INDIAN INSTITUTE OF TECHNOLOGY ROPAR

# DEVELOPMENT ENGINEERING PROJECT REPORT

On

*Anthropogenic activity and its concomitants Land use land cover changes in chandigarh*

**Under the guidance of Dr. Indramani Dhada and Dr. Shray Pathak**

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**Contents :**

# Abstract

Anthropogenic activities have profoundly influenced Land Use/Land Cover (LULC) patterns, leading to significant environmental, social, and economic consequences. This study investigates the impact of human activities on LULC dynamics and their concomitant effects on the landscape. Using remote sensing data and Geographic Information Systems (GIS) techniques, we analyze LULC changes over a specific time period in chandigarh. The study integrates multi-temporal satellite imagery and socio-economic data to identify and quantify the extent of LULC modifications attributed to human interventions.

The study highlights the implications of LULC changes on ecological integrity, biodiversity loss, soil degradation, water resources, and climate dynamics. Urban heat island effects, loss of green spaces, fragmentation of habitats, and degradation of ecosystem services are among the observed consequences of anthropogenic LULC alterations. These changes pose profound challenges to sustainable development, environmental conservation, and human well-being in the region.

## 1.Introduction :

### 1.1 background:

The rapid pace of urbanization and economic development has led to profound alterations in land use and land cover (LULC) patterns worldwide, profoundly impacting ecosystems, biodiversity, and human well-being. Chandigarh, the capital city of the Indian states of Punjab and Haryana, stands as a microcosm of this global phenomenon. Designed by the renowned architect Le Corbusier in the 1950s, Chandigarh represents a unique blend of modern urban planning and natural landscapes. However, the city's growth and development over the years have been accompanied by significant anthropogenic activities, resulting in notable changes in its LULC composition.

## 1.2 . Importance of Studying Anthropogenic Activity and LULC in Chandigarh:

Understanding the dynamics of anthropogenic activities and their concomitant effects on LULC in Chandigarh is of paramount importance for several reasons.

Firstly, Chandigarh serves as a hub of economic activity, administrative functions, and cultural vibrancy in the region, attracting migrants and industries alike. This influx of population and economic activities exerts pressure on land resources, leading to alterations in LULC patterns.

Secondly, Chandigarh's unique urban planning model, characterized by distinct sectors for residential, commercial, and institutional purposes, offers an intriguing case study for examining the impacts of anthropogenic interventions on urban landscapes.

Lastly, Chandigarh's strategic location amidst the agrarian landscapes of Punjab and Haryana underscores the interconnectedness between urban and rural areas, with implications for agricultural practices, land-use changes, and environmental sustainability.

## 2. objective :

The primary objective of this study is to analyze the effects of anthropogenic activities on LULC dynamics in Chandigarh over a specific time period. By employing remote sensing techniques, Geographic Information Systems (GIS) tools like ERDAS IMAGINE, and socio-economic data, we seek to identify and quantify the extent of LULC changes attributable to human interventions. Specifically, we aim to:

- Assess the spatial and temporal patterns of LULC changes in Chandigarh.

- Identify the key drivers of LULC alterations, including urbanization, agricultural expansion, infrastructure development, and industrialization

- Evaluate the environmental impacts of anthropogenic LULC changes on ecosystems, biodiversity, and natural resources.

- Provide insights into sustainable land management practices and urban planning strategies to mitigate the adverse effects of anthropogenic activities on LULC in Chandigarh

## 3 . Study area description :

Chandigarh, located at the foothills of the Shivalik range in northern India, spans an area of 114 square kilometers. With a population exceeding 1,364,000 residents, the city serves as a major economic, cultural, and administrative center in the region. Chandigarh's LULC composition comprises a mix of urban, peri-urban, and rural landscapes, characterized by residential areas, commercial complexes, green spaces, agricultural fields, and water bodies such as Sukhna Lake.

## 4. Methodology :

### 4.1. Data collection :

**4.1.1 Satellite Imagery:** Obtain multi-spectral satellite imagery covering Chandigarh with suitable spectral and spatial resolutions, such as Landsat or Sentinel data. We have used the data of LANDSAT 1-5 MSS C2 L1 for 1989, LANDSAT 4-5 TM C2 L1 for 1999 ,RESOURCESAT 2 LISS4 for 2009 and 2014 all from usgs earth explorer.

**4.1.2 Ancillary Data:** Acquire ancillary data including ground control points, digital elevation models (DEM), and administrative boundaries for accurate image processing.

## 4.2. Data Pre-processing:

**4.2.1 Image Calibration:** Calibrate the satellite imagery to radiometrically correct sensor-specific errors and ensure consistency in spectral values.

**4.2.2 Geometric Correction:** Rectify the imagery to remove geometric distortions caused by sensor viewing geometry and Earth's curvature.

**4.2.3 Mosaicing:** Integrate multiple satellite images to create a seamless mosaic covering the entire study area.

**4.2.4 Image Subset:** Subset the imagery to the study area extent to reduce computational load and focus on relevant areas.

## 4.3 Unsupervised Classification:

**4.3.1 Clustering Algorithm:** Apply unsupervised classification algorithms to partition the image into 50 clusters based on spectral similarity.

**4.3.2 Cluster Analysis:** Analyze the spectral signatures of resulting clusters to interpret and assign meaningful land cover classes to each cluster after connecting it with google earth and classify each cluster .

## 4.4 Post-classification Processing:

**4.4.1 Cluster Labeling:** Assign appropriate land cover labels to each cluster based on spectral characteristics, contextual information, and ground truth validation with the help of google earth .

**4.4.2 Spatial Filtering:** Implement spatial filtering techniques to remove noise and improve the spatial coherence of classified clusters with the help of recode the classified images.

**4.4.3 Accuracy Assessment:** Conduct accuracy assessment using independent validation data to evaluate the classification performance and refine classification parameters if necessary.

## 4.5 Map Generation:

**4.5.1 LULC Mapping:** Generate the final LULC map by assigning thematic labels to each classified cluster representing the 50 different land cover classes.

**4.5.2 Map Visualization:** Visualize the LULC map using suitable cartographic techniques to effectively communicate spatial patterns and distribution of land cover classes.

**4.5.3 Map Export:** Export the LULC map in standard GIS-compatible formats for further analysis, integration with other spatial datasets, and decision-making purposes.

## 5. Observations :

We have prepared the maps of chandigarh of past three decades fig 5.1,fig 5.2 , fig 5.3 , fig 5.4 ,to analyse the dynamic change in land use and land cover having different classes with some area distribution shown in Table 6.1

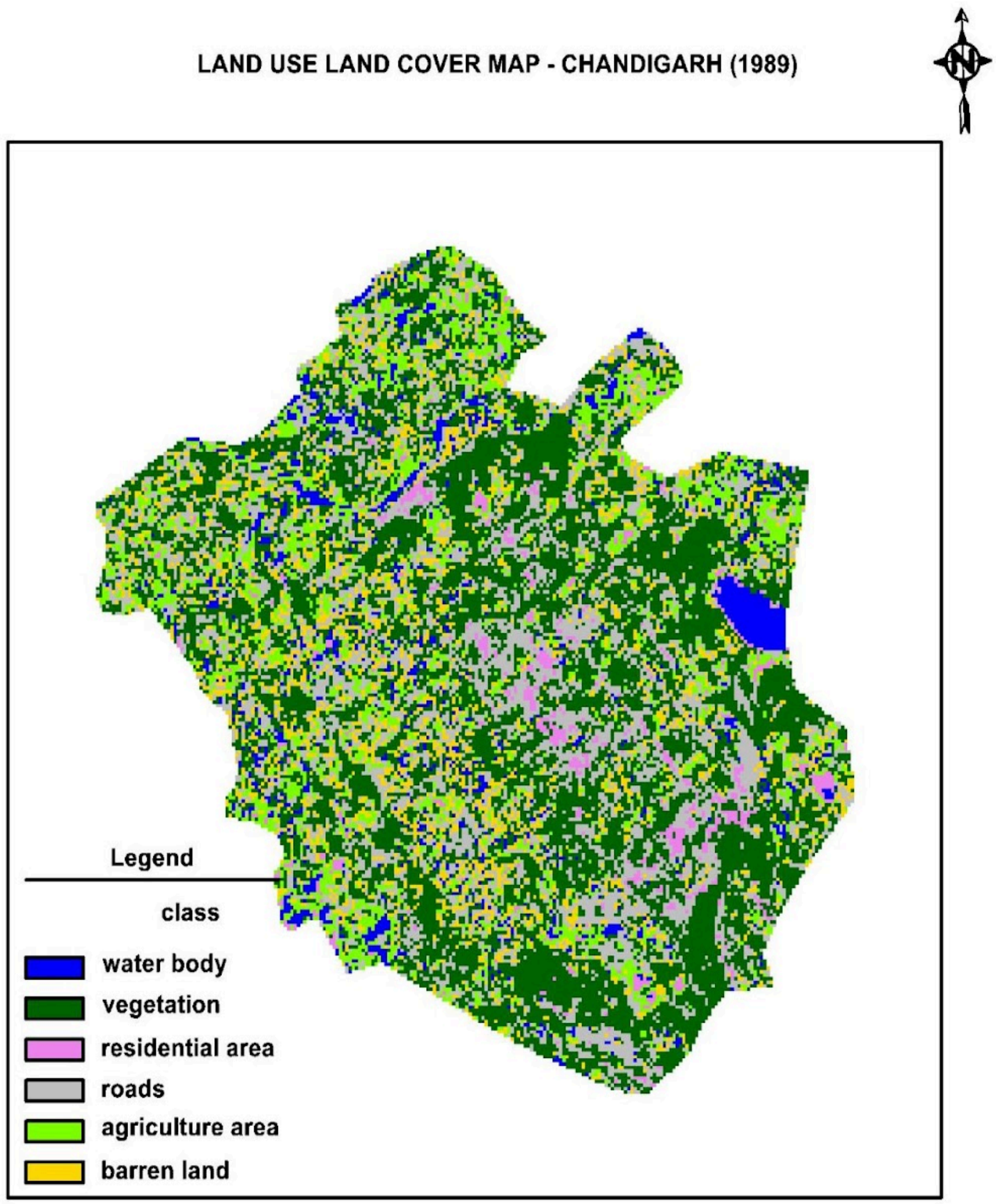



Fig 5.1 LULC map of chandigarh of year 1989

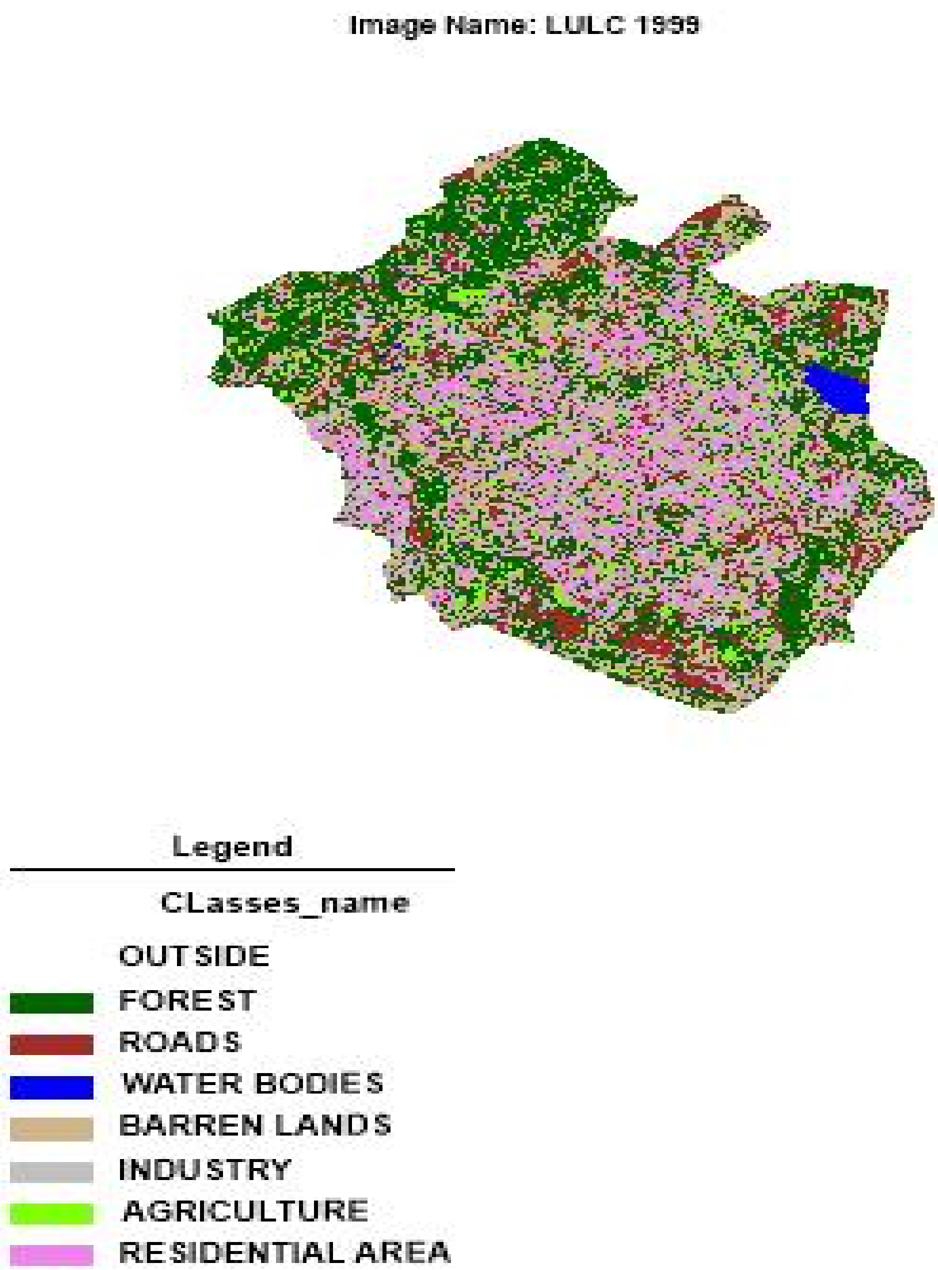



Fig 5.2 LULC map of chandigarh of year 1999

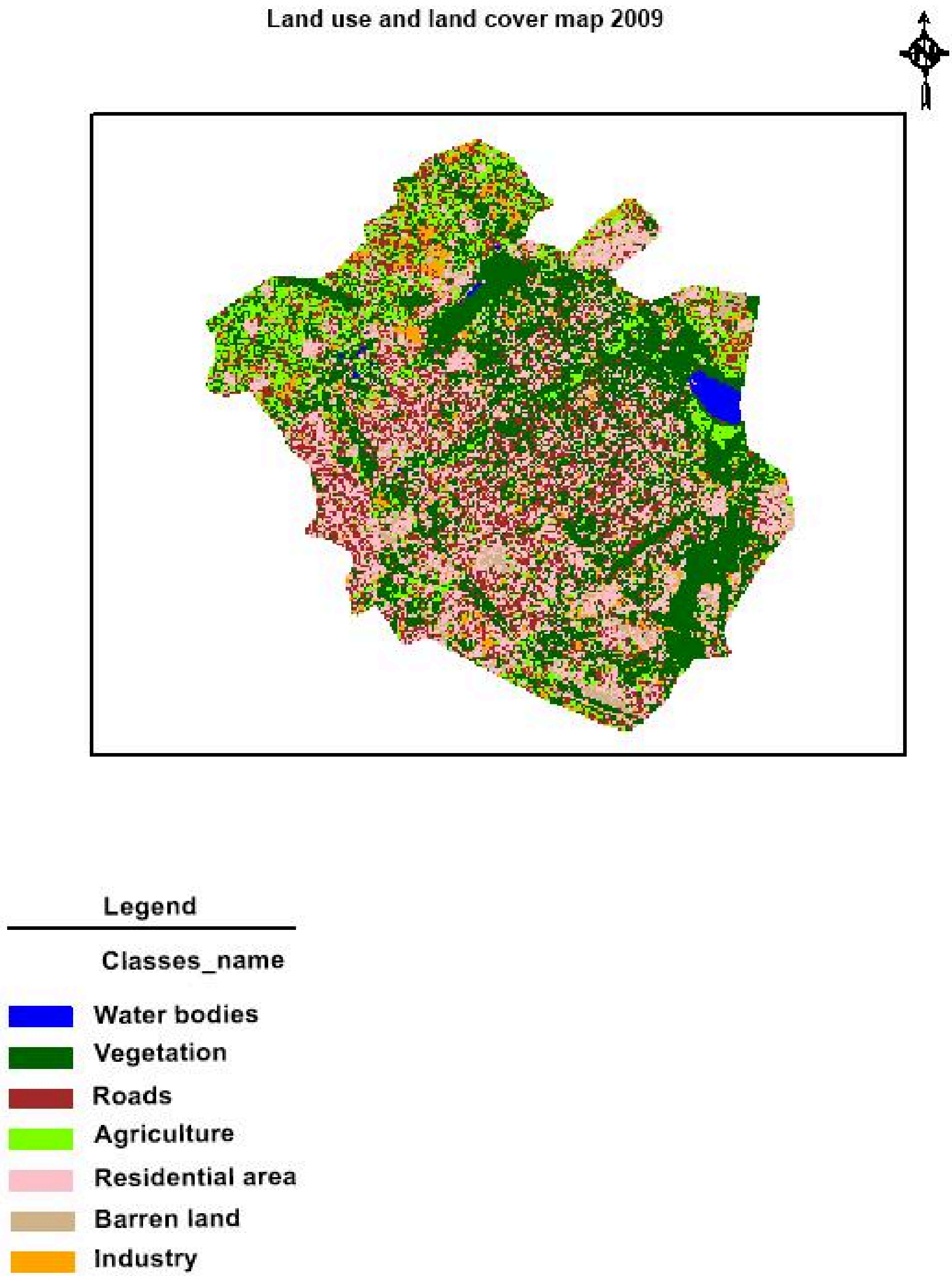



Fig 5.3 LULC map of chandigarh of year 2009 

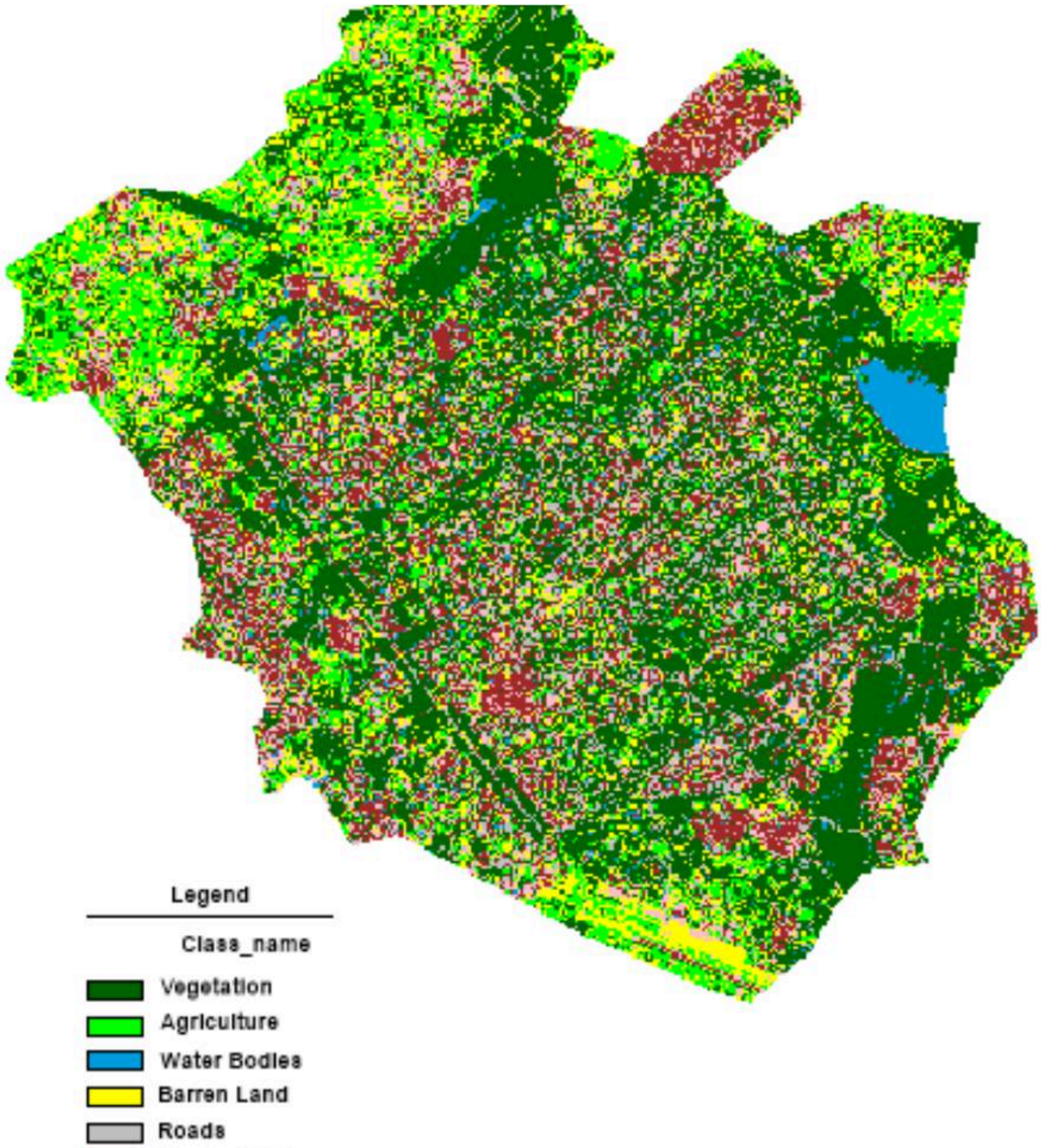
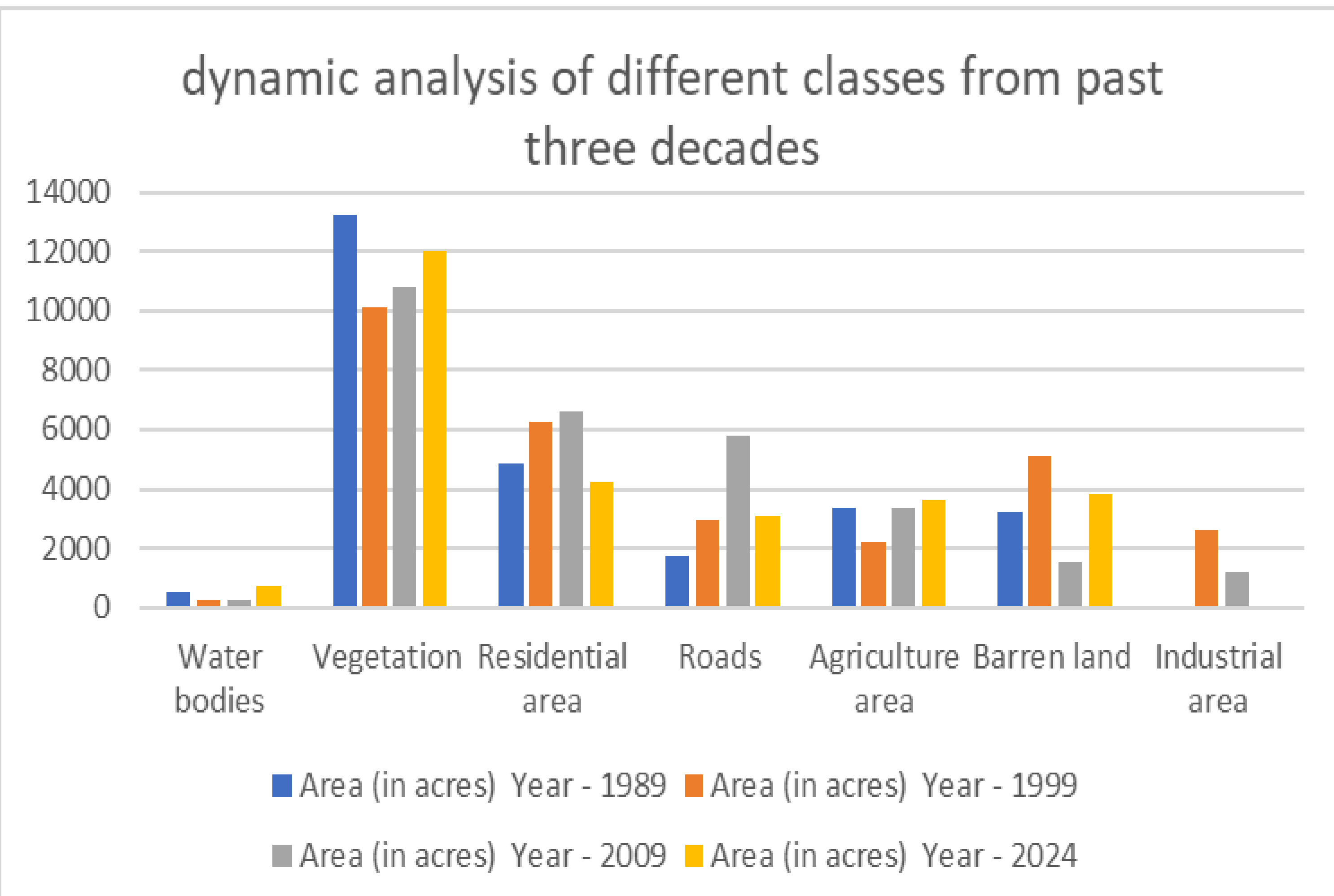



Fig 5.4  LULC map of chandigarh of year 2024

## 6. RESULT :

Table 6.1

| | Area (in acres) | | | |
|---|---|---|---|---|
| CLASSES | Year - 1989 | Year - 1999 | Year - 2009 | Year - 2024 |
| Water bodies | 546.98 | 251.974 | 265.095 | 723.68 |
| Vegetation | 13218.3 | 10109.6 | 10782.6 | 11994.5 |
| Residential area | 4837.094 | 6294.67 | 6596.24 | 4244.35 |
| Roads | 1710.84 | 2977.42 | 5783.38 | 3092.11 |
| Agriculture area | 3390.19 | 2202.16 | 3364.84 | 3629.32 |
| Barren land | 3235.4 | 5084.17 | 1565.44 | 3843.46 |
| Industrial area | | 2646.28 | 1206.05 | 1722.65 |



## 7. Conclusion :

- Conclude by emphasizing the importance of understanding past land use changes for informing future land use decisions and promoting sustainable development.
- Reiterate the significance of long-term monitoring and analysis of LULC dynamics for achieving environmental conservation, socio-economic development, and resilience in the face of global change.

## 8.References and software tool used :

Usgs earth explorer website
Google earth
Erdas imagine 2014