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Analysis of Land Use Land Cover Change and Providing Land Use Mapping Using GIS: A Case Study of West Zone, Bhavnagar

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Abstract - *The study analyses and quantifies land use land cover change of West zone of Bhavnagar from 2010 to 2020 using Geographical Information System (GIS). Based on the existing and past land use land cover maps of 2010, 2015 and 2020, the urban expansion in west zone will be determined. It also evaluates various impacts on the area due to rapid urban expansion. The main concern of this study is to quantify the substantial growth of the built-up area over significant period. By analyzing the Landsat images, the decrease or increase in land cover and land use growth patterns will be evaluated in order to forecast future changes in an area. This study will contribute to the development of sustainable land use planning and forecast possible future changes in the growth patterns of west zone of Bhavnagar. It mainly aims to prepare the development planning proposal based on the analysis of existing land use land cover change.*

***Key Words*: Land use land cover change, Land use mapping, Bhavnagar, Landsat images, Geographical Information System**

1. INTRODUCTION

In an urban environment, natural and human-induced environmental changes are of concern today because of the deterioration of the environment and human health. The study of land use/land cover (LU/LC) changes is very important to have proper planning and utilization of natural resources and their management. Traditional methods for gathering demographic data, censuses, and analysis of environmental samples are not adequate for multicomplex environmental studies, since many problems often presented in environmental issues and great complexity of handling the multidisciplinary data set; we require new technologies like satellite remote sensing and Geographical Information Systems (GISs). These technologies provide data to study and monitor the dynamics of natural resources.

The recent development in the use of satellite data is to take advantage of increasing amounts of geographical data available in conjunction with GIS to assist in interpretation. GIS is an integrated system of computer hardware and software capable of capturing, storing, retrieving, manipulating, analyzing, and displaying geographically referenced (spatial) information for the purpose of aiding development-oriented management and decision-making processes. Remote sensing and GIS have covered a wide range of applications in the fields of agriculture, environments, and integrated eco-environment assessment. Several researchers have focused on LU/LC studies because of their adverse effects on the ecology of the area and vegetation.

The present study area witnessed rapid development during the past decades in terms of urbanization, industrialization, and also population increase substantially. The main objective of this study is to detect and quantify the land use land cover change in West Zone, Bhavnagar from 2005 to 2020 using GIS.

1.1 Problem Definition

- Due to rapid growth of built-up area, urban expansion has increased that ultimately change the direction of growth.
- Natural surface cover has been replaced that eventually resulted in urban sprawl.
- Land use land cover change has made impacts on environment as well as habitat quality.
- Misuse of land is determined due to rapid population growth.
- Lack of proper land use planning.

1.2 Objective of the Study

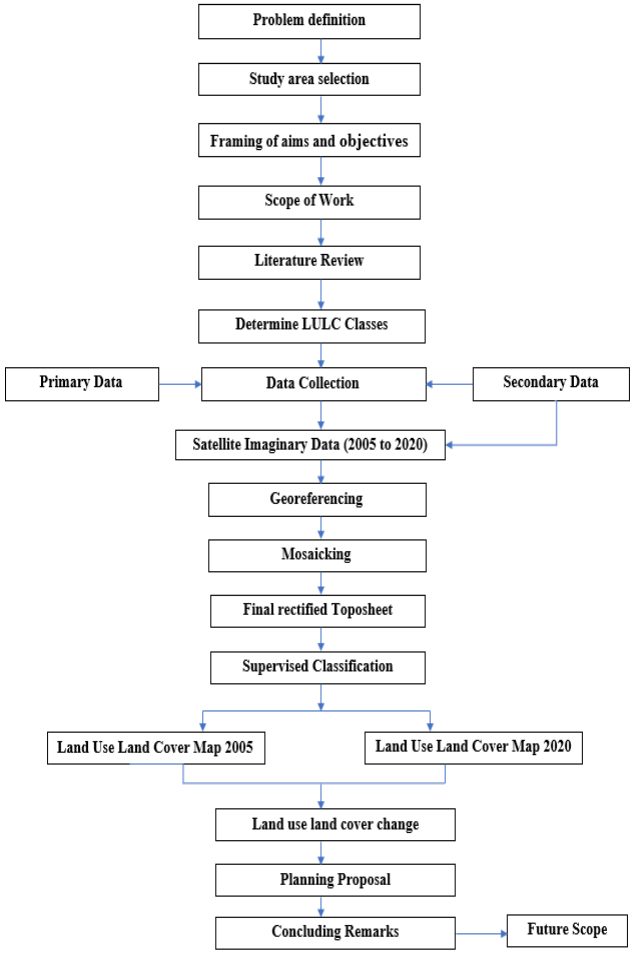
1. To analyze existing land use land cover of West zone, Bhavnagar.
2. To detect and quantify the land use land cover change of an area from 2005 to 2020 using satellite imaginary.
3. To evaluate impacts of land use land cover changes due to rapid urban expansion and forecast possible future changes in growth patterns.

1.3 Scope of Work

Land use land cover is classified in below mentioned categories for this study,

1. **Vegetation**
2. **Industrial**
3. **Barren Land**
4. **Water Body**
5. **Built-up land**

1.4 Methodology



2. Study Area Justification

Bhavnagar resides in Saurashtra region of Gujarat, a state of India. It has always been an important city for trade with many large and small-scale industries along with the world's largest ship-breaking yard at Alang.

Geographically, the district lies at 21°76'N latitude, 72°15'E longitude and 24 m altitude. In the year 2017, there was a total 2.76% forest area of total geographical area. The district encompasses a geographical area of 10,034 sq km. Major investments were witnessed in infrastructure projects during 1998–2007 which would further enhance the image of the district as a commercial region. The recent increase in the growth of food processing industries in the district has increased employment opportunities for the masses.

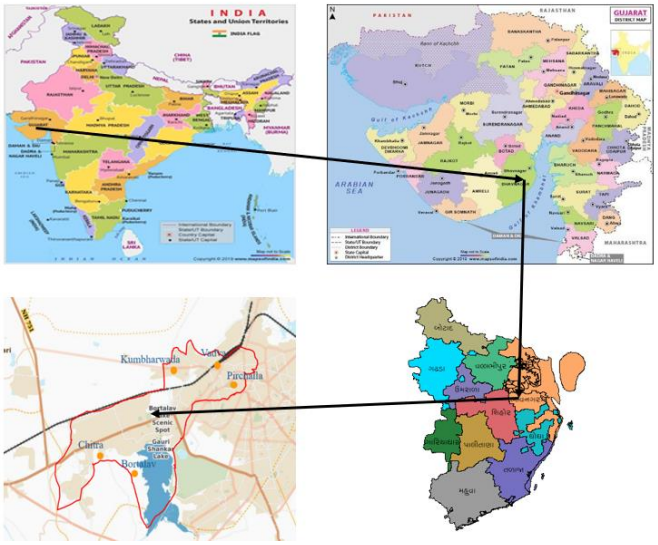


Fig.1 Study Area Location (West Zone, Bhavnagar)

The study area, West zone of Bhavnagar consisting of 6 wards – Chitra, Bortalav, Pirchhalla, Vadva 1, Vadva 2, Kumbharwada is shown in above image.

2.1 Growth of Population (West Zone, Bhavnagar)

Bhavnagar consist of total 19 wards. It has three zones- Central zone, West zone, East zone. The study area is West zone. West zone consists of five wards – Chitra, Bortalav, Vadva and Kumbharwada.

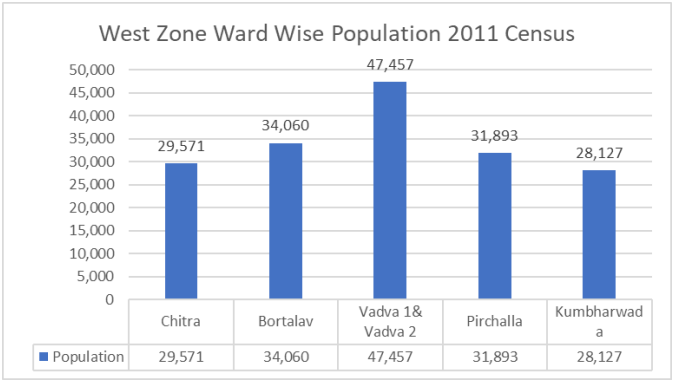


Chart 1 Population Growth (West zone, Bhavnagar)

3. Data Collection & Analysis

For this study, Landsat 8 OLI (Operational Land Imager) and Landsat 7 ETM (Enhanced Thematic mapping) with 7 bands is collected from USGS (United States Geological Survey) for the year 2010,2015 and 2020 to analyze the past land use land cover change. The Landsat image are captured from January to December for an entire year to investigate existing and past scenario of study area. Cloud Cover is 0% to eliminate the faded view of study area.

Table -1: Data Characteristics

Data Collection			
Satellite	Period	(Lat, Log)	Year
Landsat 8 OLI	1 Jan 2020 to 31 Dec 2020	(21.75598,72.146613)	2020
Landsat 8 OLI	1 Jan 2015 to 31 Dec 2015	(21.75598,72.146613)	2015
Landsat 7 EMI	1 Jan 2010 to 31 dec 2010	(21.75598,72.146613)	2010

3.1 Data Analysis of Land Use Land Cover 2020

Total area of West zone, Bhavnagar is 1614 hectares. The Coverage area observed as per LULC classes - Built-up area covers 724 hectares (44.60%), Water Body coverage is 155 Hectares (9.60%), Barren land coverage is 286 hectares (18.01%), Vegetation coverage in the area is 263 hectares (16.29%), Industrial area coverage is 185 hectares (11.46%).

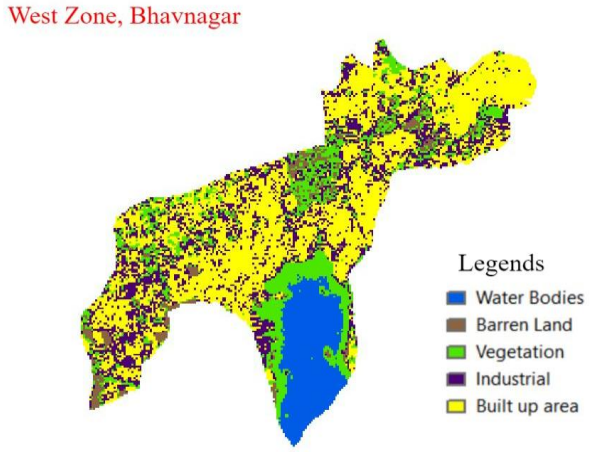


Fig. 2 LULC Map 2020

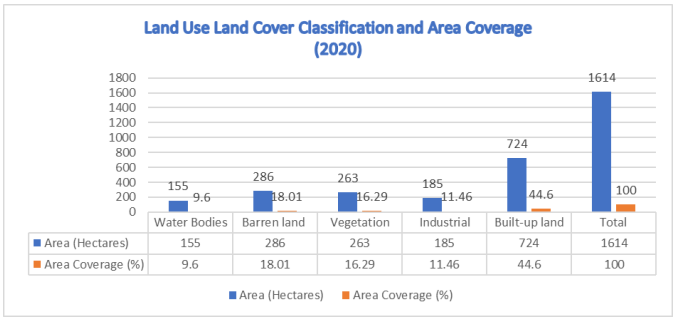


Chart 2 Land Use Land Cover Area and Area Coverage

3.2 Data Analysis od Land Use land Cover 2015

Total area of West zone, Bhavnagar is 1614 hectares. The Coverage area observed as per LULC classes - Built-up area covers 690 hectares (42.75%), Water Body coverage is 155 Hectares (9.60%), Barren land coverage is 342 hectares (21.36%), Vegetation coverage in the area is 273 hectares (16,72%), Industrial area coverage is 150 hectares (9.29%).

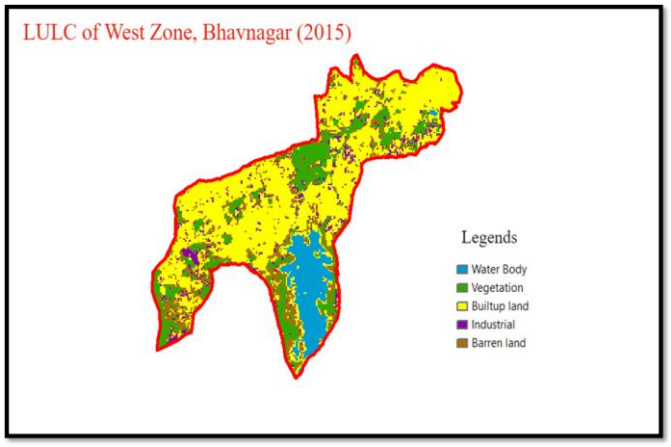


Fig.3 LULC Map of 2015

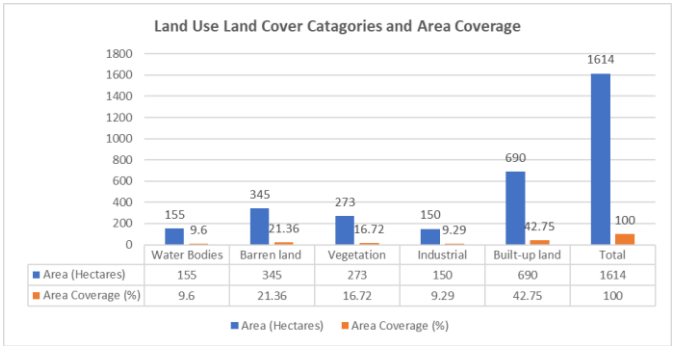


Chart 3 Land Use Land cover Area and Area Coverage (2015)

3.3 data Analysis of Land Use Land Cover 2010

Total area of West zone, Bhavnagar is 1614 hectares. The Coverage area obeseved as per LULC classes - Built-up area covers 690 hectares (42.10%), Water Body coverage is 155 Hectares (9.60 %), Barren land coverage is 405 hectares (24.73%), Vegetation coverage in the area is 253 hectares (15.48%), Industrial area coverage is 110 hectares (6.78%).

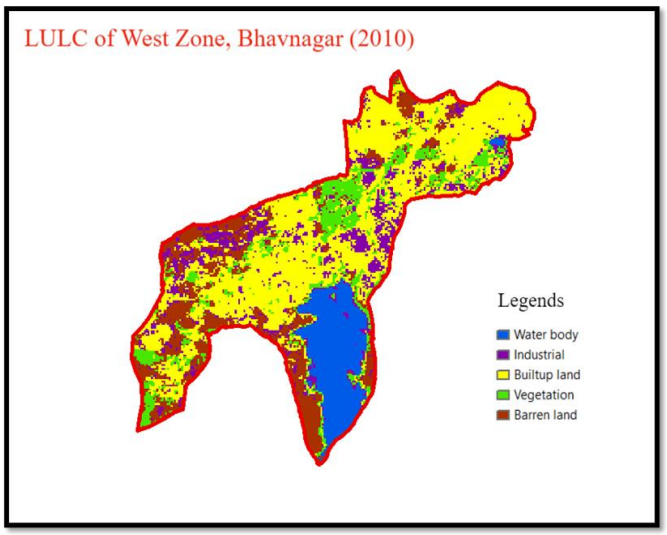


Fig.4 LULC Map 2010

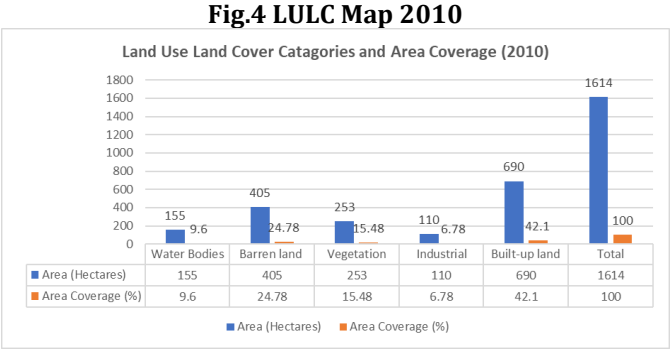


Chart 4 Land Use Land cover Area and Area Coverage (2015)

4. CONCLUSION

Land Use land cover change is observed in West Zone, Bhavnagar from 2010 to 2020. From 2010 to 2015, Industrial is increased by 2.51%. However, there is slight increase in Built-up area by 0.65%. Barren land is decreased by 3.02%. From 2015 to 2020, Industrial is again increased by 2% while built-up area is increased by 2%. Barren land is declined by 3.66%. From 2010 to 2020, barren land is declined by 6.68%, Industrial is increased by 4.68%, Built-up land is increased by 2.5%. Hence, it is concluded that industrial area is having an encroachment over Built-up area. Barren Land has been declined and Vegetation is also declined in 10 years.

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