

Land Use Land Cover Change Detection Using Remote Sensing and Geographic Information System in Raipur Municipal Corporation Area, Chhattisgarh

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Abstract- Changes in Land use Land cover are a dynamic process taking place on the surface and it becomes a central component in current strategies in managing natural resources and monitoring environmental changes. LULC change detection is the process that helps in determining the changes related with land use and land cover with reference to georectified remote sensing data. The objective of this paper is to analyze the land use land cover changes in the Raipur Municipal Corporation, Raipur, and Chhattisgarh, India is using multi temporal remote sensing data (LANDSAT of year 1999 and 2016) land use land cover changes has been performed. Eight LULC classes were established as settlement, Road, Cultivation, Industry, Drainage, Lake, Open land, vegetation and Industry. The LULC changes were of highest amount in settlement and cultivation from 1999 to 2016. Comparison of LULC 1999 to 2016 indicates that the anthropogenic activity like settlement, road and industrial area is largely broadened.

Keywords- Land Use Land Cover, Change detection, Remote Sensing and Geographic Information System

I. INTRODUCTION

Land is very important natural resource on the earth surface [19]. Despite of it today humans are using it haphazardly. Now, a days the increase in population and human activities are increasing the demand on the land and soil resources for agriculture urban and industrial uses [5]. Land cover refers to the physical characteristics of the Earth's surface like vegetation, water, soil, forest, hills and others. Land use refers changes done by anthropogenic activities [5][18]. Land use and land cover change study are very essential for determining the current scenario and for the management of natural resources and environmental problem [18].

Remote sensing and geographic information system technique makes it possible to study change in LULC [13][17][18]. Space borne remotely sensed data may be particularly useful in developing countries where recent and reliable spatial information is lacking [3][13][17]. Over the past years, data from the Earth sensing satellites

have become vital in mapping the Earth's features and provide objective information about LULC features [2][1]. Geographic Information System (GIS) provides efficient methods for analysis of LULC issues and tools for land use planning and modeling made possible to study the changes in land cover in less time, at low cost and with better accuracy [3][5][9][17]. Analysis of satellite data in combination with drainage, lithology, and land use land cover collateral data facilitates effective estimation of geomorphological conditions, water resource, cultivation, land degradation, forest and other issues related to environment and climate change [3] [5][10][14]. In the present paper, LULC change and its impact are determined by using LANDSAT image of two different years, i.e. 1999 and 2016 of the Raipur municipal corporation area Chhattisgarh, India.

II. STUDY AREA

The current study was carried-out in municipal corporation area Chhattisgarh, India. Raipur municipal corporation area is situated in western part of Raipur district, Chhattisgarh, India. Study area falls under longitude between 81°35' to 81°40' and latitudes between 21°10' to 21°20' under Survey of India (SOI) toposheet no. 64G/11 and 64G/12 (Fig 1).

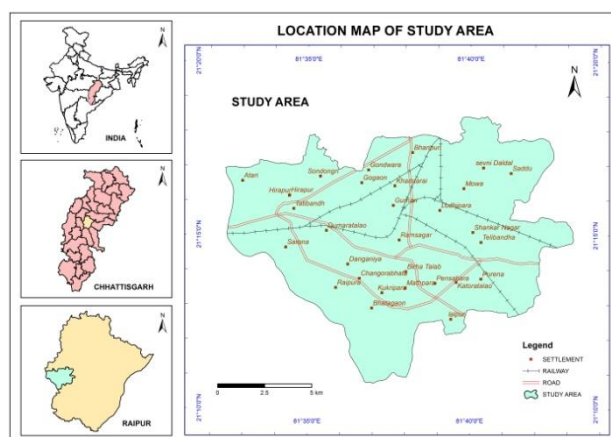


Fig 1. Location map of study area.

III. MATERIAL & METHOD

A) Data Required

1) Survey of India (SOI) Toposheet no. 64 G/11 and 64 G/12.

2) LANDSAT images of two year 1999 and 2016 download from USGS, www.earthexplorer.com. LANDSAT image (ETM+PAN mosaic) of year 1999, have resolution 15 m and second LANDSAT 8 (11 bands) of year 2016, have resolution 15 m, datum WGS1984 and UTM zone 44.

B) Software used

1) ArcGIS

2) ERDAS Imagine

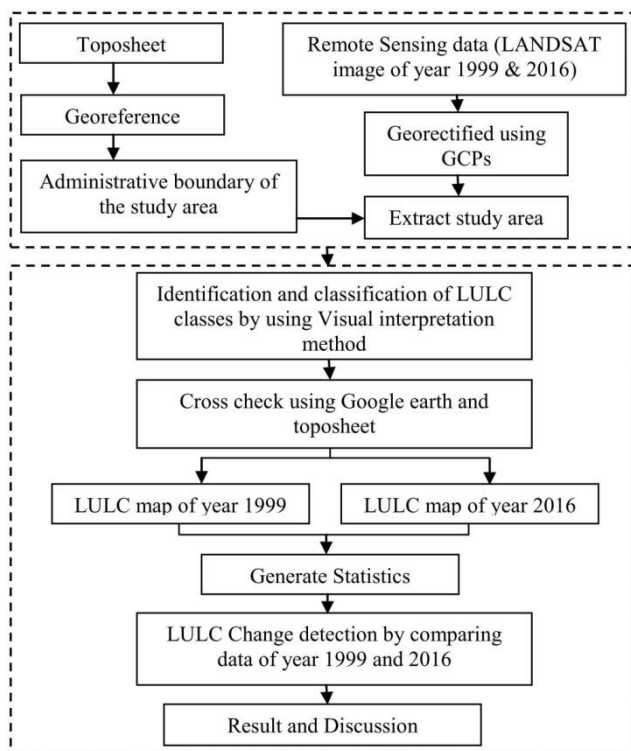


Fig. 2 Flow chart for adopted methodology.

C) Preprocessing of data

Image pre-processing mainly related to the atmospheric correction, geometric correction, image matching and mosaic and image registration, etc [4][8][10][15][16].

With the help of ERDAS imagine software, toposheet 64G/11 and 64 G/12 are georeferenced, using datum WGS, 1984 and Northern UTM zone 44 followed by toposheet mosaic. To correct distorted or degraded image data to create a more faithful representation of the original scene, image rectification and restoration process is needed which is always termed as preprocessing. With the help of georeferenced toposheet, few Ground control points

(GCPs) are taken and rectified the satellite image. The image of the study area was clipped by overlaying district boundary over the geo-referenced image [11][15]. Finally, with the help of GIS municipal boundaries layers of the study area, was extracted from the images using the 'Extract by Mask' function in the "Spatial Analyst Tools" module of ArcGIS software[12].

D) Preparation of LULC map

For the preparation of LULC map, methodology adopted was on screen visual interpretation of satellite images. Using visual interpretation keys like tone, texture, size and pattern are verified with the help of Google earth Survey of India toposheet and field check [4] [7] [6][9]. The study area from satellite image of year 1999 and 2016, were digitized using ArcGIS software and created a spatial database. In present study area eight LULC classes were established as settlement, Road, Cultivation, Industry, Drainage, lake, open land, vegetation and Industry.

IV. RESULT & DISCUSSION

According to the result of analysis and data presented in Table 1 and Fig. 3 and 4, shows that there is a dramatic changes occur from year 1999 to 2016. The LULC changes were of highest amount in settlement and cultivation from 1999 to 2016. Comparison of LULC 1999 to 2016 indicates that the anthropogenic activity like settlement, road and industrial area is largely broadened like 15.6%, 2.4% and 3.1% in the year 2016. The cultivated land which are used for paddy, vegetables, fruits and other mixed varieties are largely decreased, in the year 1999 it is 56.8% and in the year 2016 it is 37.9% with a net decrease of 19.2%. In year 1999 industrial area was founded 2.1%, but in the year 2016 area is 5.2% with a net increase of 3.1%. Drainage and lake area also decreases because of anthropogenic activity.

In the study area, mainly the northern part of Kota and Gudhiyari, in western part mainly Changhorabhata, in eastern part mainly Mowa and in southern part mainly Mathpurena and Tikrapara areas has involve abrupt increase in settlement. Settlement mainly encroaches over the cultivation land.

Fig. 3 & 4 shows the Land use/land cover map respectively year 1999 and 2016 and change analysis rate is given in Table 1.

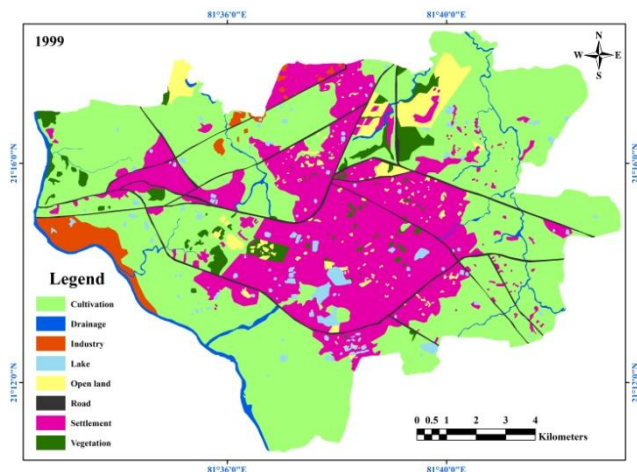


Fig. 3 LULC map for year 1999

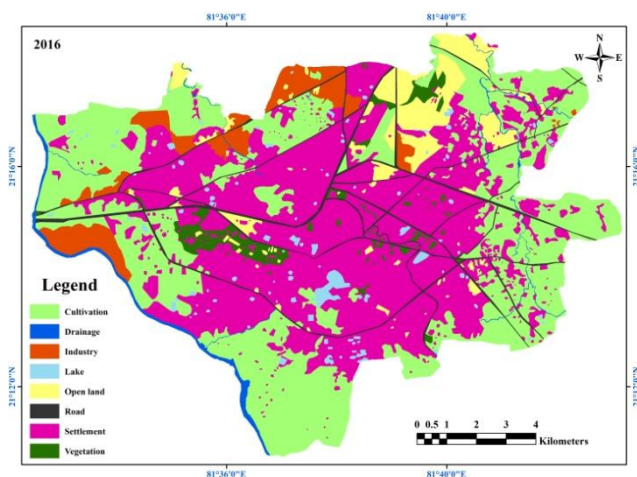


Fig. 4 LULC map for year 2016

Table 1: LULC changes from year 1999 to 2016

Class	Area in 1999 (%)	Area in 2016 (%)	Change in area 2016 (%)
Settlement	27.5	43.1	+15.6
Cultivation	56.8	37.9	-18.9
Industry	2.1	5.2	+3.1
Drainage	2.3	1.5	-0.8
Vegetation	2.9	2.5	-0.4
Open land	3.7	6.1	+0.9
Road	2.8	3.7	+2.4
lake	2.2	1.4	-0.8

V. CONCLUSION

- 1) The present study demonstrates the application of Remote sensing and Geographic Information Technology technique to access the change in LULC by using satellite image of year 1999 and 2016.
- 2) In the present study Settlement area is drastically changed. It increases 15.6 % in the year 2016. Increase in urbanization may leads many environmental and social

economic problems. Like it increases the demand of water, land, natural resources and employment and also increases the urban temperature.

3) Cultivated land in the study area has been decreased 18.9 % in year 1999, due to the encroachment of urbanization. And, land degradation is highly impact the soil texture and fertility, which affects the crop productivity.

4) Drainage and lake are also decreases 0.8% and 0.4% in the year 2016. Surface water bodies are an important source for groundwater recharge. In the present study area due to the increase in urbanization, the natural earth surface is covered by the settlement, which blocked the natural recharging condition of groundwater and also results in an increase in runoff, which are leading urban flooding during rainy season and in future this will create a serious problem.

5) Industry area has been increased due to Industrialization which creates environmental pollution. In Raipur city, the air is highly polluted because of industrialization.

Therefore, there is need of sustainable land/use land cover planning and development to reduce the undesired impacts on environment.

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