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Mapping of Land Resources and their Temporal Utilization in Baragudha Block of Sirsa District Using Remote Sensing and GIS

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Abstract: ***Land Resource mapping plays a vital role in resource management. It assists in the planning for future land use, particularly agriculture, because it assesses the land resource and its potential for sustainable agricultural production. Land resource mapping can serve many purposes, including business planning and research. However the major traditional uses, which are still important today, are to help plan new developments (like agriculture, forestry, urban, recreation) and to identify management, conservation or degradation issues. The present study aims to investigate the monitoring of resource and temporal utilization using multi-temporal IRS P6 AWiFS satellite data (2007- 2009-10) of Baragudha block of Sirsa district and to identify the hot spots of land use changes pertaining to various categories. At the same time, land use and land cover transfer matrixes are used to assess the dynamic change trends for different land cover types. Agriculture land class covered 519.97 sq. km area in 2007 & 507.73 sq. km area in 2009-10 that was 96.24 percentage of the study area in 2007 and 93.98 percentage of the study area in 2009-10.***

Keywords: Land Resource, Satellite data, Temporal utilization, Remote sensing, GIS

1. Introduction

Land plays the key role in the determination of man's economic activities as well as social and cultural progress. Land resource maps tell us about our planet and our communities [8]. They attempt to describe what is on and under the surface and also the ways in which we demarcate the environment for many purposes, including recreation, education, property, assessment, and posterity.

The use of new technologies and science developments such as Remote Sensing, Geographic Information System, field data collection and database development have made it possible to approach the study of land use land cover and its impact from a multi-disciplinary perspective. Remote Sensing, currently offers an important tool to the synoptic and timely evaluation of natural resources over large areas [9]. Geographic Information System (GIS) has emerged as a powerful tool for handling spatial and non-spatial geo-referenced data for preparation and visualization of input and output, and for interaction with models [10].

The present study aims to analysis the spatial analysis and temporal composition of land resources during the period 2007to 2009-10.

2. Study Area

The Baragudha block situated between 29°34'35" to 29°50'25" N latitude and 74°50'24" to 75°14'21 E longitude. The total geographical area of the Baragudha block is 540.27 sq. km. It is located on the border of Haryana and Punjab in the north east, Sirsa block in the south, Odhan block in the west [11].

Climate of Baragudha block is arid and hot which is mainly dry with very hot summer and cold winter except during monsoon season when moist air entered. The summer starts from mid March to last week of the June followed by the south- west monsoon which lasts till September. The transition period from September to October forms the post-monsoon season [15]. The winter season starts late in November and remains up to first week of March. The south western monsoon sets in from last week of June and withdraws in end of September. Physiographically it falls under Ghaggar river sub-basin which flows from east to west. The block is formed by aeolian and alluvium plain which has been further divided into many sub geomorphic divisions viz. recent flood plain, nearly level old flood plain, aeolian plain (sand dunes), old flood plain with occasional sand dunes. Location map of study area is displayed in figure-1.

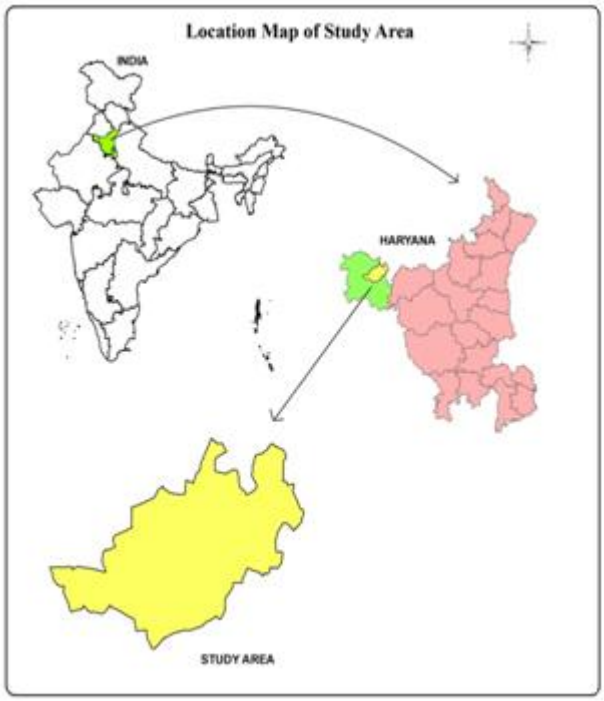


Figure 1: Location map of study area

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3. Materials & Methodology

3.1 Satellite Data

Mainly Indian Remote Sensing Satellite (IRS-P6) AWIFS satellite data of both rabi and kharif seasons was used for the present study. This satellite data for both seasons & years (2007 & 2009-10) was downloaded from Bhuvan and used to prepare thematic layers [5]. The specification of remote sensing satellite data is given in the table-1.

Table 1: Specification of satellite data used during 2007 and 2009-10

Sr. No.	*Satellite*	*Sensor*	*Date of acquisition*
1	IRS-P6	AWiFS	March & October 2007
2	IRS-P6	AWiFS	Sept. 2009 & March 2010

3.2 Software Used

ERDAS IMAGINE 9.3, ARC GIS Desktop 9.3, Microsoft Office 2007.

3.3 Scale

The present change mapping was prepared on 1:50,000 scale to monitor land use / land cover change during the year 2007 to 2009-10.

3.4 Ground Truth

All doubtful areas are checked by field verification. Land use /land cover classification methodology for study area is presented in figure-2.

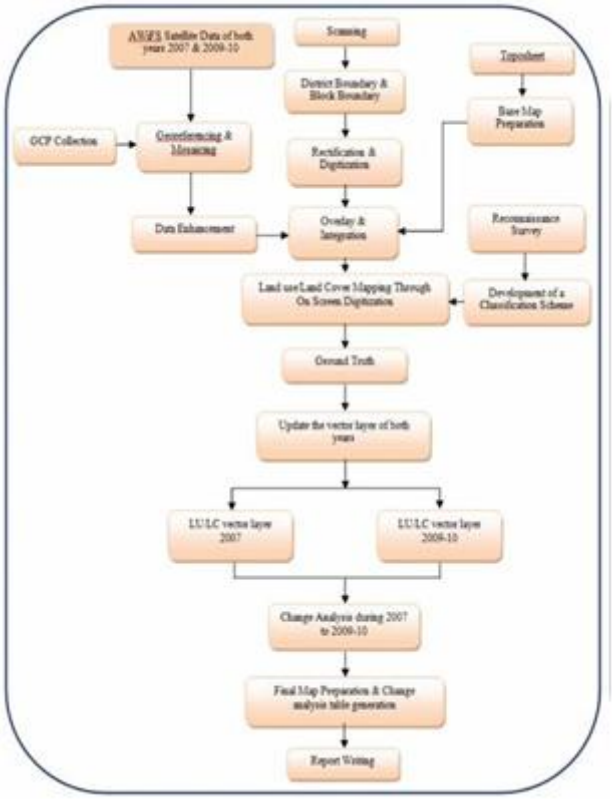


Figure 2: Methodology flow chart

4. Results & Discussion

Based on the interpretation of two season satellite data, the land use/ land cover categories identified in this block were double cropped area, rabi only, kharif only, current fallow, strip plantation, strip plantation, horticultural plantation, degraded grazing land, land with open scrub, sandy area, single/ group building, water body and village settlement [1] [12]. The interpreted satellite maps for the years 2007 and 2009-10 are shown in Figure-2 & 3 respectively. The areal extent of these categories during both the years along with change in their area is given in Table-2. The brief description of various classes is as follows:

4.1 Built Up Land

Built-up Land is comprised of areas of intensive use with much of the land covered by structures [7]. It is further divided into village, urban built up, single/group building.

Built up Rural & Urban – Out of the total built up rural land, settlement area of Baragudha block was 3.56 sq. km. in 2007. During the year 2009-10, it was found that there is increase of 2.57 sq. km in the settlement area of this village i.e. 6.13 sq. km. Minor urban built up area 0.14 sq. km observed in 2007 and in 2009-10; it was increased to 1.04 sq. km.

Single/Group Building – This class includes those buildings which are scattered in the study area and may be the tubewell or poultry farms in the farmers' fields. This class during 2007 was not mapped. In 2009-10, 0.21 sq. km. area founded under this class.

4.2 Agricultural land

Agricultural land may be defined broadly as land used primarily for production of food grains and fodder. This category is further divided into double crop, rabi only, kharif only and current fallow sub-classes.

Double crop- This sub-class includes an area which is cultivated during both rabi and kharif seasons in a year [14]. Double crop is the dominant category in Baragudha block. The area under this class during 2007 was 500.71 sq. km. whereas it became 494.07 sq. km. in 2009-10. The decreased area of 6.64 sq. km. is also justified from the increased area of kharif only & strip plantation classes in this block.

Rabi only - The area cultivated only during rabi season and remains fallow during kharif season is classified as rabi only. This class covered an area of 11.84 sq. km in 2007 and 1.48 sq. km. in 2009-10. The decrease of 10.36 sq. km. in this category may be due to the shifting of this area in kharif only category.

Kharif only - The area which is cultivated only during kharif season and remains fallow during rabi season is called kharif only. It covered an area of 3.20 sq. km in 2007 and 10.89 sq. km in 2019-10 i.e. a increase of 7.69 sq. km.

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Current Fallow - Land which is kept fallow in both rabi and kharif seasons due to rainfall or the other reasons falls under this category. A small area of 4.22 sq. km. of this class was found during 2007 whereas this class was decreased to 1.29 sq. km. in 2009-10.

4.3 Plantation

Plantations are the cultivated trees or plants grown in agricultural fields. This category includes Agricultural plantation, Strip plantation and Horticultural plantation classes also [13].

Agricultural plantation- Agricultural plantation is done around the crop field. Agricultural plantation covered an area of 0.17 sq. km in 2007 and this class not observed in 2009-10. Mostly this class was changed in horticultural plantation class and this class covered 0.12 sq. km. area.

Strip plantation - Strip plantation is mainly done on both sides of roads/ kachcha ways. Strip plantation covered an area of 9.40 sq. km area in 2009-10 and this class was not mapped in 2007. This class increased due to decreased double crop class.

4.4 Wastelands

The term wastelands refer to degraded lands that are currently underutilized, and are deteriorating for lack of appropriate soil & water management or on account of natural causes [2]. These are further divided into degraded grazing land, scrub land and sandy area.

Degraded Grazing and Grass Land- These lands are the Panchayat lands, irregular in shape, and are found close to settlement fringes. The areal extent of this class during 2007 was 8.92 sq. km and it decreased by 3 sq. km. during 2011-12 due to increase in settlement area of the village.

Land with Open scrub- These lands generally occupy topographically high locations and possess sparse vegetation [3]. These are subjected to excessive aridity with scrubs dominating the landscape. This class occupied an area of 6.43 sq. km. in 2007 and 4.15 sq. km. in 200-10 i.e. decreased of 2.28 sq. km. during this period.

Sandy area- A small area of 0.32 sq. km was found during 2007 in the Baragudha block. Most of the sandy wastelands have been leveled and put under cultivation.

Salt affected area- Lands affected by salinity/alkalinity have excess soluble salts (saline) or high exchangeable sodium [4]. Salinity is caused due to movement of water, capillary rise during extreme weather conditions leaving salt encrustation on the surface. This class was observed only in 2009-10 that contains 1.26 sq. km area.

4.5 Water Body

This class includes ponds present in the study area. Ponds were observed in this block covering an area of 0.76 sq. km. in 2007 and 4.31sq. km. in 2009-10.

Table 2: Areal extent and change in area of land use/ land cover categories of Baragudha Block

Land use/Land cover Categories		*Area in Sq. km. (2007)*	*Area in Sq. km. (2009-10)*	*Change*
Built Up Land	Rural	3.56	6.13	2.57
	Urban	0.14	1.04	0.90
	Single group building	0	0.21	0.21
Agricultural Crop	Double crop	500.71	494.07	-6.64
	Rabi only	11.84	1.48	-10.36
	Kharif only	3.20	10.89	7.69
	Current Fallow	4.22	1.29	-2.93
Plantations	Horticultural plantation	0.00	0.12	0.12
	Agricultural plantation	0.17	0	-0.17
	Strip plantation	0.00	9.4	9.40
Wastelands	Land with open scrub	6.43	4.15	-2.28
	Degraded grazing & grass land	8.92	5.92	-3.00
	Salt affected area	0.00	1.26	1.26
	Waterlogged area	0.00	0	0.00
	Sand desertic	0.32	0	-0.32
Waterbody	Waterbody	0.76	4.31	3.55
Total		540.27	540.27	0.00

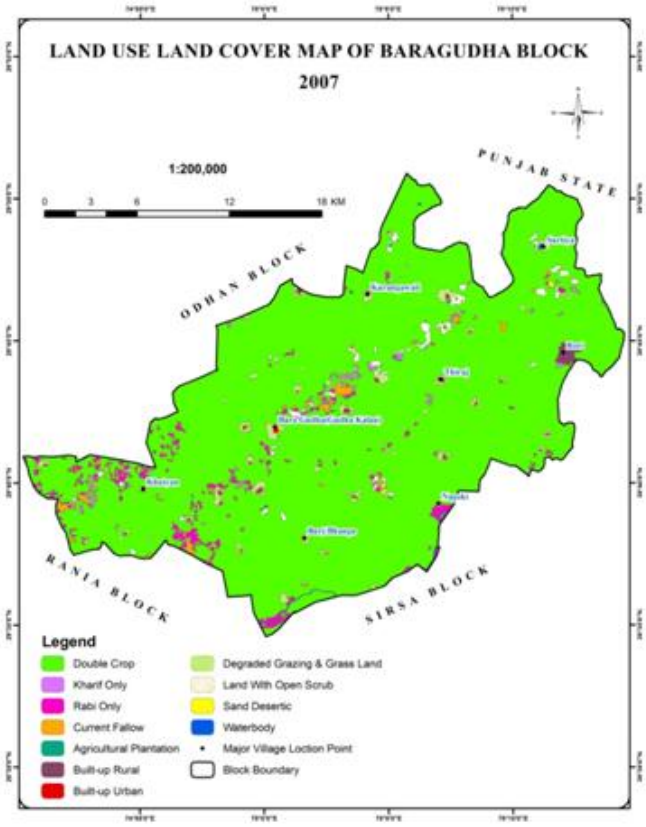


Figure 3

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4.6 Spatio- temporal Change Analysis:

A common or union layer was generated on the basis of vector layers of both years 2007 & 2009-10. With this common vector layer, changes between all land use/ land cover categories during 2007 and 2009-10 were calculated as shown in Table-3 and the change map was prepared as shown in Figure-5. Green color used to denote no change and red color for changes in existing class that is shown in table-3. Table -3 rows total presents area during 2007 and column total presents area during 2009-10 of different land use land cover classes. The change analysis data shows that 480.16 sq. km. area of double crop remained unchanged but a reasonable area i.e. 9.25 sq. km. area of double crop changed into strip plantation category. 1.50 sq. km. area changed into built up rural and 8.92 sq. km. changed in to double crop from rabi only. On the other hand in 2009-10 year data 4.24 sq. km. area of double crop was shifted into kharif only.

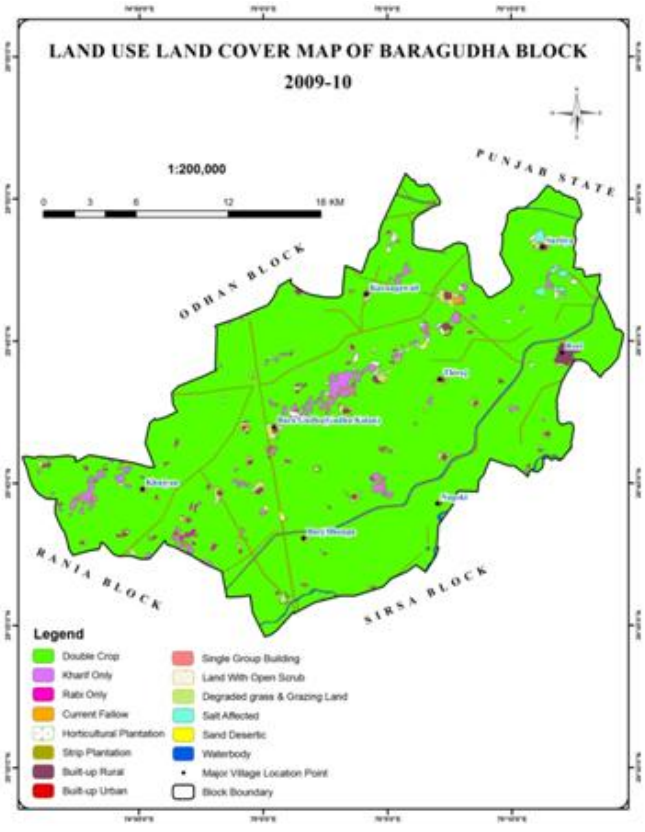


Figure 4

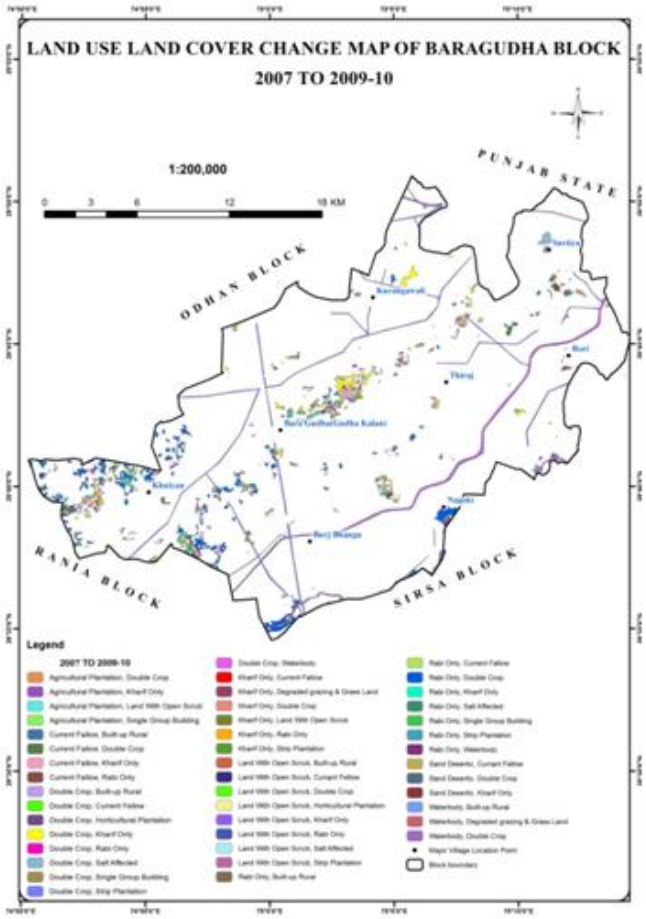


Figure 5

5. Conclusions

The present study was conducted to evaluate change analysis of Baragudha block of Sirsa district by using satellite data of both rabi and kharif seasons for the years 2007 & 2009-10. The change analysis is based on the changes observed in land use/ land cover in Baragudha block between 2007 and 2009-10. After going through the final land use/land cover data of both years and the changes occurred during these years, following conclusions were drawn.

- Built-up area, agricultural crops, agricultural plantation, wastelands & waterbody are major LU/LC classes that were observed in both years 2007 & 2009-10.
- Agricultural crop class covered 519.97 sq. km area in 2007 & 507.73 sq. km area in 2009-10. This class covers 96.24 percentage area of the study area in 2004-05 & 93.98 percentage area of study area in 2009-10.
- Built-up area was observed 3.71 sq. km in 2007 that was 0.68 percentage of total geographical area of the district and 7.38 sq. km area was observed in 2009-10 that was 1.37 percentage of total geographical area of the block.
- Wastelands class was observed 15.67 sq. km in 2007 that was 2.90 percentage of total geographical area of the district and 11.33 sq. km area was observed in 2009-10 that was 2.09 percentage of total geographical area of the district.
- The analysis of landuse/ land cover data of Baragudha block of Sirsa district revealed that the major changes

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occurred in agricultural crop categories. The substantial decrease of 6.64 sq. km was observed in double crop area, 10.36 sq. km area decrease in rabi only and 2.93 sq. km area decrease in current fallow class whereas kharif only class was increased 7.69 sq. km. Total wastelands area in 2007 was 15.67 sq. km that was decreased 4.34 sq. km during 2007 to 2009-10. Total built up area of this block was 3.7 sq. km in 2007 & 7.38 sq. km was observed in 2009-10. Horticultural plantation & strip plantation classes were also observed in 2009-10 that covered 0.12 & 9.4 sq. km area respectively.

- The data reveals that total agricultural area was decreased 12.12 sq. km during 2007 to 2009-10. This is due to increase in built up area & strip plantation classes. Minor changes were also observed in wastelands categories in the study area.
- Degraded grazing and grass lands are spread mainly on village panchayat lands associated with village surroundings. This is the major category of wasteland in the study area.

Table 3: Category wise change analysis of land use/ land cover classes during 2007 and 2009-10 of Baragudha Block (Area in sq. km.)

2007 \ 2009-10	Built-up Rural	Built-up Urban	Current Fallow	Degraded grazing & grass land	Double Crop	Horticultural Plantation	Kharif Only	Land With Open Scrub	Rabi Only	Salt Affected	Single Group Building	Strip Plantation	Waterbody	Grand Total
Agricultural Plantation	-	-	-	-	0.09	-	0.01	0.05	-	-	0.02	-	-	0.17
Built-up Rural	3.54	-	-	-	-	-	-	-	-	-	-	-	0.02	3.56
Built-up Urban	0.10	0.04	-	-	-	-		-	-	-	-	-	-	0.14
Current Fallow	0.00	-	0.32		1.66	-	2.13	-	0.11	-	-	-	-	4.22
Degraded grazing & grass land	1.50	-	-	5.75	1.57	-	0.01	-	-	0.03	-	0.05	-	8.92
Double Crop	0.75	-	0.19		480.16	0.11	4.24	-	0.56	0.58	1.16	9.25	3.70	500.71
Kharif Only	-	-	0.06	0.09	1.38	-	1.60	0.05	0.01	-	-	0.01	-	3.20
Land with Open Scrub	0.16	-	0.32	-	-	0.02	1.21	4.04	0.04	0.57	-	0.07	-	6.43
Rabi Only	0.02	-	0.35	-	8.92	-	1.46	-	0.75	0.07	0.03	0.03	0.22	11.84
Sand Desertic	-	-	0.04	-	0.07	-	0.21	-	-	-	-	-	-	0.32
Waterbody	0.07	-	-	0.07	0.25	-	-	-	-	-	-	-	0.37	0.76
Grand Total	6.13	0.04	1.29	5.92	494.11	0.12	10.87	4.15	1.48	1.26	1.21	9.40	4.31	540.27

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