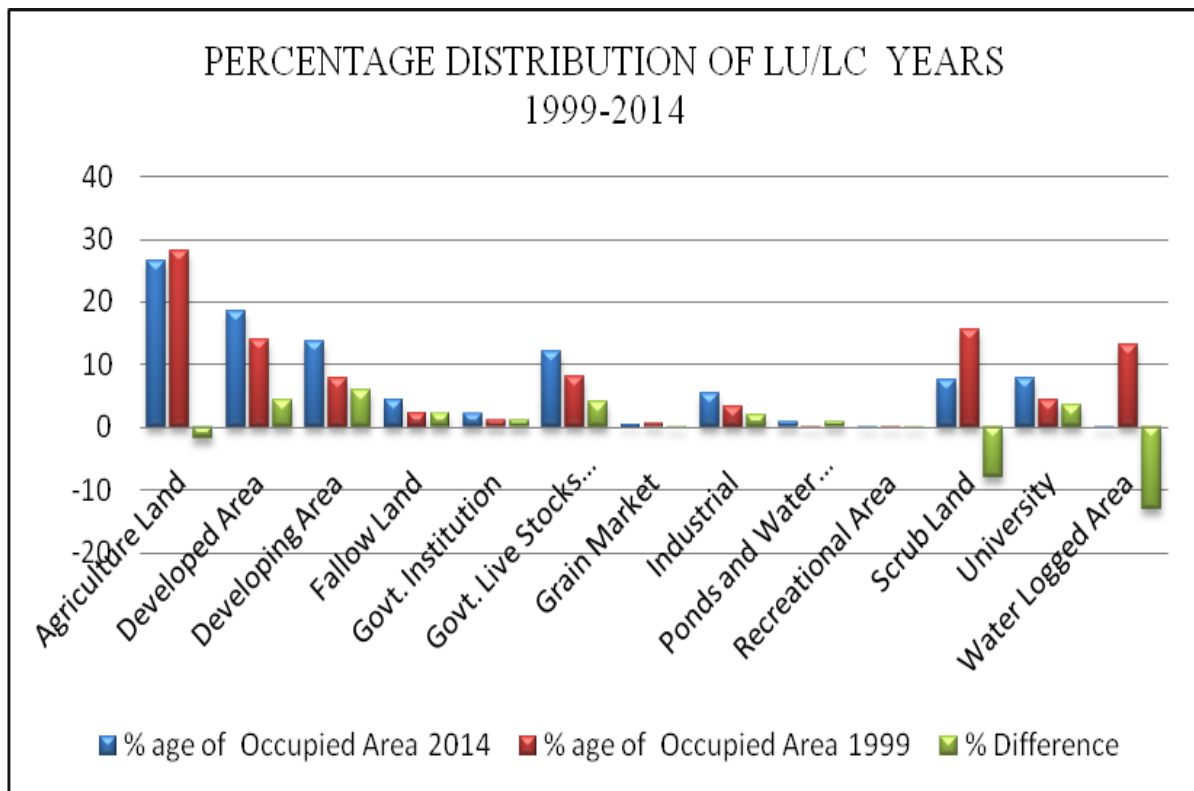
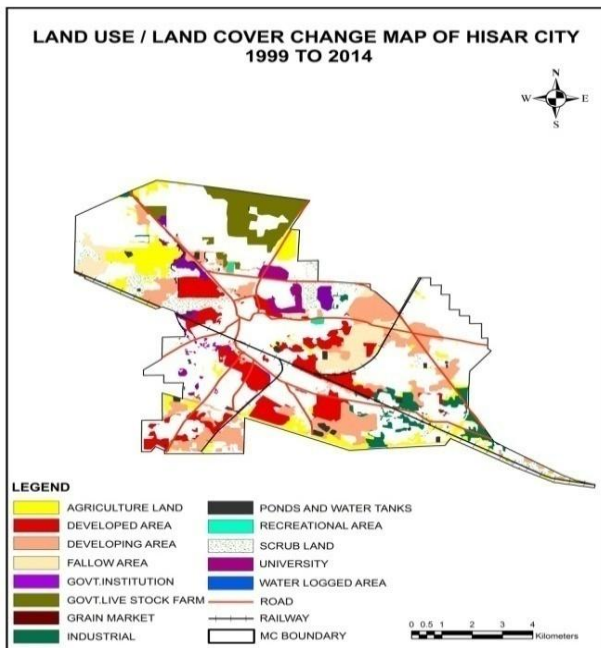


Fig 4: Percentage Distribution of LU/LC during years 1999 to 2014.



Map 4: Change Map of Hisar City during 1999 to 2014.

VIII. Conclusion

The main conclusion from this research is that the urban change detection of any place can be achieved within a short span of time using current generation of high-resolution satellite data and GIS. Remotely sensed imagery when integrated with GIS has the capabilities to improve the information structure to handle the problem arising due to rapid urbanization and population growth. High-resolution satellite data is an important source of information for urban analysis at micro level. Major findings of the research include-

The built up area is increased with the passage of time due to socio economic development of the area and most of the developing area is converted into developed area in 2014 from 1999.

An accurate characterization of the surfaces allows reliable relationship and increased understanding about land cover composition at micro level, which provides scientific support and visualization for the sustainable development of the city.

As the people come for employment purposes in Hisar city the pressure on roads is also increasing as the no. of private vehicles are increased. Congestion is mainly found in the old city area. Nearly 14 % of the people are lived in slums area. Hisar city lacks in air connectivity. And lastly the Built up area increased in the city and Scrub land is decreased.

IX. REFERENCES

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