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RS and GIS Application for Land use Land Cover Mapping of the Narihalla Watershed Sandur, Bellary District, Karnataka, India

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***Abstract*— In the present study, we created a land use and land cover map of the Narihalla watershed in Sandur Taluk, Bellary District of Karnataka using IRS LISS III satellite and Google Earth images on a 1:50,000 scale, along with collateral data such as topographic maps on the same scale in GIS platform, using ArcGIS, ERDAS, and QGIS software. In this study, the major land use land cover is categorized into five types, which are as follows: Built-up land, Agricultural land, Forest land, Wasteland, and Water bodies. All settlements are included in built-up land. Cropland, fallow land, and plantation land are all forms of agricultural land. Scrub degraded forest land, forest plantation are examples of forest land. Wasteland was defined as land with and without scrub, barren rock/stony waste, and mining/industrial waste, and water bodies were defined as streams, reservoirs, and lakes. Image features such as tone, texture, shape, color, association, and so on are interpreted using the Classification scheme developed by National Remote Sensing Agency (NRSA, 1995) standard methods. During the interpretation, doubtful units are verified by field verification. From this study, we estimated agricultural land covered a maximum area of about 44%, Forest, Built-up land, wasteland, and water bodies cover an area of about 32.7%, 3.50%,18.23%, and 2.05% respectively. Remote sensing and GIS techniques are extremely useful tools for effectively delineating land use and land cover maps, which saves time and money and gives a solution for future LU/LC management plans.**

Keywords*— *RS and GIS, Narihalla watershed, Land use land cover pattern.

I. INTRODUCTION

The land is the most natural resource on which all man activities are based. Growing population and human activities have increased the demand for limited land and soil resources for Agriculture, Forest, Mining, and Industrial land uses. Information on the rate and kind of changes in the use of land resources is essential for proper planning and management. Further, Land use data are needed in the analysis of environmental processes and problems (Anderson et al., 1976).

Land cover is a fundamental parameter describing the earth's surface. Changes in land use can be due to urban expansion and the loss of agricultural land, changes in river regime, the effect of shifting cultivation, the spread of erosion and desertification, and so on. This requires not only the identification of features but also the comparison of subsequent data to recognize when rapid changes have taken place. Various hydrological processes such as interception, infiltration, evapotranspiration, soil moisture, runoff, and groundwater recharge are influenced by land use/land cover characteristics of the region (Jaiswal et al, 1999, Minakshi et al, 1999, Bektaa, 2005)

Urbanization has enhanced resource exploitation and changed land use and land cover patterns. The National Remote Sensing Agency (NRSA) created a national land use and land cover classification system in 1989, The primary goal of this nationwide land use land cover categorization is to create a framework for covering all of the different land use land cover types accessible in India, which could then be mapped using satellite data through visual interpretation as well as digital techniques. The basis for any development planning is information on existing land use/land cover and the pattern of their geographical distribution.

II. STUDY AREA

The present LU/LC Mapping is carried out for the Narihalla watershed which lies in the Sandur taluk of Bellary district in the State of Karnataka. it is located between 15° 13' 39.45"N and 14° 52' 33.15"N in latitude and 76° 25' 23.03"E and 76° 40' 31.50"E in longitude, and is covered by an area of 56039.2 Hectares. Fig.1 depicts a location map of the Study area.

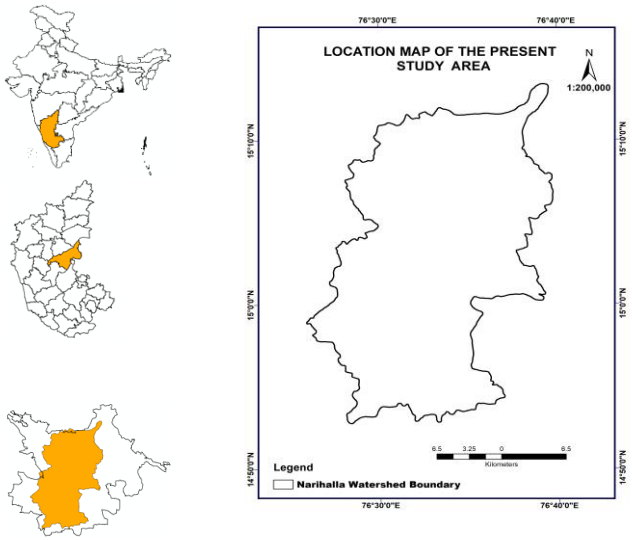

Figure 1: Location map of the study area.

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III. METHODOLOGY

Land use land cover maps are prepared using satellite images in conjunction with collateral data like Survey of India (SOI) toposheets number 57 A/8, 57 A/12, 57 B/5, and 57 B/9 on a 1:50,000 scale taking into consideration permanent features such as road, tanks, settlements, etc. IRS LISS III FCC band 2, 3, 4, and Google Earth Image on 1:50,000 scales are interpreted visually, and different land use/land cover categories are demarcated. Land use Land cover categorization is based on using the Classification scheme developed by National Remote Sensing Agency (NRSA, 1995). The usage of land the visual features such as tone/color, texture, shape, association, and background are used to delineate land use/cover groups such as built-up land, agricultural land, forest, wasteland, and water bodies. Wherever doubtful units are discovered during the interpretation, a ground truth survey is conducted to verify the same. Fig.2 shows a flow chart depicting the methodology adopted for the land use and land cover mapping of the Narihalla watershed.

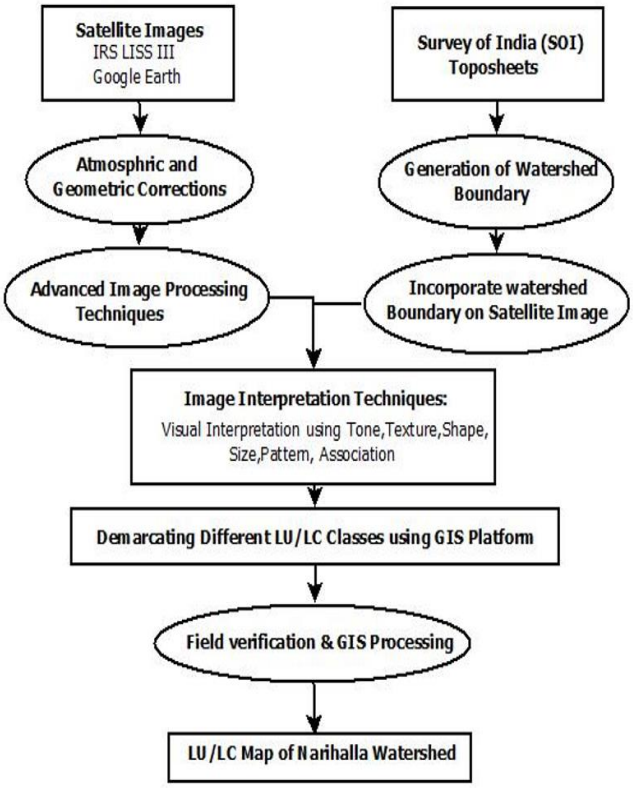

Figure 2. Flow chart representing the Methodology for the present Study.

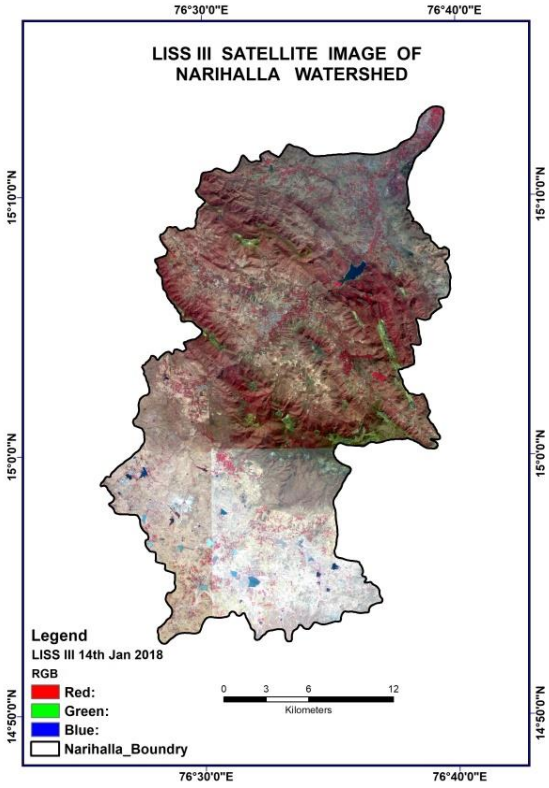

Figure 3. IRS LISS III Satellite image of Narihalla watershed.

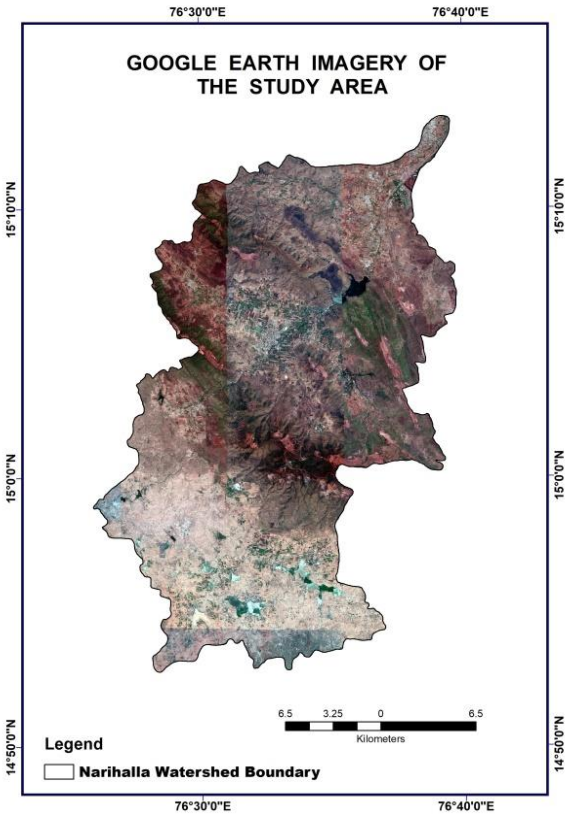

Figure 4. Google Earth Imagery of Research area

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IV. RESULT AND DISCUSSION

Land use /land cover of Narihalla watershed:

The major land use and land cover categories identified in the Narihalla watershed are Built-up lands, Agriculture land, Forest land, Wastelands, and Water bodies. Fig.5, Fig.6, and Table.1 describe land use and land cover patterns of the research area

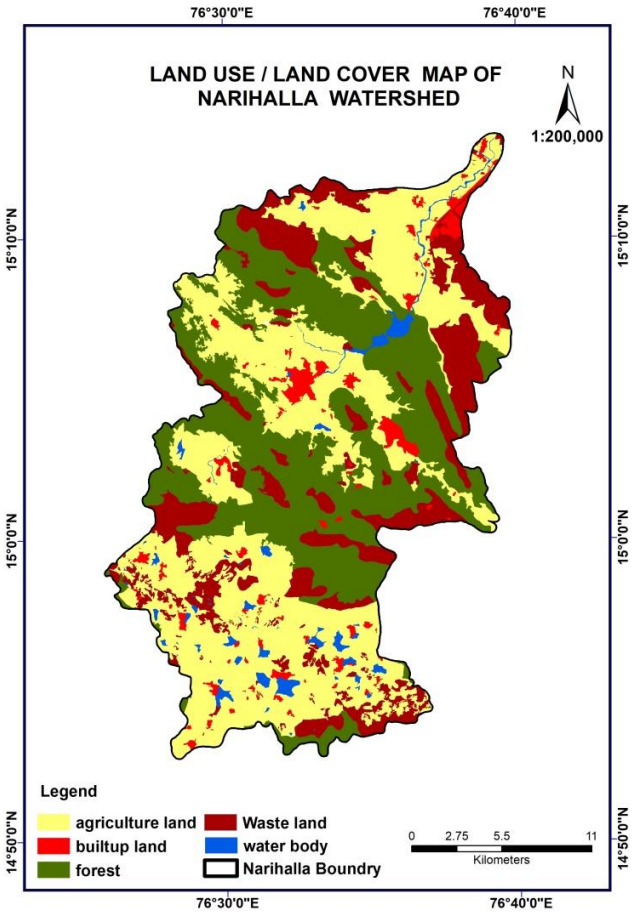

Figure 5. Map showing Different Land use Land cover patterns in the present study area.

1. Built-up land:

It consists of both urban (towns and cities) and rural (village) settlements, with much of the land covered by structures, strips developments along highways, transportation, power, and communication facilities, and areas such as those occupied by mills, shopping malls, industrial and commercial complexes, and institutions, which may be isolated from urban areas in some cases.

Urban (Towns and Cities): Land utilized for human settlements with populations more than 5000, of which more than 80% are engaged in non-agricultural activities, with much of the land covered by building structures, including parks, institutes, playgrounds, and other open spaces within built-up areas. Sandur and Chornuru towns are seen in the middle and southern part of the study area respectively.

Rural (Villages): Land utilized for human settlements of a smaller scale than urban communities, with more than 80% of the population engaged in agricultural activities.

2. Agriculture land:

Agriculture lands are defined as lands that are predominantly utilized for farming and the production of food, fiber, commercial, and horticultural crops. The most visible signs of agricultural activity will be distinct geometric field and road patterns on the terrain, as well as traces left by animals and mechanical equipment. Agriculture is primarily limited to depressions, mild slopes, and valley sides where water and soil conditions are favorable. It contains cropland (irrigated and non-irrigated), grassland, plantations, etc. We have seen crops such as maize, cotton, onion, groundnut, sunflower, and others in the current study area.

3. Forest:

It is a region (within the designated forest border) dominated by trees and other plant types capable of generating timber and other forest products. Through visual and digital techniques, satellite data has been used to map different forest types and density classes with high precision. It consists of scrub, degraded, and deciduous forests. The vegetative density of the scrub forest is less than 20% of the canopy cover. A shrub is a stunted tree or bush. The degraded forest is a stage in which the vegetation density is still low and gradually declining; this stage can be seen in some areas near mines in the current study region. Forest covers an area of approximately 183.04 square kilometers in the current research area.

4. Wasteland:

Wastelands are degraded areas that, with moderate effort, can be restored to vegetative cover and are currently unutilized land. These lands are deteriorating as a result of a lack of natural causes or poor soil and water management. These lands have low capabilities for life. Wastelands can inherent/imposed constraints such as location, environment, chemical and physical properties of the soil, or financial or management constraints (NWDB, 1987). Marshy/swampy, land with or without scrub, barren rocky, stony waste, mine, sheet rock area, and industrial waste are all examples of wasteland. The wasteland in the current research area is estimated to be 102.189 square kilometers.

5. Water bodies:

It is an area of trapped water in the form of ponds, lakes, and reservoirs, or flowing water in the form of streams, rivers, canals, and so on. These serve as a source of irrigation, electricity generation, and flood control. A river/stream is a natural course of flowing water on land that follows a specific channel. It encompasses everything from a little stream to a large river and its tributaries. It could be either perennial or seasonal. A tank/canal is an enclosed natural or man-made water body with a regulated flow of water. Lakes are naturally confined bodies of water that are not flowing or regulated. Tanks are smaller than lakes and have limited utility for farmers. We notice the Narihalla reservoir near Taranagara and several lakes in the southern section of the research

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region. Water bodies cover an area of approximately 11.45 square kilometers.

LU/LC Pattern	Area in Sq.km	Percentage
Built-up land	19.59	3.5%
Agriculture land	244.12	43.56%
Forest	183.04	32.66%
Wasteland	102.189	18.23%
Water bodies	11.45	2.05%

Table 1. Table showing Land use Land cover area of Narihalla watershed.

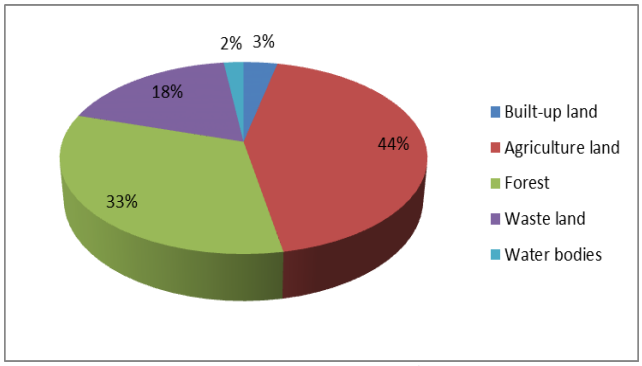

Figure 6: Pie Chart showing the distribution of Land use/ Land cover pattern of the study area

V. CONCLUSION

In the current study, a land use land cover map was created based on visual interpretation of satellite imagery, which shows that Agricultural land covers an area of about 244.12 square kilometers, Forest land covers 183.04 square kilometers, Wasteland covers 102.18 square kilometers, Built-up land covers 19.59 square kilometers, and Water bodies cover 11.45 square kilometers. Information on the rate and nature of change in land resource use is essential for proper natural resource planning, management, and regulation.

The pattern of land use influences infiltration, runoff, erosion, and evapotranspiration. In the present study area, Gap filling, reseeding, and transplanting should be used to regenerate degraded forest areas. Using techniques such as trenching and contour furrowing to conserve soil and water. Growing suitable scrub and grass species in contour furrows should improve the ground flora. This Land Use Land Cover (LULC) map also provides information to know the current landscape of the Research area and it provides information for, wildlife habitat protection, urban expansion/encroachment, resource extraction activity routing and logistics planning, and legal boundaries for tax and property evaluation.

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