

Land Use Change Detection Using Remote Sensing Technology

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Abstract- Land use land cover of any areas highly dynamic in nature and is highly prone to ongoing socio-economic and demographic changes in spatial perspective in this context the role of urbanization and consequent urban development in a fast urbanization country like India is crucial in bringing about rapid changes in rate of conversion of natural landscape into built-up landscape which finally is leading to a number of environmental problems. Therefore, an effort has been made in this paper to examine the land use land cover change of the district Gautam Budh Nagar, Uttar Pradesh, India over two different time periods of 2011 and 2021 in response to ongoing urbanization process and its impact on natural vegetation cover. For this purpose, the present study has identified the role of geospatial techniques to examine the change detected in land use land cover and associated changes in natural environments. The paper is based on remote sensing data of LANDSAT 8 for analyzing the LULC and its differential impacts on environment due to urbanization in Gautam Budh Nagar, Uttar Pradesh, India. Supervised classification of all the satellite images have been done to show various land use type on the study area.

Keywords- socio-economic, LANDSAT, land cover etc.

I. INTRODUCTION

Urbanization has been a universal and important socio-economic phenomenon taking place all over the world. Rapid industrialization and urbanization have resulted in the loss of significant amount of agricultural land and water bodies. During the mid-20th century many countries experienced rapid urbanization. It is a world-wide trend with more than 50% of the world's population currently living in cities (N Pop.Div.2009), the growth lead to urban sprawl, with the surface of urban areas growing rapidly. Rapid urbanization, especially in the developing world, will continue to be one of the crucial issues of global change in the 21st century affecting the dimensions (Sui and Zeng, 2001).

In developing countries proper planning of land use and the management practices are extremely poor and as a result quick disappearance of agricultural land, water bodies, area of natural vegetation as well as open or any fallow land and have had severe environmental consequences. In this regard, it is necessary to analyze the land use and land cover changes of an area more vigorously with its differential parameters.

Satellite remote sensing in conjunction with GIS, has been widely applied and being recognized as a powerful and effective tool in detecting LULC change. Remote sensing represents a major, though still under-used, source of urban information by providing spatially consistent coverage of land areas.

II. STATEMENT OF THE PROBLEM

Urbanization is the global phenomenon and many parts of the world are affected by the impact of urbanization. Present study is based on the district Gautam Budh Nagar which is one of the most impacted areas of urbanization in India. A series of problems of the study area, for instance, high rate of land transformation, surface water degradation, quick vanishing of agricultural field and natural vegetation of this area show the impact rate of urbanization over the region.

III. AIM AND OBJECTIVES

- To create a land use land cover classification scheme.
- Change detection analysis

The findings can help the policy makers and as well as the governmental organizations to prepare a proper strategy to address these multifactored issues of urbanization in the study area.

IV. LOCATION OF THE STUDY AREA

Gautam Budh Nagar district is located in the north-western part of the state of Uttar Pradesh, in the vicinity of India's capital 'Delhi'. It is a newly created district which emerged in the year 1997 from portions of Bulandshahr & Ghaziabad districts. Geographical coordinate point of the study area is 28°34' N and 77°55' E. According to the

district brochure of Gautam Budh Nagar (AAP 2008-09), the district has a geographical area of 1442 km with headquarters at industrial city of Greater Noida.

It has three Tehsils and four developmental blocks viz. Bistrakh, Dadri, and Dankaur and Jewar. The district is bounded by Ghaziabad District to the North, Bulandshahr district to the East and Aligarh District to the South. The Yamuna River separates the district from Haryana State and Delhi to the West.

Topographically the area is flat surface in which soil ranges from pure sand locally named as Bhur to stiff clays known as Matiar. As per the district administrative data, the dominant climate of the study area is sub-humid and characterized by hot summer and cold winter.



Fig 1. Boundary of Gautam Budh Nagar.



Fig 2. Satellite image of Gautam Budha Nagar.

V. METHODOLOGY

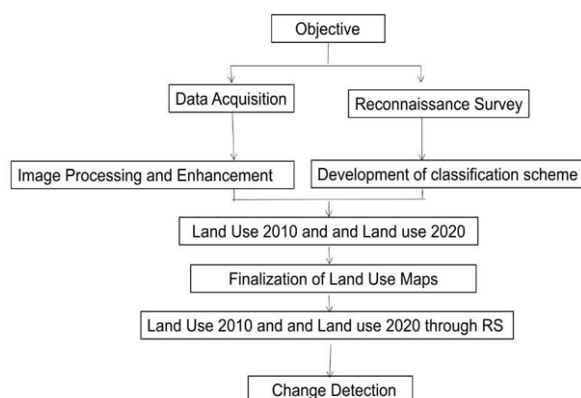
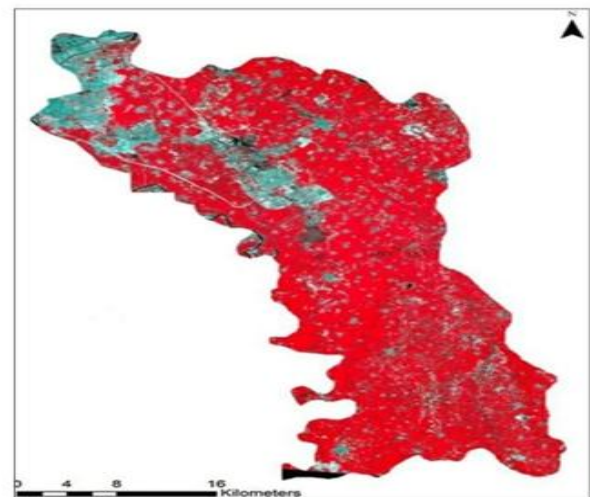


Fig 3. Methodology flow chart of LULC changes detection analysis.

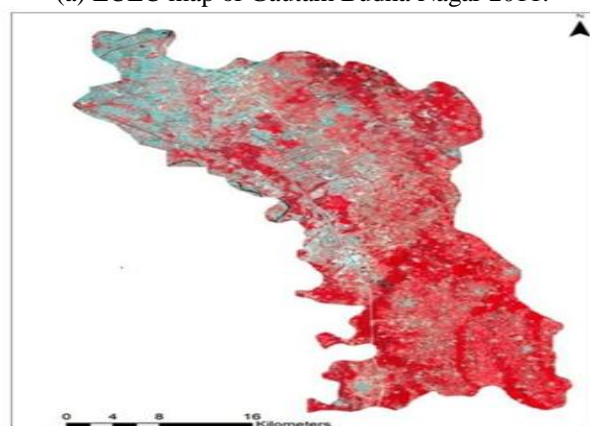
The methodology that was followed: - The satellite image (Landsat 8) was downloaded from the United States Geological Survey (USGS) site. All the Geometric and Radiometric corrections were done and the image was further processed for the image enhancement. Then the supervised classification was done with the help of signature files.

4 Major classes i.e.:- Built-up land, Vegetation, Transportation and Water bodies. The area and percentage were calculated and finally the outcomes (Changes) were analyzed and the results were given. The results show that there is a rapid fall in the percentage of water and Vegetation of the area.

VI. RESULTS AND DISCUSSIONS



(a) LULC map of Gautam Budha Nagar 2011.



(b) LULC map of Gautam Budha Nagar 2021.

Fig 4. Land Use and Land Cover map of Gautam Budha Nagar 2011 and 2021.

The change scenario of the Land use and Land cover are depicted in (Figure 3) and the area of each category that is changed within 10 years are presented in Table no. 1. The

supervised classification based on maximum likelihood shows 4 different categories of Land use and Land cover that has been changed.

They are as follows:

- Built-up Land
- Vegetation
- Transportation
- Water bodies.

The changes are mentioned in area as well as in percentage. The changes can be identified visually also through both the Land use and Land cover map shown in (fig 3). The maps are well defining the changes that have been taken place within the past 10 years i.e.: the change in the area of water bodies earlier it was 2.50% and changed to 0.69% in the year 2021 so, the total percentage of change in the water bodies was 1.81%.

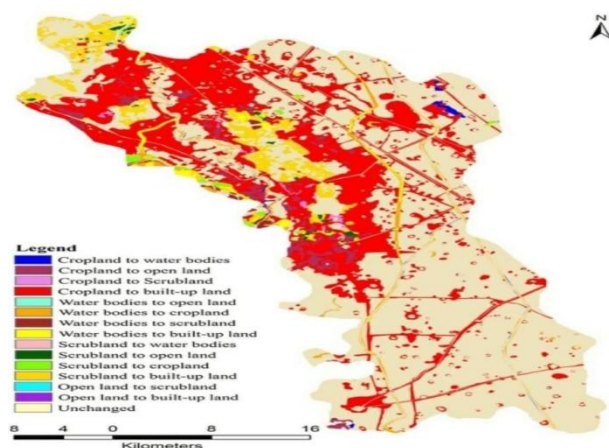


Fig 5. Change Detection Analysis LULC change (2011-2021).

Table 1. Area and amount of change in different LULC classes in Gautam Budha Nagar 2011 and 2021.

Land Use	2011 (ha)	%age	2021(ha)	%age
Built-up	9750	67.7	13394.03	61.8
Vegetation	3010	20.9	4885.73	22.5
Transportation	1280	8.89	3232.7	14.9
Water Bodies	360	2.50	150	0.69
Total	14400	100	21662.46	100

The above table shows all the major classes of Land use and Land cover of the Gautam Budha Nagar that has been studied in the change analysis. The results clearly show that there is a rapid decrease in the water bodies (1.81%) which is deliberately affecting the natural and cultural heritage of the Gautam Budha Nagar.

VII. CONCLUSION

The protection of water bodies especially in urban areas are very important as these are degrading at a rapid speed which is not in the favor of the natural environment and the measures are not enough for conserving them.

All these factors should be kept in mind that there should be a need not only to conserve these areas but also to understand these areas at a deeper level and thus these areas can be monitored and mapped through satellite data and the analysis can be done. In the present study the efforts are made to monitor and map the changes that had taken place in the area through various Remote Sensing and GIS techniques.

The satellite images were taken from the United States Geological Survey (USGS) site, the area was interpreted with the help of various remote sensing techniques i.e.: - the False color composite FCC was created; Supervised classification was done with maximum likelihood classification method and the area that has been changed in the past 10 years have been detected and analyzed.

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