APPLICATION OF GEOSPATIAL TECHNOLOGY FOR LAND USE LAND COVER CHANGE DETECTION OF DHARBANDORA TALUKA OF GOA, INDIA

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Abstract

The term land can be defined as "a portrayal figure on the earth's surface enclosing all physical attributes of the biosphere and the also the immediate environment. The meaning of land use varies from natural scientists to social scientists. According to him 'natural scientists define land use in terms of syndromes of human activities than Social scientists define land use from the perspectives of socio-economic rationale and the mode of relative use of land. Land use is generally inferred based on the cover, yet both the terms land use and land cover being closely related are interchangeable. Settlement is covered but if we include buildings whether it is being used for residence or industrial activity, it shows the land use component. This paper is an attempt to assess the changes in land use/land cover in Dharbandora taluka, Goa State over 13 years. The study made use of ETM+ & OLI-TIRS Satellite Imageries with 30 m Spatial resolution for 2006 & and 2020 Year respectively. The results show that degraded Waterbody, Agriculture, Barren land, and Minning areas & its converted into Built-Up, Roads and forests. The increasing population and economic activities were noted to be putting pressure on the available land resources. This paper highlights the importance of remote sensing and GIS techniques in LULC Change Detection mapping of Dharbandora taluka, Goa State.

1. INTRODUCTION

Information regarding land cover is essential to outdo the problems arising from regular, uncontrolled progress and destruction of environmental quality, and loss of basic water bodies and their associated life forms while planning the national development. 'A high-quality understanding is necessary to ensure sustainable land use management'[1]. To amend proper development plans highly maintained and timely managed data regarding land cover and detection is a must[5]. Change detection in land use and land cover 'is the measure of the separable data layout and noticeable change in information that can lead to more visible insight into subtle process enclosing land cover and land use changes than the data observed from the usual change'[3]. In the modern era, adequate information is needed to make rational decisions about better administration, business, and establishment of institutions or industries, planning natural resource management, environmental protection, and so on Economic and cultural advancement can better be carried out only through the systematic and balanced utilization of land. Consequently, the knowledge about land use and land cover has become gaining importance day by day[7]. Change detection is the procedure of discovering and observing the difference in a

body or phenomenon by visualizing at difference times [2]. The better understanding of landscape change from past to present helps the planner to make sustainable management of resources. It is necessary for selection, planning and implementing, for evaluating and protecting the natural cover of the region thus protecting the environment[8]. In the present paper, LULC change and its impact are determined by using Temporal satellite imageries for two different years, i.e. 2006 and 2020 of Dharbandora taluka, Goa State, India.

2 STUDY AREA

  Dharbandora is the newest taluka of Goa. It was formed on 17th March 2011 and its amendment took place on 20th May 2011. It lies in the North district of the state of Goa. It is situated at the extent of 15.488271 meter N and 15.293274 meter N latitudes and 74.050761 meter E and 74.321222 meter E longitudes. Dharbandorataluka is surrounded by Sattari taluka to the north, Sanguem taluka to the south, Ponda taluka to its west and Joida taluka of Karnataka to its east. The location of Dharbandora taluka is represented (Fig I).
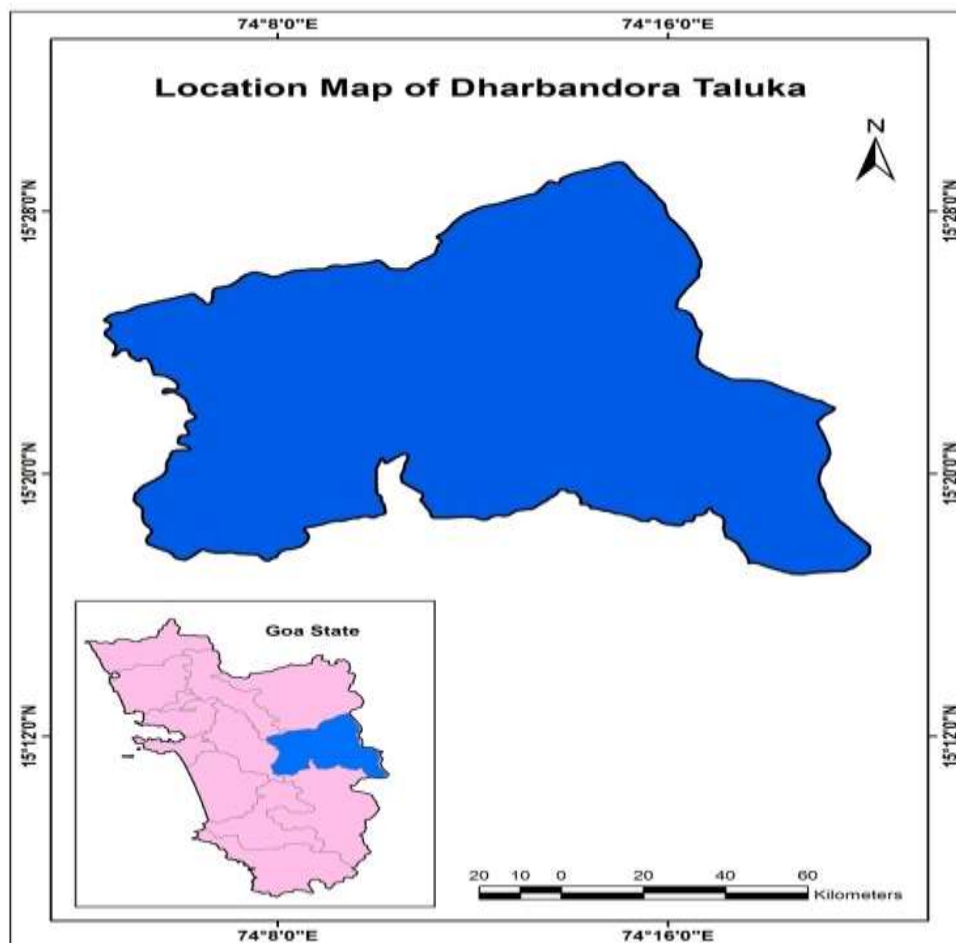

Fig -1: *Location Map of Dharbandora Taluka*

3 DATABASE & METHODOLOGY

3.1 Satellite Data

Landsat 7 and Landsat 8 satellite imagery of years 2003 and 2016 are obtained from www.glovis.usgs.gov.in.

Month and year	Satellite	Sensor	Resolution
January 2006	Landsat 7	ETM+	30m
January 2020	Landsat 8	OLI-TIRS	30m
Source: www.Glovis.usgs.gov.in			

Table 1: *Landsat imagery data*

3.2 Software used

a) ERDAS imagine
Used for satellite images enhancement, processing, classification and analysis

b) Q GIS 7.2.2
Used for study area digitization.

c) Arc GIS 10
Used for digitized temporal polygon layer union, cartography, map analysis and editing in maps.

subset of images and page layout generation.

d) Microsoft office Excel 2016
Is used for making PIVOT tables and graphs.

e) Microsoft office Word 2016
Is used for research paper writing

4 METHODOLOGY

The raster form of data that is satellite images that are of 2006 year and 2020 are downloaded from the www.Glovis.usgs.gov.in. Two different dates that are raw satellite images used were in the raster grid in which each cell have the value similar to a particular class. These images are corrected that is the radiometric and geometric correction is carried out.

Boundary of the Dharbandora taluka is extracted from the satellite image. For this the shape file is created first in the Arc GIS which is overlayed on it and the Dharbandora tehsil area from the satellite image is removed for this the extract by a mask.

Regional plan maps of the year 2006 and 2020 of Dharbandora taluka are being used as reference. For further reference Google earth maps of the year 2006 and 2020 are being referred. The Google earth maps of the Dharbandora taluka of the years 2006 and 2020 give a broad as well as a clearer idea of the ground features present on the satellite images. The Google earth maps help to identify the features on the satellite images.

4.1 Image classification

Image classification refers to the task of extracting information classes from a multiband raster image. The resulting raster from image classification can be used to create thematic maps. Image classification is of two qualitative (visual) image classification and quantitative (Digital) image classification.

4.2 Qualitative (visual) image classification

It is done using false color composite. False color refers to a group of color rendering methods used to display images in color which is recorded in the visible or non-visible parts of the electromagnetic spectrum. A false-color image is as image that depicts an object in colors that differ from those a photograph (a true-color image) would show. For true color, the RGB channels (red "R", green "G" and blue "B") from the camera are mapped to the corresponding RGB channels of the image, yielding an "RGB – RGB" mapping. For false color, this relationship is changed. The simplest false color encoding is to take an RGB image in the visible spectrum, but the map is different, e.g. "GRB-RGB".

Classification is done by using different keys to identify and classify different objects in the false color composite image. The tools or keys used in visual image classification are size, shape, color, shadow, texture, tone, pattern, association.

Pan sharpened tool is being used and clip operation is being carried out. Further, by using the map the digitization of the satellite image of 2006 and 2020 is carried out by using the cut polygon tool. The digitization is done in Arc GIS 10.2 and geo database file for 2003, 2016 are created. The attribute table of these two years is used in order to detect that how much area falls under each class. The number is assigned for each class and with the help of cut polygon, the digitization process is carried out the shape file is geo referenced in order to get the correct co-ordinate and it provides the attribute information of the region. This are then visually interpreted.

4.3 Matrix table

Further, in order to analyze or see the change that has taken place in the different classes of the land use land cover of Dharbandora taluka from 2006 to 2020 the matrix table is being created. To obtain the matrix table the union operation function of both files is carried out in the geo processing. In union operation, both the files of 2006 and 2020 of the Dharbandora taluka are over layed and the union area found. The union area which is being found is further used in the matrix. Matrix is a statistical tool which is being used in order to find out the change detection of the land cover over certain periods of time. It gives the details about the change which have occurred of land from one class to another class. The systematic distribution of the shift that happens or the land use and land cover is being identified and the areas are being calculated by using the matrix. By coping the area and the feature identities from the attribute table to MS excel. In MS excel a pivot table is being created. The pivot table gives areas of shifting of different classes over a period of 13 years from 2006 to 2020. The areas and classes are being shown in the pivot table. The results show positive and negative changes that have occurred in the areas of different classes in Dharbandora taluka from 2006 to 2020. The green color represents a positive change and the red color represents the negative changes that have occurred in the taluka. The diagonal blocks represents the unchanged area of different classes and is in yellow color. The total areas of each class are seen in the last row and column and the last block shows the total area of the taluka.

5 RESULT & DISCUSSION

There is a certain change in the land cover which has occurred in the Dharbandora taluka from 2006 to 2020. The forested area in 2006 and in 2020 does not show much of a difference in their land coverage but in 2006 there exist lesser forested cover towards the western part of the taluka. The area under barren land in 2006 is much more and in bigger patches exists in the western part and the central parts of the taluka as compared to 2020 where the size of the barren land patches decreases, But it can be observed that there exist more barren land in the eastern part of the taluka in 2020 as compared to 2006. In 2020 the ghat section of the taluka shows increase in the area under barren land. The area covered by the water bodies in 2006 and in 2020 of the Dharbandora taluka is almost the same. The area covered by built up area in the Dharbandora taluka in 2006 is observed to be very less. There exist small patches of land area under built up area mainly in the western and the central parts of the Dharbandora taluka. Most of the built up area is near the rivers and the agricultural area. The area covered by mining in 2006 is mainly concentrated in the south western and the south central parts of the taluka. There is a little area under mining towards the north central parts of the taluka. In 2020 mining can be observed in the same areas as in 2006 but in 2020 the size of the area under mining has considerably decreased.
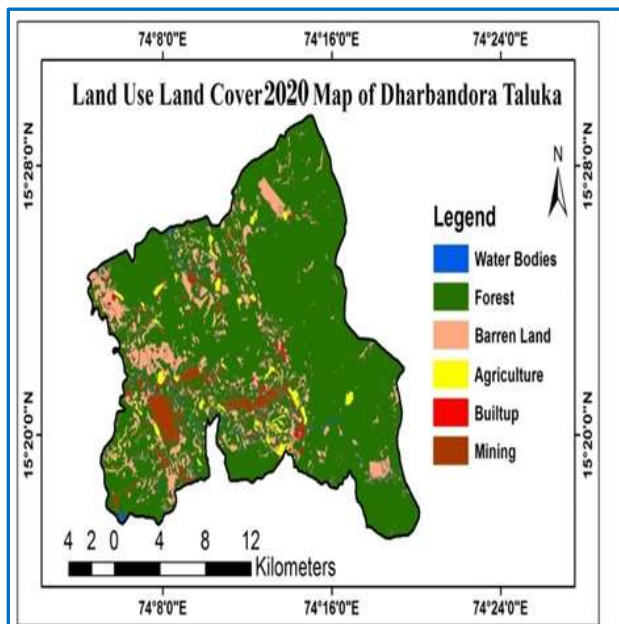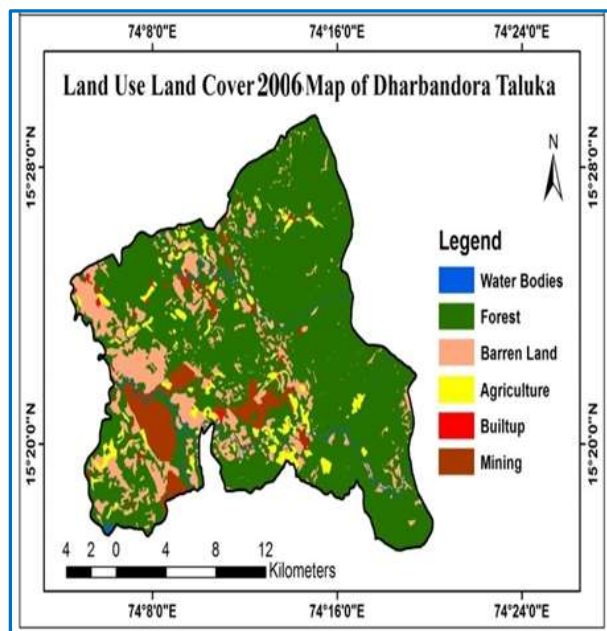
Fig- 2: LU/LC of 2020

Fig- 3: LU/LC of 2006

Table -1: Matrix Table Land use Land cover   conversion 2006 to 2020

Categories 2020	2006 Waterbodies	Forest	Barren land	Agriculture	Built up	Mining	Grand Total
Waterbodies	195.885334	52.543824	12.705109	4.051596	0.788161	1.709721	267.683745
Forest	194.779977	24888.91325	1929.216007	580.267619	150.275065	572.477223	28315.92914
Barren land	26.025519	1466.119978	2955.288147	306.732674	60.645111	336.680857	5151.492286
Agriculture	13.703473	230.640865	118.977333	578.245751	30.704162	13.502976	985.77456
Built up	0.518194	200.731719	154.230275	46.533167	102.520346	19.898258	524.431959
Mining	0.362835	129.75768	195.01954	13.016232	2.163871	1023.976249	1364.296407
Grand Total	431.275332	26968.70732	5365.436411	1528.847039	347.096716	1968.245284	36609.6081

Positive change	
Negative change	
Constant area	

6 CONCLUSION

Though in the study it can be observed that there aren't any drastic changes happening in the land use land cover area of the Dharbandora taluka. But changes have occurred in different classes of the land of the Dharbandora taluka. The water bodies show a decrease in its coverage from 1.17% in 2006 to reducing to 0.73% by 2020. This indicates that the natural water bodies in the taluka are decreasing. The forest cover in 2003 was 73.66% which has increased to 77.34% in

2020, which is an increase of 3.68% in the total forest cover of the Dharbandora taluka. The increasing forest cover is a positive thing happening to the environment and the local habitats of the taluka.

The barren land cover in 2006 was 14.65% and has decreased by 14.07% by 2020. There is a decrease of 0.58%, which shows that the barren land in the Dharbandora taluka is going through a steady decrease, which is a good thing for the environment. The agricultural area from 4.17% in 2006 has decreased to 2.69% in 2020. This shows a decrease of 1.48% in the agricultural area of the taluka, which suggests that agriculture is decreasing in Dharbandora taluka and people of Dharbandora taluka are taking up other occupations.

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