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Impact of Urbanization on Land Use Land Cover – A Case Study of Banglore Rural Region Using GIS and Remote Sensing Techniques

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ABSTRACT

Remote sensing is one of the tool which is very important for the production of Land use and land cover maps through a process called image classification. The changes in land use and land cover help the planning Authority to identify imbalance in urban development, water resources, waste land and Agriculture. The LULC map Developed of the study region also helps to take corrective actions for the imbalances detected. For the image classification process to be successful, several factors should be considered including availability of quality Land satellite imagery and secondary data, a precise classification process and user's experiences and expertise of the procedures. The objective of this research was to classify and map land-use/land-cover of the study area using remote sensing and Geospatial Information System (GIS) techniques for the study area Bangalore rural district, which consists of four taluks Nelmangla, Hoskote, Devanhalli and Doddaballapura. This research includes Land use/Land cover (LULC) classification .In this study supervised classification was performed and The major LULC classified for the year 2000 were agriculture(82.00 %) , water body (5.05%), and built up areas (2.67%), forest (5.4%), waste land (4.9%) and for the year 2010 were agriculture(81.53%) , water body (4.545%), and built up areas (5.75%), forest (5.5%), waste land (2.46%). This study presents essential source of information whereby planners and decision makers can use to sustainably plan the urban growth.

Keywords : Geographical Information Systems (GIS), Land Use Land Cover (LULC), Remote Sensing

I. INTRODUCTION

Land use and land cover information is considered essential for policy making, business and administrative purposes. By considering spatial details like the data is very important for environmental protection and spatial planning. Land use classification is vital because it gives data which can be used as input for modelling, especially the one dealing with environment, for instance models deals with climate change and policies developments [1]. Hence the combined LULC grant a comprehensive means of understanding the interaction of geo-biophysical, socioeconomic systems behaviours and interactions [2]. To provide more useful information in land cover, Remote Sensing is often paired with Geographic Information System (GIS) technique.

Remote sensing is the main source for several kinds of thematic data critical to GIS analyses, includi9ng data on land use and land cover characteristics. Aerial and Landsat satellite images are also frequently used to evaluate land cover distribution and to update existing geospatial features. With the introduction of remote sensing systems and image processing

software, the importance of remote sensing in Geospatial Information System (GIS) has expanded significantly [3]. The faster usage of remote sensing data and techniques has made geospatial process faster and powerful, although the increased complexity also creates increased possibilities for error.

The objective of this research was to classify and map land-use/land-cover of the study area using remote sensing and Geospatial Information System (GIS) techniques.

II. STUDY AREA

Bangalore Rural district is located in the south-eastern corner of Karnataka. The district is covered with the latitudes 12°98'11" to 13°28'00" N and longitudes 77°57'46" to 77°60'00" E. The District has four taluks viz. Devanhalli, Doddballapura, Hoskote and Nelamangala. The district is surrounded by Tamil Nadu State on the East, Tumkur and Mandya districts on the West, Chamarajanagar on the South and Kolar and Tumkur districts on the North. Administrative Setup: The Bangalore rural district has 1061 village 185 Panchyat 22 hoblies covering area of 2298 sq km. Population: According to 2011 census, Bangalore Rural district population was 990,923 were 509,172 male and 481,751 female. The study area is shown in Figure 1.

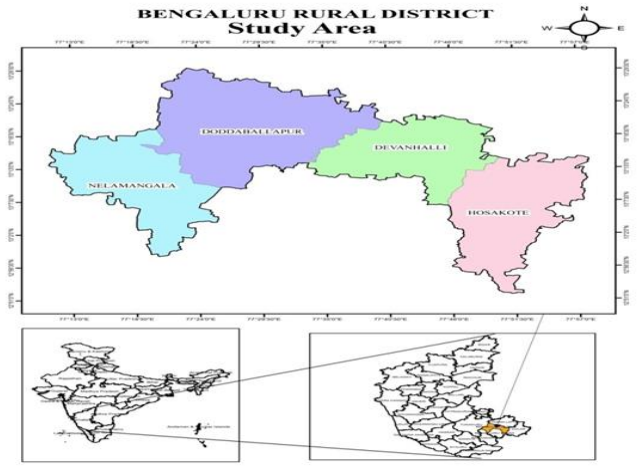

Fig 1: Location of study area Map

III. MATERIALS AND METHODS

The present research covers Land use/Land cover (LULC) classification. The land use/cover classification of the study area was carried out as per the methodology shown in the figure 2. Land use/ Land cover Classification Image Pre-Processing Classification process and analysis of the different LULC classes were done using Land sat satellite images. The Land sat images were downloaded from United States Geological (USGS) Earth Explorer (https://earthexplorer.usgs.gov/). The selection of the Landsat satellite images dates was influenced by the quality of the image especially for those with limited or low cloud cover. Each Landsat was geo-referenced to the WGS_84 datum and Universal Transverse Mercator Zone 35 North coordinate system.

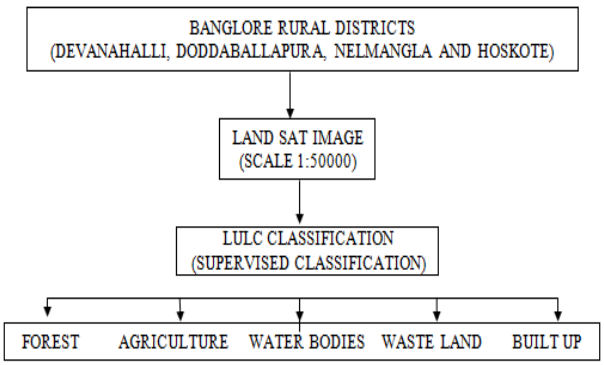

Fig. 2 Parameters for Land Use and Land Cover Classification

IV. LAND USE/ LAND COVER (LULC) CLASSIFICATION

For the Bangalore Rural District study area, supervised classification was carried out. As per this supervised classification Bangalore rural area comprises of four taluks Devanahalli, Doddaballapur Nelmangla and Hoskote. From this classification "the user develops the spectral signatures of known categories, such as forest, Agriculture, water bodies, waste land and Built up area. Then the software assigns each pixel in the image to the cover type to which its signature is most comparable". "Supervised classification is the process most frequently used for quantitative analyses of remote sensing image data".

The supervised classification was applied after defined area of interest (AOI) which is called training classes. More than one training area was used to represent a particular class. The training sites were selected in agreement with the Landsat Image, Google Earth and Google Map (Figure 3). The basic sequence operation followed on supervised classification was.

From this supervised classification it is observed that in Devanhalli taluk due to construction and industrial activities the land use and land cover has been impacted and converted from agricultural land to build up area and other public utilities have come up from the last ten years. Similarly in other taluks of Bangalore rural district Dodabbalpur , Hoskote and Nelmangla there is Dramatic increase in growth of urbanization , industrial activities And also in educational infrastructures. It is seen that waste land is converted to build up area and due to impact on urbanization there is decrease in water bodies also from the last 10 years.

3.1 Steps of Supervised Classification:

STEP 1:

Defining of Training Sites:The first step is to undertake supervised classification by defining areas which will be used as training sites for each land cover class. This is usually done by using the on-screen digitized features. The created features are called Area of Interest (AOI).The selection of the training sites was based on those areas clearly identified in all sources of images. In this study, one hundreds training sites were been identified.

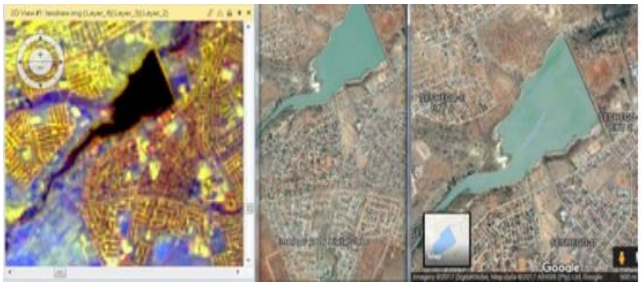

Fig. 3: Identification of training sites using Landsat image

STEP 2:

Extraction of Signatures: After the training site (AOI) being digitized, the next step was to create statistical characterizations of each information. These are called Signatures editors in ERDAS Imagine 2015. In this step, the goal was to create a signal (SIG) file for every informational class. The SIG files contain a variety of information about the land cover classes described.

STEP 3:

Classification of the Image (Supervised classification): The supervised classification has been applied after defined training classes. One or more than one training area was used to represent a particular class. During the supervised classification process, the entire Signature editor was selected in order to be used on the classification process. . Then the classify was selected from the Editor Menu bar, classify/supervised. Non Parametric Rule was used in this classification. The Image was classified into five classes namely; Agriculture, built up, forest, waste land and Water body.

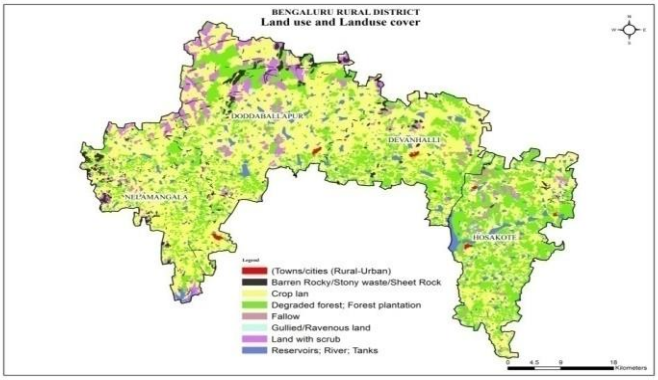

Fig.4: Classified map of 4-Taluk in Bangalore Rural District

V. CLASSIFICATION RESULTS AND DISCUSSION

Supervised classification was carried out for study area Bangalore Rural District. The area of each class was calculated taking into account the pixel count and total area (study area). Thus allocations of each classified area, (percentage) are tabulated in Table 1. The percentage of areas as classified are; for the year

2000 and 2010 were agriculture (81.53.00 %) , water body (5.05%), and built up areas (2.67%), forest (5.4%), waste land (4.935%) and similarly Agriculture (81.35.0%), built up areas (5.75%), Forest (5.4750%), waste land (2.46%) and water bodies (4.54%) respectively. Agriculture was found to be the dominant type of Land use classified which covers about 81.53% of the total study area, followed by Built-up areas while the least classified was waste land which accounts for 2.46% and it is also observed from the results there in more impact on land due to urbanization, industrial activities etc from the last 10years

Table- 1: Land use classes Classification of Doddaballapur, Devanhalli, Nelmangla and Hoskote (Bangalore Rural District) (2000)

Land cover	Area in Km²	Percent
Agriculture	1215177874	81.53
Built-up	12607144.28	2.67
Forest	24247086.03	5.5
Wasteland	26934626.87	4.935
Water Bodies	21055925.54	5.05

Table - 2: Land use classes Classification of of Doddaballapur, Devanhalli, Nelmangla and Hoskote (Bangalore Rural District) (2010)

Land cover	Area in Km²	Percent
Agriculture land	585333492.6	81.35
Built up land	32307320.56	5.75
forest	48261605.09	5.475
wasteland	17686031.54	2.46
water bodies	29128147.82	4.54

From Figure 5 is observed a pie chart of LULC for the year 2000 and the results for the year 2000 is shown in a pie chart covering agriculture, builup, forest, waste land and water bodies' categories of each area in percentage.

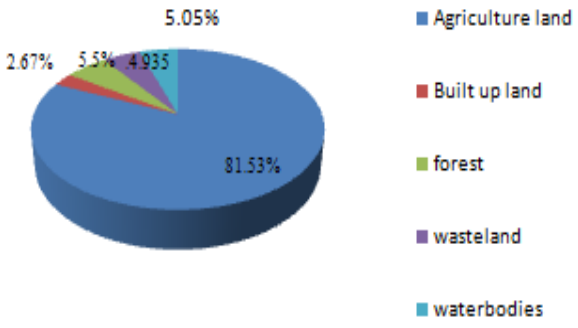

Fig. 5: Pie chart of LULC classification 2000

From Figure 6 is observed a pie chart of LULC for the year 2010 and the results for the year 2010 is shown in a pie chart covering agriculture, built up, forest, waste land and water bodies' categories of each area in percentage.

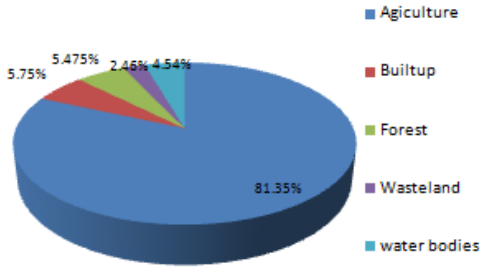

Fig.6: Pie chart of LULC classification (2010)

TABLE 3: LULC changes observed from the Results of Supervised Classification:

LAND COVER	2000	2010	Change
Agriculture land	81.53	81.35	-0.175
Built up land	2.67	5.75	+3.08
forest	5.5	5.475	-0.025
wasteland	4.935	-2.46	-2.475
Water bodies	5.05	4.54	-0.51

VI. CONCLUSION

The supervised classification was performed for four Taluks of Bangalore rural district using Non Parametric Rule.

i. The image is classified in to 5 classes; Agriculture land, Built up land, forest, waste land and water bodies.
ii. Agriculture was found to be the dominant type of Land use classified which covers about 81.53% of the total study area, followed by Built-up areas while the least classified was waste land which accounts for 2.46% and it is also observed from the results there in more impact on land due to urbanization, industrial activities etc from the last 10years.
iii. From the classification it is observed that there is increase and decrease in land use and land cover pattern taken place from the last 10 years.
iv. The changes are due to International Air Port at Devanahalli taluk. In Devanahalli it is seen that majority of the waste land is converted to built up area and there by decrease in the agriculture activities.
v. In other three taluks of Bangalore rural slight variations are observed due to increase in growth of urbanization, industrial activities and many educational infrastructures are brought from the last 10years.
vi. The changes which is observed in LULC pattern brings changes in socio-economic conditions of people connected with different land cover and also in the usage of land changes, in the social production relations (that people must enter into in order to survive, to produce, and to reproduce their means of life).

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