Land Use and Land Cover Mapping Using Indian Remote Sensing Satellite and GIS

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Abstract

Land use/land cover mapping serve as a basic inventory of land resources throughout the world. Whether regional or local in scope, remote sensing offers a means of acquiring and presenting land cover data in timely manner. Land use/land cover pattern of Kudri, Shahdol District and its surroundings were studied using IRS P6 LISS III data. The land use/land cover patterns were visually interpreted and digitized using ERDAS IMAGINE software. The study observed that agriculture area (50.88%) is dominant in Katni, District and its surroundings followed by Land with/without scrub 3.12% and builtup land 1.97% The study recommends the use of satellite imageries for future environmental monitoring studies.

Keywords: Land use, Land cover, Satellite, GIS, Kudri, Agriculture.

INTRODUCTION

The knowledge of land use/land cover change is very important to understand the natural resources, their utilization, conservation and management [1]. Land use is obviously constrained by environmental factors such as soil characteristics, climate, topography and vegetations. But, it also reflects the land as a key and finite resource for most human activities including agriculture, industry, forestry, energy, production, settlement, recreation and water catchments and storage. The main emphasis of agricultural development all over the world was on increasing productivity per unit area of land used for production to feed the ever increasing population [2]. It has been tightly coupled with economic growth. Improper management of land use is causing various forms of environmental degradation.

Identifying delineating and mapping land cover are important for global monitoring studies with the component of resource management and planning activities. Identification of

land cover establishes the base line from which monitoring activities can be performed and provides the ground cover information for base line thematic maps. Land use refers the purpose of the land serves, for example, recreation, wild life habitat, agriculture [3]. Land use applications involve both baseline mapping and subsequent monitoring. Since, the timely information is required to know the current quantity of land which is in use and to identify the land changes from year to year [4].

The remote sensing techniques are used to measure the land cover, from which land use can be inferred particularly with ancillary data or priority knowledge [5]. Land use/cover studies are multidisciplinary in nature and thus the participants involved in such work are numerous and varied, ranging from international wild life and conservation foundation to government researchers and forestry departments. In addition, facilitating sustainable management of the land, land cover and use information may be used for planning, monitoring and evaluation of development, industrial activity or reclamation. Detection of long ten changes in land cover may reveal an idea for the shift in local or regional climatic conditions and analyzing the basis of terrestrial global monitoring [6]. In order to improve the economic condition of the area without further deteriorating the ecosystem, every bit of the available land has to be used in the most rational way. For this type of mapping it requires the present and the past land use/land cover data of the area [7]. In this context, remote sensing technology plays an effective role in the sustainable development and management of our environment and resources [8]. Though many studies were undertaken to understand the land use and land cover in different parts of India, not much studies were carried out in the Kudri, Shahdol District and its surroundings. So, a preliminary study was carried out to understand the present overlay of land use and land cover. The study also focuses on the effectiveness of the satellite for land use/land cover studies.

Location of the Study Area

Study Area: Kudri is a village Sohagpur Taluk located in the Shahdol district of MadhyaPradesh state,India.Study area lies between 23°55' to 24 0'N and 80°45' to $80^0$55'E ,falls under the smvey of India toposheet No. 64A9,64A13,64A16 and 63D16 The Study area is bounded by Sidhi,Satna,Umaria and Anuppur districts.

MATERIALS AND METHODS

The following materials were used for the present study IRS P6 LISS III digital data of May 2013 and Survey of India toposheets No: 64A9,64A13,64A16 and 63D16. As the digital data did not have any real earth coordinates, data were geometrically corrected using

ground control points viz. road-road intersection, road-rail intersection, canal-road intersection, etc. were taken from the toposheet using ERDAS IMAGINE 8.5 image processing package. False Colour Composite of the Kudri was generated with the band combinations of 3, 2, I in Red Green Blue LISS III data (Fig. I.2). The displayed image with the above classes was spectrally enhanced by histogram. Equalization method. Laud use land cover map of Kudri was then prepared by on-screen visual interpretation method using ERDAS IMAGINE 85.

Different land use/land cover classes like agriculture, settlement with vegetation, fallow land, plantation, sand, Water Body etc. were then identified using visual interpretation keys such as colour, tone, texture, pattern, size and shape Land/land cover map with the above classes was then transferred to base map of 1:50,000 scale, which was used for ground truth collection. Based on the ground truth data, land use/land cover map of Kudri and its surroundings were corrected and finalized.

RESULTS AND DISCUSSION

Land cover mapping serves as a basic inventory of land resource. For all levels of government, environmental agencies and private industry throughout the world [9] Kudri is being of the important tourism spot in India with shore area and areas of rapid developments, there is a need for real time monitoring of the land based changes. In the present study, 31415.15 Ha area in and around Kudri was selected to delineate the present overlay of land use/land cover changes. The various features in the study area was depicted using the visual interpretation of the satellite imagery IRS P6 e and was described with the area coverage. Land use classes can be effectively delineated from the digital remote sensing data [10].

The study revealed that nearly 15985.73Ha of the area was covered by agriculture, 618.36 Ha of the area covered with settlement, Forest 3946.56Ha, Fallow Land 7354.74Ha, Land with/without Scrub 981.45, Water body 2528.31 Ha, Land use/ land cover map of the study area was shown in Fig. 2. The classified image map of the study area (In and around Kudri) showed that most of the lands were used for agricultural purposes.

Areal extend of different land use/land cover features

Agriculture is the world's major user of land, water and biological resources. It is the major source of livelihood of more than 70% of the people of the country [11]. In the present study the agricultural land are seen to be occupied by nearly 50.88% of the study

area, which is the major land use activity in this area. Further agricultural area can be increased by identifying cultivable fallow lands using remote sensing followed by field verification. The percentage of agricultural area may decrease during the years to come as over population and the setting up of more industries in the vicinity. using IRS P6LissIIIdata provided due importance to various resource sectors like agricultural planning, settlement surveys, environmental studies and operational planning based on agro-climatic zones.

In the study area, settlement with covers nearly 1.97 % (618.36) of the total area. This increase is due to population explosion and the construction of buildings and factories. Increasing population and industrialization along the coastal areas are adding pressure on the coastal ecosystems [12]. Information needs for water security and management area of diverse nature ranging from mere inventory of surface water bodies to more 60 complex irrigation performances. Water storage, reservoir sedimentation ground water exploration etc. In the present study tanks are observed in many locations. It is the main source of irrigation in the agricultural land and also for drinking in the villages. It occupies nearly 50.88% (15985.73 Ha) of the total 31,415.15 Ha study area. Remote sensing data in conjunction with sufficient ground truth information provides the wise use and supply of drinking water to deprived villages[13].

In the present study, nearly 23.41% (7354.74 Ha) of the area comes under fallow land (Table I). Information on land use/land cover also provides a better understanding of the cropping pattern and spatial distribution of fallow lands, forests; land with/without scrub and surface water bodies, which are vital for developmental planning [14]. Water Body covers nearly 9.21% of the study area. River is the important source for agricultural and drinking purposes in Kudri. Due to variation in the monsoons and rainfall in the study area the river areas are seen to be covered by sand and mud in different seasons. Sand deposited in the river banks are temporary, they are seen mainly in summer season.

CONCLUSION

The present study revealed using the satellite imagery confirm that Kudri and its surroundings up to12 km circle still retain more agricultural land when compared to all other land use/land cover features, though the rate of conversion of agricultural land for other purposes like industries and building construction were increased alarmingly for the past few years. The present study also found that remote sensing coupled with GIS

can be effectively used for real time and long ten monitoring of the environment. The baseline information generated on land use/land cover pattern of the area would be of immense help in formulation of policies and programmes required for developmental planning.

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Table 1: Areal extend of different land use/land cover features

Name of the features	Total area(Ha)	Area %
Agriculture Doublcrop	6306.5	20.07
Agriculture single crop	9679.23	30.81
Forest	1053.25	3.35
Fallow land	7354.74	23.41
Landwith/withoutScrub	981.45	3.12
Built up land	618.36	1.97
Open forest	2893.31	9.21
Water body	2528.31	9.21

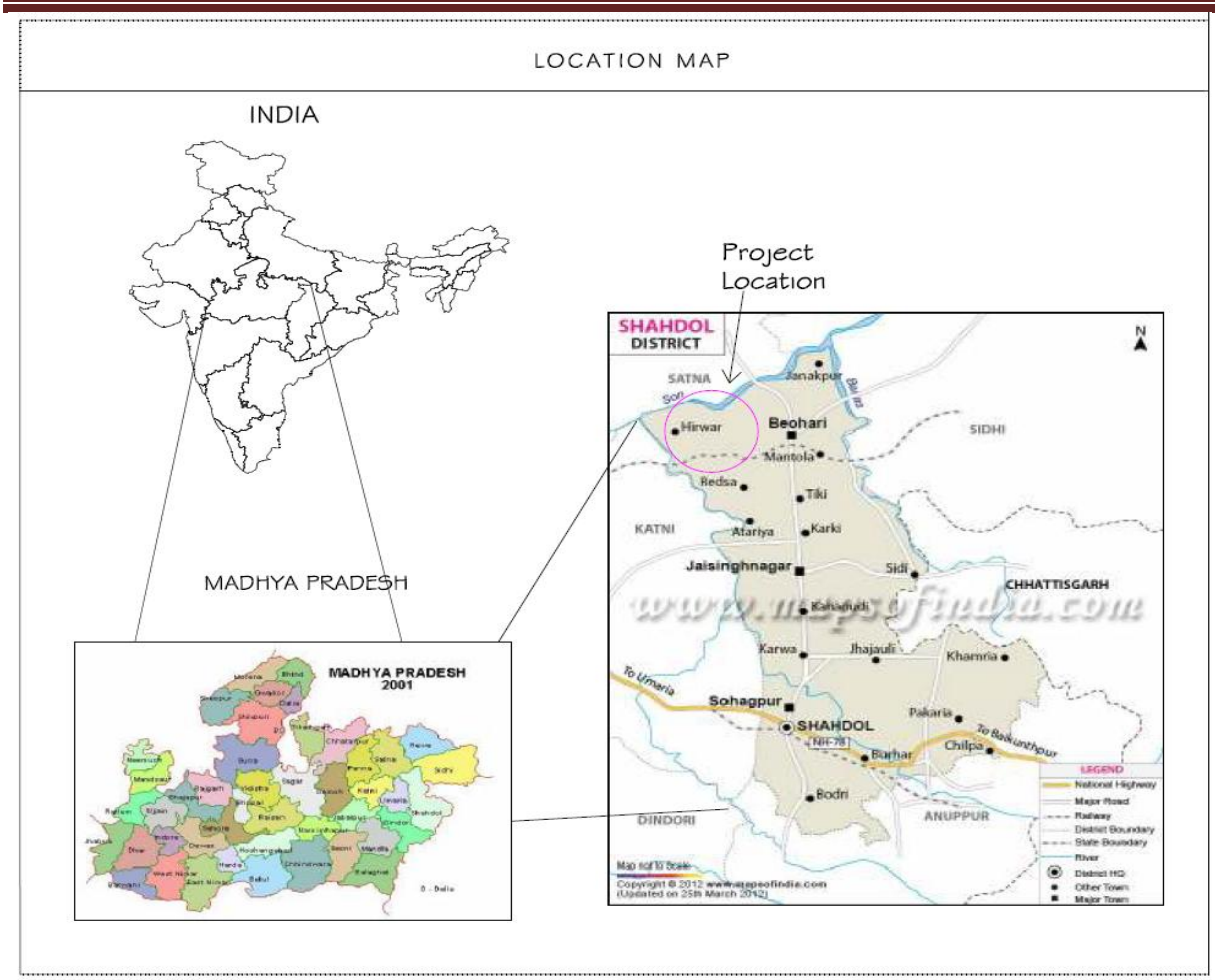

Fig1.1: Location Map of the study area

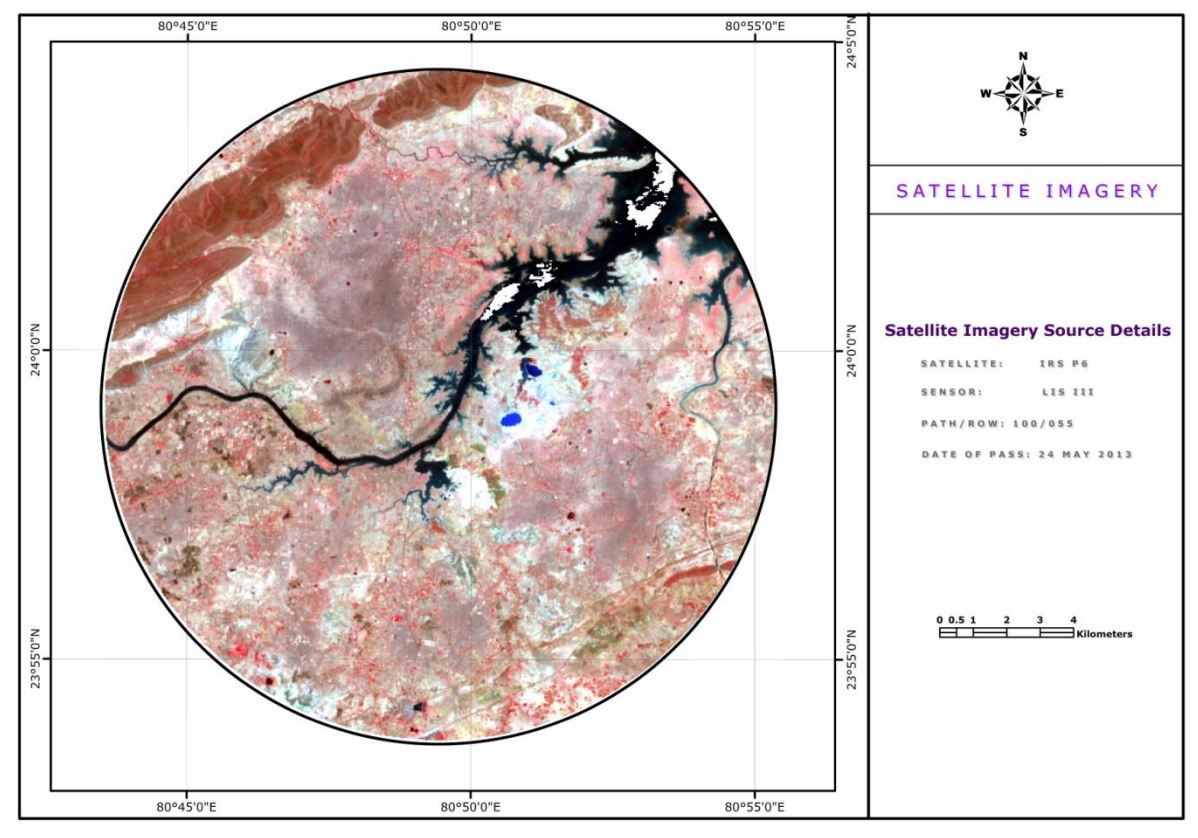

Fig. 1.2: IRS P6 LISS III satellite imagery of the study area

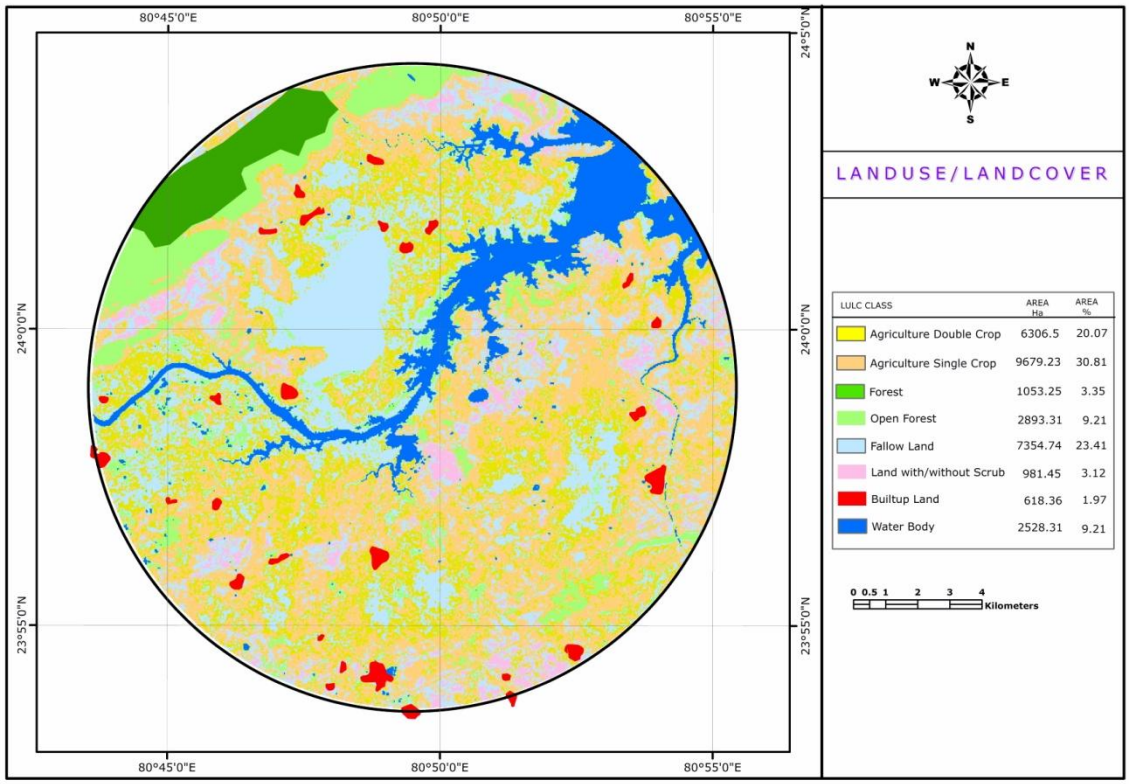

Fig.2 Classified Land use and land cover map of the Study Area

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