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Change detection mapping of Land use / Land cover area In Lalitpur district: using remote sensing and GIS Technique

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Abstract

The temporal change (2000 to 2020) in land use / land cover has been studied using temporal satellite data of Lalitpur district. Land Use and Land Cover mapping is a more significance in scientific, planning, research and management. Regional land use pattern reflects the character of interaction between man and environment and influence to the mankind's basic economic activities. Due to advancement in satellite sensors, their analysis techniques are making remote sensing systems fruitful, realistic and attractive for use in research and management of natural resources. Land use map is a valuable tool for agricultural and natural resources studies, updating of these maps are essential due to strength of natural resources,

Remotely sensed satellite images provide a synoptic overview of the terrain or earth in a very short time span. The major aim of this study is to prepare land use land cover and their change detections. The integration of remote sensing and GIS is a topic of general interest in the field of photogrammetry, remote sensing and GIS. It mainly contributes to two kinds of applications: one is GIS database updating by remote sensing images and the other is remote sensing analysis by the support of GIS data. These two aspects complement each other to make the GIS databases updated continually.

Key Word: Land Use and Land Cover, Satellite data , Photogrammetry, RS and GIS

Introduction

Land use/cover change has become a central and important component in current strategies for managing natural resources and monitoring environmental changes. Land use is a product of interactions between a society's cultural background, state and its physical needs on the one hand and the natural potential of land on the other (Balak and Kolarkar, 1993). Land use is the intended employment of land management strategy placed on the land cover by human agents or land managers to exploit the land cover and reflects human activities such as industrial zones, residential zones, agricultural fields, grazing, logging and mining among many others (Zubair, 2006). With the invention of remote sensing and GIS techniques land use/cover mapping is a useful and detailed way to improve the selection of areas designed to agricultural, urban and/or industrial areas of a region (Selcuk et al., 2003). Application of remotely sensed data made possible to study the changes in land cover in less time, at low cost and with better accuracy (Kachhwala, 1985) in association with GIS that provides suitable platform for data analysis, update and retrieval (Star et al., 1997; Chilar, 2000). Digital change detection techniques based on multi-temporal and multi-spectral remotely sensed data have demonstrated a great potential as a means to understanding landscape dynamics-detect, identify, map, and monitor differences in land use/cover patterns over time, irrespective of the causal factors. The present study demonstrates the application of multitemporal satellite imageries in defining land use/cover dynamics of a Lalitpur district, Uttar Pradesh.

Objective

- To generate spatial database on land use/land cover for the 2000-2020.
- To generate land use/land cover change database along with change matrix with respect to 2000-2020

Fig. 1 : Location map of the Study area

Study Area

Lalitpur District is one of the districts of Uttar Pradesh state of India. Lalitpur district is a part of Jhansi Division. Lalitpur is the main town and administrative headquarters. The district occupies an area of 5,039 km^2. Lalitpur district lies between latitude 24°11' and 25°14' (north) and longitude 78°10' and 79°0' (east) and is bounded by district Jhansi in the north, districts Sagar and Tikamgarh of Madhya Pradesh state in the east and Guna district of Madhya Pradesh separated by river Betwa in the west. The district had a population of 977,447 as per the census of year 2001.

Lalitpur district are well known for its culture, peace and natural beauty and have maximum dams in the state. The district forms a portion of the hill country of Bundelkhand, sloping down from the outliers of the Vindhya Range on the south to the tributaries of the Yamuna River on the north. The extreme south is composed of parallel rows of long and narrow-ridged hills. Through the intervening valleys the rivers flow down over ledges of granite or quartz. North of the hilly region, the granite chains gradually turn into clusters of smaller hills.

The Betwa River forms the northern and western boundary of the district, and most of the district lies within its watershed. The Jamni River, a tributary of the Betwa, forms the eastern boundary. The Dhasan River forms the district's southeastern boundary, and the southeastern portion of the district

lies within its watershed. The climate of the district is sub-tropical, which is characterised by a very hot dry summer and a cold winter.

Meterial and Mathods

The following flow chart shows the general methodology adopted for preparation of Landuse/Landcover map-

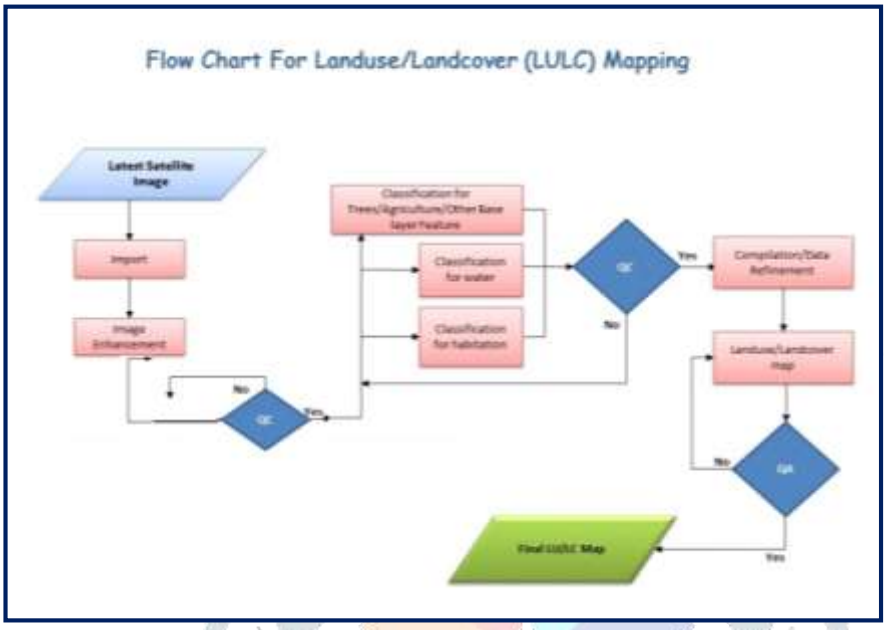

Fig. 2 : Showing Process Flow for Creation of Landuse/Landcover Map

The land use / land cover maps have been prepared adopting digital interpretation techniques in conjunction with collateral data such as topographical map sheets. Initially satellite image was enhanced by using enhancement techniques for better visual interpretation. The signatures points collected from the were used as signatures for the classification purpose. For the individual layers quality checks were done and finally all these three layers were integrated. The compiled data was further refined for the final Land use Land cover map in raster form and converted into vector data (format: shape file).

Result and discussion

The results obtained through the analysis of multi-temporal satellite imageries were diagrammatically illustrated in Figs. 2–4 and data are registered in Tables 1 and 2. Fig. 2 depicts land use/cover status, Fig. 3 depicts land use/cover change in different land use categories and Fig. 4 illustrates magnitude of change in different land categories. A brief account of these results is discussed in the following paragraphs. Change matrix is prepared to understand land encroachment for different land categories during the last two decades,

Table: 1 Area Statistics of Land Use/ Land Cover distribution in Lalitpur district during 2000 to 2020

S.No.	Class	Year- 2020 Area in ha	Year- 2000 Area in ha	Change in ha (2020-2000)
1	Agriculture	293170	302183	-9013
2	Forest	51938.2	52081.3	-143.1
3	Habitation	7898.76	6510.33	1388.43
4	Low Vegetation	18667.4	18900.1	-232.7
5	Open Land	104648	100514	4134
6	Water body	28980.6	25137.8	3842.8
7.	Total	505302.96	505326.53	0

Table : 2 Percentage difference between 2000 and 2020

S.No.	Class	Area in % 2000	Area in % 2020	Change in % (2020--2000)
1	Agriculture	58.02	59.80	-0.78
2	Forest	10.28	10.31	-0.03
3	Habitation	1.563	1.29	0.273
4	Low Vegetation	3.694	3.74	-0.0476
5	Open Land	20.710	19.89	0.82
6	Water body	5.74	4.97	0.77
7.	Total	100	100.00	0

Database on land use is highly crucial in analyzing the environmental processes and complications that must be taken into consideration so as to make living standards to be imperishable. In this study, land use and land cover in Lalitpur district using the unsupervised classification on sentinel-2 satellite data. On the basis of this classification, the whole area was classified into six categories, viz., Agricultural land, Forest, Habitation, Low vegetation, Open land, and Waterbody.

The present study land use/ land cover of Lalitpur district was mapped for the years 2000 and 2020. 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 2006, therefore a novice approach to overcome the same was followed.

These data reveal that in 2000, about 10.28 % (52081.3 ha) area of Lalitpur district was under forest land, 20.71% (100514 ha) under Open land, 58.02% (302183 ha) under

Agriculture/ fallow land, 3.694 % (18900.1 ha) under Low Vegetation, 1.563% (6510.33 ha) under habitation, 5.74 % (25137.8 ha) under Waterbody . (Table: 1 and 2 s)

During 2020 the area under these land categories was found about 10.28% (51938.2ha) area of Lalitpur district was under forest land , 19.89% (104648 ha) under Open land, 59.80% (293170 ha) under Agriculture/ fallow land, 3.74% (18667.4 ha) under Low Vegetation, 1.563% (6510.33 ha) under habitation, 1.29% (7898.76 ha) under Waterbody. (Table: 1 and 2) Change matrix is prepared to understand land encroachment for different land categories during the last two decades.

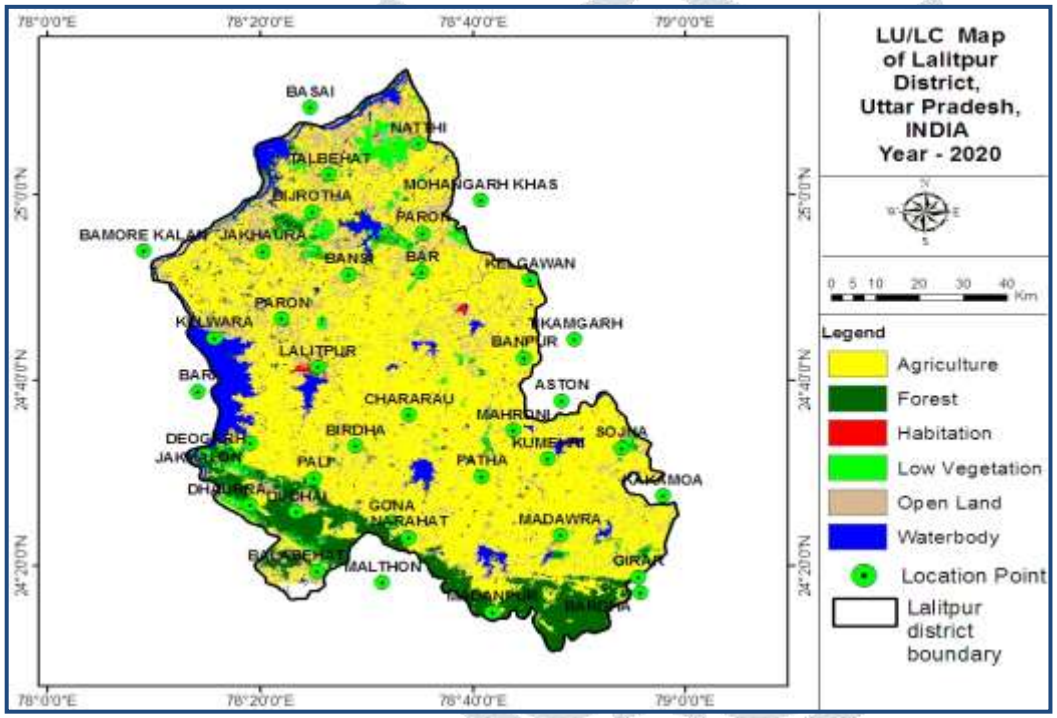

Fig.3: LU/LC map of the Study area Year- 2020

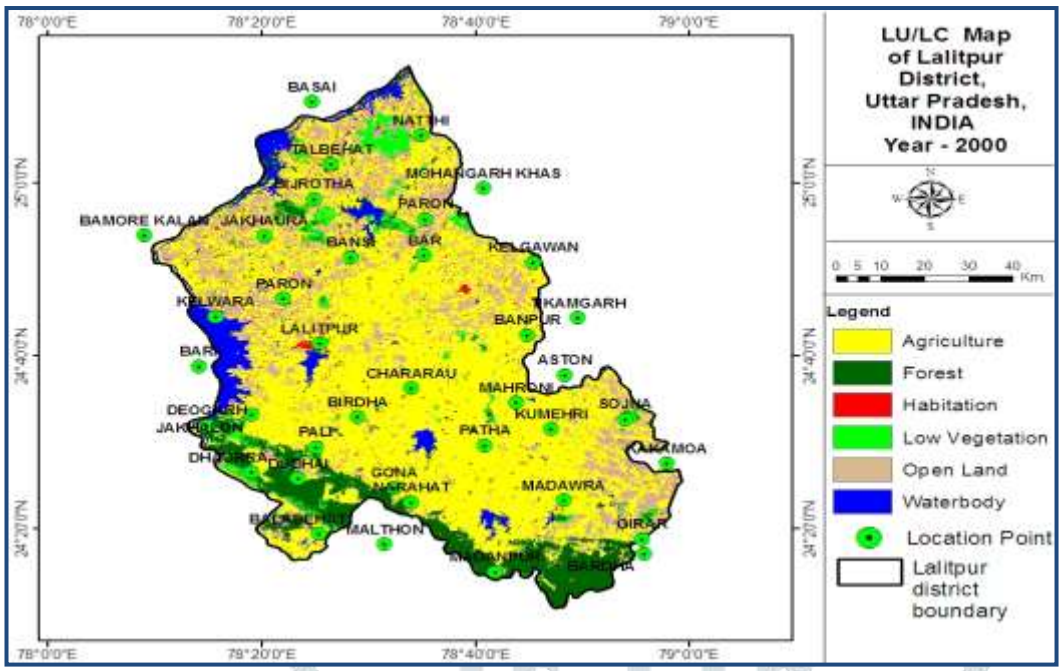

Fig. 4 : LU/ LC map of the study area Year - 2000

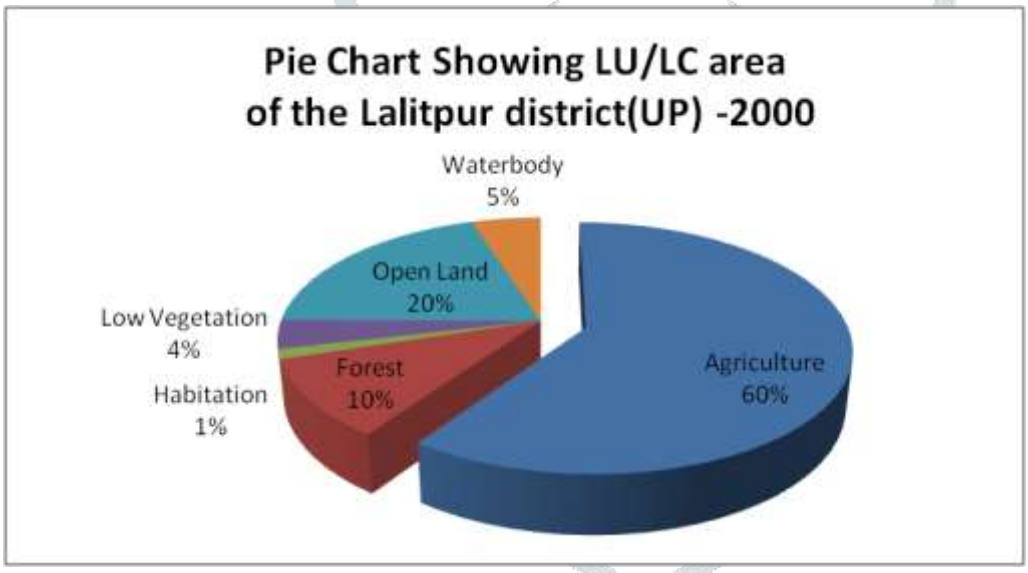

Fig. 5 : Pie chart showing LULC area of the Lalitpur district 2020

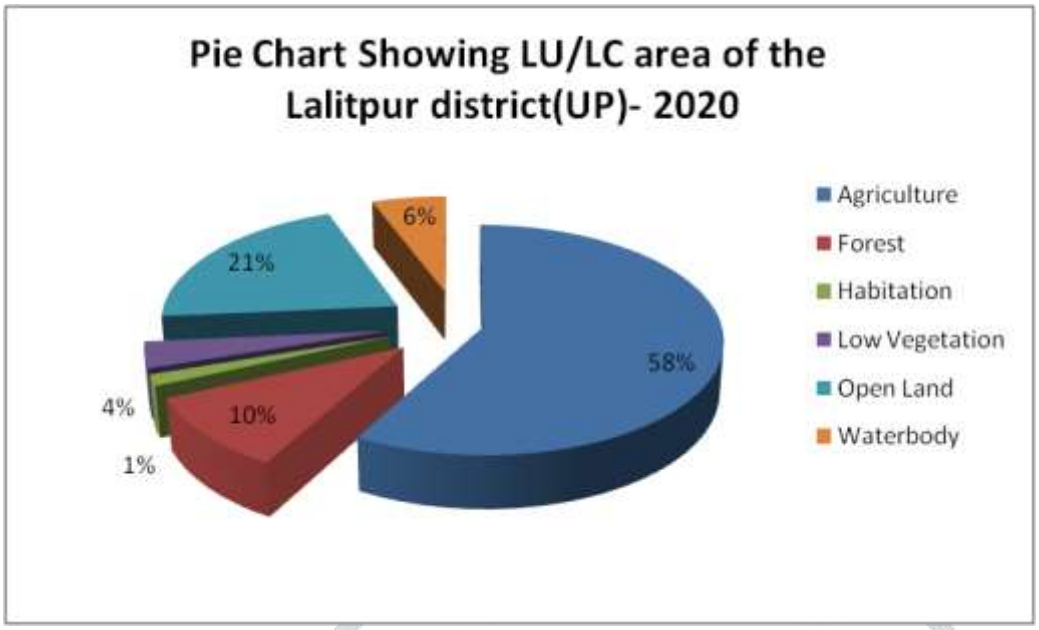

Fig. 6 : Pie chart showing LULC area of the Lalitpur disrict 2020

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