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RESEARCH ARTICLE

MONITORING OF LAND USE/ LAND COVER CHANGE USING GIS AND REMOTE SENSING TECHNIQUES: A CASE STUDY OF SAGAR RIVER WATERSHED, TRIBUTARY OF WAINGANGA RIVER OF MADHYA PRADESH, INDIA

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ABSTRACT

Study area Sagar River Watershed is a located in Seoni district of Madhya Pradesh, India. The total geographical area of 427.89 sq. km. is covered by Sagar River Watershed. The area is bounded by 22°8'2" N to 22°22'37' N latitude and 79°34'32" E to 79°56'29" E longitude. Result are drawn on status and extent of Changes in Sagar River Watershed, Land use / Land cover maps was prepared using remote sensing data. The Land use / Land Cover map was prepared using Landsat 5 (1989) and Landsat 8 (2017). The change of a particular area and land use/land cover categories into different categories. The prepared maps were overlaid using Arc GIS 10.2 to obtain change detection map. The final maps were prepared and area statistics was obtained using Arc GIS software. Overall increase in agriculture land in 71.15 sq. km. and built up area is also11.33sq. km. increase. Forest area is transformed in open scrub land and agriculture land.

INTRODUCTION

Land cover refers to the physical characteristics of earth's surface, captured in the distribution of vegetation, water, soil and other physical features of the land, including those created solely by human activities e.g., settlements. While land-use refers to the way in which land has been used by humans and their habitat, usually with accent on the functional role of land for economic activities. The land use/cover pattern of a region is an outcome of natural and socio-economic factors and their utilization by man in time and space. Information on land use/cover and possibilities for their optimal use is essential for the 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 involves both the manner in which the biophysical attributes of the land are manipulated and the intent underlying that manipulation and the purpose for which the land is used (Turner, *et al*., 1995). In a similar way Skole (1994) stated that, Land use is a description of function, the purpose for which land is being used, i.e. the management of land to meet human needs. Meyer and Turner (1994) stated that, Land use is the way in which, and the purpose of which, human beings employ the land and its resources. Land use affects land cover and changes. Changes in land cover by land use do not necessarily imply degradation of the land. However, many shifting land use patterns driven by a variety of social causes, result in land cover changes that affects biodiversity, water and radiation budgets, trace gas emissions and other processes that come together to affect climate and biosphere (Riebsame *et al*., 1994). India is facing a serious problem of natural resource scarcity, especially that of water in view of population growth and economic development (Yadav *et al*., 2013). Moreover this type of analysis provides a valuable tool to increase the efficiency of land use and land cover, and to diminish the negative environmental and social impacts related to land use/land cover. 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, 1985). Remote sensing and Geographical Information System (GIS) techniques, land use/cover mapping has given a useful and detailed way to improve the selection of areas designed to agricultural, urban and/or industrial areas of a region (Reis *et al*., 2003).

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Objective

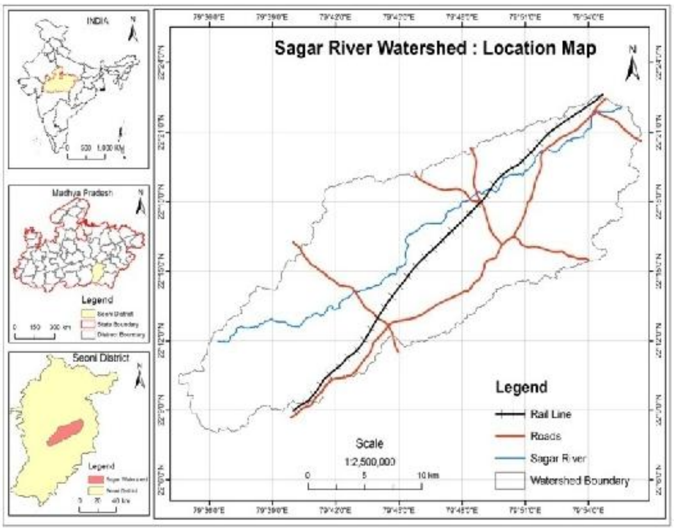
The main objective of this study is

- To prepare various thematic data such land use and Land cover

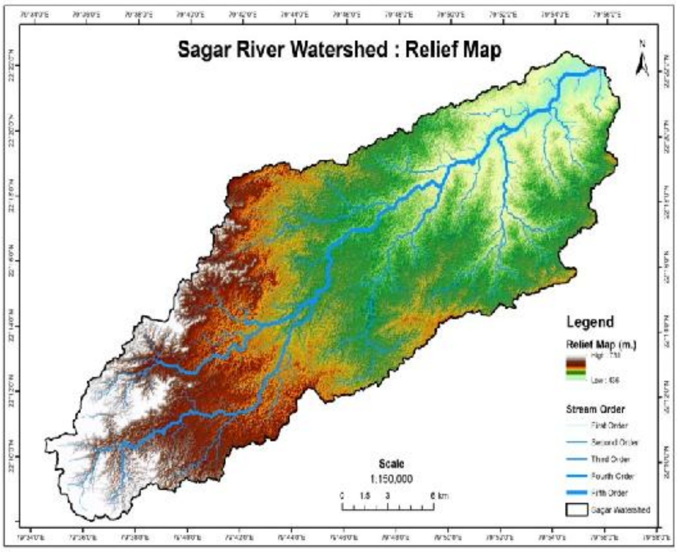
- To analyze nature and extent of land use land cover changes in Sagar River Watershed.

Study area

Sagar River Watershed is physically situated at Central part of Seoni district of Madhya Pradesh. Southern part of this watershed comes in Seoni development block and Northern part in Keolari development block of District Seoni. The extant of study area is lies between latitudes 22°8’2” N to 22°22’37’ N and between longitudes 79°34’32” E to 79°56’29” E. Sagar river is originates near Ghatpiparia village. It flows south west to north east (Map 1). Total length of Sager River is 47.50 km. The river meets Wainganga River near Keolari. The total geographical area of Sagar River Watershed is 427.89 sq. km. and perimeter of watershed is 132 km. Height of watershed is maximum 731m and minimum 436m and average height of watershed is 501.39 meters above the sea level (Map 2). This area is a geographically part of satpura range. South west area of basin is hilly and central and north east part is plain. The aspect of basin is south west to north east.



Map 1. Location Map



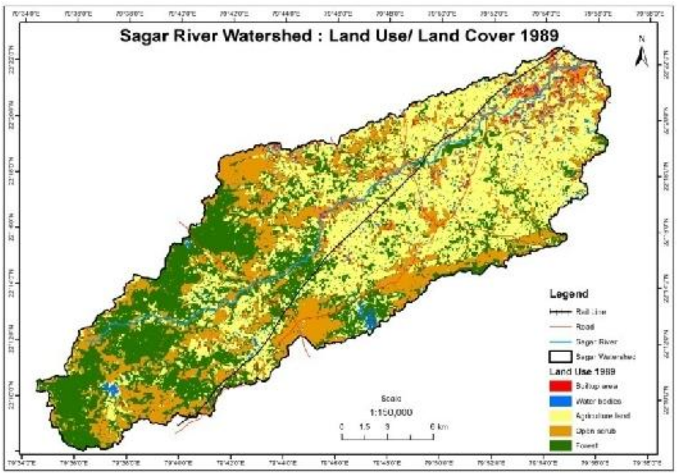
Map 2. Relief Map

MATERIALS AND METHODS

To assess the LULC cover changes satellite imageries of at least two different timelines are required. So, satellite imagery of different years i.e., Landsat Thematic Mapped at a resolution of 30 m Landsat-5 1989 and Landsat-8 of 2017 were used for land use/cover classification. The satellite data covering study area were obtained from USGS earth explorer site. These data sets were imported in Arc GIS 10.2 version. Satellite image processing and create false colour composite (FCC). Aster Dem has been used for watershed creation. Digital land use land cover classification through supervised classification method is done to perform the LULC classification in Arc GIS 10.2 Software. Area statistics of each land use category is calculated in kilometers in attribute table in Arc GIS 10.2. Change detection analysis by using overlay operation in Arc GIS-10.2 Software.

RESULTS AND DISCUSSION

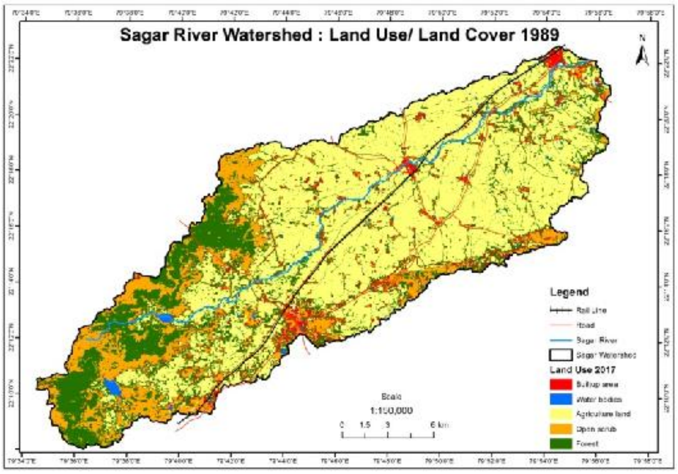
In the present study land use/land cover of Sagar River Watershed was mapped and evaluated between Twenty seven years of period 1989 and 2017 (Map 3 and Map 4). In order to monitor the changes in land use/ land cover proper care was taken in the selection of cloud free temporal data. Mapping was done for the year 2017 data and this was used as template to analyses the data of 1989. The major land use/land cover categories in the study area are Built-up Area, Water Bodies, Agriculture area open scrub and vegetation. The finding of Present study is showing in Table 1. It is estimated from the table that in the year 1989 the watershed is dominated by built-up area (1.99%) land use type, followed water bodies (2.63%) agriculture area (40.61%) open scrub land (23.61%) and forest (31.16%). In the year 2017 the land use percentages built-up area (4.64%), water bodies (0.86%) agriculture area (57.24%) open scrub land (13.52%) and forest (23.73%).



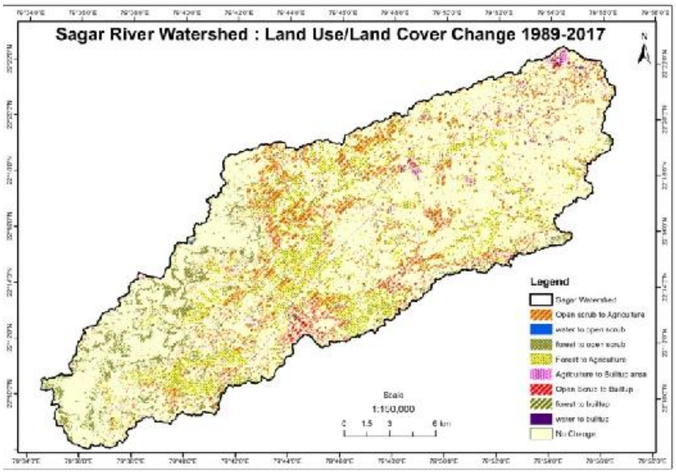
Map 3. Land Use /Land Cover 1989

Land Use/Land cover Change Detection

Here it is found that open scrub land and forest area is dercreased in the year 2017. Becasuse these area (open scrup land and forest area) are converted in to agriclulture area. It is observing that 16.63 % agriculture area is increased during the periods.



Map 4. Land Use 2017



Map 5. Land Use/Cover Change 1989-2017

The perceintage of forest area (07.43%) and open scrub land (10.08) are decreased becasuse human populaion growth is increased and forest area is converted into agriculture area.

Table 1. Land Use/Land Cover Change Analysis, 1989-2017

Land use/cover Categories	Land Use 1989		Land Use 2017		Change Detection	
	(sq.km)	%	(sq.km)	%	(sq.km)	%
Built up Area	8.5	1.99	19.83	4.64	11.33	+02.65
Water Bodies	11.27	2.63	3.7	0.86	-07.57	-01.77
Agriculture area	173.73	40.61	244.88	57.24	71.15	+16.63
Open Scrub Land	100.98	23.61	57.85	13.52	-43.13	-10.08
Forest Area	133.31	31.16	101.53	23.73	-31.78	-07.43
Total	427.79	100.00	427.79	100.00	0	0

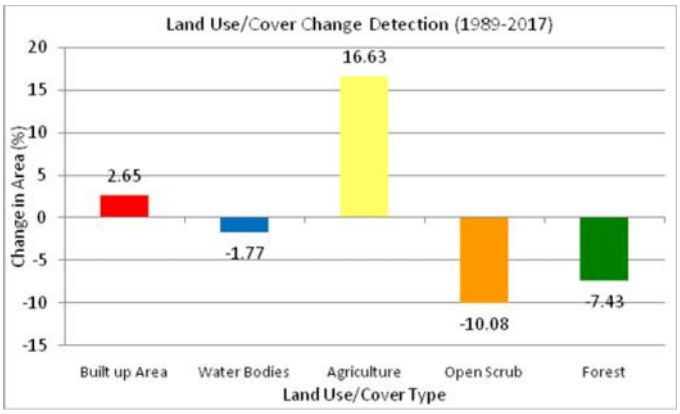


Figure 1. Land Use/Land Cover Change Detection (1989-2017)

Built-up area is also incerased (2.65%). Wetlands, ponds, streams and rivers are included in Water bodies. In the year1989 water bodies cover only 2.63% of the total area which decreases to 0.86% in 2017 probably due to seasonal variation. In this duration water Bodies decreased 1.77% (Table 1 and Figure 1).

Conclusion

The present study clearly show the efficacy of remote sensing and GIS techniques in examine the land use/land cover changes which have taken place in Sagar River Watershed from 1989 to 2017.

In view of the fact that remote sensing data furnish repetitive coverage, it can be used more effectively with multiple data. It has found its use in five land use/land cover features and its analysis with the help of Arc GIS tools. The major positive changes which have taken place in the study area increase 71.15 sq. km. in agriculture area and 11.33sq. km. in built up area, decrease in forest area (-31.78 sq. km.) and open scrub land (-43.13 sq. km). Negative changes include reduction water body (-7.57 sq. km.). The study shows that good agricultural practices and positive results in the overall environmental set up of the watershed.

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