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Land Use Land Cover Change in Detection using remote sensing and ArcGIS in Gautam Budh Nagar region

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ABSTRACT: Land use land cover study is aimed to analyse the dynamic of land use land cover changes in a newly created special economic zone, Gautam Budh Nagar district. The role of urbanisation and subsequent urban development in a rapid urbanising country like India is crucial in bringing about rapid changes in the rate of conversion of natural landscape into built-up landscape which ultimately leads to a number of environment problems. The research area's land cover land use pattern was mapped using Landsat satellite data and with the use through software QGIS (Quantum Geographic Information System) of our research area Gautam Budh Nagar. As a result, in this study area, an effort has been made to examine the land use and land cover change in district Gautam Budh Nagar, Uttar Pradesh, India, spanning two time periods, 2011 and 2021 and at also different time of the intervals. In response to the ongoing urbanisation process and its impact on natural vegetation cover. Furthermore, land cover land use changed the most in the northern portions of the district, while it has changed the least in the southern parts. According to the report, the growth in built-up area came primarily at the expense of agriculture and scrubland. The research analyses the land cover land use and its differential implications on the environment owing to urbanisation in Gautam Budh Nagar, Uttar Pradesh, India using Landsat data. All satellite pictures have been supervised classified to show distinct land use type on the research region. The study area concludes that cropland and scrubland are the main LU/LC type get transformed into the built-up area the study area and good indicator in the study of LU/LC classification and changes analysis.

I. INTRODUCTION

Natural and socio-economic factor, as well as human activity in time and space, influence land use and land cover change in a given location [1-3]. Change in land use and land cover (LULC) are primarily driven by population of their growth, economic growth, and physical variables such as terrain, slope condition, soil type and climate [4-7]. Urbanisation has been a worldwide and significant socio-economic phenomena. Rapid industrialization and urbanisation have resulted in the loss of vast swaths of agriculture land and body of water [8-11]. Land-use change directly affects the amount of evapotranspiration, ground water infiltration and overland runoff [12].

Many countries witnessed rapid urbanisation in the midtwentieth century. With more than half of the world's population now residing in cities (N Pop.Div.2009), the tendency has led to urban sprawl, with the surface area of metropolitan regions quickly expanding [13-15]. Satellite imagery with conjugation geographic information system (GIS) has been widely used and is now acknowledged as a potent and effective method for identifying LCLU changes [16].

Land use planning and management procedures in developing countries are exceedingly poor, resulting in the rapid disappearance of agriculture land, water bodies, natural vegetation areas, as well as open or fallow land, with significant environmental implications [17-18]. In this regard, it is required to conduct a more thorough analysis of area's land use and land cover changes using its differential parameters [19].

II. AIM AND OBJECTIVES

1. To create a land use land cover classification scheme.
2. 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 [20].

III. LOCATION OF THE STUDY AREA

Gautam Budh Nagar is a district of Uttar Pradesh, named after Gautam Budha. It is a part of Delhi NCR and is divided into three sub-division, i.e. Noida Sadar, Dadri and Jewar. Greater Noida is the administrative headquarters of Gautam Budh Nagar district. Ghaziabad district and the Bulandshahr district were combined to become Gautam Budh Nagar district on September 6, 1997. Ghaziabad is provided the Dadri and Bisrakh block, while Bulandshahr provided the Dankaur and Jewar block. Geographical coordinate point of the study area is 28°34' N and 77°55' East. 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.

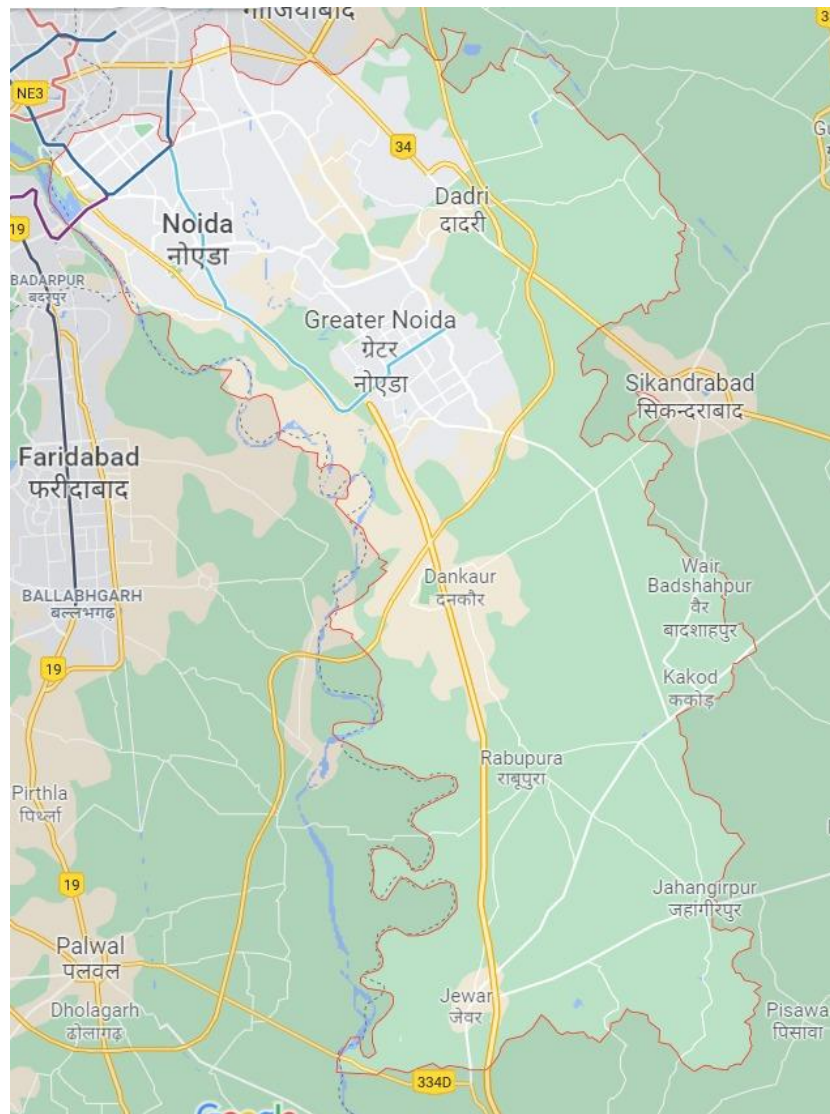


Fig 1. Satellite Image of Gautam Budh Nagar

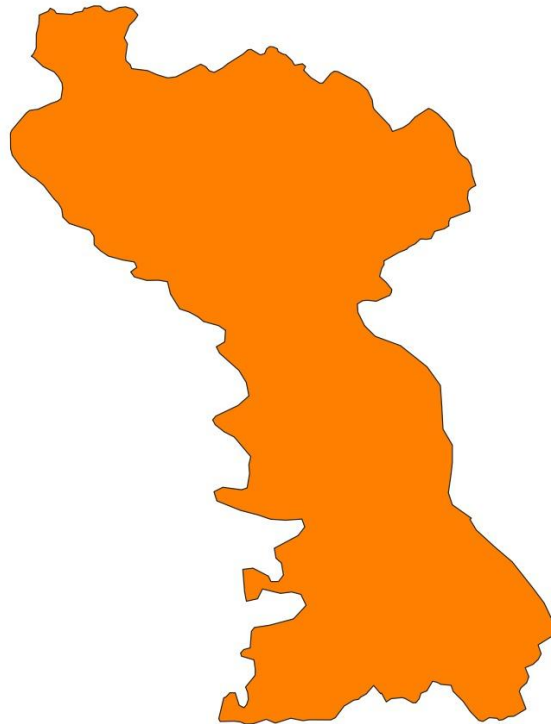


Fig 2. Boundry of Gautam Budh Nagar

IV. METHODOLOGY

SOFTWARE USED

The full name of ArcGIS is that Aeronautical Reconnaissance Coverage Geographic Information System. ArcGIS is an segment for GIS to make, breakdown and share geographic data. It can also to make maps, perform topographical examination and information.

ArcGIS is a cloud-based planning and examination arrangement. It works with information driven styles to investigate and 2D and 3D information. All elements of information and more information is conceivable with ArcGIS. It can include imagery tools and workflow for visualization and analysis. The ArcGIS interface is made up of a graphical user interface (GUI) including several applications.

ArcGIS is a type of software consisting of:

- ArcMap
- ArcCatalog
- ArcGIS Pro
- ArcGlobe
- ArcScene

DATA REQUIRED

Survey of India (SOI) Toposheet no. LANDSET image of two year download from USGS, www.earthexplorer.com. LANDSAT images of years

PREPROCESSING DATA

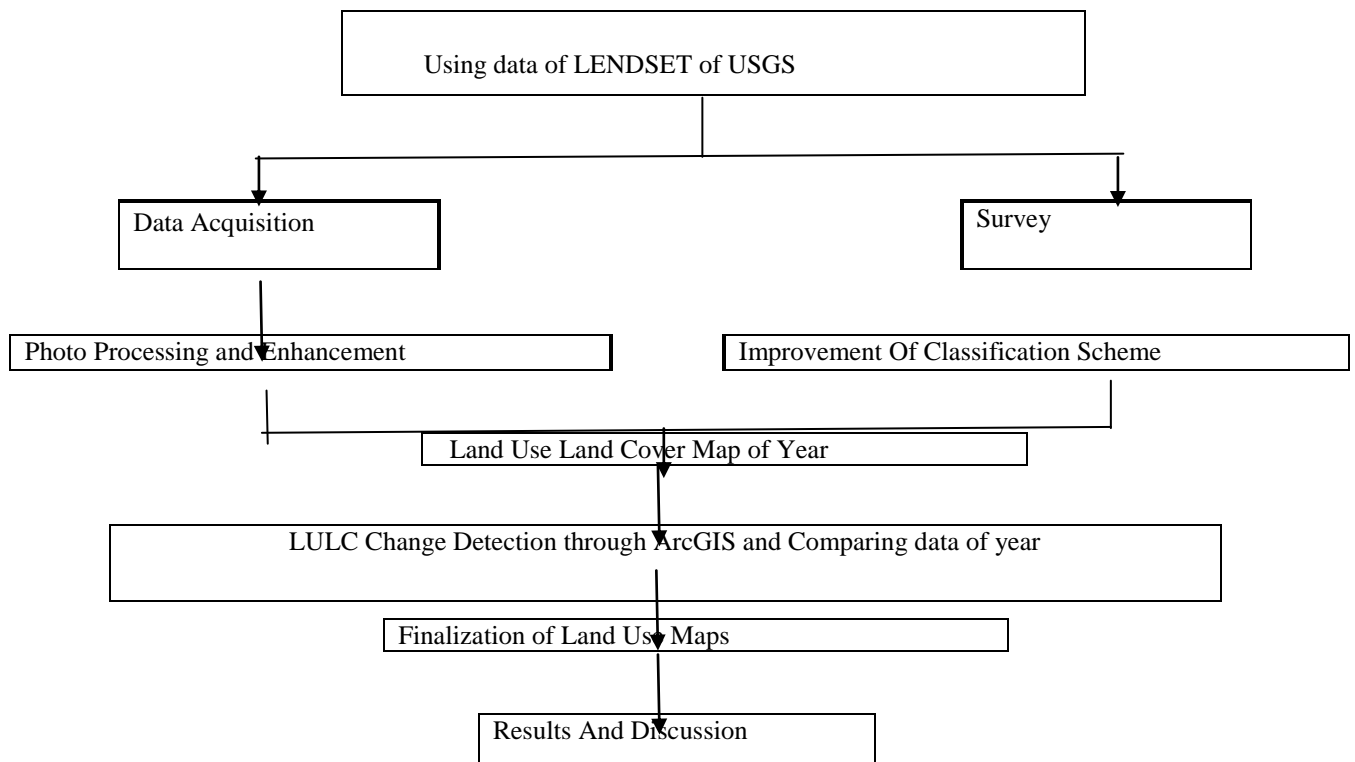
The image of the review region was cut by overlaying locale limit over the geo-referred image. At last, with the assistance of GIS limits layers of the review region, was extricated from the pictures utilizing work in the "Spatial Analyst Tools" module of ArcGIS Software.

The assistance of programming, toposheet are georeferenced, utilizing datum WGS, UTM zone followed by toposheet mosaic.

PREPARATION OF LULC MAP

For the preparation of LULC map, methodology was on screen visual understanding of satellite pictures. Utilizing visual understanding keys like tone, surface, size and example are confirmed with the assistance of Google earth Survey of India toposheet.

In present review region eight LULC classes were laid out as settlement, Road, Cultivation, Industry, Drainage, lake, open land, vegetation and Industry.



Methodology Flow Chart of Changes Detection Analysis.

V. RESULTS AND DISCUSSION

Land use and land cover of Gautam Buddha Nagar of three different time periods (2000 & 2020). The total area of every land use category and percentage of each class between 2000 to 2020 were calculated and are presented [21].

- The result shows a drastic change of land uses during the study periods. The most dramatic change has occurred in built-up class which increased from 7.20% in 2000 to 32.64% at present and a decrease in the natural vegetation, agricultural field and water bodies has also been noticed due to the rapid response to urbanization.
- Total area of built up land and the road which are the two most significant parameters of urbanization have

increased continuously while the areas of open land and water body along with other environmental parameters have been upon almost in the same proportion.

- Change Detection in Land use/ Land Cover (2000-2020). The change detection of land use and land cover of the study area over three time periods has been done.
- Urbanization also impacts on the open land which demonstrates that a steady decrease of open land from 10.45% to 6.78% has been placed during the study period. The comparative analysis of changes in land use land cover from 2000 to 2020.

In 2000, 8400 hectares area came under built up category which has increased to 24139 hectares in 2015 and further increased to 39570 hectares in 2020. Continuous increase of land area has also been found for area under road whereas a continuous decreasing rate has been observed for other land use classes in the study area. In the present condition of urbanization, built up areas have been developed in more than 25% of the study area in 2020 which has been expanded towards the central part of Gautam Buddha Nagar [22].

During the period in between 2011-2021, the built up area and the area of roads increased enormously whereas the negative changes have been recorded in case of the land use types of natural vegetation, agricultural field, water body and open land. This trend of negative changes for these land use classes and the positive changes for the urbanization parameters of built up area and roads also increased even more rapidly during the periods of 2011 to 2021 [23].

VI. CONCLUSION

For any application of satellite imagery, accurate picture classification is required. The accuracy and confusion matrix are used to analyse the efficiency of classification results. The salt accumulated zones of Gautam Buddha Nagar district have less flora, which has been found to be a good predictor of salt-affected soils using ARC GIS and Remote sensing technique. In agricultural field, the indices of Salinity Index and Normalized Differential Salinity Index (NDSI) used to detect salt affected areas are ineffective in providing correct result. Finally, we conclude that random sample survey in farmlands which include soil quality, are a useful tool for evaluating the consequences of proposed land improvement projects. This research also shows how statistical analysis combined with high-resolution satellite imagery can effectively forecast and monitor geographical changes in soil quality across agricultural land. As a result, the knowledge provided here can aid agricultural workers, scientist, and engineers in addressing soil-related issues that have an impact on the environment.

Furthermore, the simplicity of this approach, together with its adequate correctness can contribute significantly to soil salinity and mapping in more cost-effective ways than traditional method. It will be useful information for policymaker and decision-maker interested in ensuring food security and agricultural yield through sustainable land resource development.

Cropland, vegetation cover, and water bodies, which make up the remaining LU/LC classes, have decreased to roughly 34%, 73 %, and 58% respectively. The loss of green cover and surface water bodies has a negative impact on the urban environment as well as the Gautam Buddha Nagar.

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