

# Change Detection of Land use Land Cover using GIS & Remote Sensing for Doon Valley

Ashish Bhandari<sup>1</sup>, Nitin Bela<sup>2</sup>, Nitin Mishra<sup>3#</sup> and Sakshi Gupta<sup>4</sup>

<sup>1</sup>(M.Tech. Student, Dept. of Civil Engg, Graphic Era University, Dehradun,India)

<sup>2</sup>(M.Tech. Student, Dept. of Civil Engg, Graphic Era University, Dehradun,India)

<sup>3</sup>(Assistant Professor, Dept. of Civil Engg, Graphic Era University, Dehradun,India)

<sup>4</sup>(Assistant Professor, Dept. of Civil Engg, Graphic Era University, Dehradun,India)

## Abstract

*In understanding the interactions of the human activities with the environment an important component is the Land use and Land cover and therefore it is necessary to be able to replicate changes. The study has been done by using GIS and through remote sensing approach. The rapid growth of population in urban India is a reason of worry among the country's urban and town planners land cover changes. Land cover is a physical substance at the surface of the earth. In recent years, the application of remotely sensed data and geographical information system (GIS) has been widely used for the significance of spatial data technologies. The aim of this study is to detect land use and land cover change between years 2000 to 2011 using satellite images of resolution 30 m. The three satellite images of year 2000, 2005 and 2011 of path row 146-39 were acquired from the GLCF website. The objective is to provide a land use/land cover map at two epochs of Doon valley in order to identify the changes that have taken place mostly in the built up land and forest areas. Image processing method in ERDAS Imagine 9.2 and ARC GIS 9.3 has been used to detect Land use changes. Supervised classification method is used for the urban land use and land cover classification. The different layers belonging to various land uses identified from remotely sensed data are prepared by using GIS software. The analysis of the results shows a radical increase of the built up area or urban area from 4.1% to 17.61%, an increase in agriculture area from 10.57% to 18.13%, an increase in barren land area from 0.15% to 8.81%, a reduced green cover (forest cover) from 80.8% to 53.3% and a decrease in water area from 4.35% to 2.12%.*

**Keywords** – Urban, land use and cover, change detection, remote sensing, geographical information system.

## I. INTRODUCTION

Urbanization is a vital part of modern world which plays an indirect control of economic growth of any country. Urbanization makes a major contribution in the economic growth as India is one of the

developing country. In India, the growth rate has been slow for all the towns and cities in the nineteenth and the twentieth century's. The growth of urban population mainly near metropolitan and new cities in the recent years has been resolute. In earlier times, along the river banks, religious centers and agricultural hub the settlement of population was focused. The major cause was an easy accessibility of water for drinking and domestic uses for such a settlement. The land use / land cover map was generated by means of satellite images of 2000, 2005 and 2011, through ERDAS IMAGINE (version 9.2), which is a powerful image - processing software. The determination of digital land cover classification is to have a meaningful information class value, which can evaluate the landscape accurately. Land cover refers to the land covered which includes vegetation, urban, water, barren land, etc.

## II. STUDY AREA

Doon valley, a unique micro- geomorphic unit, is a parallelogram shaped structural valley and is bounded in the North by lesser Himalaya and in the South by Shiwalik, in the NW by river Yamuna and in the SE by the river Ganga. Geographically, it lies between latitudes 29°55' and 38°30' N longitudes 77° 35' and 78°28' E covering an area of 222.95 sq.km. Its elevation range from 315 m. to 2500 m while the gradient varies between 7 & 10 m/km this synclinal trough receives 210cm. Rainfalls annually and the summer temperature ranges between 38°C and 41°C, while the winter temperature varies between 15°C and 50°C.

As per interim reports of Census the population of Dehradun in 2011 was 303,411 male and 275,009 female as a total population of 578,420. The number of educated population in Dehradun city is 463,791, which includes 251,832 males and 211,959 females. Average literacy rate is 89.32 percent of Dehradun city, in which male literacy rates is 92.65 and female literacy rate is 85.66 percent, respectively.

The study area comprises of alluvium parent matter derived from lesser Himalayas & comprises of

sedimentary and meta-sedimentary rocks. The area is composed of gravels, pebbles, cobbles & boulders mainly of quartzite with fine sandy & silty matrix & also fragments of shale , slate , phyletic , limestone, sandstone etc.

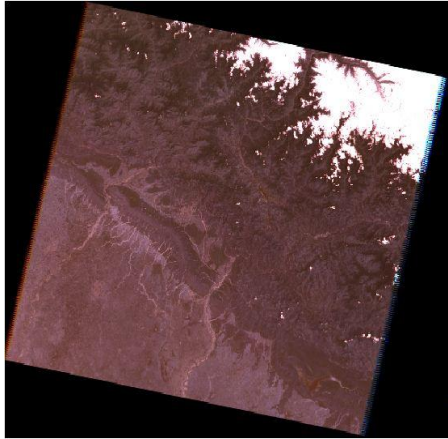


Fig 1: Satellite Image of Study Area (146/39)

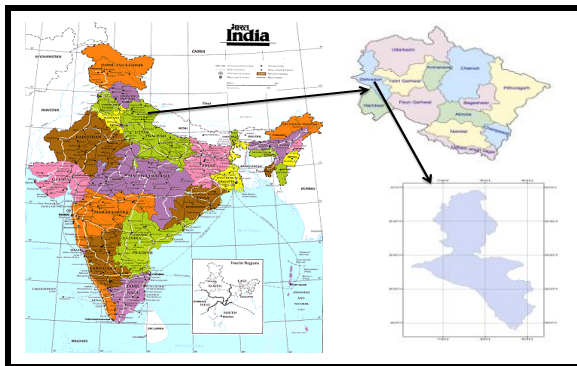


Fig 2: Study Area Map of Doon Valley

### III. LAND USE CLASSIFICATION

A number of methods have been invented for land use classifications, known as unsupervised and supervised classification. Land use classification by their relative spectral similarity may be either by an unsupervised method in groups cases, or by a supervised method based on similarity of cases to asset of predefined classes that have been characterized spectrally. Here, supervised method of classification is done so as to get the accuracy in classification.

The land use/cover map was generated by using satellite images of 2000, 2005 and 2011, through ERDAS IMAGINE (version 9.2), which is a powerful image- processing software. The determination of digital land cover classification is to have a meaningful information class value, which can evaluate the landscape accurately [1].

Land cover refers to the cover including vegetation, urban infrastructure, water, barren land, etc. Land cover is a fundamental variable that impacts on and links many parts of the human and physical environments. Land cover is highly affected by human- induced activities rather than natural events. Today, mainly agriculture expansion, burning activities or fuel wood consumption, deforestation, some construction works and urbanization cause land cover changes.

Consequently, such changes may have great impacts on the catchment by varying hydrological processes such as infiltration, groundwater recharge, and base flow and runoff. Land use change is the main concern for worldwide environment change and is used by town and country planners to design eco-friendly and sustainable economic growth.

### IV. RESULT OUTCOME

Images of path and row 146/39 and 40 for different years are used as listed in Table 1 with their data of acquisition and resolution for study. Classified images are shown below:

Table 1: Detail of Data Acquired

S.No.	Date of acquisition	Data	Resolution (m)
1	25 <sup>th</sup> November 2000	Land Sat Data	30
2	25 <sup>th</sup> November 2005	Land Sat Data	30
3	25 <sup>th</sup> November 2011	Land Sat Data	30

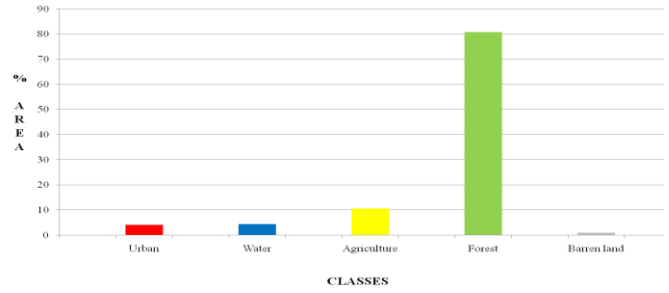
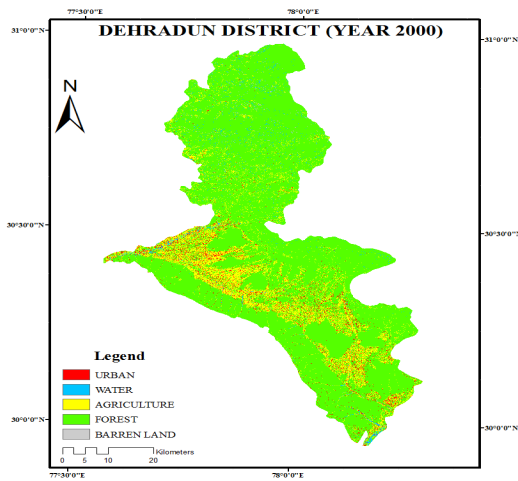


Fig 3: Land Use/Land Cover Map and Histogram of Study Area (2000).

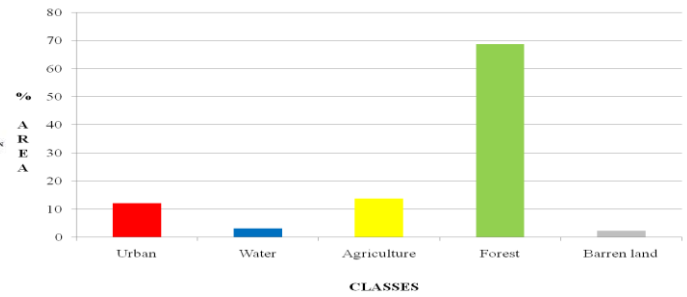
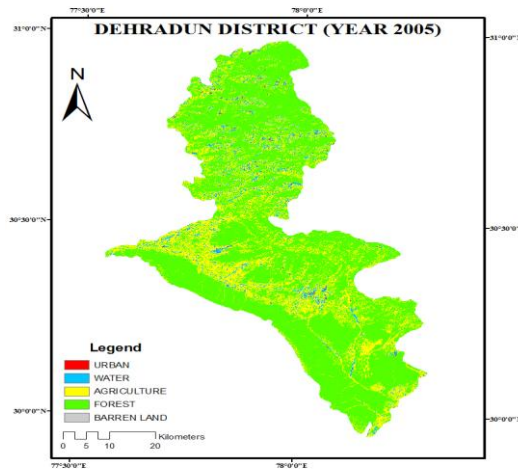


Fig 4: Land Use/Land Cover Map and Histogram of Study Area (2005)

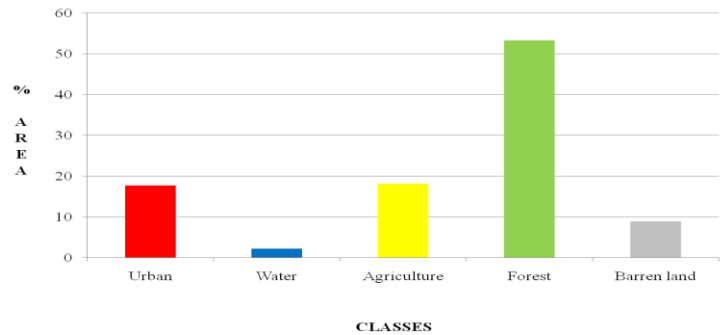
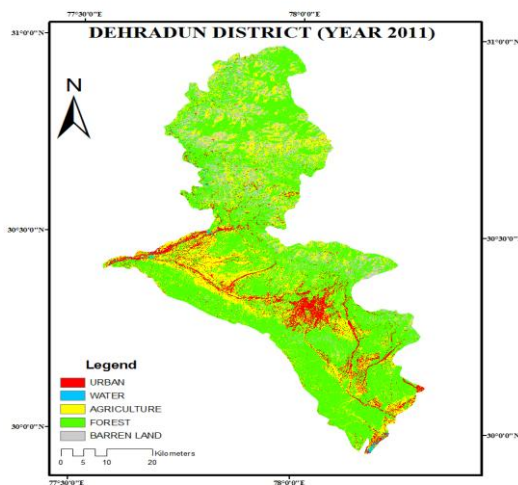


Fig 5: Land Use/Land Cover Map and Histogram of Study Area (2005).

The result we have observed so far by analyzing the images shows a drastic increase of the built up area or urban area from 4.1% to 17.61%, an increase in agriculture area from 10.57% to 18.13%, an increase in barren land area from 0.15% to 8.81%, a reduced green cover (forest cover) from 80.8% to 53.3% and a decrease in water area from 4.35% to 2.12.

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**Table 2: Land use and Land Cover for Dehradun District  
(in sq. Km)**

CLASS	YEAR 2000		YEAR 2005		YEAR 2011	
	AREA (sq. km)	AREA (%)	AREA (sq. km)	AREA (%)	AREA (sq. km)	AREA (%)
URBAN	126.1719	4.1	371.1015	12.08	541.053	17.61
WATER	133.8399	4.35	95.8311	3.12	65.4111	2.12
AGRICULTURE	324.648	10.57	423.2637	13.78	556.7859	18.13
FOREST	2481.5799	80.8	2112.0606	68.77	1637.0244	53.3
BARREN LAND	4.7529	0.15	68.7357	2.24	270.7182	8.81

**V. CONCLUSIONS**

The change in land use and land cover has rapidly changed as the study shows a drastic increase of the built up area or urban area from 4.1% to 17.61%, an increase in agriculture area from 10.57% to 18.13%, an increase in barren land area from 0.15% to 8.81%, a reduced green cover (forest cover) from 80.8% to 53.3% and a decrease in water area from 4.35% to 2.12% from the year 2000 to 2011. The results analysis shows the drastic increase of built up, barren land and agricultural area and reduction in the green cover and water area within the study area boundary limit.

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