

ASSESSMENT OF CHANGE IN LAND USE LAND COVER OF THE PHULPUR TEHSIL, AZAMGARH

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Abstract

Today anthropogenic environmental changes are rampant, particularly in developing areas, has brought major changes in Land Use Land Cover (LULC) which can be analyzed by mapping the land cover classes. The present study describes the spatial-temporal changes in LULC in Phulpur Tehsil of Azamgarh. To detect the land use land cover variation, satellite images of two time period has been considered. Landsat TM and OLI data are used for mapping the 1990 and 2022 land use land cover classes. The results indicate that there is 22 sq km increase in built-up area, and 22 sq km increase in crop land in 32 years. In the present report, the researcher concludes that satellite digital image processing is useful for identifying and mapping LULC modifications. One of the most significant features of environmental changes made by human activities, particularly in developing areas, is a change in LULC.

Keyword: LULC, Environment Changes, Satellite Imagery

Introduction

Economically, socially, and physiologically, human communities cannot coexist in isolation. For the mutual fulfilment of their requirements and in order to fulfill their most fundamental needs, they must be interdependent. They rely on nature, especially on their surroundings, to supply their basic requirements. Rapid population expansion and migration from rural areas into urban areas have thrown the ecological balance off (Broussard and Turner, 2009).

Unplanned urbanization and industrialization disrupt the environment and wipe off biodiversity (Chaurasia et al., 1996). Although both naturally occurring and manmade changes in land cover occur, it has been discovered that people are the primary agents of land transformation (Gupta and Choubey, 2015). In order to exploit the Earth's surface for industrial, agricultural, and infrastructure reasons has led to changes in the terrain and land resources. An excessive amount of force has been placed on the land as a result of anthropogenic pressure and the quickly rising demand for resources there (Taufik and Ahmad, 2016). Accessible land is under unsustainable stress due to the rapidly growing demand for land. Rapid population growth forces people to move to more fragile habitats, such as highlands, marshes, and forests, to meet growing demands for land resources. This overuse of land then results in environmental degradation

The LULC categorization has a significant impact on regional development, planning and decision making. For the analysis of diverse socio-ecological issues, accurate and pertinent LULC

information is crucial. Numerous applications, such as urban land planning, agriculture, rural management, and sustainable development, require this knowledge. In order to accomplish sustainable development, proper land planning and management are essential (Babykalpana, and ThanushKodi, 2014). The estimation of LULC changes is extensively studied using remote sensing technology. Many satellites have provided remote sensing data, widely utilized to comprehend and analyze the land cover dynamics (Alam et al., 2020).

In the present study, Phulpur Tehsil of Azamgarh has been studied to understand the change in land cover in 32 years using remotely sensed data.

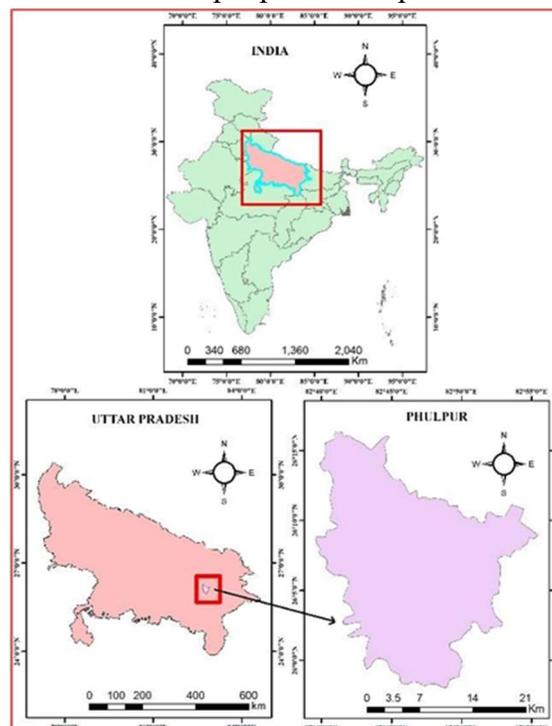
Objectives

Present study deals with following objectives:

1. To assess the degree of land use and cover change between 1991 and 2021
2. To determine the factors causing land cover shifts in Phulpur Tehsil of Azamgarh.

Study Area

The study is conducted in Phulpur Tehsil of Azamgarh, located at $26.079774^{\circ}\text{N} - 82.314093^{\circ}\text{E}$. It is located at average height of 81 metres (265 feet) above sea level. Majhee river, tributary of Tamsa river is the major river of the study area. Figure 1 presented the location of the study area. As per census of India, Males make up 51% of the population, while females make up 49%. Male literacy is 69% and female literacy is 57%, putting Phulpur's average literacy rate above the national average of 59.5% at 63%. 18% of people in Phulpur are under the age of six.



Source: Nakshey Portal

Figure 1: Location of the study area

Data Base

The absolute dataset of all the land use land cover classes is created by using multi-temporal satellite imageries of LANDSAT series satellite of Landsat 5 and Landsat 8 (Table 1). Five LULC classes were identified in the area: vegetation cover, water, cropland, fallow land and built-up.

Table 1: Satellite data

S.No	Satellite	Description of satellite	Resolution	Data of acquisition
01	Landsat 5	LANDSAT/LT05/C02/T1 TOA/LT05 142042 19900315	30 m	15-03-1990
02	Landsat 8	LANDSAT/LC08/C02/T1 TOA/LC08 142042 20220323	30 m	23-03-2022

Imageries of LANDSAT 5 and Landsat 8 were used to acquire the LULC for the years 1990 and 2022 respectively. All the satellite imageries were collected from the USGS web portal (<https://earthexplorer.usgs.gov/>). High-Resolution imagery (Google Earth) and a toposheet of the AOI were included in creating the study area. This toposheet was georeferenced in Quantum GIS (A free software for GIS applications) by using the nearest neighbourhood resampling method. Visual interpretation-based method was adopted to create the tanning samples of the study area. The characteristics of Landsat 5 and Landsat 8 are shown in Table 2, and 3.

Table 2: Description Characteristics of Landsat 5 satellite

Band Name	Resolution	Wavelength
Blue	30m	0.45 - 0.52 μm
Green	30m	0.52 - 0.60 μm
Red	30m	0.63 - 0.69 μm
NIR	30m	0.76 - 0.90 μm
SWIR-1	30m	1.55 - 1.75 μm
TIR	30m	10.40 - 12.50 μm
SWIR-2	30m	2.08 - 2.35 μm

Source: <https://www.usgs.gov>

Table 3: Description Characteristics of Landsat 8 satellite

Band Name	Resolution	Wavelength
Coastal aerosol	30m	0.43 - 0.45 μm
Blue	30m	0.45 - 0.51 μm
Green	30m	0.53 - 0.59 μm
Red	30m	0.64 - 0.67 μm
Near infrared	30m	0.85 - 0.88 μm
Shortwave infrared 1	30m	1.57 - 1.65 μm
Shortwave infrared 2	30m	2.11 - 2.29 μm
Panchromatic	30m	0.52 - 0.90 μm
Cirrus	30m	1.36 - 1.38 μm
TIR-2	100m	10.60 - 11.19 μm
TIR-2	100m	11.50 - 12.51 μm

*Note TIR and NIR stand for thermal infrared and near-infrared, respectively.

Source: <https://www.usgs.gov>

Methodology

The Figure 2 illustrate methodology to understand the role of earth observation techniques for determining the shift and change in the LULC of the Phulpur tehsil area of Azamgarh district of Uttar Pradesh state, India, by using the semi-automatic classification techniques. In the present study, the following methods and approaches have been used to map the Land Use Land Cover over three decades from 1990-2022 in the study area.

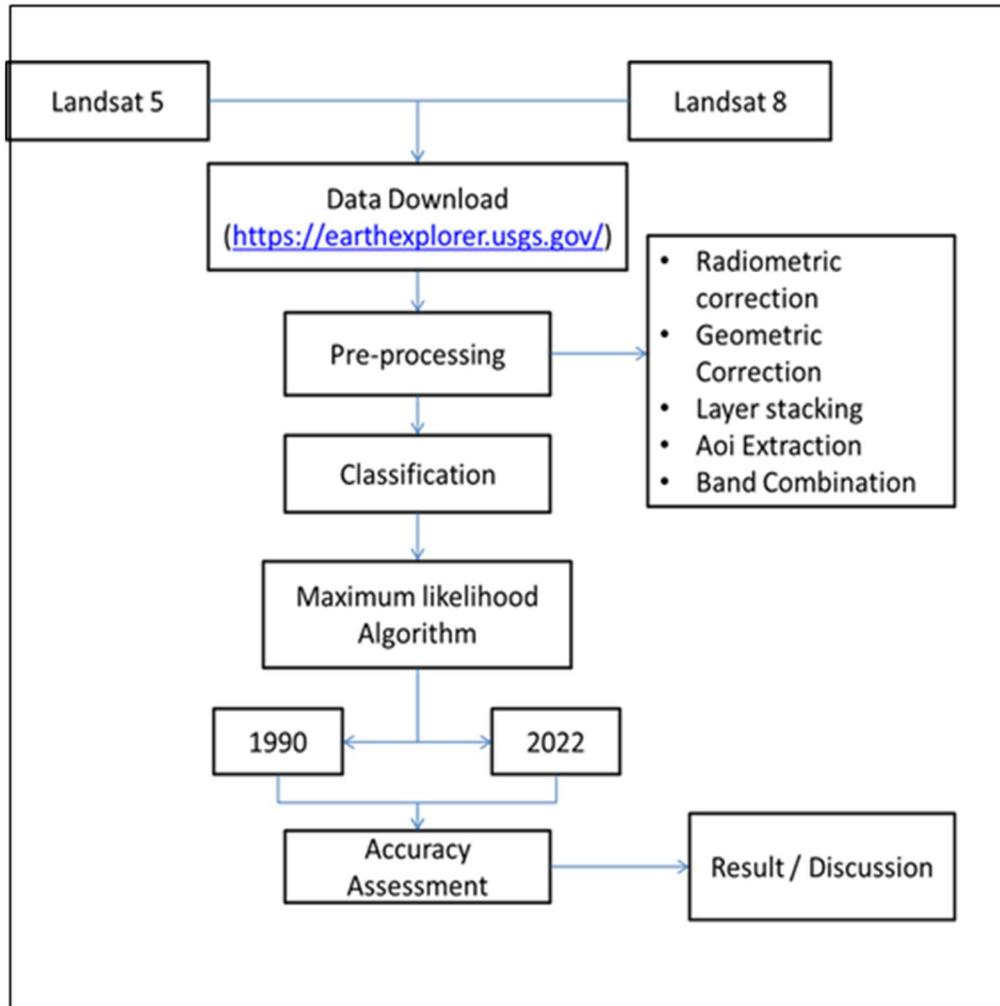


Figure 2: Methodology

All the imageries were first radiometrically corrected by calculating ToA (top of atmosphere) reflectance to get atmospheric error-free data. After the radiometric corrections, the geometric correction was applied to remove the geometric error and after that, with the resample method of nearest-neighbor the image was resampled appropriately. The study area was then masked from the tile imagery. The supervised image classification algorithm (maximum likelihood) was included for classification of LULC.

The method of supervised classification was performed using the algorithm of maximum likelihood and a band composition of Green, Red, and NIR to select training samples for the feature classes of water bodies, while the true composite of blue green and red bands was included for collecting the training samples of features classes of settlement, cropland, fellow land and band composition of NIR, red and green for vegetation.

In the study area various LULC classes were divided into five categories to facilitate the process of assessment and analysis of change detection. Vegetation cover, cropland, water, built-up, and fallow land, are all included in the classification output. The two independently classified images were compared to provide a change detection analysis. The classification proved to be useful since it has the benefit of identifying the type and degree of shift and change that has occurred via pixel-level comparison.

Results

From the LULC analysis of Phulpur tehsil from 1990 - 2022, it was observed that in 32 years development has taken place in Phulpur tehsil which has been clearly seen from the increase in built-up area. The LULC statistics are presented in Table 4. Figure 3 and 4 showed the percentage of various LULC in Phulpur in 1990 and 2022.

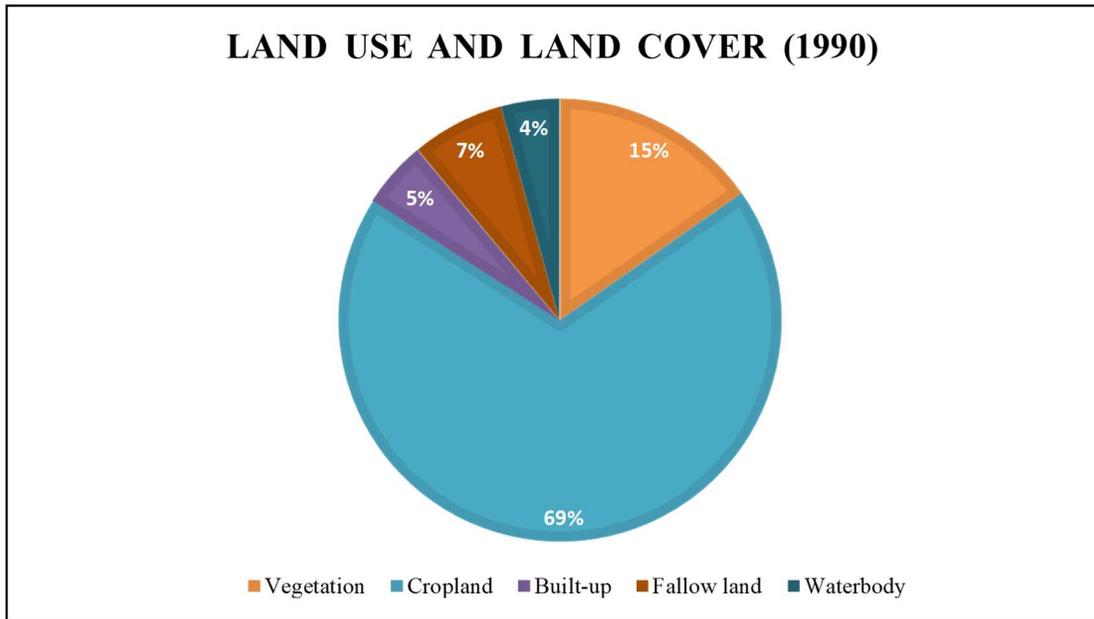
From the Figure 5, it was observed that there is less increment in the built-up area. The 22 sq km surge has been observed in built-up category in 32 years. In the study region, the built-up classes are seen in scattered pattern. The increase in road network can be clearly seen in Figure 5 (b).

Table 4: Statistics of the LULC classes

LULC classes	1990 Area in sqkm	2022 area in sqkm	Change
Vegetation Cover	72	61	-11
Cropland	324	346	22
Built up	23	45	22
Fallow land	32	15	-17
water body	20	4	-16
Total Area	471	471	0

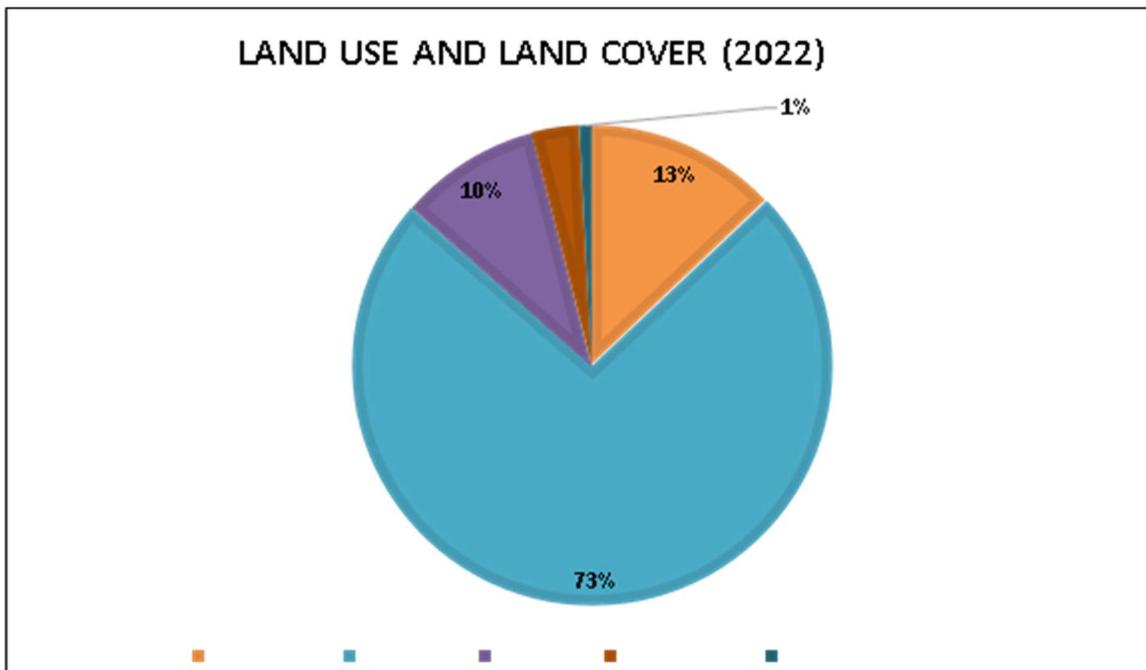
Source: USGS (LANDSAT 5 and LANDSAT 8)

This region is primarily dominated by agriculture fields, in 1990 the cropland accounts for 324 sq km area which increased to 346 sq km in 2022, there is 22 sq km increment in the cropland, which is the result of the removal of forest / scrub land which is represented by vegetation cover in the study.



Source: USGS (LANDSAT 5, 1990)

Figure 3: The land use and land cover statistics of Phulpur Tehsil in 1990



Source: USGS (LANDSAT 8, 2022)

Figure 4: The land use and land cover statistics of Phulpur Tehsil in 2022

Source: USGS (LANDSAT 5, 1990 and LANDSAT 8, 2022)

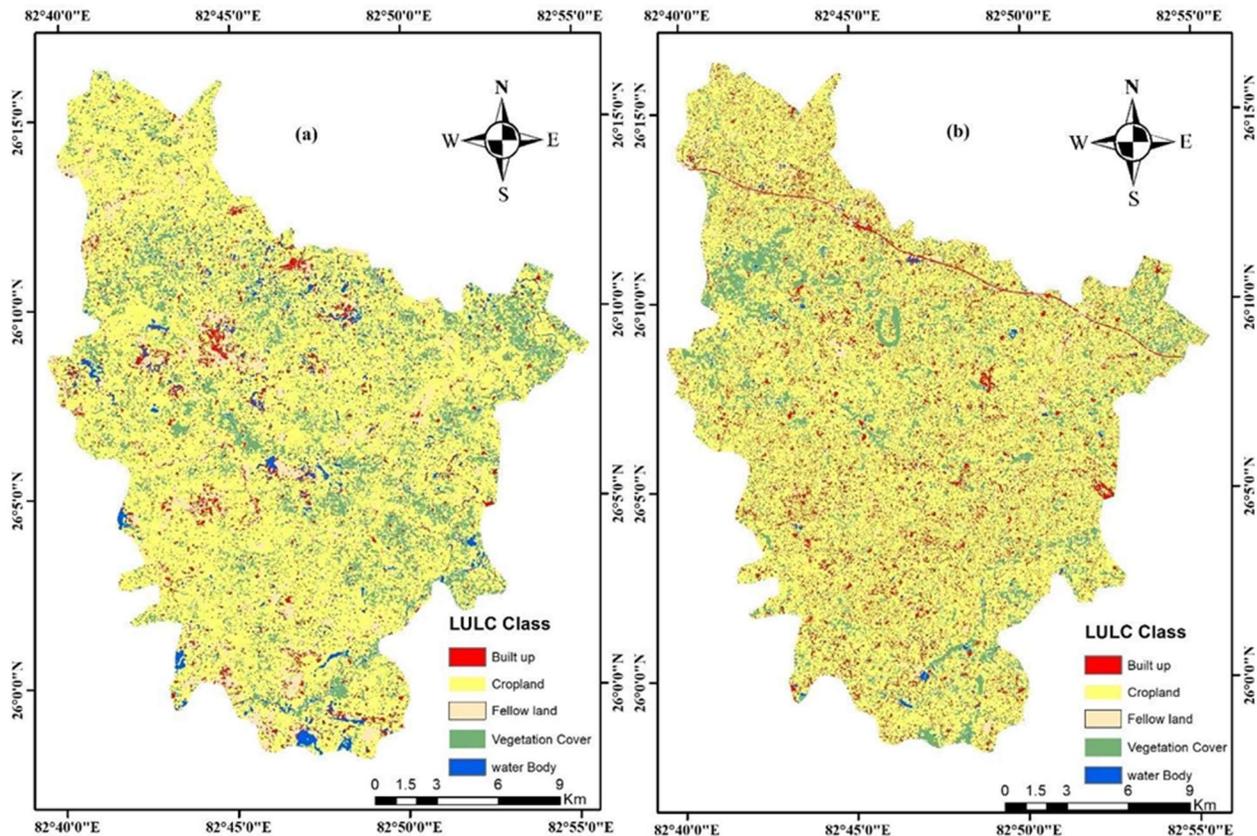


Figure 5: Land cover change in Phulpur Tehsil of Azamgarh in 32 years; (a) showed the LULC in 1990, and (b) showed the LULC in 2022

Conclusion

The LULC change is defined as significant changes from the past to the present. This paper focuses on the land cover variation in 32 years. The results indicate that there is 22 sq km increase in built-up region. As the region is predominately an agriculture region, the crop land accounts for 324 sq km in 1990, which surge by 22sq km in 32 years. There is no huge change in built-up areas. As the region is predominated by agricultural field. Regional natural resource mapping can be accomplished with the aid of remote sensing. The investigation's findings, which are summarized in this study, demonstrate the value of satellite digital image processing for mapping and locating LULC alterations. To produce somewhat accurate maps of LULC changes, maximum likelihood supervised classification of Landsat TM5, and OLI 8 imagery and post-classification comparison technique can be utilized.

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