Change Detection in Land use / Land cover in Akola Taluka Using Remote Sensing and GIS Technique

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Abstract:

In the present study of Akola Taluka is a part of Akola districts of Maharashtra, India. It covers an area of 1042.71sq. km. In Survey of India (SOI) topographic sheets (55-D/13, 55-D/14, 55-H/1, 55-H/2, 55-H/5, 55-H/6 and 55-H/12,) of 1:50,000 scale. In study area is located in Akola Districts of Maharashtra which is located between 69°68'23" to 23°08'21" N latitude and 73°98'29'' to 22°76'23'' E longitude. For finding the status and extent of Changes in Murtizapur Taluka of Land use/ Land cover maps was prepared using remote sensing data. The Land use / Land Cover map during 1998 and 2013 was prepared using LISS-III and Land sat TM data The transformation of a particular land use/land cover categories into different categories were derived by spatial intersection of 1998-2013. The prepared maps were overlaid using GIS to obtain Change Detection maps to know the changes occurred in different land use classes during 1998-2013. The final maps were prepared after reconciliation of doubtful areas observed in preliminary maps. The final maps were prepared/ composed and area statistics was generated using visual interpretation techniques and Arc Map 10.1 Software.

Keywords: Land use, Land covers, Change Detection, LISS-III Data, GIS, Remote Sensing.

1. Introduction

The population is increasing day by day so the land use/land cover areas also change. 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 scarce resource due to immense agricultural and demographic pressure. Hence, information on land use / land cover and possibilities for their optimal use is essential forthe 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. This involves development of spatial and temporal database and analysis techniques. 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. Further, satellite remote sensing data have been successfully used to estimate Leaf Area Index (LAI), based on the relationship between LAI and the Normalized Difference Vegetation Index (NDVI) (Kale et al., 2005). An accurate forest cover-type and/or land-classification system is essential to providing information for effective management of natural resources (Schriever and Russell, 1995). The remote sensing technology in integration with Geographical Information System (GIS), helps in extracting maximum amount of vegetal information that describe vegetation diversity i.e. extent, structure, composition and condition. The availability of new high-resolution satellite image sources e.g., IKONOS Provides an opportunity to map ground features that was not previously available using medium resolution imagery (e.g. Landsat, SPOT 4). 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 (Wilkie and Finn, 1996).The present study has been taken up in order to understand the changes that have taken place in land use/land cover in Murtizapur Taluka of Akola district. Therefore, attempt will be made in this study to map out the changes status of land use land cover map of

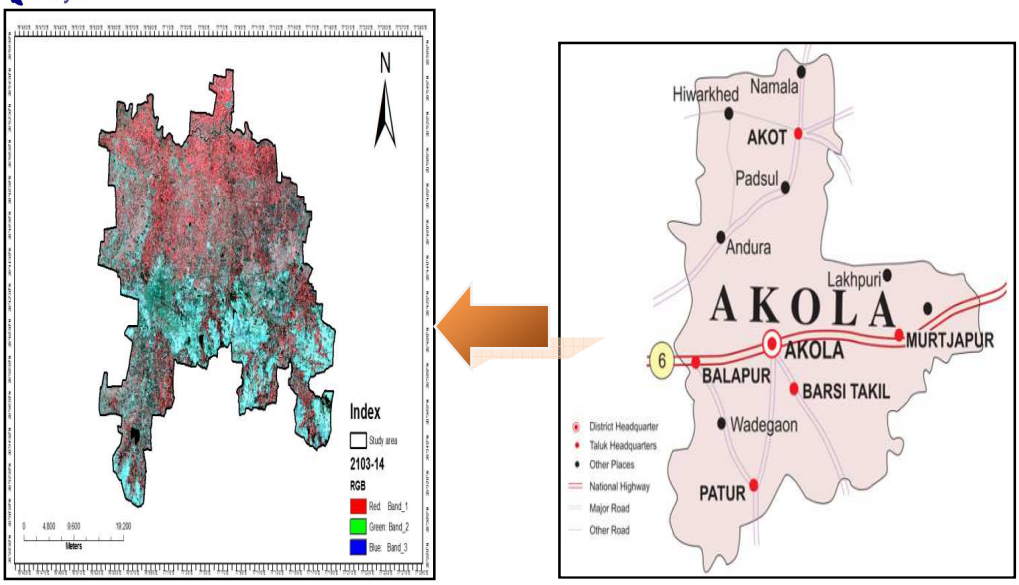
Murtizapur Taluka between 1998 and 2013 with a view to detecting the land consumption rate and the changes that has taken place in this status particularly in the built-up land so as to predict possible changes that might take place in this status in the next 10 years using both Geographic Information System and Remote Sensing data.

2. Study Area:-

The study area is situated in Akola Districts of Maharashtra which is located between 69°68′23” to 23°08′21” N latitude and 73°98’29’’ to 22°76’23’’ E longitude. The study area is covered by Survey of India (SOI) toposheets 55D/13, 55D/14, 55-H-1, 55-H-2, 55-H-5, 55-H-6, 55-H-12 and on 1:50,000 scale.

India

Maharashtra State of India



AkolaTaluka **Akola District**

Figure 1. Location Map of Study Area

3. Research Methodology:-

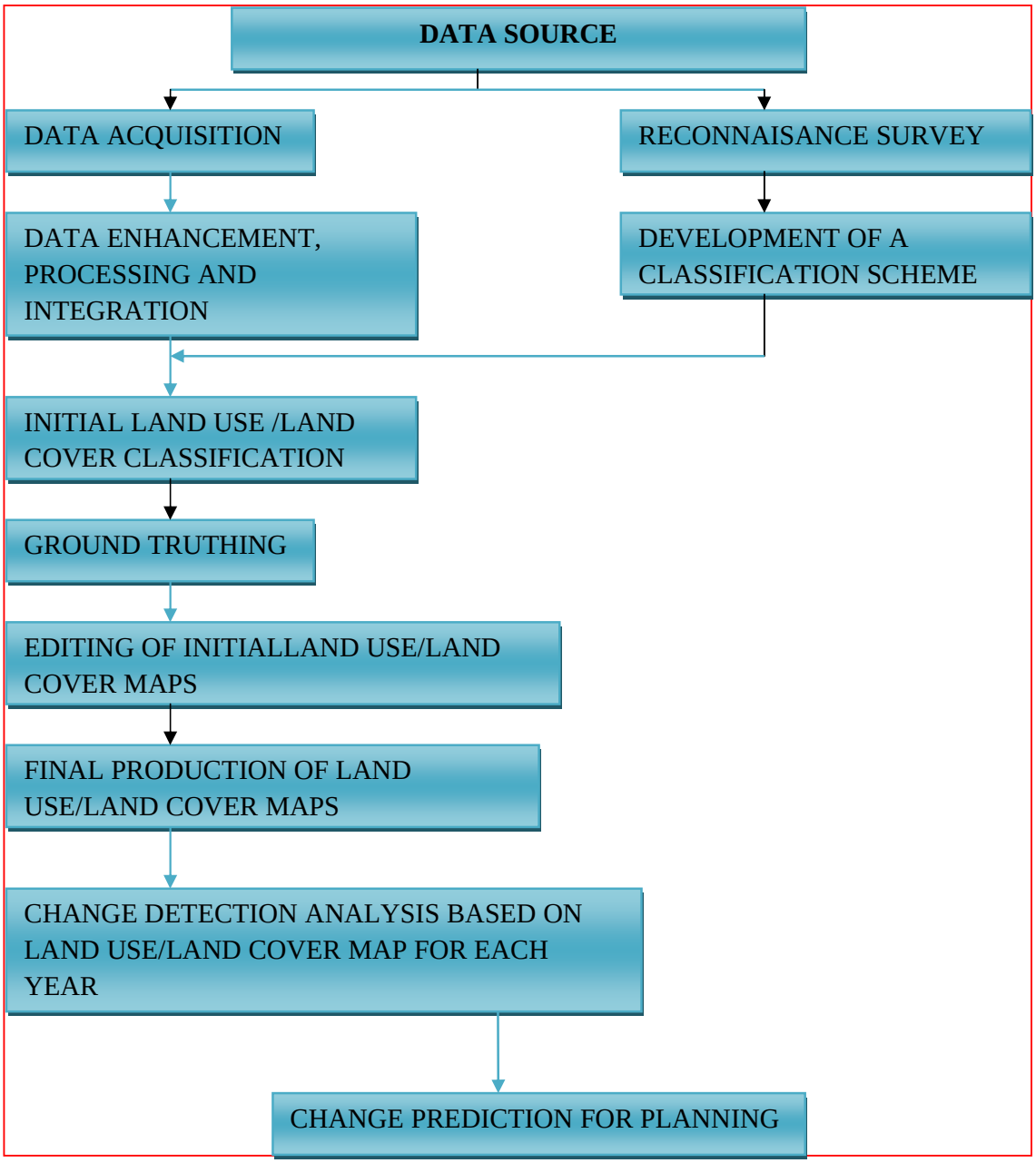


Figure 2. Flow chart of Methodology

4. Data Products:-

The present study was based on primary and secondary data sources.The study has made use of various primary and secondary data. These include Survey of India (SOI) topographic sheets (55-D/13, 55-D/14, 55-H/1, 55-H/2, 55-H/5, 55-H/6 and 55-H/12,) of 1:50,000 scales; and satellite images Landsat TM (geocoded data (for the year 2013). These (Landsat) data were visually and digitally interpreted by using the ArcGIS 9.3v.

Software (for processing, analysis and integrationfinalization of the thematic maps. The main goalof of spatial data) to reach the objectives of thethis study is to extract land use and land cover study. Adequate field checks were made beforechanges using multi- temporal satellite data.

S/N	Data Type	Date of Production	Resolution	Source
1.	Landsat image	1998	30m ™	NASRDA
2.	LISS-III	2013	23.5M	www.nrsa.com
3.	Toposheets	1970	1:50,000	GSI

Table 1. Data used of LULC Mapping

5. Visual Analysis:-

Visual interpretation technique was used for the mapping of land use/land cover. Prior to interpretation of multidate satellite data, a reconnaissance survey of the study area was done to develop a classification scheme based on local knowledge and ancillary information. An interpretation key was also developedbased on standard Photo-elements like tone, texture, size, shape, association, pattern, location etc. To identify and map different classes. With the help of interpretation key onscreen preliminary interpretation of satellite data was done using ARC GIS 10.1software.

6. Ground truth verification:-

Entire study area was visited to get an acquaintance of different ground feature and cover type with respect to satellite data. The doubtful area on preliminary interpreted maps from satellite data were carefully verified in the field. After verification, these areas were reconciled on the maps and corrections were made to create the final maps of study area.

7. Overlay analysis, Final Map Preparationand Area statistics Generation:-

Union method is applied for Overlay analysis using ARC GIS 10.1 Software. The final maps were prepared after reconciliation of doubtful areas observed in preliminary maps. The final maps was prepared/ composed and area statistics was generated using Arc Map 10.1 Software.

8. Conclusion:-

In the present study land use/ land cover map of study area for the years 1998, and 2013. In order to monitor the changes in land use / land cover proper care was taken in the selection of cloud free temporal data. It was not possible

to obtain the ground truth pertaining to older data of satellite image of Land sat 1998 therefore a novice approach to overcome the same was followed. Mapping was done for the year 2013 data. The major land use / land cover categories identified in the study area are Built-up, Agricultural land, wasteland, Water Body and Forest, their area extent are presented in Table 1 and Fig 4, and 5 In general major area was occupied by Agricultural land followed by Wasteland ,Forest, built-up land and minimum by Water Body. Built-up area identified in the study area was mainly large city settlements.The total area which was 41.36 sq. km. in 1998 increased to 68.13 sq. km. In 2013 Agricultural land was observed mainly on plain land and uplands and accounted 916.98 and 866.35 sq. km. during 1998 and 2013 respectively and decrease in the area was 50.63 sq. km. /year.

Wasteland was noticed on uplands with or without scrub. The total wasteland which was 18.87 and 145.70 sq. km. in 1998 and 2013 respectively and increases in the area was increase 126.83 sq.km/ year.

Forests are mainly located on hilly and upland areas. The total area during 1998 was 51.88 and 32.87 sq. km. which decreased to 19.01 in 2013 respectively. The forests were further classified into Dense, Open and Scrub forests. As the forest for the year 1998 was extracted from SOI toposheet, it was not possible to delineate further sub-classes. The area covered by river was same during all the years while area of reservoirs is 13.62 % in 1998 and increased -44.00 in 2013.

Table 1 Land Use and Land Cover Distribution (1998, 2013):-

Forest and non-forest Categories	1998	2013
	AREA (sq. Km)	AREA (sq. Km.)
AGRICLUTRAL LAND	916.98	866.35
WASTE LAND	18.87	145.70
BUILT-UP LAND	41.36	68.13
FOREST LAND	51.88	32.87
WATER BODY	13.62	44.00
TOTAL	1042.71	1042.05

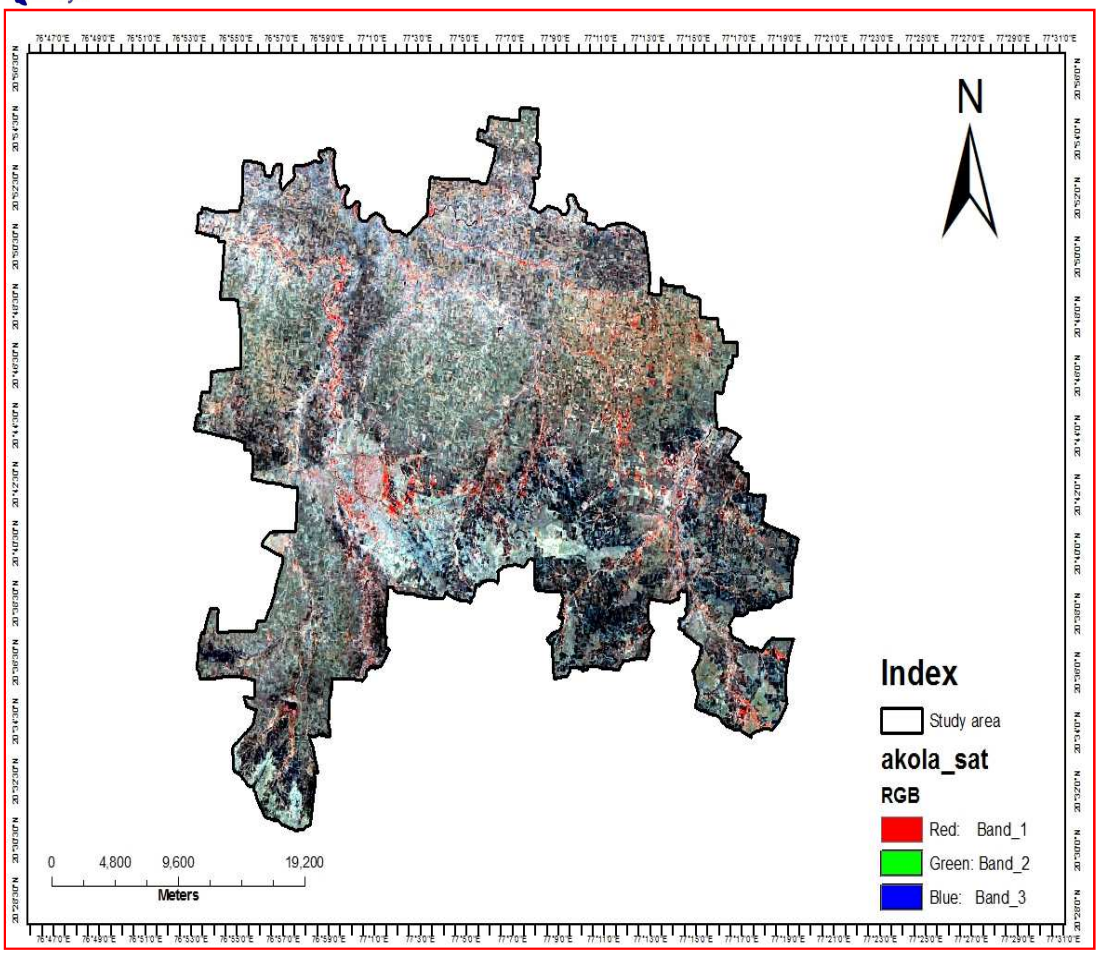


Figure 3. Land sat TM Image of 1998 year in Akola Taluka

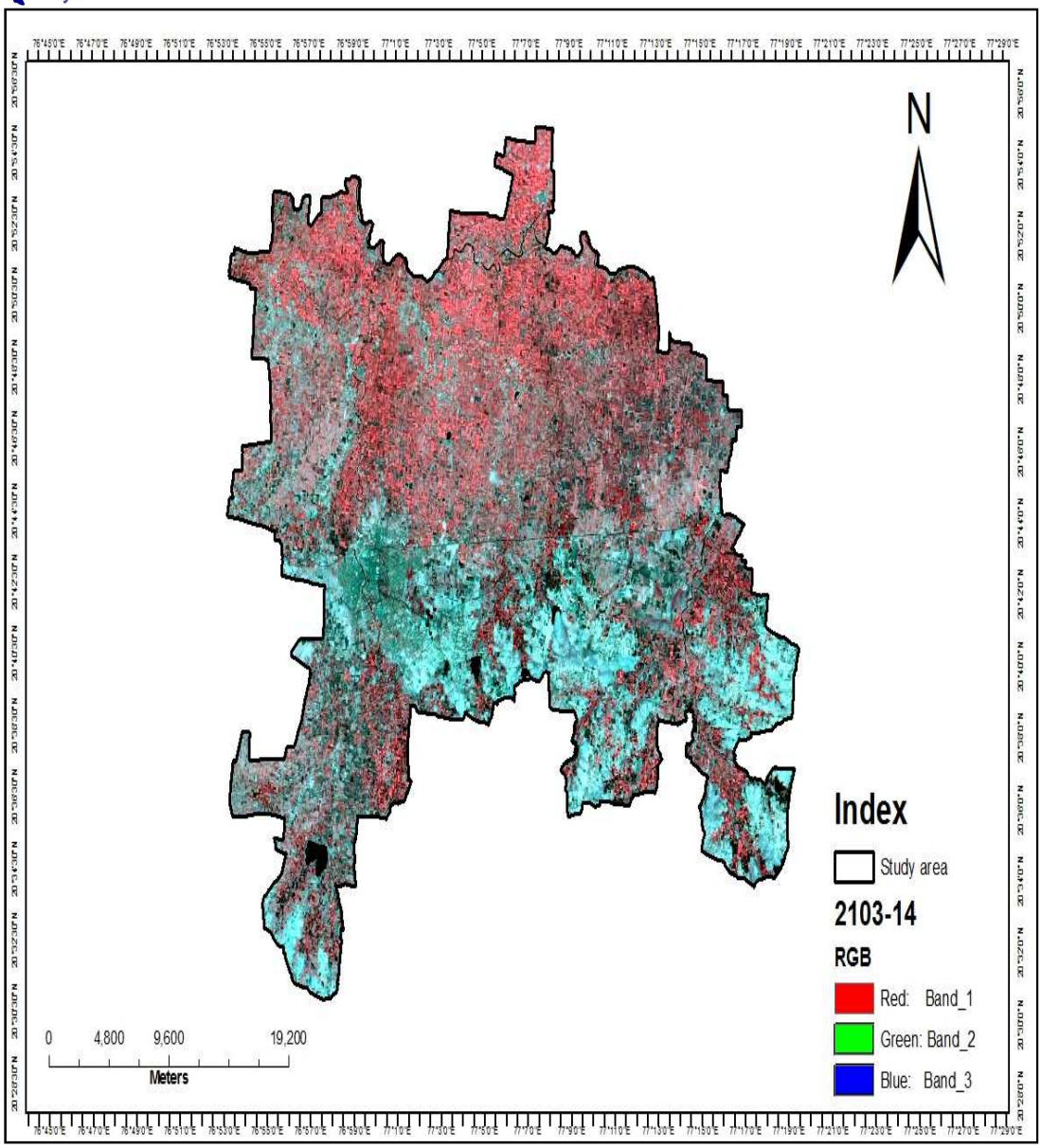


Figure 4. Land sat TM Image of 2013 year in Akola Taluka

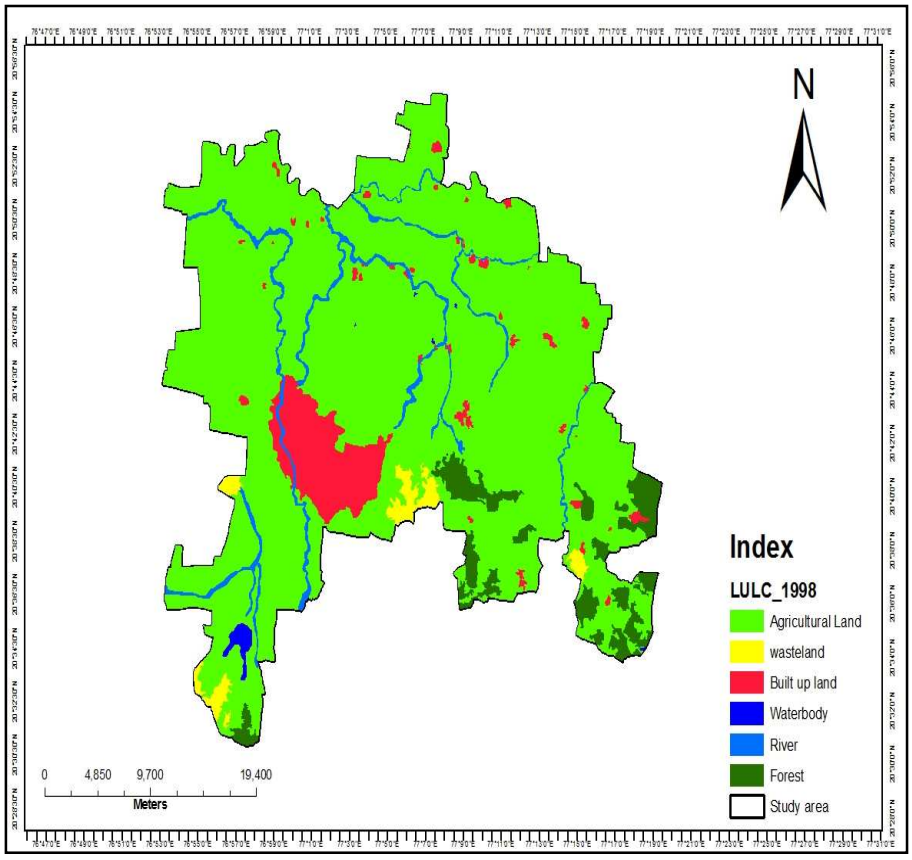


Figure 5. Land Use Land Cover Map of 1998 year

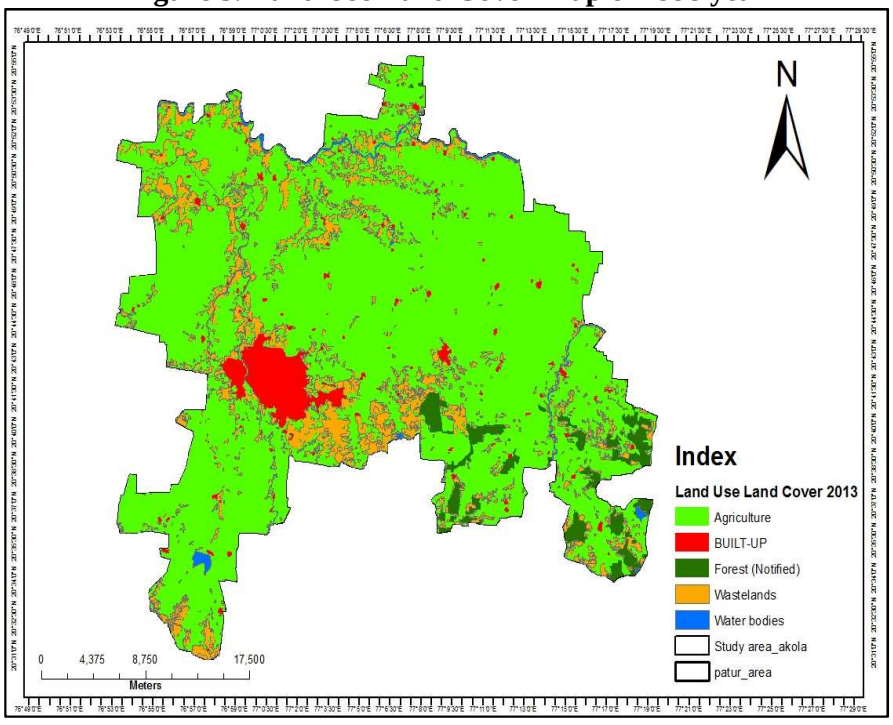


Figure 6. Land Use Land Cover Map of 2013 year

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