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ANTHROPOGENIC IMPACT ON WAGHUR BASIN CHANGING LAND USE / LAND COVER

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ABSTRACT:
Land use and land cover is an important constituent in understanding the interactions of the human activities with the environment and thus its essential to be able to simulate changes. The Present paper attempted the change detection of land use during 1990 to 2020 on the basis of Remote Sensing data and GI Software. The base map Land use and land Cover is prepared with the help of Landsat 5 TMin year 1990 and Landsat 8 OLI in year 2020. It is found that considerable change in land use and land covers have been detected during 1990 to 2020 on the Landsat 5 TM and Landsat 8OLI Imagery. The present study of land use on a micro scale natural region of meso watershed like Waghur Basin. Amongst various parameters of the land uses following five have been considered in this study agriculture land, forest, Bare Land, Settlement and waterbodies. The catchment of Waghur Basin is 2485 sq.km and it extends between 20° 27'32.04" North latitude to 21° 05' 43.16" North latitude and 74° 30' 7.35" East to 76 ° 05' 1.65 " East longitudes. The five classes were distinctly produced for each study year but with more emphasis on Settlement and Agriculture land as it is a combination of anthropogenic activities that make up this class; and indeed, it is one that affects the other classes.

Key words: - Climate change, Land use/ Land cover change, Remote Sensing, GIS

INTRODUCTION :

With increasing population pressure on the land, the land utilization on land use has acquired a special significance in various populous countries including India since; past studies have made to assess the various aspects of land use to correlate with the agricultural crops with a view to increasing the productivity of the land to its maximum capacity (Singh 1967). Land use and land cover (LULC) change is a major issue of global environment change. Scientific research community called for substantive study of land use changes during the 1972 Stockholm Conference on the Human Environment, and again 20 years later, at the 1992United Nations Conference on Environment and Development (UNCED). At the same time, International Geosphere and Biosphere Programme (IGBP) and International Human Dimension Programme (IHDP) co organized a working group to set up research agenda and promote research activity for LULC changes. Land use / land cover mapping is essential component where in other parameters are integrated on the requirement basis to drive various developmental index for land and water resource. Land use refers to man's activities and the varied uses which are carried on over land and land cover refers to natural vegetation, water bodies, rock/soil, artificial cover and others noticed on the land (NRSA, 1989). Land Cover, defined as the assemblage of biotic and a biotic component on the earth's surface is one of the most crucial properties of the earth system. Land cover is that which covers the surf ace of the earth and land use describes how the land cover is modified. Land cover includes water, snow, grassland, forest, and bare Soil.

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Land use includes agricultural land, built up land, recreation area, wildlife management area etc.

In this study to map out the status of land use land cover of Waghur Basin between 1990 and 2020 with a view to detecting the land use change. Remote Sensing data is very useful because of its synoptic view, repetitive coverage and real time data acquisition. The digital data in form of satellite imageries, therefore, enable to accurately compute various land cover / land use categories and helps in maintaining the spatial data infrastructure (SDI) which is very essential for monitoring urban expansion and change detections studies (Lo, 1981; Mukherjee, 1987; and Quarmby & Cushine, 1989). In other words, the remote sensing satellite data in multi-resolution and multispectral means to provide spatial information for land cover / land use at different levels for various aspects as built-up land, agricultural land, forests, wastelands and water bodies etc. So, the land cover / land use maps prepared using multi-date and multispectral data provides different levels of spatial information which are used in change detection studies (Burrough, 1986).

Application of remotely sensed data made possible to study the changes in land cover in less time, at low cost and with better accuracy (Kachhwaha, 985) in association with Geographical Information System (GIS) that provide suitable platform for data analysis, update and retrieval (Star et al.1997; McCracker et al.1998; Chilar,2000). Sp ace-borne remotely sensed data may be particularly useful in developing countries where recent and reliable spatial information is lacking (Dong et al. 1997). Remote sensing techno logy and geographic information system (GIS) provide efficient methods for analysis of land use issues and tools for land use planning and modeling. By understanding the driving forces of land use development in the past, managing the current situation with modern GIS tools, and modeling the future, one is able to develop plans for multiple uses of natural resources and nature conservation. The change in any form of land use is largely related either with the external forces and the pressure built-up within the system (Bisht and Kothyari, 2001). The present study of land use on a micro scale natural region of meso watershed like Waghur basin. Amongst various parameters of the land uses following five have been considered in this study i.e., Agriculture land, Forest land, Settlement, Bare land and water bodies.

Study Area:

The study area i.e., Waghur basin is the major southern tributary of river Tapi. Its source lies in Ajant Satmal hills at an elevation of 778 m above mean sea level. Waghur river flow from World famous Ajanta cave. The study area comes under the monsoon type of climate with marked season ability of rainfall.

It is classified as good catchments because it is hilly and intensive rainfall zone. On the Waghur Basin there is a dam constructed 12.5 km East from Jalgaon and it is benefited to Jalgaon City and many villages for drinking and irrigating purpose this major irrigation dam was constructed. Monsoon rainfall recorded for 60 years i.e., from 1950 to 2010 are available average monsoon rainfall is 809.3 mm. The catchments of the Waghur Basin is 2485 sq km and it extends between 20° 27’ 32.04” North latitude to 21° 05’43.16” North latitude and 74° 30’ 7.35” East to 76 ° 05’ 11.65 “ East longitudes. The study area lies under monsoon climatic region. It lies in Ajanta Satmal hilly area and becomes good catchments in respect of rainfall.

Aim

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The aim of this study is to produce a land use land cover map of Waghur Basine at different epochs in order to detect the changes.

Objectives

The following specific objectives will be pursued in order to achieve the aim above.

1) To create Land use map of Waghur Basine from Landsat 5 and Landsat 8 image.
2) To create a land use land cover classification scheme using supervised classification in ERDAS 9.2 software.
3) Understand the land use of Waghur basin.
4) To detect Land use Change between year 1990 to 2020.

Methods and Material

The aim of this paper is to detect the Land use / Land cover change from 1990 to 2020. The multi-spectral satellite data is used for supervised classification for prepare Land use map. The software ERDAS-9.2 and ARCGIS 10 is used for data processing. The data utilized is given in the following tables for the years 1990 and 2020. The Geographic Information System (GIS) and Remote Sensing (RS) tools have been applied to find out the land cover / land use changes over periods in the Waghur basin. Such as the ArcGIS and ERDAS have been used for geographical analysis, integration, and presentation of the spatial and non-spatial data for land cover / land use change detection. So, these tools are more effective for monitoring and modeling for land cover / land use changes.

Results and Discussion

The Land use maps of Waghur basin for both the years reveal five classes of Land use. Viz Agriculture land, Forest land, Settlement, Bare land and water bodies. The classified images obtained after preprocessing and supervised classification which are showing the land use and land cover of the Waghur basin are given in the following figures viz., Fig. These images provide the information about the land use pattern of the study area.

Five major LULC classes were described, namely, Agricultural land, Water bodies, Waste land, Forest and Built-up area, for the LULC classification purpose. The agricultural land enclosed major crop-sown area and cultivable lands with patches and croplands in pattern. Water included natural water bodies, small to medium reservoirs and dams. Bare land enclosed minimum vegetation to bare soil, dry lands and rocks. Forest enclosed majorly reserved forests, with medium to high density of plant growth, while built-up area included small villages and town. The most considerable LULC conversion took place from agricultural land to waste land, followed by bare land to agricultural land and forest cover to bare land. The spatial extent of Agriculture Land increased at the cost of Bare Land and forest in the Waghur River Basin during 1990 to 2020.

CONCLUSION:

This research work demonstrates the ability of GIS and Remote Sensing in capturing spatial-temporal data. Attempt was made to capture as accurate as possible five land use classes as they change through time. The five classes were distinctly produced for each study year but with more emphasis on Settlement and Agriculture land as it is a combination of anthropogenic activities that make up this class; and indeed, it is one that affects the other classes. However, the result of the work shows a rapid growth in Water bodies (17.25 km2), Settlement (15.96 km2) and Agriculture land (401.68 km2) while rapid decrease in forest (26.89 km2) and bare land (408 km2) between 1990 and 2020.Above finding gives potential for land evaluation of Waghur basin.

Conflict of interests:

The authors declare that they have no known competing financial interests or personal

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relationships that could have appeared to influence the work reported in this paper.

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Table 1 Data Source and Acquisition (Remote Sensing data)

RS data	**Date**	**Band**
Landsat 5 TM	Oct 1990	2,3,4
Landsat 8 OLI	Oct 2020	3,4,5
Landsat 5 TM imaginary	**Band combination**	**Date**
True Color	1,2,3	Oct 1990
Fales Color	2,3,4	Oct 1990
Landsat 8 OLI imaginary	**Band combination**	**Date**
True Color	2,3,4	Oct 2020
false Color	3,4,5	Oct 2020

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Table 2 Spatial-Temporal distribution of Land use of Waghur basin

Land use Type	Year 1990 Area in sq km	Area in %	Year 2020 Area in sq km	Area in %
Forest Land	332.11	13.36	186.51	7.51
Agriculture Land	987.61	39.74	1405.72	56.57
Bare Land	1142.50	45.98	744.5	29.96
Settlement	7.74	0.31	15.98	0.64
Water Bodies	15.04	0.61	32.29	1.30
Total Area	2485	100.00	2485	100.00

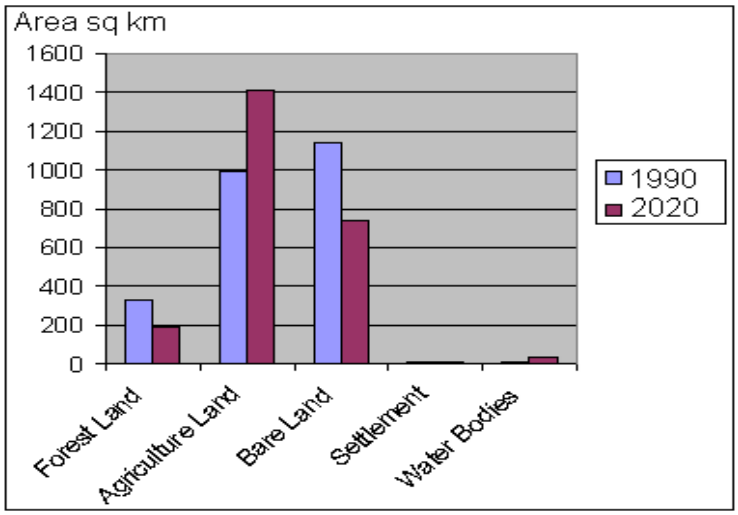

Table 3 Land use Change Detection during 1990 - 2020

Land use Type	Year 1990 Area	Year 2020 Area	Increase Area	Decrease Area
Forest Land	332.11	186.51		145.6
Agriculture Land	987.61	1405.72	418.11	
Bare Land	1142.50	744.5		398.00
Settlement	7.74	15.98	8.24	
Water Bodies	15.04	32.29	17.25	
Total Area	2485	2485		

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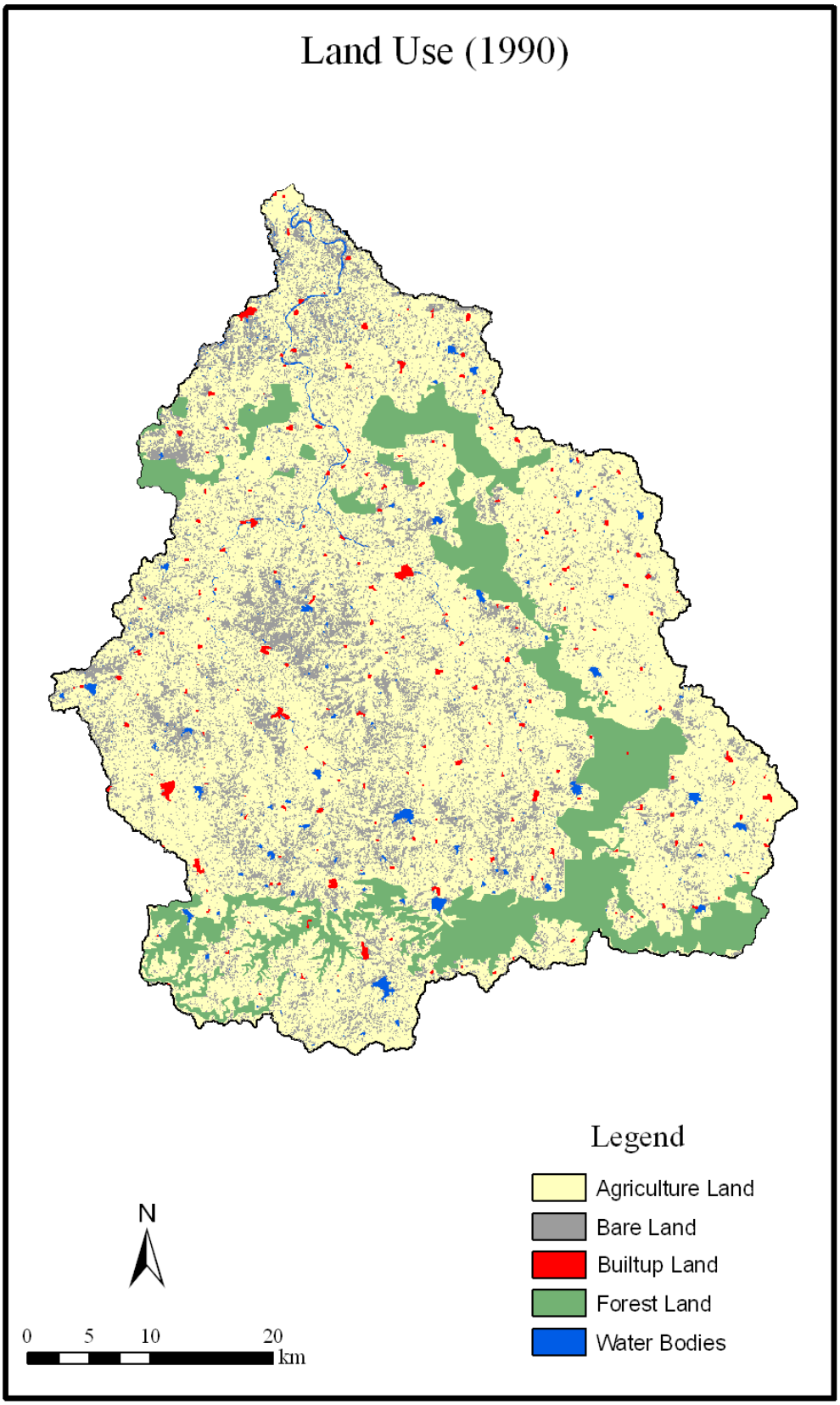

(Source: Landsat 5 Satellite Image)

Figure 1 Land Use of the Waghur basin in 1990

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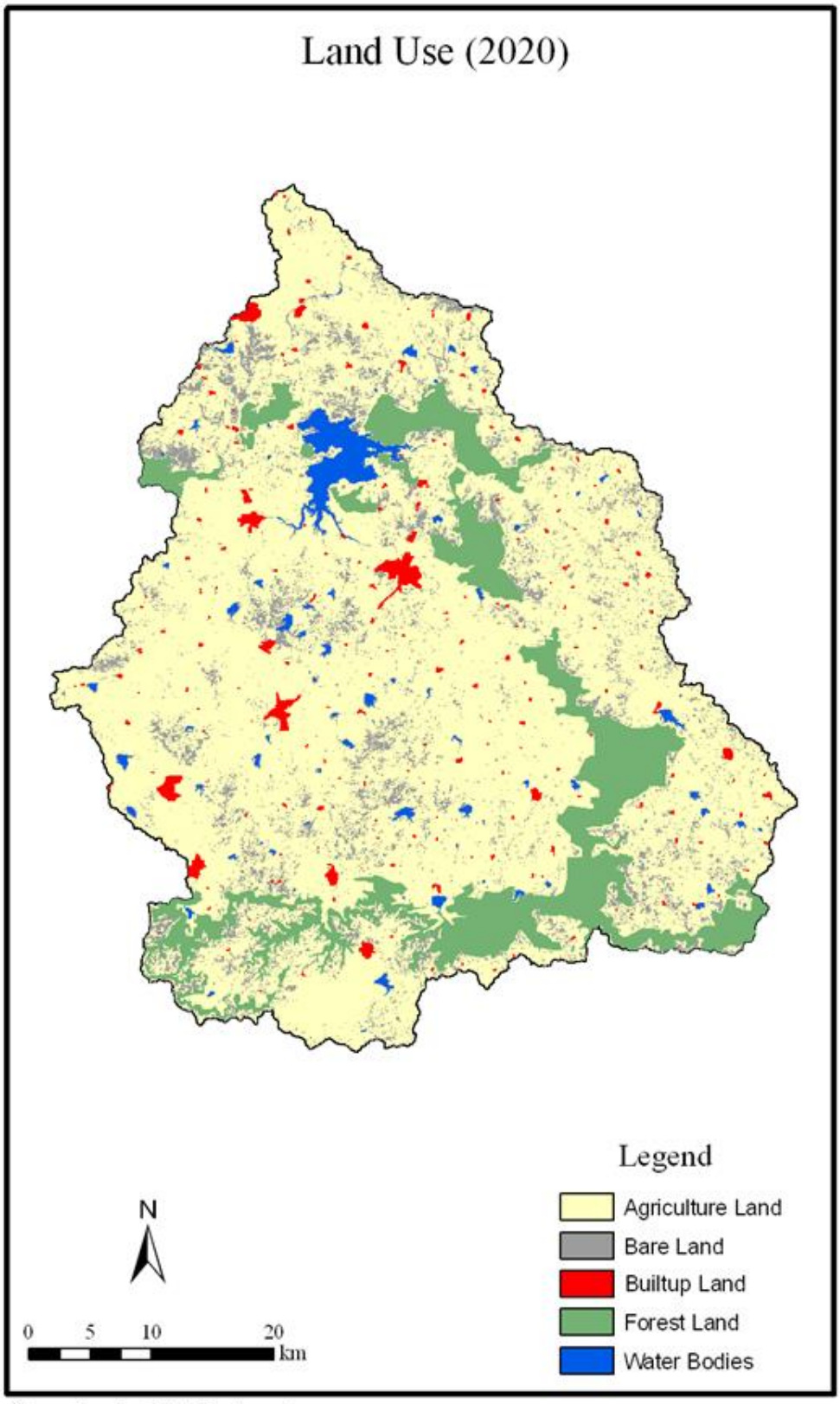

(Source: Landsat 8 Satellite Image)

Figure 2 Land Use of the Waghur basin in 2020

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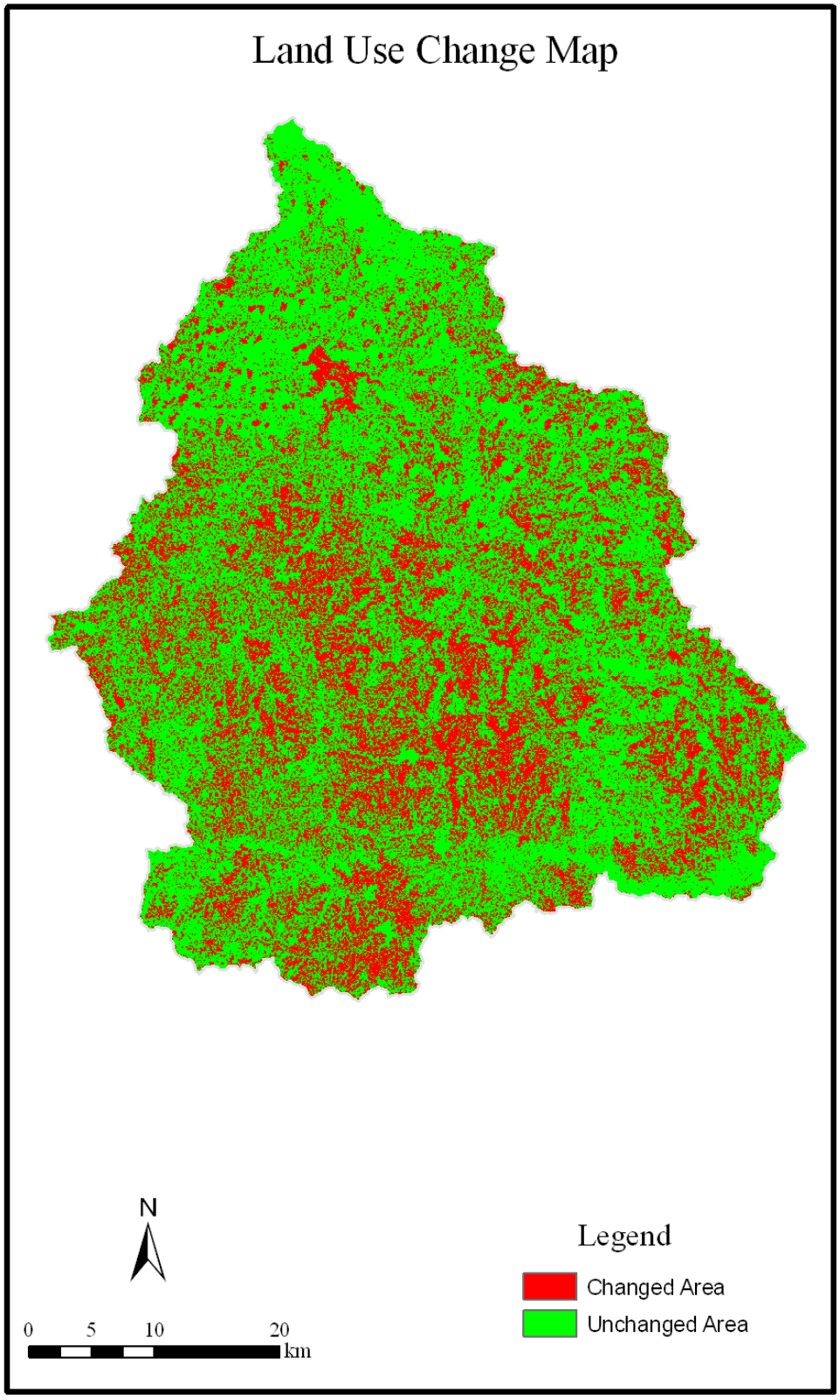

(Source: ERDAS & ArcGIS Analysis)

Figure 3 Land Use change Map