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Preparation of LULC map and change detection of Navsari District

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***Abstract* — This project examines the use of GIS and Remote Sensing in mapping Land Use and Land Cover of Navsari District between 2008 and 2013. So the change in land forms has to be detected in this study. Subsequently, an attempt was made at projecting the observed land use land cover in the next 10 years. The result of the work shows a rapid growth in built-up land between 2008 and 2013.**

Keywords- water resource planning; land use; land cover; satellite imagery; geo-referencing; raster image

I. INTRODUCTION

Studies have shown that there remains only few landscapes on the Earth that are still in their natural state. Due to anthropogenic activities, the Earth surface is being significantly altered in some manner and man's presence on the Earth and his use of land has had a profound effect upon the natural environment thus resulting into an observable pattern in the land use/land cover over time.

The land use/land cover pattern of a region is an outcome of natural and socio – economic factors and their utilization by man in time and space. Land is becoming a scarce resource due to immense agricultural and demographic pressure. Hence, information on land use / land cover and possibilities for their optimal use is essential for the selection, planning and implementation of land use schemes to meet the increasing demands for basic human needs and welfare. This information also assists in monitoring the dynamics of land use resulting out of changing demands of increasing population.

Land use and land cover change has become a central component in current strategies for managing natural resources and monitoring environmental changes. The advancement in the concept of vegetation mapping has greatly increased research on land use land cover change thus providing an accurate evaluation of the spread and health of the world's forest, grassland, and agricultural resources has become an important priority.

Viewing the Earth from space is now crucial to the understanding of the influence of man's activities on his natural resource base over time. In situations of rapid and often unrecorded land use change, observations of the earth from space provide objective information of human utilization of the landscape. Over the past years, data from Earth sensing satellites has become vital in mapping the Earth's features and infrastructures, managing natural resources and studying environmental change.

Remote Sensing (RS) and Geographic Information System (GIS) are now providing new tools for advanced ecosystem management. The collection of remotely sensed data facilitates the synoptic analyses of Earth - system function, patterning, and change at local, regional and global scales over time; such data also provide an important link between intensive, localized ecological research and regional, national and international conservation and management of biological diversity.

Therefore, attempt will be made in this study to map out the status of land use land cover of Navsari district between 2008 and 2013 with a view to detecting the land consumption rate and the changes that has taken place in this status particularly in the built-up land so as to predict possible changes that might take place in this status using both Geographic Information System and Remote Sensing data.

II. MATERIALS AND METHODS

LULC change mapping will help to take up clear strategies for managing natural resources and monitoring environmental changes. Urban expansion has brought serious losses agricultural land, vegetation land in the recent years. The improper study of the urban land expansion is responsible for a variety of urban environmental issues like decreased air quality, increased runoff and subsequent flooding, increased local temperature, deterioration of water quality etc. Knowledge of drainage, LULC and hydro geomorphology and other terrain attributes are important for planning and management activities. Remote sensing and GIS both from the conventional sources has proved to be an effective tool in planning for land and water resources management and imply utilization of land and water resources for optimal and sustained production with min hazard to natural resources and environment.

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2.1 Study area

Navsari district is situated in the southern part of Gujarat State. It is one of the most important districts in Gujarat State bifurcated from Valsad district. It lies between Latitude 20°32' & 21°05' North and Longitude 72°42' & 73°30' east and falls in Survey of India Toposheet Nos 46C, 46D, 46G& 46H. It is bounded by Surat district in the north, Dangs district in the east, Valsad district in the South and Arabian Sea in the west. Navsari district has a geographical area of about 2210.97 sq. km.

The district comprises of five Talukas, i.e., Navsari, Jalalpore, Gandevi, Chikli, and Bansda. The administrative divisions of the district have been reconstituted recently by dividing Valsad district into two district such as Navsari in the north and Valsad in the south. There are 374 villages and 09 towns in the district. Index Map shows administrative boundies, drainage, topography, and ground water structures (Figure-1).

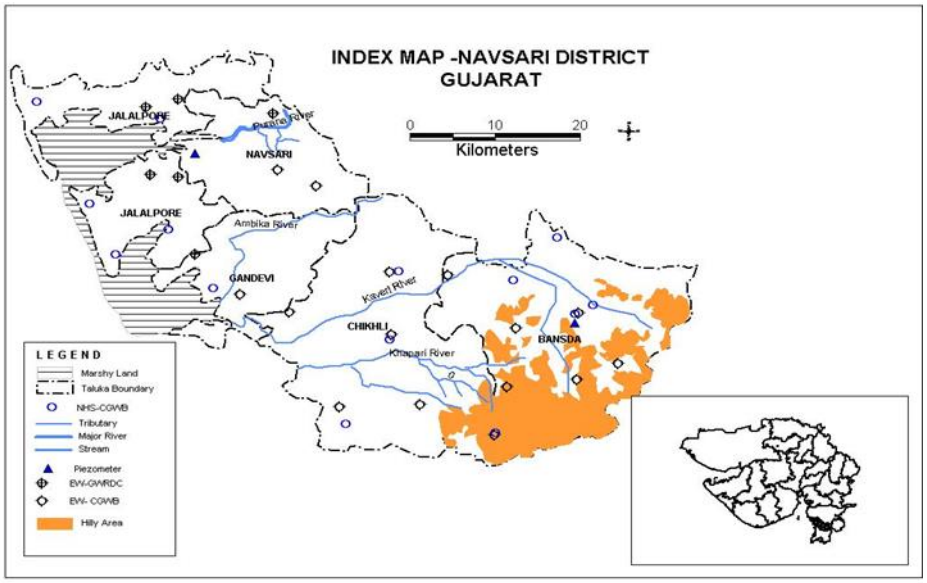

Figure 1 Index Map of Navsari District

2.2 Data sets

For the development of LULC map, and change detection the initial step is the data acquisition. This study is based on remotely sensed data combined with extensive field checks. Remote sensing is a strong tool for LULC classification study and both aerial photography and satellite imagery are appropriate for the preparation of LULC map; this is because it is generally concentrated within large area and the data is of a medium resolution. Sometimes, aerial photographs can be uneconomical and difficult to obtain, so quick updating and monitoring becomes difficult. Thus satellite imagery is often the better option.

Different countries have their agency for providing satellite and aerial data. In India, the National Remote Sensing Centre (NRSC), established in 1975 in Hyderabad, is an autonomous body under the Department of Space (DOS), Government of India which mainly carries out operational remote sensing activities. These activities are Satellite and Aerial data capturing, data processing, data dissemination and application for providing value added services and training to the client. The NRSC has a wealth of images from Indian and foreign remote sensing satellites in its archives and also has the capability to acquire data pertaining to any part of the globe on demand. NRSC also supports, through ANTRIX, establishment of International Ground System and International reseller network to receive, process and market IRS data products globally.

Some satellite data products have free access and they can be downloaded from different websites developed by the data provider. A variety of remote sensing systems exist, for which the specification is disturbed among a variety of websites from data providers, satellite operators and manufacturers. In order to choose a data product for a given project, a remote sensing data user must be aware of the different products and their applications.

Bhuvan-NRSC Open EO Data Archive (Bhuvan-NOEDA) facilitates free satellite data and derived products to select, brown and download satellite data and products with Metadata as per NSDI 2.0.

2.2.1 Properties of LISS images

Resourcesat-1 (also known as IRS-P6) is an advanced remote sensing satellite built by Indian Space Research Organization (ISRO) and it is tenth satellite of ISRO in IRS series. Resourcesat-1 carries three cameras with vastly improved spatial resolutions – a medium resolution Linear Imaging Self Scanner (LISS-III) operating in three spectral

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bands in VNIR and one in Short Wave Infrared (SWIR) 23.5 metre spatial bands in VNIR and one band in SWIR with 56 metres spatial resolution. Satellite imaginary properties are shown below in Table-1.

Satellite	Resourcesat-1
Sensor	LISS-III
No. Of Bands	4
Spectral Bands Wavelength (μm)	Band-2 (0.52-0.59) (Green) Band-3 (0.62-0.68) (Red) Band-4 (0.77-0.86) (NIR) Band-5 (1.55-1.70) (SWIR)
Spatial Resolution	23.5 m
Swath	141 km
Date Of Pass	11-12-2006
Path	93
Start And End Row	57, 57
Correction	Ortho Rectified
Accuracy	Better than 24 m

Table 1 Properties of Satellite Imagery

III. METHODOLOGY

The objective of this study forms the basis of all the analysis carried out in this chapter. The results are presented in form of maps, charts and statistical tables. They include the static, change and projected land use land cover of each class.

3.1 Development of Classification Scheme

Based on the priori knowledge of the study area for over 20 years and a brief reconnaissance survey with additional information from previous research in the study area, a classification scheme was developed for the study area after Anderson et al (1967). The classification scheme developed gives a rather broad classification where the land use land cover was identified by a single digit. The number of categories chosen for this study is given in Table-2.

CODE	LAND USE/LAND COVER CATEGORIES
1	Coastal land
2	Agricultural land
3	Water bodies
4	Forest land
5	Built-up land

Table 2 LULC Categories

3.2 Landsat Image Rastering in ArcGIS 10.2

When enlarged, individual pixels appear as squares. In computer graphics, a raster graphics image is a dot matrix data structure, representing a generally rectangular grid of pixels, or points of colour, viewable via a monitor, paper, or other display medium. Raster images are stored in image files with varying formats. Raster image of Navsari District is shown below in Figure-2

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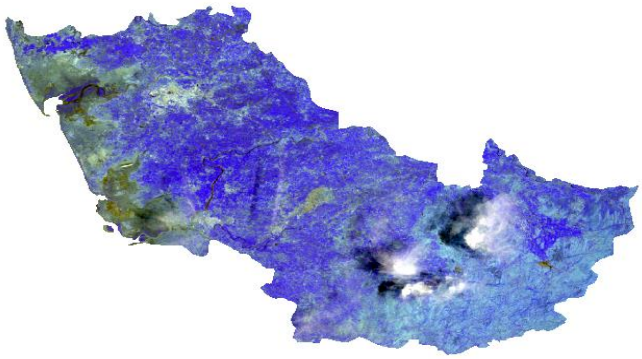

Figure 2 Raster Image of Navsari District

3.3 Land Use/ Land Cover Classification of Raster Image in ArcGIS 10.2

Creating a shapefile into folder connection and then go to "customization"→"Toolbar"→"image classification". Now draw polygons according visual land forms. Now it is seen that classes according to different land form categories are prepared in training sampler manager, so create a signature file. At final step LULC map of Navsari district is to be prepared using LULC classification, which is shown in Figure-3.

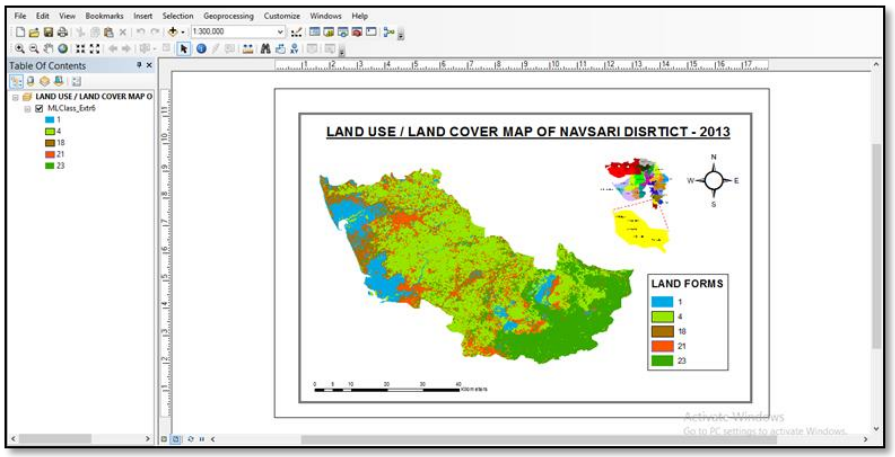

Figure 3 LULC Classification of Navsari District in ArcGIS 10.2

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IV. RESULT AND CONCLUSIONS

Land use / land cover map of Navsari District of year 2008 and 2013 are given below which were prepared by software ArcGIS 10.2 as shown above. Figure-4 shows LULC map of Navsari District of year 2008.

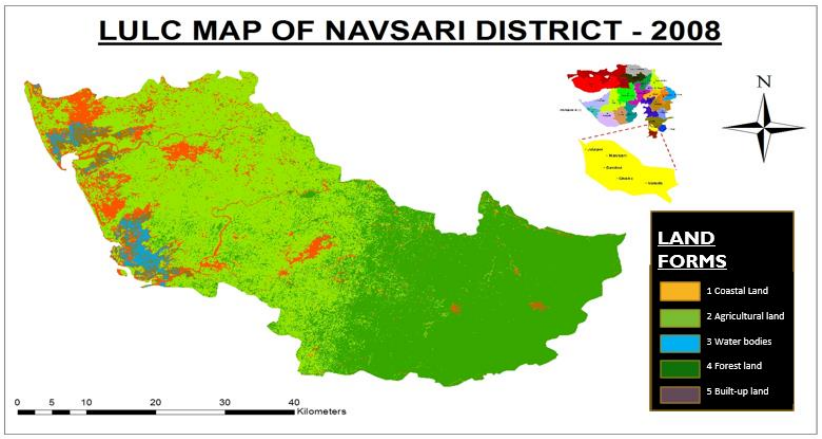

Figure 4 LULC Map of Navsari District of year 2008

Figure-5 shows LULC map of Navsari District of year 2013.

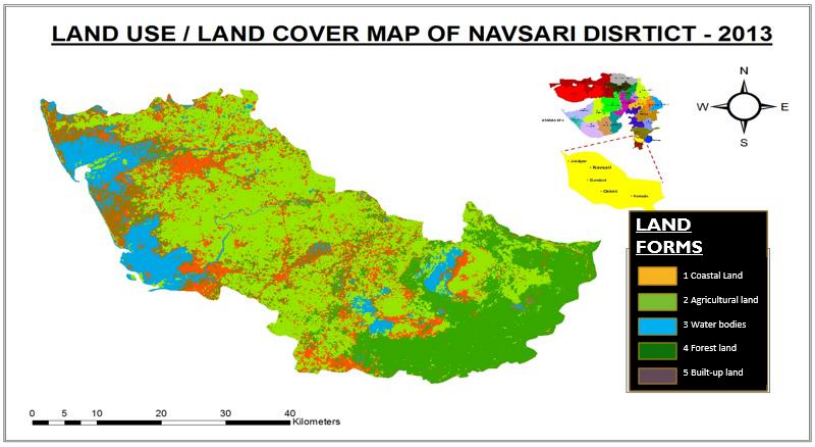

Figure 5 LULC Map of Navsari District of year 2013

Changes in land forms of Navsari District between years 2008 and 2013 are given in below table-3.

LAND USE / LAND COVER CATEGORIES	AREA IN 2008 (%)	AREA IN 2013 (%)
COASTAL LAND	2.57	10.21
AGRICULTURAL LAND	43.72	44.67
WATER BODIES	1.73	10.41
FOREST LAND	44.11	22.90
BUILT-UP LAND	7.87	11.81
TOTAL	100	100

Table 3 Land form areas of Navsari District of years 2008 and 2013

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