
Landuse/Land Cover Mapping and Change Detection – A Case Study of Hisar-Bhiwani Watershed, Haryana

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ABSTRACT:

The land use information collected for Hisar-Bhiwani watershed in Haryana from the analysis of the IRS-P6/1D LISS – III data for the year 2004-2005 and NRDMS Resource Atlas of Haryana data for the year 1999-2000 revealed a large change in the area of different land use categories during the period from 1999- 2005. The total geographical areas the present watershed is 3531.05 km². The cropped land covering an area of about 3322.32 km² (94.11 percent of the total area) in 1999-2000 reduced to 2934.62 km² (83.1 percent of the total area) in 2004-2005, while the area under rural settlements increased from 51.73 km² in 1999-2000 to 101.26 ha. in 2004-2005. The watershed lacks the forest cover of required limit, which was covering an area of 5.00 km² in 1999-2000 reduced to 4.50 in 2004-2005.

Key Words- *Landuse/Land Cover, Built up area, Non built up area, Change Detection, Hisar-Bhiwani Watershed, NRDMS*

INTRODUCTION:

Land-use analysis is an important aspect of geographical studies. This aspect of geography is represented in the land-use maps prepared with the help of the land use survey. It has become essential to prepare land-use maps because they are recognized as necessary tools for the preparation of land capability and land classification maps which in turn provide guidelines for the regional planning and development (Singh, 1995).

Land-use in an area is the cumulative outcomes of historical events, the interaction of economic forces with the natural environment, and the values of society. Despite the significant influence of the natural environment on the original distribution of the use of the geographical area, subsequent adjustments of land-use to the cultural ecology are clearly evident. This is an opportune moment for an appraisal of the relationship between land-use and environment. It needs field studies and land-use surveys, the two most commonly used approaches to the study of land-use geography (Singh, 1995).

The land in a watershed has to be used for several purposes such as settlement, agriculture and livestock, forest, etc. The land can rarely be put to use, which will provide maximum or most desirable uses for watershed protection; Land use affects rates of runoff, infiltration and the types and quality of vegetation cover (Tideman, 2004).

Large pressure of growing population and increased demand for food, fodder, and fuel wood combined with industrial activities have essentially led to rapid change in land/use land cover patterns particularly in developing countries. Planning for development of natural resources without endangering the environment is a crucial issue, the world is facing today (Chaurasia et.al. 1999). Information on the rate and kind of changing with the use of land resources is essential for proper management planning and regularizing the use of such resources (Shankaranarayanan and Sewn, 1977). Land use data are needed in the analysis of environmental processes and problems. That must be understood if living conditions and standards are to be improved or remained at current level (Anderson et.al. 1976). Remote Sensing Technology has emerged as an efficient and powerful tool; in providing reliable information on various natural resources of the region in a special format so essential for planning (Ray et. al 1991). In the light of the above, the present study was taken up to monitor changes in the land use.

STUDY AREA:

The present study area, located in the western part of Haryana state, is geographically situated between $28^{\circ} 35' 31.42''$ North to $28^{\circ} 58' 23''$ North latitude and $75^{\circ} 24' 15.27''$ East to $75^{\circ} 54' 22''$ East longitude. The total area of the watershed is 3531.62 km^2 .

The geologically study area is a part of sub-basins of River Ghaggar. The area is being covered by districts Hisar and Bhiwani. The watershed area is consisted of alluvial land and sandy soil, known as Khadder and Banger soil. Reolight Rocks found in some parts of watershed area.

This subtropical location has the semi arid climatic condition, where mean annual temperature ranges between 25.1°C to 25.5°C , mean annual rainfalls is 30 cm.

METHODOLOGY:

Digital Image processing techniques are employed to carry out land use classification on IRS –P6/1D LISS-III data of 2004-2005 (Map-2). The land use map for the year 1999-2000 is derived from NRDMS Resources Atlas of Haryana, 2004 (Map-1). Area of each land use category was measured using the grid method. The change in the extent of different land uses categories in the extent of different land use categories during the period from 1999-2005.

Result and Discussion

Land use / Land Cover

The satellite remote sensing data for the year 2004-2005 provided the recent information about the land use of the watershed (Map-1). The built-up area in a scattered pattern, Non built-up area under Cropped area (Kharif cropped, Rabi cropped and Rabi + Kharif cropped), Sand dunes, Barren and Rocky land, Scrub land, Fallow land, water logged area, Salt affected land, Forest and Plantation cover are various land use/ land cover classes is determined for each of these periods (1999-2000 to 2004-2005) and is presented in table- 1 and map 1 & 2.

1. Built- Up area

The watershed constituted mostly the rural settlements, as there is a very small part under urban settlement. The total built-up area in 1999-2000 was only 51.73 km^2 , which was just 1.46 percent of the total geographical area. It has increased to about 101.26 km^2 in 2004-2005 i.e. 2.86 percent. This is the second major land use category after cropping area. Growth of the settlement size was more in the north central area.

2. Cropped Area

Total cropped area in 1999-2000 is 3322.32 km^2 , which 94.06 percent of the total area. The cropped land decreased by about 11.37 percent of the total geographical area, during the period of 1999-2000 to 2004-05. During the period 2004-2005, the cropped area in the

watershed was about 2958.79 km² (83.77 percent of the total area), which was about 363.5 km² less than in the period of 2004-2005, which was 3322.32 km² (94.07 percent of the total area) in that period. More than 50 percent cropped area was under double crop. The area of double crop is rapidly increased during 1999-2000 to 2004-05. In 2004-2005 it was become 70 percent of total geographical area. Single cropped (both Rabi and kharif area) was decreased in that period.

Kharif season crops like jowar, bajra, cotton, rice, maize, and pulses were grown in 385.80 km², which is 10.92 percentage of the total geographical area. Rabi crops like wheat, barley, gram, and other pulses were grown in 1049.38 km², which 29.71 percent of the total area. Rabi + Kharif both crops were grown in 1877.14 km², which is of 53.43 percent of the total area.

Table- 1 Change in Land use and Land cover of Hisar-Bhiwani Watershed

Sr. No.	Category	Land Use/Land Cover Pattern (1999-2000)		Land Use/Land Cover Pattern (2004-2005)		Change	
		Area in km ²	Area (Percent)	Area in km ²	Area (Percent)	Area in km ²	Area (Percent)
1	Built up area	51.73	1.46	101.26	2.86	+49.53	1.39
2	Cropped area						
	i) Kharif Cropped	385.80	10.92	136.08	3.850	-249.72	7.08
	ii) Rabi Cropped	1049.38	29.71	315.15	8.920	-734.23	20.81
	iii) Rabi + Kharif Cropped	1887.14	53.43	2458.79	69.620	+595.90	16.88
3	Waste land						
	i) Sand dunes	86.00	2.43	72.54	2.054	-13.46	0.39
	ii) Barren and Rock Land	3.47	0.098	3.47	0.00	0	0
	iii) Scrub Land	60.88	1.72	129.65	3.67	+68.77	1.12
	iv) Fallow Land			286.11	8.100	+286.11	8.100
	v) Water logged area			1.53	0.040	+1.53	0.040
	vi) Salt affected land			0.06	0.001	+0.06	0.001
4	Forest & Plantation						

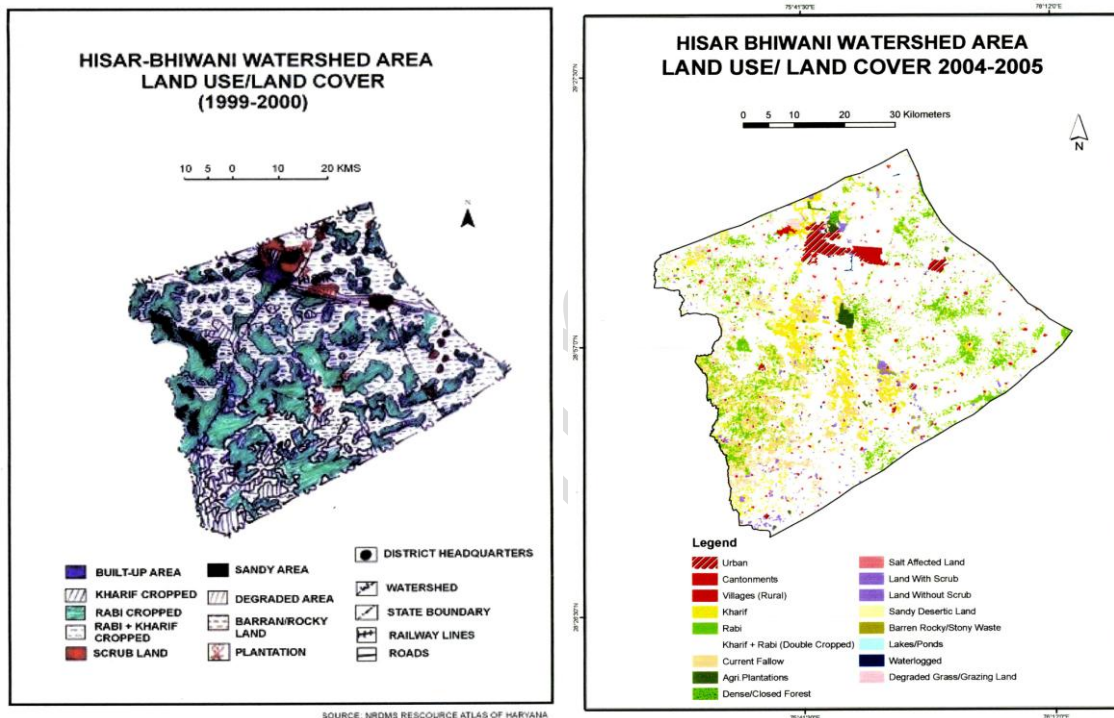
i) Forest	5.00	0.14	4.50	0.127	-0.50	0.013
ii) Plantation	2.22	0.06	22.48	0.636	+0.26	20.26

‘+’ Area increase, ‘-’ Area decrease

3 Wasteland

Wasteland is divided into six classes, i.e. Sand dunes, Barren and Rock Land, Scrub Land, Fallow Land, Water logged area, and Salt affected land

Sand dunes have occupied of the area 86.00 km² in 1999-2000, which is of 2.43 percentage of the total area. This area slowly descres in 2004-2005, and spread in the 2.05 percent in this period.



Barren and rocky land have occupied of the area 3.47 km², which is about 0.09 percentage of the total area, at that time barren and rocky land known as Tosham and Khanak hills. These are the residual hills of Aravallis mountain. This area of wasteland neither increase or nor descres.

The area contains scrubland covering about 61 km² in 1999-2000, This area rapidly increases in 2004-2005 and spread in the 129.65 km² of the watershed area. The fallow land in the watershed area was not during the period of 1999-2000. But this area rapidly grows during the period of 2004-2005. In this period, it covers more then 8 percent of the total area.

A very little area is also covered by the waterlogged area and salt effected area in the present watershed region, during the period of 2004-2005, which is 0.04 percent and 0.001 percent of the total area of the watershed.

4. Forest and Plantation

The area has degraded forest 5.00 km² (0.14%) and agricultural plantation covering a very small area of 2.22 km², which is about 0.06 percentage of the total area during the period of 1999-2000. However, this area rapidly increases during next years. In 2004-2005, the 4.5 km² are has forest, which is 0.13 percent of the total area, and 22.48 km² area has agricultural plantation, which is 0.64 percentage of the total area.

CONCLUSION:

This analysis indicates that the built up area and double-cropped area (Rabi+ Kharif) has rapidly increased in the watershed during the period of 1999- 2005, which is due to increasing population and habitation size. There has been a slight improvement in the area under the plantation, but forest condition has very bed the watershed. According to National Forest policy, 1952 an area equivalent to 33 percent is recommended for the forest use, but in the present case only 4.5 percent area is covered under forest in 2004-2005, which have a negligible value. The cropped area in the watershed has decreased during the period from 1999-2000 to 2004-2005. In 1999-2000, it covered more than 94 percent area of total watershed, but in 2004-2005, the cropped land decreased by about 10 percent. Wasteland also increases during the last years. In 1999-2000, there is no fallow land, salt affected land and water logged area, but in 2004-2005, it covers an area of 287.7 km², which is 8.1 percent of the total area. Scrubland is also increasing during 1999-2000, the Scrub land spread in the 60.88 km², which covered in the 130 km² area of the watershed during 2004-2005. However, the increase in the waste land by 69.12 km² is a disturbing phenomenon. Therefore, there is great need of planning to control the increasing rate of wasteland, and needs to be brought under production immediately.

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