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RESEARCH ARTICLE

APPLICATIONS OF REMOTE SENSING GIS FOR LAND USE AND LAND COVER CHANGE ANALYSIS OF GADAG TALUK, KARNATAKA

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ABSTRACT

In India, urbanization is progressing at a rapid pace. The urban population was 11.4% at the 1901 census. This percentage gradually increased to 31.16% according to the 2011 census. The main side effect of urbanization is the conversion of agricultural land to non-agricultural land use. This article aims to identify changes taking place on agricultural land and transform them into a different type of land cover (LULC). To achieve this goal, land-use change mapping is done using Remote Sensing and GIS. The study used satellite imagery along with field studies and statistical data to detect a change in agricultural land into a different LULC type at Gadag Taluk in the Gadag District. This study is conducted over a 13-year period from 2001 to 2014. This paper presents in detail the expansion and shrinkage of agricultural land and open areas at the Taluk level. Resourcesat -LISS III and IV data as well as Sentinel-2 were used in this study. LISS and MSI images from the study period, i.e. from 2001 to 2014, are collected and then pre-processed. The classification of images is done manually. Training samples are collected using ground truth information (GCPs). The identification of land use changes is done on the basis of polygons. This would determine which LULC class is mainly responsible for agricultural land shrinkage. These space-time and statistical studies will help build the basis of a model of sustainable development

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INTRODUCTION

Indian economy majorly depends upon the agriculture. India is considered as the agricultural country (Brien *et al*., 2004). Here the agriculture is continuously facing challenges because of climate change, crop diseases, insufficient irrigation and volatile market (Bhan and Behera, 2014). Agricultural land loss is a global problem (Ghar *et al*., 2007). In order to preserve nature and ensure output the sustainable agriculture concept has been given (Mendas and Delali, 2012). GIS and remote sensing can be used to support the agriculture. Several papers were found where these techniques are utilised in agriculture. Some of these are discussed here. Ray and Dadhwal (2001) have applied remote sensing and GIS to compute evapotranspiration in disease free crops. Some researchers have utilised satellite imagery for land suitability assessment for agriculture which is a very essential feature for agriculture development and future planning (Abdelrahman *et al*., 2016; Bandyopadhyay *et al*., 2009). Land Use Land Cover (LULC) informs the type of human activity or natural cover present at a particular location (Kassawmar *et al*., 2016). 20 Change detection in LULC of any geographic location by using multi-temporal satellite imagery helps in understanding landscape dynamics (Rawat and Kumar, 2015). Conversion of agricultural land into non- agricultural use is the major problem of urbanization (Fazal, 2000).

Classification of satellite image is used for converting the image into LULC map. It is the way for allocating pixels to particular classes. Pixel is an individual unit made out of values in several spectral bands (Lillisand *et al*., 2004). There are many satellite missions launched by different countries which are used for research works but only some of them are freely available. Landsat images are used in this work. They are open source and freely downloadable (Hu *et al*., 2016). Landsat data are used in LULC change studies because of the continuous availability of images (Hansen and Loveland, 2012). It would provide the indetails of expansion or shrinkage of agriculture land.

STUDY AREA AND DATA USED

The Gadag-Betageri is a city municipal council in Gadag district in the state of Karnataka, India. It is the administrative headquarters of Gadag District. The original city of Gadag and its sister city Betageri have a combined city administration. The Study area of the present work is Gadag Taluk of Karnataka as shown in Figure 1. Gadag Taluk, Gadag district, Karnataka State. Gadag Taluk located in the western part of northern Karnataka lies between 14º 56' to 15º 53' North latitude and 75º 17'to 76º 02' East longitudes.it falls in northern dry zone of agroclimatic zones of Karnataka which has mean elevation of 800m to 900m and annual rainfall ranges from 500mm to 625mm.

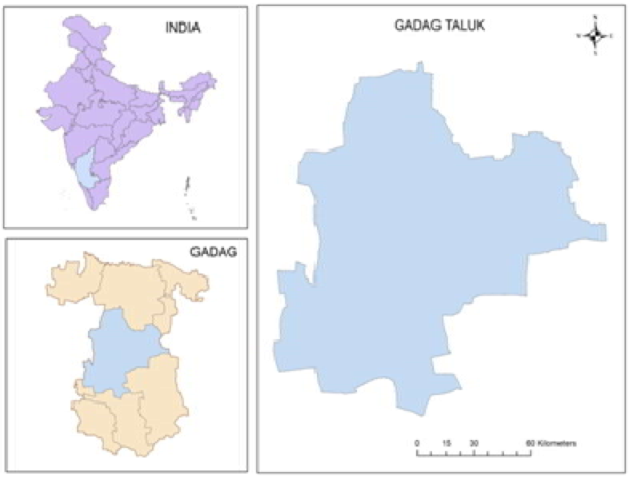

Figure 1. Study area map Gadag Taluk

METHODOLOGY

The study involves the analysis of agricultural and open land use change in Gadag Taluk. Seven major LULC classes are present in the Gadag Taluk. For getting LULC information from satellite imagery visual interpretation and digital image processing methods has been used.

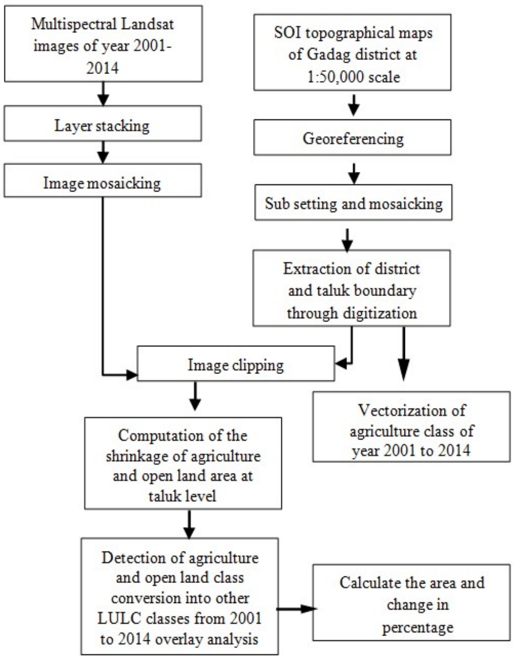

Figure 2. Flowchart of methodology

To recognize and delineate objects in the image various elements of visual image interpretation is used like size, shape, tone, surface and association. The overall methodology of this work is performed on ArcGIS software. After scanning, georeferencing is performed using affine transformation and nearest neighborhood interpolation technique. In this datum is set to WGS 84 and projection is set to UTM. Then sub-setting and mosaic king of all maps is done Landsat satellite and Resource sat image are used in this work which are open source and freely downloadable. As per available data, images of Landsat Enhanced Thematic Mapper plus (ETM+), Thematic Mapper (TM), and Operational Land Imager (OLI), Resourcesat LISS III sensors are used for 2001 to 2014, respectively. The spatial resolution of images is 30m.The images of the study area are delineated with the help of Survey of India (SOI) top sheet. SOI topographical map of OSM series cover the whole geographic extent of the study area are used. These maps are at the scale of 1:50,000.

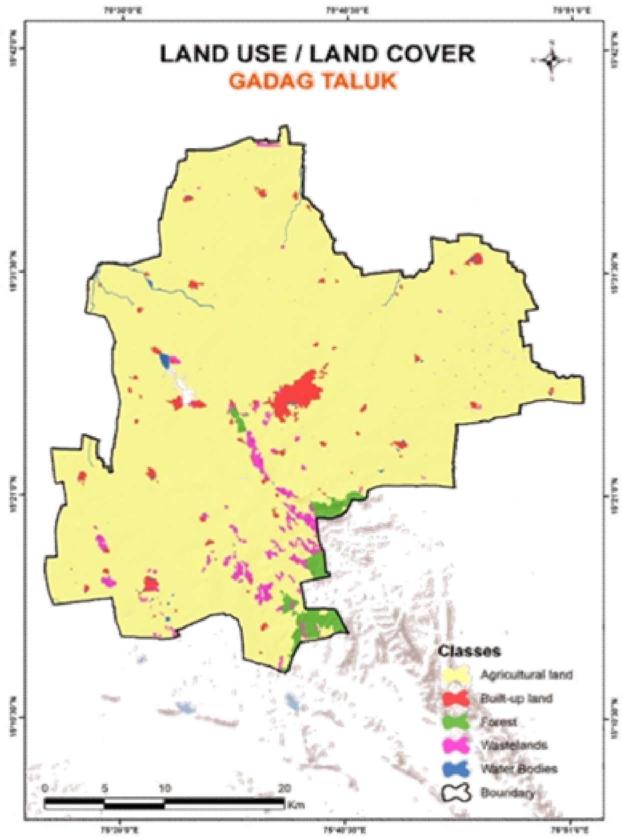

Figure 3. Gadag Taluk LULC map of year 2001

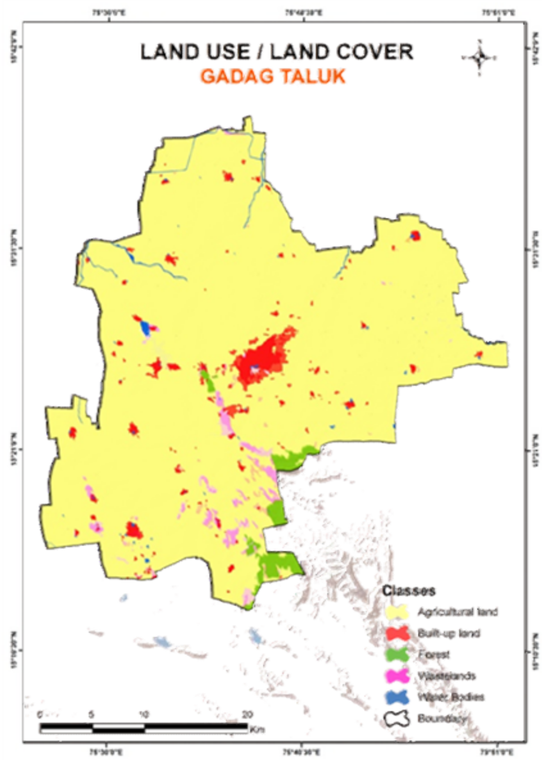

Figure 4. Gadag Taluk LULC map of year2014

RESULT AND DISCUSSION

The LULC map has been generated from the integration of remote sensing data i.e. pixel values with thematic features present on the earth surface. The image is classified into seven LULC classes viz agriculture, built-up, forest, wasteland, water bodies. Accuracy assessment of this classification is then performed.

Table 1. Change in features area from year 2001 to 2014. All values of area are in km^2

Sl.No	Class	Area in 2001	Area in 2014
1	Agriculture and open land	1016.44	1007.35
2	Other LULC classes	71.627	85.38

Table 2.LULC classes. All values of area are in km^2.area is very slight in 2014

Class	Transformation of agriculture and open land into other LULC classes			
	2001		2014	
	Area	%	Area	%
Agriculture Land	1016.44	93.42	1007.35	92.19
Built Up	22.38	2.06	37.00	3.39
Forest	19.26	1.77	19.93	1.82
Wastelands	3.80	0.35	21.10	1.93
Water Bodies	20.35	1.87	7.35	0.67

The ground information or previous knowledge of ground truth for assessment of classified image accuracy is required. This information is collected through SOI topographical maps, Google Earth and field survey. One of the most important ways to express the classification accuracy is by the preparation of classification by investigation ground and validation. Figure: 3, 4 and are the maps of Gadag Taluk which is showing two LULC classes of the year 2001and 2014. This map is obtained after manual (digitization) classification. In the map, agriculture and other land classes are clubbed together and are shown by the various colors ramps. From the maps it can be clearly visualized that the area of yellow color is continuously shrinking while the red color area is increasing. From this it apparent, that over the years there is a significant loss of agriculture land in 2014 and where agriculture could be done. The decreasing of the agriculture land more from 2014 compared to 2001. Further the study is carried out at the Gadag. For this area of agriculture and open land is calculated for each tehsil. The area change from 2000 to 2013 is shown in Table1.

Transformation of agriculture and open land use area into other LULC classes: As per the above discussion about the area of different LULC classes, it can be concluded that a small amount area of agriculture land is converted into other LU classes. To study this, the class transformation of the agriculture and open land area from 2000 to 2013. Agriculture land converted into other LULC classes as shown in table 2. From this table it can be seen that the maximum loss of agriculture land is due to increase in built up land. Reduction in the agriculture land use area. As per the GIS based calculations the agriculture land use area was 1016.44 km2 in the year 2001 and 1007.35 km2 in the year 2014. The total reduction from 2001 to 2014 is 9.09 km2.

CONCLUSION

The aim of this paper is to investigate the LULC and agriculture and open land changes occurred in Gadag taluk due to rapid urbanization from year 2001 - 2014 using Landsat 7 ETM+ Resources at LISS III satellite images. From the analysis it is concluded that the rate of agriculture shrinkage is increasing day by day. The image classification is performed to create the LULC mapping of the Gadag Taluk On the basis of this classification it is concluded that there is a constant. As there is a constant shrinkage of agriculture and open land use area, therefore it is required to identify the LULC classes in which they are converting. For this LULC transformation study is carried out. From this it is concluded that most of the agriculture land area is converted into the built up area. This conversion was 3.39 % in between year 2001 to 2014.

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