Land Use/Land Cover Change through the Applications of GIS & Remote Sensing in blocks of Mahendragarh district of NCR, Haryana

M.P. Sharma, Ravindra Prawasi, T. P. Babu, Om Pal, R.S.Hooda

Abstract— **Land use/ land cover change has become a central component in current strategies for managing natural resources of a region. Urban expansion has brought losses of agriculture land, vegetation and water bodies. Remote Sensing and Geographic Information System (GIS) are vital tools for monitoring the fast land use changes. The present study demonstrates the use of IRS-Resourcesat-2 (LISS-III) data and GIS for land use/land cover change analysis of Mahendargarh district in Haryana. The data was interpretated using hybrid approach for mapping various land use/land cover categories on 1:50,000 scale for the years 2005-2006 and 2011-2012. The land use/land cover classes in the study area are divided into six categories. The present study revealed that good Agricultural Land in the district which has been reduced from 1621.97 sq.km. to 1568.91 sq.km. from 2005-06 to 2011-2012. Most of the area has shifted into built up due to fast urbanization. It is suggested that the industrialization and urbanization should be restricted to wasteland or unproductive lands. The findings and spatial data generated in the study may be used for land use planning of the Mahendragarh district.**

Keywords — Remote sensing, GIS, Land use/land cover, Resourcesat-2, LISS-III, change detection NCR.

I. INTRODUCTION

Land use/land cover (LU/LC) changes are affected by human intervention and natural phenomena such as agriculture, population growth, consumption, patterns, urbanization, economic development etc. As a consequence, timely and precise information about (LU/LC) change detection of the area of interest is extremely important for understanding relationships and interactions between human and natural resources for better decision making. 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. Remote Sensing (RS) and Geographic Information System (GIS) technology has are now the new tools for monitoring land use changes. The Urban planners formulated 1962 the concept of National Capital Region (NCR) in the first Master Plan of Delhi in 1962. The main objective of creation of NCR was to decongest Delhi by diffusing the population pressure towards ring towns. Thereafter, the NCR came into existence in 1985, when some surrounding districts of neighboring states became part of it. This plan has to achieve its objectives through an inter-related policy framework in context to socio-economic development and environmental parameters such as the population re-distribution, settlement patterns, regional land use / land cover patterns, economic activities, infrastructural facilities etc. So, the NCR comprises by the National Capital Territory (NCT) and the delineated area of the surrounding states of Haryana, Uttar Pradesh, and Rajasthan. The land use / land cover patterns are changing fast in the (NCR) over the period. Mahendragarh town falling in the Haryana which is a part of NCR has gained national recognition in the last few years due to fast growing service sector. Therefore, it has witnessed fast land use / land cover changes in recent times. This is one of the important factors for selecting Mahendragarh for this case study to have an appreciation of changing land use patterns in NCR. This present study has been under taken with an objective to generate spatial database on land use/land cover for the years 2005-06 and 2011-12 and to identify the pattern of (LU/LC).

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II. STUDY AREA

Mahendragarh in Haryana is bounded by Bhiwani and Rohtak districts on north, by Rewari district and Alwar district on east, by Alwar, Jaipur and Sikar districts of Rajasthan on south, and by Sikar and Jhunjhunu districts of Rajasthan on the west. It is Hot in summer. Mahendargarh District summer highest

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day temperature is in between 23 ° C to 45° C. Mahendragarh, district in the north of Haryana State is located between 27°0'47"N to 28°0'26"N latitude and 75°0'56"E to76°0'51"E longitude. Total geographical area (TGA) of the district is 1899 sq.km. The district is subdivided into five development blocks namely Ateli Mandi, Kanina Khas, Mahendargarh, Nagal Choudhary and Narnaul.

III. MATERIALS AND METHOD

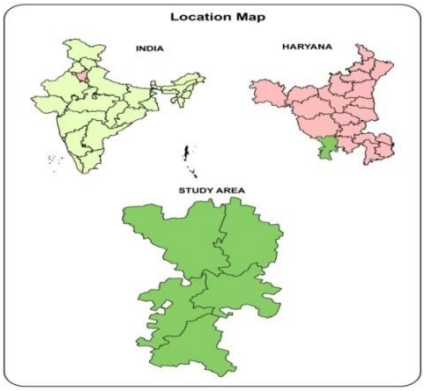
Indian Remote Sensing Satellite Resourcesat-2(IRS-P6) LISS-III data of October-20, March-31 and June 11 & 28 for Kharif, Rabi and Zaid seasons respectively prepare were used to analyze the changes in land use/land cover map of the Mahendragarh district for the three seasons data. The sensor provides 23.5 m spatial resolution in Green, Red, NIR and SWIR bands with 24 days revisit period.

3.1 ANCILLARY DATA

In the preparation of land use / land cover map the ancillary data in the form of topographic maps, and other published relevant material were used as reference data. Survey of India digital topographic maps on 1: 50,000 scale were also used for identification of base features and for planning ground data collection. Legacy data on land use/land cover; wastelands generated for 2008-09 were also used as a reference during delineation of various wasteland classes. ERDAS Imagine 9.3 software was used in importing, image rectification and Geo-referencing, Arc GIS 10.0was used for digitization, preparation of land use/land covers layer and creation of database and MS Office was used for database preparation.

3.2 METHODOLOGY

The methodology followed was on-screen visual interpretation using interpretation keys like tone, texture, shape, size, pattern and association, etc. Methodology flow chart provided in Fig. 1 indicate different steps followed in the updation of land use/ land cover map of 2005 -06 using three seasons (Kharif / Rabi /Zaid) satellite data of 2011-12 leading to preparation of Land use/Land Cover (LU/LC) map 2011-12 and also the Land use/Land Cover (LU/LC) change detection map generation.



Map 1**:** Location Map of Study Area

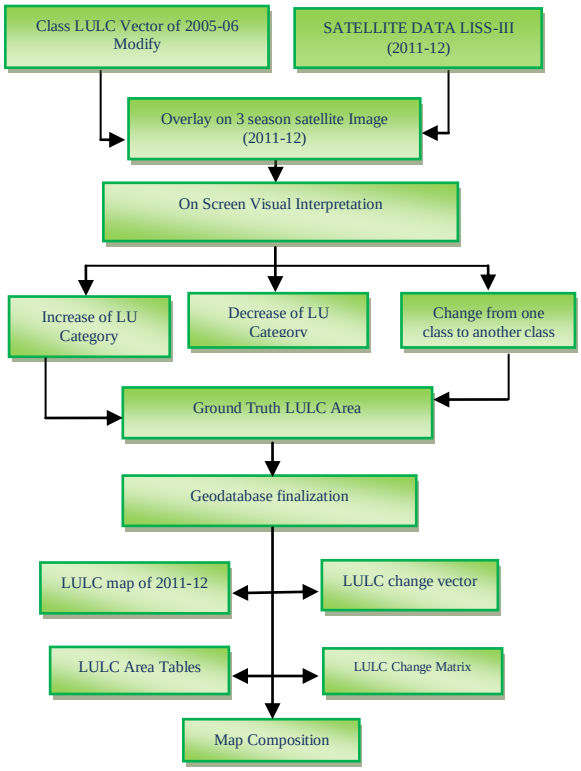


Fig. 1 - Methodology flow chart for land use/land covers and change detection.

3.3 LAND USE/LAND COVER (LU/LC) CHANGE ANALYSIS

Land use/ Land cover change analysis was done by computing the Relative Deviation (RD) of different land use categories from the year 2005-06to 2011-12.

$$\%RD = \frac{A\ (2011\text{-}12) - B\ (2005\text{-}06)}{B\ (2005\text{-}06)} \times 100$$

Where: A (2011-12) is the area under a specified land use class for the year 2011-12.

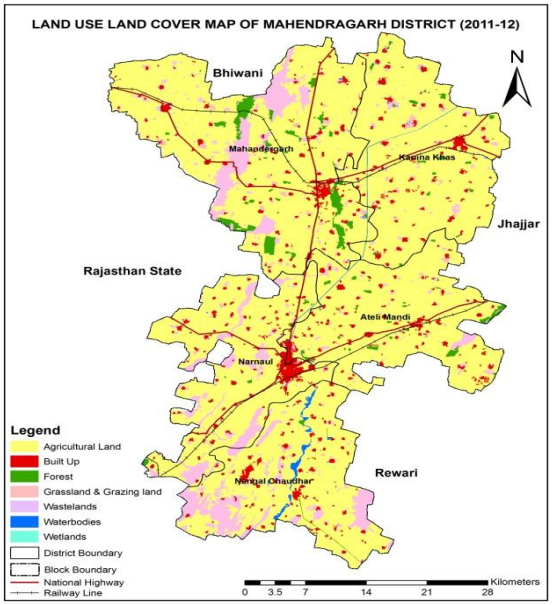
B (2005-06) is the area under the same land use class for the year 2005-06.

III. RESULT AND DISCUSSION

Following results have been concluded on the basis of the land use/ land cover maps prepared for the two different years using multi-date satellite data i.e. 2005-06 and 2011-12. The distribution of land use/ land cover classes in the study area in 2005-06 and 2011-12 (Map 3 & 4) is represented in Table 1.

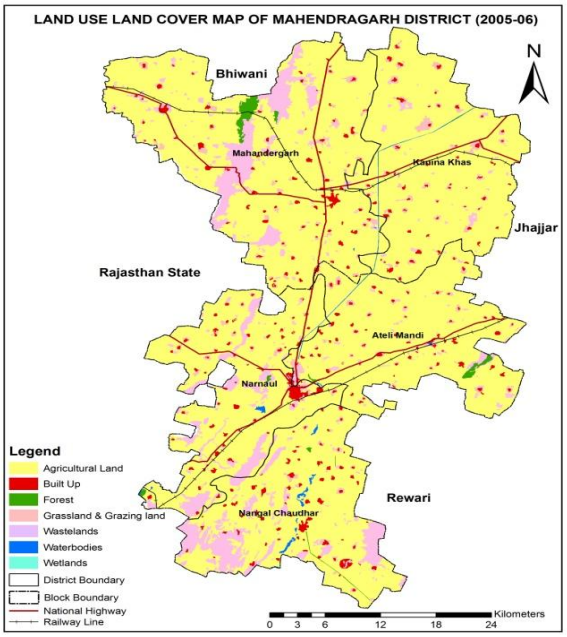
Categories	LISS-III Data 2005-06		LISS-III Data 2011-12		RD % from 2005-06 to 2011-12
	Area occupied in (sq.km.)	% of Area occupied	Area occupied in (sq.km.)	% of Area occupied	
Agricultural Land	1621.97	85.41	1568.61	82.60	-3.30
Built Up	45.70	2.41	84.92	4.47	85.80
Forest	11.45	0.60	39.44	2.08	245.30
Wastelands	44.33	2.33	33.51	1.76	-24.41
Grass/Grazing	169.55	8.93	162.79	8.58	-3.87
Water bodies	5.99	0.32	9.67	0.51	61.28
Total	1899	100	1899	100	

Table1: Statistics of land use / land cover (LU/ LC) change in Mahendargarh district during 2005-06 to 2011-12.



Map 3: Land use/land cover Blockwise map of Mahendragarh district during 2005-06.

Map 4: Land use/land cover Blockwise map of Mahendragarh district during 2011-12.



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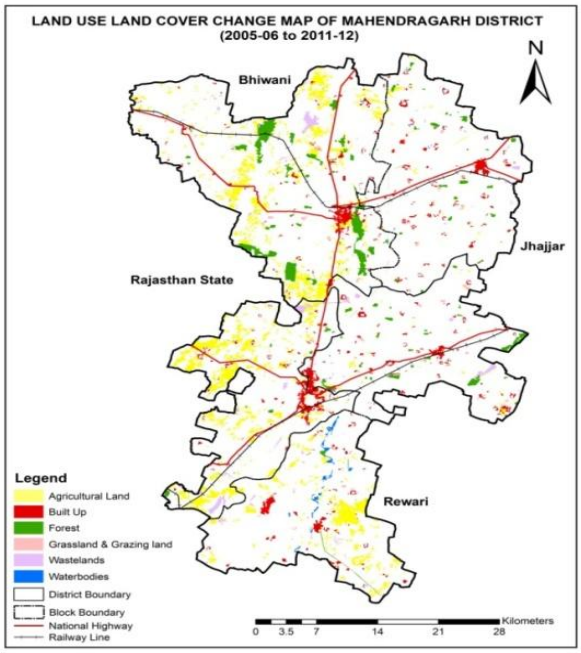

Map 5. Land use/land cover Blockwise change in Mahendragarh distict from 2005-06 to 2011-12.

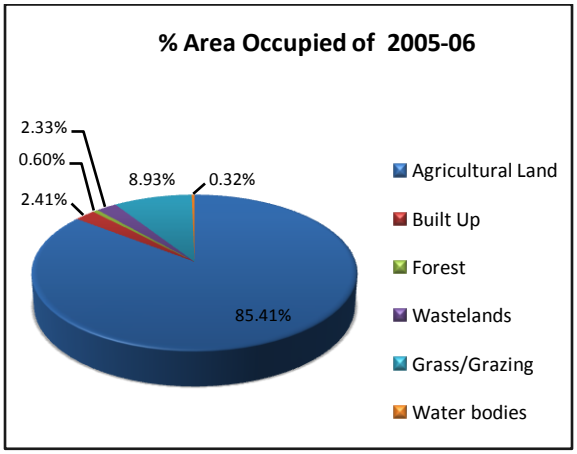

Fig. 2 (A) Land use/land cover area % in Mahendragarh district in 2005-06.

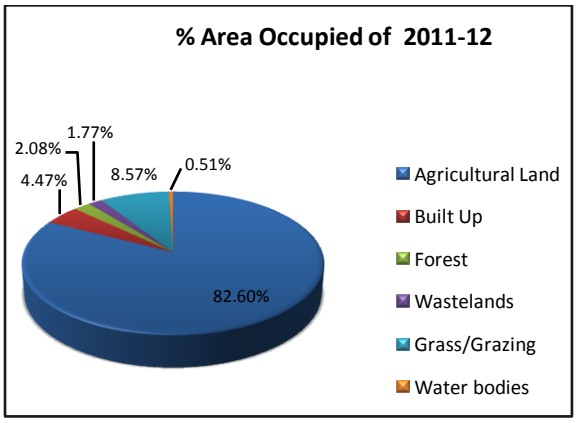

Fig. 2 (B) Land use/land cover area % in Mahendragarh district in 2011-12.

IV. RESULT AND DISCUSSION

Following results have been concluded on the basis of the land use/ land cover maps prepared for the two different years using multi-date satellite data i.e. 2005-06 and 2011-12. The distribution of land use/ land cover classes in the study area in 2005-06 and 2011-12 (Fig.5A &5B) is represented in Table 1.

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S.No	Categories	Ateli Mandi	Kanina Khas	Mahendragarh	Nangal Choudhary	Narnaul
		2005-06 Area in (Sq.km.)	2011-12 Area in (Sq.km.)	2005-06 Area in (Sq.km.)	2011-12 Area in (Sq.km.)	2005-06 Area in (Sq.km.)
1.	Built-Up	7.78	17.19	6.80	15.07	11.41
2.	Agriculture Land	293.34	283.58	347.23	338.33	474.70
3.	Forest	2.73	6.70	0.45	4.27	6.5
4.	Grass/Grazing	9.17	5.58	13.14	8.97	12.29
5.	Wastelands	8.17	8.11	5.79	5.59	63.69
6.	Water bodies	0.80	0.83	1.30	1.78	0.37
Total	322.00	374.00	569.00	320.00	314.00	

Table No. 2. Statistics of land use/land cover (LU/LC) Blockwise change in of Mahendragarh district during 2005-06 to 2011-12 (Area in sq.km)

4.1 Built Up - In Mahendragarh district the built up area among the blocks of Mahendragarh, the maximum area under buit-up category was Kanina Khas block that is 17.19 sq.km and the minimum area of this category is Mahendragarh block i.e. 6.80 sq.km.

4.2 Agricultural area - In Mahendragarh district the Agricultural area among the blocks of Mahendragarh, the maximum area under Agricultural category is Narnaul block i.e. 474.70 sq. km and the minimum area of this category is Kanina Khas block i.e. 283.58sq.km.

4.3 Water bodies - In Mahendragarh district the Water bodies among the blocks of Mahendragarh, the maximum area under Water bodies category is Nangal Chaudhary block i.e. 1.78 sq. km and the minimum area of this category is Narnaul block i.e. 0.37 sq.km.

4.4Wasteland - In Mahendragarh district the Wasteland among the blocks of Mahendragarh, the maximum area under Wasteland category is Narnaul block i.e. 63.69 sq.km and the minimum area of this category was Nangal Chaudhary block i.e. 5.59 sq.km.

4.5 Forest - In Mahendragarh district the Forest among the blocks of Mahendragarh, the maximum area under Forest category is Kanina Khas block i.e. 6.70 sq.km and the minimum area of this category is Mahendragarh block i.e. 0.45 sq.km.

4.6 Grazing land - In Mahendragarh district the Grazing land among the blocks of Mahendragarh, the maximum area under Grazing land category is Mahendragarh block that is 13.14 sq.km and the minimum area of this category was Kanina Khas i.e. 5.58 sq.km.

V. CONCLUSION

The study shows that there has been a dynamic change in the land use/land cover in Mahendragarh district from 2005-2006 to 2011-2012. These changes may likely to alter the structure, function and complexity of the local ecology. The urban area increased due to migration of people and industrialization. There is need of scientific land use planning in the district due to high urban growth because of falling the district in National Capital Region. Mainly agricultural area, grazing land and wasteland categories have been converted into built-up area during this period. The methodology protocol adapted for identification and delineation of each class using standard image interpretation techniques and interpretation keys have played a decisive role in generating the area estimates.

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