



Land use and Land cover Analysis of Ghaziabad Region using GIS Tools

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Abstract:

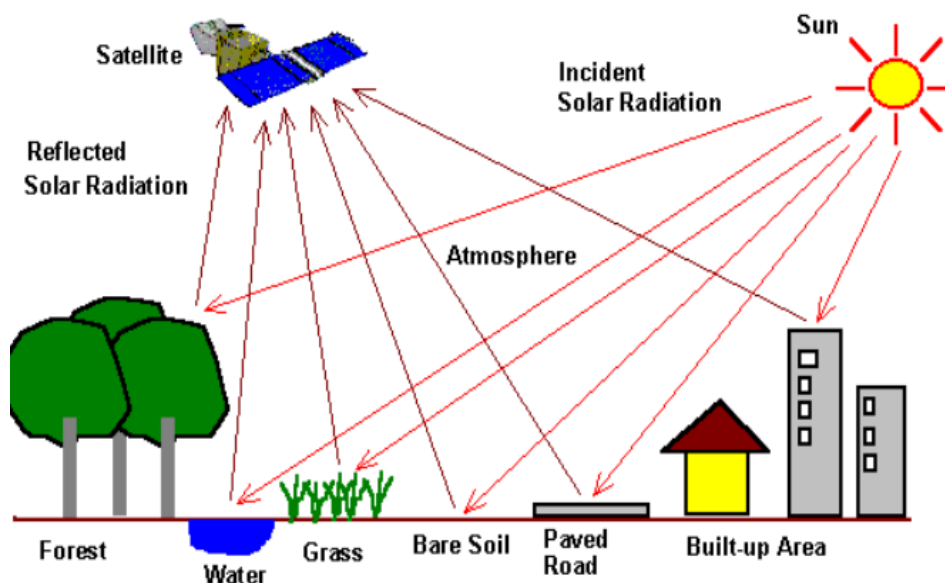
Remote sensing and Geographical Information System (GIS) are widely accepted and more dependable advance techniques to detect change in land area of Ghaziabad region of Uttar Pradesh a part of National Capital Region Delhi. LANDSAT satellite images from 2003(ETM), 2008(ETM), 2013(OLI/TIR), 2018(OLI/TIR), and 2022(OLI/TIR) were downloaded from USGS Earth Explorer and used to quantify the changes in Land Use and Land Cover in the city of Ghaziabad from 2003 to 2022. With the help of the ArcGIS Imagine software, the supervised classification method has been used. Urban, water, and barren land were three of the six categories used to classify the research area's photographs.

For image classification of Ghaziabad district, first of all existing map of Ghaziabad was downloaded from www.ghaziabad.nic.in This map was georeferenced using co-ordinate collected for important locations throughout area by hand held GPS After georeferencing. Shape file of Ghaziabad district was created by digitization using Arc GIS software with the help of this shape file. Multi-sensor satellite data was extracted for Ghaziabad district by sub-setting in Imagine Software.

Keywords : Arc GIS , Image Classification , Remote sensing , Landsat Satellite , Clipping , Layer Stacking.

Introduction

Remote sensing may be defined as the innovative science by which information about any object on the surface of the earth may be obtained without any physical contact with the same. In fact, remote sensing is used by common people in daily life in the form of vision, hearing and smelling.



The system for collecting satellite imagery of the Earth with the longest history is Landsat. The arrangement's first satellite, Landsat-I, was launched in July 1972. It was a collaborative effort between NASA and the US Department of the Interior. Before being rebranded as Landsat in 1975, Earth Resources Technology Satellites (ERTSS) was the program's official name. Each of the mission's eight satellites is launched separately. In February 2013, Landsat-8, sometimes referred to as the Landsat Data Continuity Mission (LDCM), was sent into orbit.

Multiple sensor types, including the Multispectral Scanner (MSS) and Return Beam Vidicom (RBV). Thematic Mapper, Enhanced Thematic Mapper (ETM), and Enhanced Thematic Mapper Plus (ETM+) have all been used to different Landsat missions. Every mission of the Landsat programme uses a sun-synchronous orbit that is close to a polar region but at a different altitude.

operational. One could sustain 8-day repeat coverage. For the purpose of creating two-dimensional images, MSS employed in Landsat programmes uses across line scanning. The Operational Land Imager (OLI) and Thermal Infrared Scanner (TIRS) are two instruments that are part of the Landsat 8 project. As of the now, the OLI is in excessive use.

In supervised classification technique, the area of land spread sorts ought to be known from the earlier. The zones of each land spread sorts are known as preparing destinations. The phantom qualities of pixel computerized numbers inside every one of the land spread sorts can be utilized to produce multivariate factual parameters for every one of the preparation destinations. As the managed arrangement strategies depend on measurable ideas, this order is likewise named according to point or per-pixel grouping

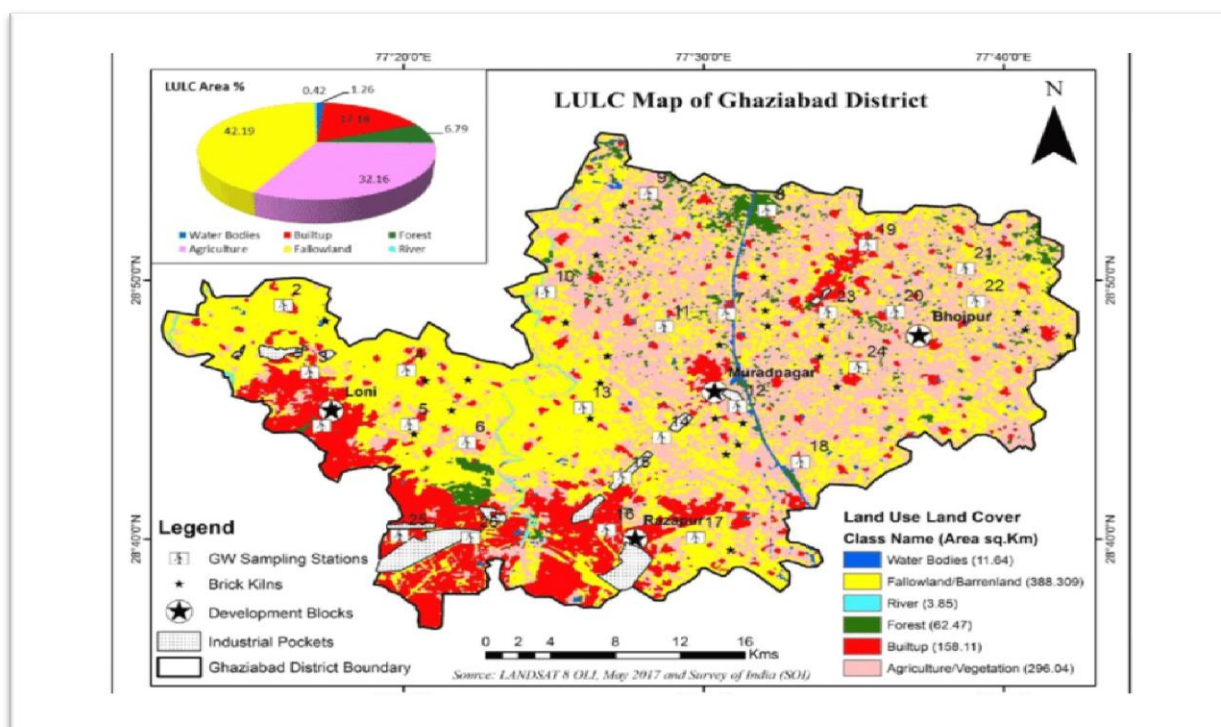
Study Area, Data And Software Used

Ghaziabad is a city in Uttar Pradesh, India. It is located 28.67 latitude and 77.44 longitude and it is situated at an elevation 214 meters above sea level. It is located approximately 1.5 kilometres away from the river Hindon

Landsat satellite images are downloaded from USGS earth explorer website. The images are of the months between April and May. The selection of LANDSAT depends on the availability of data of that Landsat in April and May of selected year.

Year	Satellite	Sensor	Date of acquisition
2003	LANDSAT	ETM	08/04/2003
2008	LANDSAT 7	OLI	01/01/2008
2013	LANDSAT 8	OLI	13/05/2013
2018	LANDSAT 8	OLI	11/05/2018
2022	LANDSAT 9	ETM	01/02/2022

Below map is the map of Ghaziabad District, which is our study area. Ghaziabad is one of the major districts of Uttar Pradesh. The map is official and verified through tahsil Map is downloaded through the official website of Ghaziabad district which is www.ghaziabad.nic.in ArcGIS is a geographic system (GIS) for operating with maps and geographic information. It is utilised for creating and utilizing maps, aggregating geographic info, breaking down mapped information, sharing and finding geographic information, utilizing maps and geographic information in a very scope of utilizations, and overseeing geographic information.



METHODOLOGY

The various steps followed to complete the work have been listed as follows:

1. Satellite data collection

Landsat satellite images are downloaded from USGS earth explorer website. The images are of the months between April and May. The selection of LANDSAT depends on the availability of data of that Landsat in April and May of selected year.

2. Georeferencing and shape file creation

The shape file is a standard geospatial vector data position for Geographical information system (GIS). The shape file can spatially depict vector features: points, lines, polygons, addressing for ex: district boundaries, lakes and conduits. The shape file has file name expansions shp, shx and dbf.

3. Layer stacking of raw bands and spectral indices

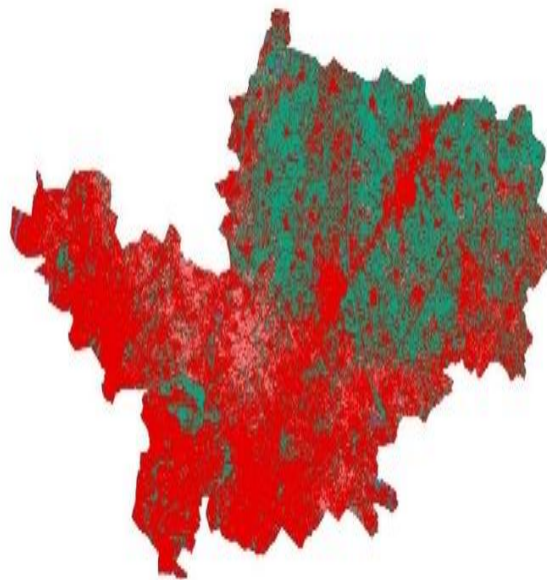
To extract our study area from the layer stacked image the process of sub-setting is done. After obtaining sub-set image it is used in making various spectral indices. These indices are used in various purposes like depicting the special feature of an area like water, vegetation, soil, and built-up area.

Normalized Difference Vegetation Index (NDVI) uses the NIR and red channels in its formula

$$NDVI = \frac{NIR - Red}{NIR + Red}$$

4. Supervised Image classification

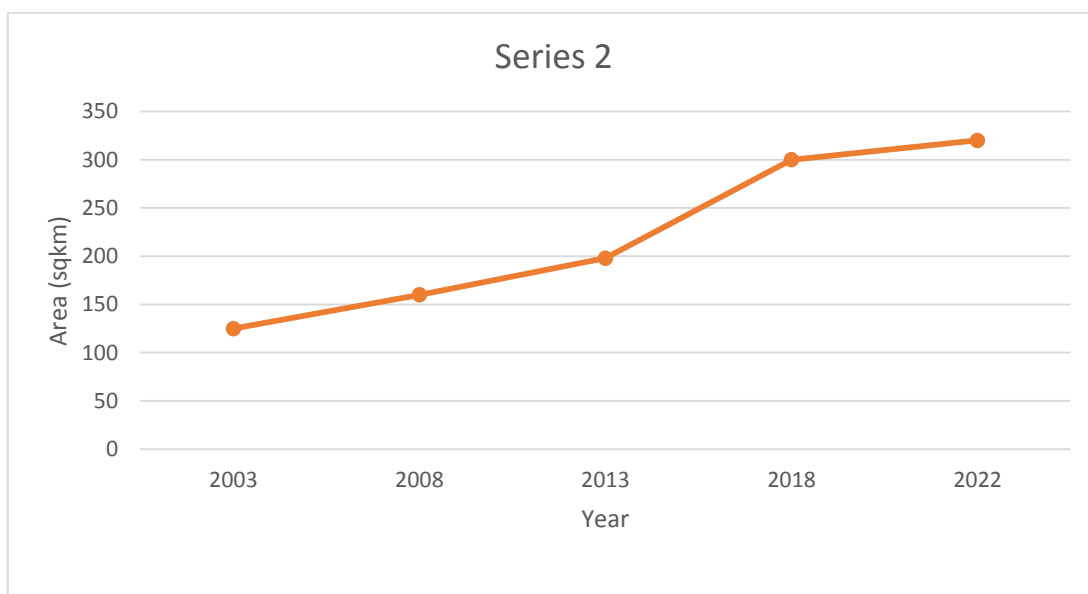
Instead of utilising an automated process to establish the most separable classes, the analyst chooses and digitises polygons (training areas) and sets these polygons in an AOL (Area of Interest) layer from which to construct the signature files.



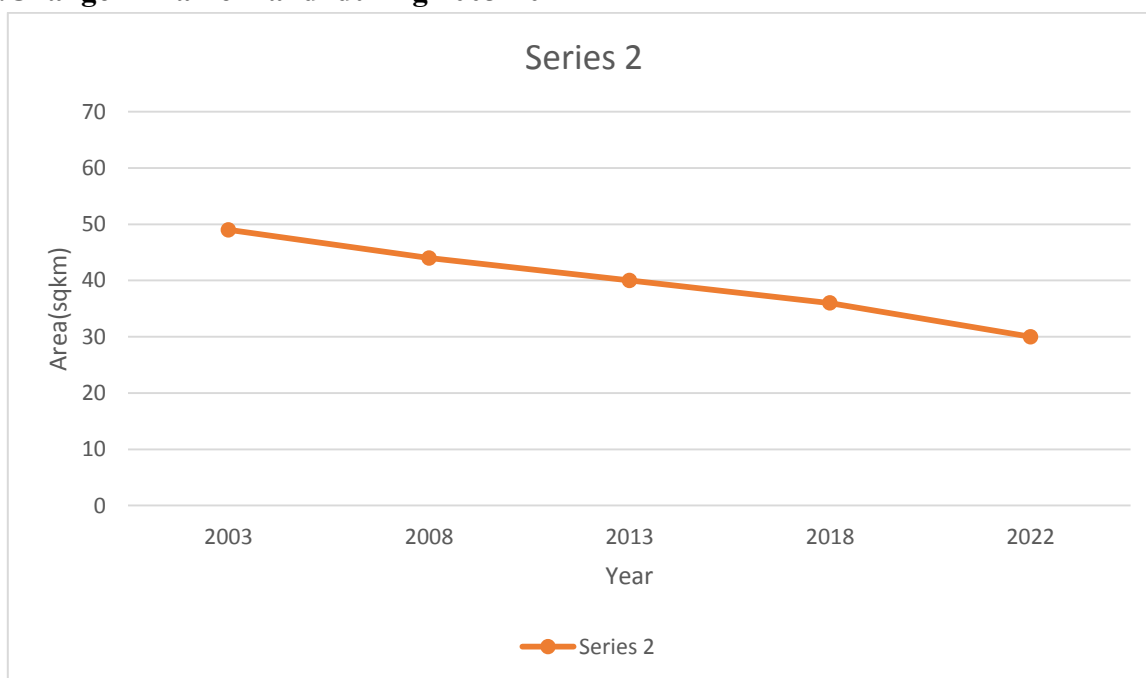
Results

Following observation have been made from pattern of urban areas over the period of 20 years in the district of Ghaziabad

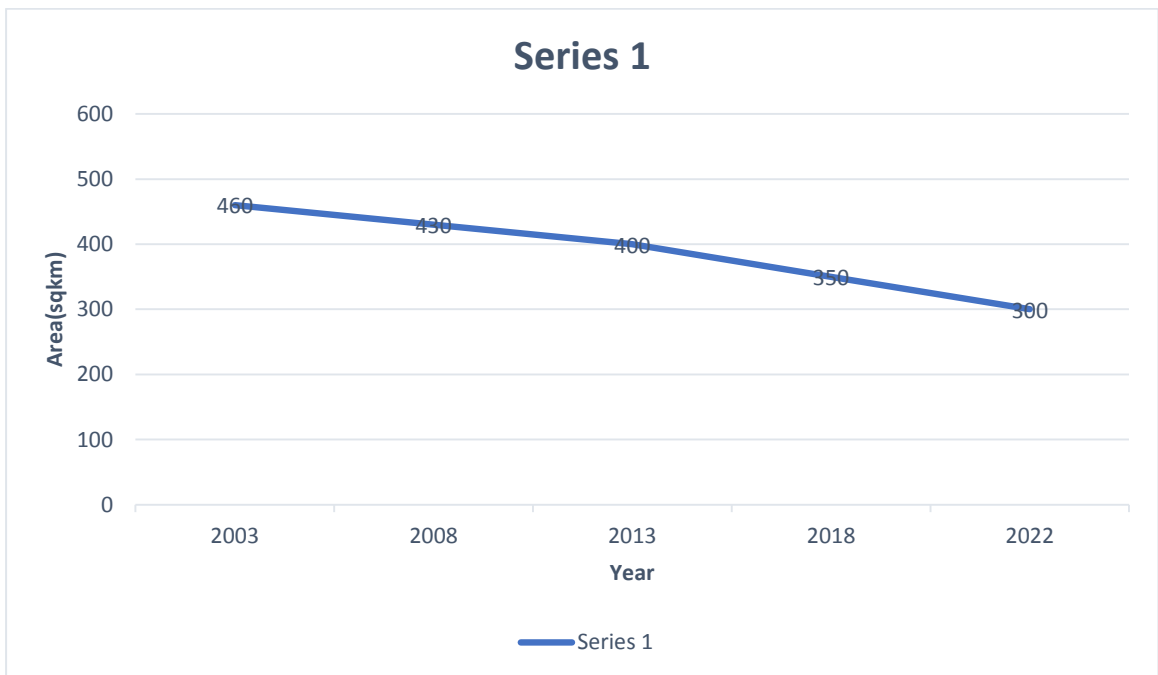
1. Change in Urban area during 2003-2022



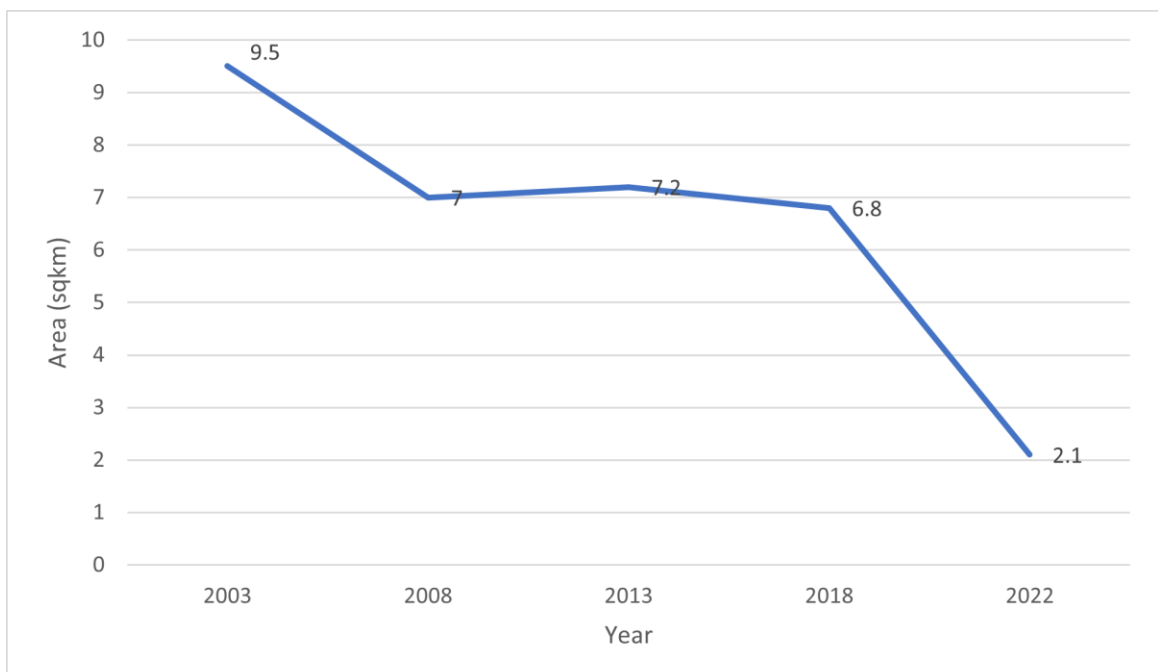
2. Change in Barren land during 2003-2022



3. Change in Agriculture area during 2003-2022



4. Change in Surface water area during 2003-2022



Conclusion

According to the report, urban areas have undergone the greatest shift in land use and land cover in the Ghaziabad district between 2003 and 2022.

The following list summarises the study's main findings:

Due to the development of new buildings on agricultural land and barren land, the area beneath urban land has expanded by 195.20 km².

- Deforestation activity resulted in a 150 km² decrease in the area of land used for agriculture.
- The agricultural land has also shrunk by 150 km², indicating that agricultural land is being cleared and sold off to be used for infrastructural and commercial development.
- The barren land is Decreased by 20 km² which shows transformation stage from barren land to urban area.
- The water is decreased by 7.5 km² the urban area is expanding towards southern direction near Hindon River. While it expanding min towards the north eastern direction.

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