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Assessment of land use and land cover change using GIS and remote sensing techniques: A case study of Satna District, India

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Abstract
Land use and Land cover mapping is of great significance in scientific, research, planning and management. This Paper examines the use of GIS and Remote Sensing in mapping Land Use Land Cover in Satna between 2003 and 2016 so as to detect the changes that has taken place in this status between these periods. The result of the work shows a rapid growth in built-up land between 2003 and 2016. The aim of this paper is to prepare land use land cover and their change detections. The land cover and land use study was conducted by mapping Sentinal data of different years (2003, 2005) with the help of ERDAS and Arc GIS. The integration of remote sensing and GIS is a topic of general interest in the field of Remote Sensing and GIS. It mainly contributes to two kind of application: one is GIS database updating by Remote Sensing Image and the other is remote sensing analysis by the support of GIS data.

Keywords: GIS, remote sensing, LU/LC, photogrammetry, change detection

Introduction
The land use/land cover pattern of a region is an outcome of natural and socio – economic factors and their utilization by man in time and space. Hence, information on land use / land cover is essential for the selection, planning and implementation of land use and can be used to meet the increasing demands for basic human needs and welfare. This information also assists in monitoring the dynamics of land use resulting out of changing demands of increasing population (Zubair, 2006). Today remote sensing and GIS technology has enabled ecologists and natural resources managers to acquire timely data and observe periodical changes. With multi-temporal analyses, remote sensing gives a unique perspective of how rural area evolves. The most important element for mapping land use change due to mining is the ability to discriminate between rural uses (farming, forests and water body) and quarries.

Study area

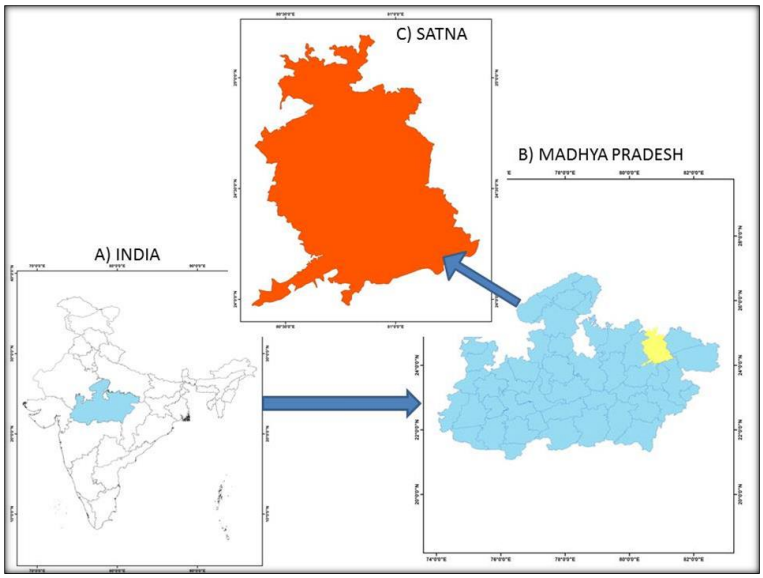

Fig 1: Study area of Satna District

The study area Satna is the northern part of Rewa Commissioner's Division in Madhya Pradesh state of India.

It is situated between latitudes 23^0 58' and 25^0 12' north and longitude 80^0 21' and 81^0 23' east with an average elevation of 317(m) above the mean sea level (MSL). The month of October witness the transition of rainy season to the winter season. The location is renowned for dolomite mines and limestone. Tons, Son, and Paisuni are the important rivers of the district draining them into the Ganga. The Kaimur and the Panna hills act as water-dividers. Most of the river flows towards the east, with an inclination in the north direction. The Simrawal and the Satna rivers are, however, inclined towards the south. Satna had a total population of 280,222, of which 147,874 were males and 132,348 were females. Population within the age group of 0 to 6 years was 32,774. The total number of literates in Satna was 209,825, which constituted 74.9% of the population with male literacy of 79.5% and female literacy of 69.7%. The effective literacy rate of population of Satna was 84.8%, of which male literacy rate was 90.1% and female literacy rate was 78.9%. The Scheduled Castes and Scheduled Tribes population was 38,978 and 9,381 respectively. Satna had 54699 households (Census- 2011).

Methodology

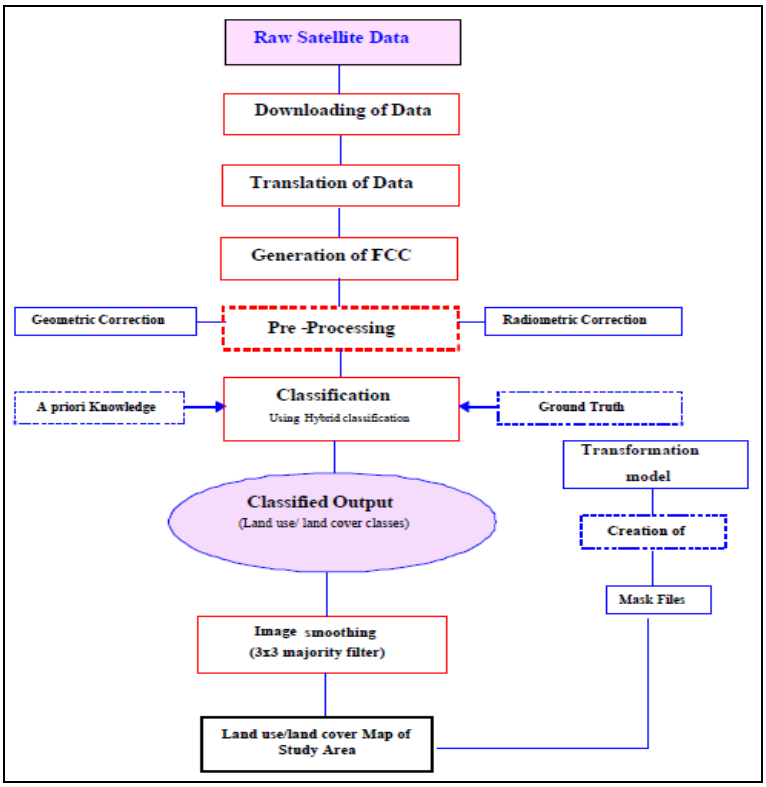

Fig 2: Flow chart for land use/ land covers map classification

Result and Discussion

In the present study land use/ land cover of Satna district was mapped for the years 2003 and 2016. In order to monitor the changes in land use / land cover proper care was taken in the selection of cloud free temporal data. It was not possible to obtain the ground truth pertaining to older data i.e. IRS 2003, therefore a novice approach to overcome the same was followed. Mapping was done for the year 2016 data and was used as template to analyses the data of 2003.

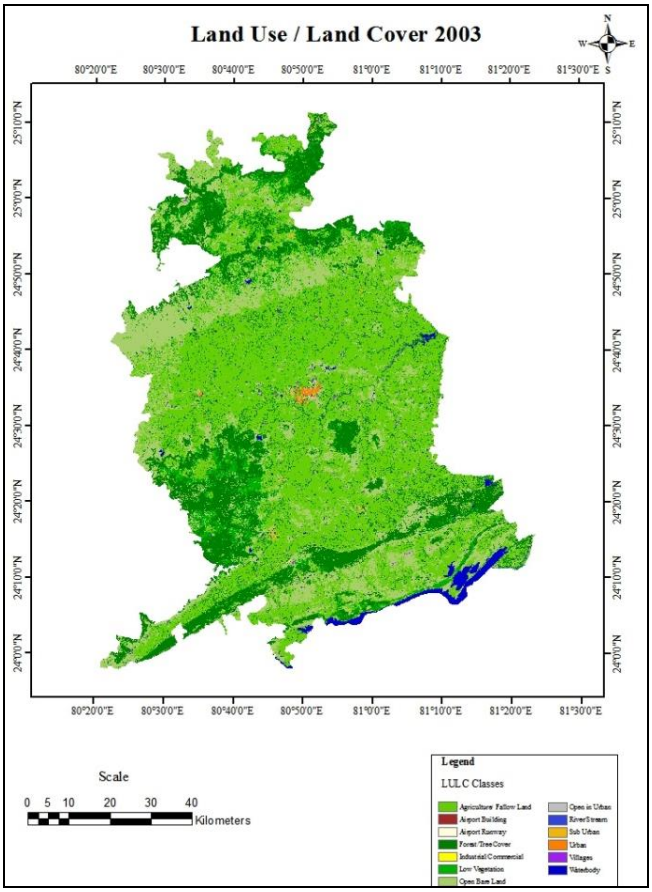

Fig 3: Land use land Cover map of Satna 2003

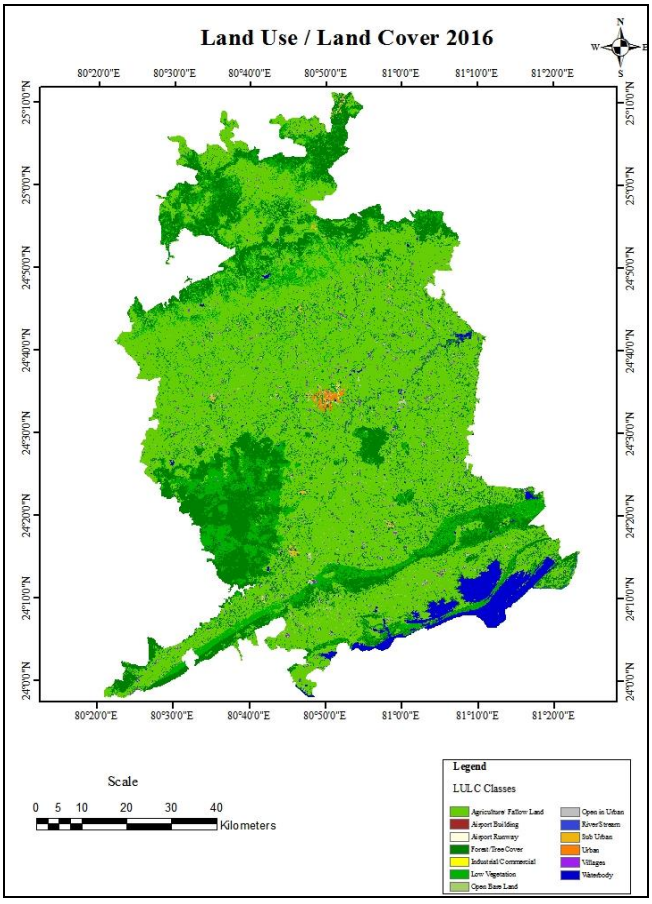

Fig 4: Land use land Cover map of Satna, 2016

Table 1: Difference area change in percentage 2003 to 2016

Difference area change in percentage 2003 to 2016					
Class name	Area (sq Km) 2016	Area (sq Km) 2003	Area in (%)2016	Area in (%) 2003	Difference Area in (%)
Urban	13.13	11.26	0.18	0.15	0.03
Sub Urban	10.00	6.81	0.13	0.09	0.04
Villages	52.34	22.91	0.70	0.31	0.39
Industrial/Commercial	2.36	1.36	0.03	0.02	0.01
Airport Runway	0.09	0.09	0.001	0.001	0.00
Airport Building	0.00	0.00	0.00003	0.00004	-0.00001
Open in Urban	61.98	61.34	0.83	0.82	0.01
Open Bare Land	24.82	1652.54	0.33	22.10	-21.77
Agriculture/ Fallow Land	4623.92	3491.78	61.84	46.70	15.14
Low Vegetation	801.84	461.66	10.72	6.17	4.55
Forest/Tree Cover	1643.83	1627.72	21.98	21.77	0.22
River/Stream	12.58	13.01	0.17	0.17	-0.01
Waterbody	230.86	127.27	3.09	1.70	1.39
Total	7477.75	7477.75	100.00	100.00	0.00

Table 2: Mask area of 2016 from Agriculture of 2003 in sq. km. and percentage

Mask area of 2016 from Agriculture of 2003 in sq. km. and percentage		
Class name	Mask area of 2016 from Agriculture of 2003 in Sq. km.	Agriculture change mask %
Villages	2.009	0.06
Industrial/Commercial	0.336	0.010
Airport Runway	0.000	0.000
Airport Building	0.000	0.000
Open in Urban	1.121	0.032
Open Bare Land	2.066	0.059
Agriculture/ Fallow Land	3390.082	97.088
Low Vegetation	20.944	0.600
Forest/Tree Cover	2.237	0.064
River/Stream	0.019	0.001
Waterbody	72.598	2.079
Total	3491.776	100

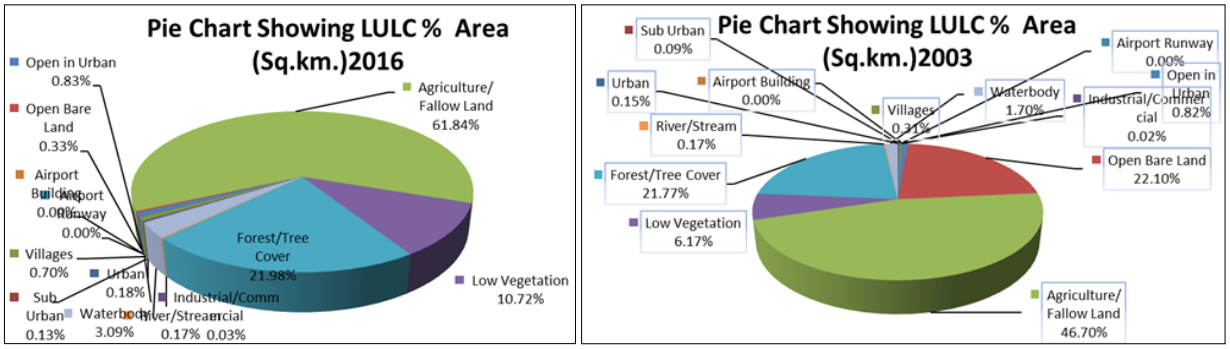

Fig 5 Pie Chart Showing LU/LC Area in %

Conclusion

Present study of Delhi land cover from 2003 to 2016 shows rapid change in the landscape as there is high growth in the built-up area only within thirteen years. Built-up areas have occupied the sparse and densely vegetated lands while fallow land has reduced marginally and water body is showing almost stagnant condition over time. Firstly, download the satellite image using land sat 8. Then layer stack process. We made the image of 15 m. The image using the unsupervised classification both image. Then classification is both images in 13 classes. The compression of image 2003 and 2016 we find the change detection. The change of increment of 2003 to 2016 is Urban in 0.03%, Sub Urban in 0.04%, Village in 0.39%, Industrial/Commercial in 0.01%, Open in Urban in 0.01%, Agriculture/Fallow Land in 15.14%, Low Vegetation in 4.55%, Forest/Tree Cover is 0.22%, Water body in 1.39% and decreased area of Airport Building in 0.00001%, Open Bare Land in 21.77%, River/Stream in 0.01%.

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