RESEARCH FRONT

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LANDUSE PATTERN ANALYSIS USING REMOTE SENSING AND GIS: A CASE STUDY OF JAMNI RIVER BASIN, BUNDELKHAND REGION INDIA

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ABSTRACT

Land use mapping is fundamental for assessment, managing and protection of natural resources of a region and the information on the existing land use is one of the prime pre-requisites for suggesting better use of terrain. Advances in satellite sensor and their analysis techniques are making remote sensing systems realistic and attractive for use in research and management of natural resources. Land use maps are valuable tools for agricultural and natural resources studies. Due to strength of natural resources, updating these maps is essential. Employing traditional methods through aerial photos interpretation to produce such maps are costly and time consuming. With the growth of population and socio-economic activities, natural and cover is binge modified for various development purposes. This has increased the rate of changes on land use pattern over time and thus, affecting the overall ecosystem health. Land use mapping is an important tool for land management and monitoring. This paper analyzes land use pattern of Jamni river basin Bundelkhand region India using remotely sensed data and classified using ERDAS IMAGINE software. The various categories of land use in the area recognized are forest, agriculture, Fallow land, and Waste land and water bodies. Agriculture is the major land use categories in the study.

Key words: Remote sensing, land use pattern, GIS Jamni basin Erdas imagine

INTRODUCTION

Landuse refers to man's activities on earth, which are directly related to land, where's land cover denotes he natural features and artificial construction covering the land surface. Land use practices of a region are influenced by a number of parameters namely physical and chemical environments, socio-economic factors and needs of the masses. Ever increasing demand due to rapid growth of population has put heavy pressure on natural resources of the country. The removal of poverty and unemployment through judicious planning and use of available resources is the hallmark of the development process. Since the adoption of the policy of planned economic development, efforts are being continually made to achieve sustainable rates of growth in all key sectors with a view to attain economic self-sufficiency and resource sustainability. To achieve such a major goal, it is imperative to have information on exiting natural resource scenario, their physical/ terrain features, climate parameters, ecological conditions, socio-economic profile of the area, current practices of planning and management, and the contemporary technologies to be used for the sustainability of natural resources.

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Uncoordinated development can lead to inefficient and undesirable environmental, social and economic conditions [2]. Land use and land cover information are important elements for monitoring; evaluating. Protecting and planning for earth resources. Remotely sensed multicultural data collected from satellites provide a systematic, ability to assess conditions over large areas and on a regular basis [5]. Remote sensing has traditionally concentrated on rural or natural areas when looking at land use change. With most image analysis applications, the aim is to produce classified end products through classification methods. The problem with using either of these methods over a time-series of imagery is that the classification errors will propagate over the length of the analysis period. With most image analysis application, the aim is to produce classified end products through classification methods. Land cover classification refers to matching land cover classes identified particular features within the vicinity. It is a process that allows generating a land cover map with detailed information about the composition and physiognomy of the area of interest.

A variety of image classification techniques have been developed to generate the process of land cover classification [6,8]. In general, land cover classification is divided into two basic approaches, namely (1) unsupervised and (2) supervised classifications, which depend on a priori knowledge regarding the land cover types across the study region.

In recent years geo-spatial information technologies are becoming increasingly important in the development. Management and monitoring of various earth resources. Geographic Information System (GIS) coupled with satellite data provides decision-makers with a unique view of the landscape, which enables land managers to improve natural resource management [13]. The use of geo-spatial information establishes a dialogue linking local knowledge and science, and national development strategies. One general advantage of geospatial data is the capability to increase the accuracy of data gathering and analysis. These technologies have been widely used successfully to manage land resources. Recent studies have revealed widespread application of geospatial information technologies in the decision-making process of land use mapping and monitoring for natural resource assessment and management of different locations of the globe [14,3,12,4,1]. Land use pattern along with geophysical data are used to find out the groundwater prospect zones in the hard rock terrains [15, 16]. The present work has been carried out to understand the capability of geospatial techniques in land cover mapping in the area.

LOCATION AND EXTEND OF THE RIVER BASIN

Jamni sub river basin lies between 24°,4,' 12.0" N to 25°,22',12.0" N latitude and 78°,18',0.0" E to 78°, 53',24.0" E longitude, Fig (1) with an area of 4777 sq. km comprises major part of Lalitpur district (U.P) some part of Tikamgarah and Sagar district of (M.P). The major tributary of Jamni river are Shahzad, Sajnam and Jamrar, which are cover the major part of Lalitpur district of U.P and Bargi river flow in Tikamgarah district. Finally Jamni river meets in the Betwa at Orchha. The length of the river is 144.2 km and width is 55.57 km. The total population of the basin, is 72,2,00 in (1981).133,041(2011).

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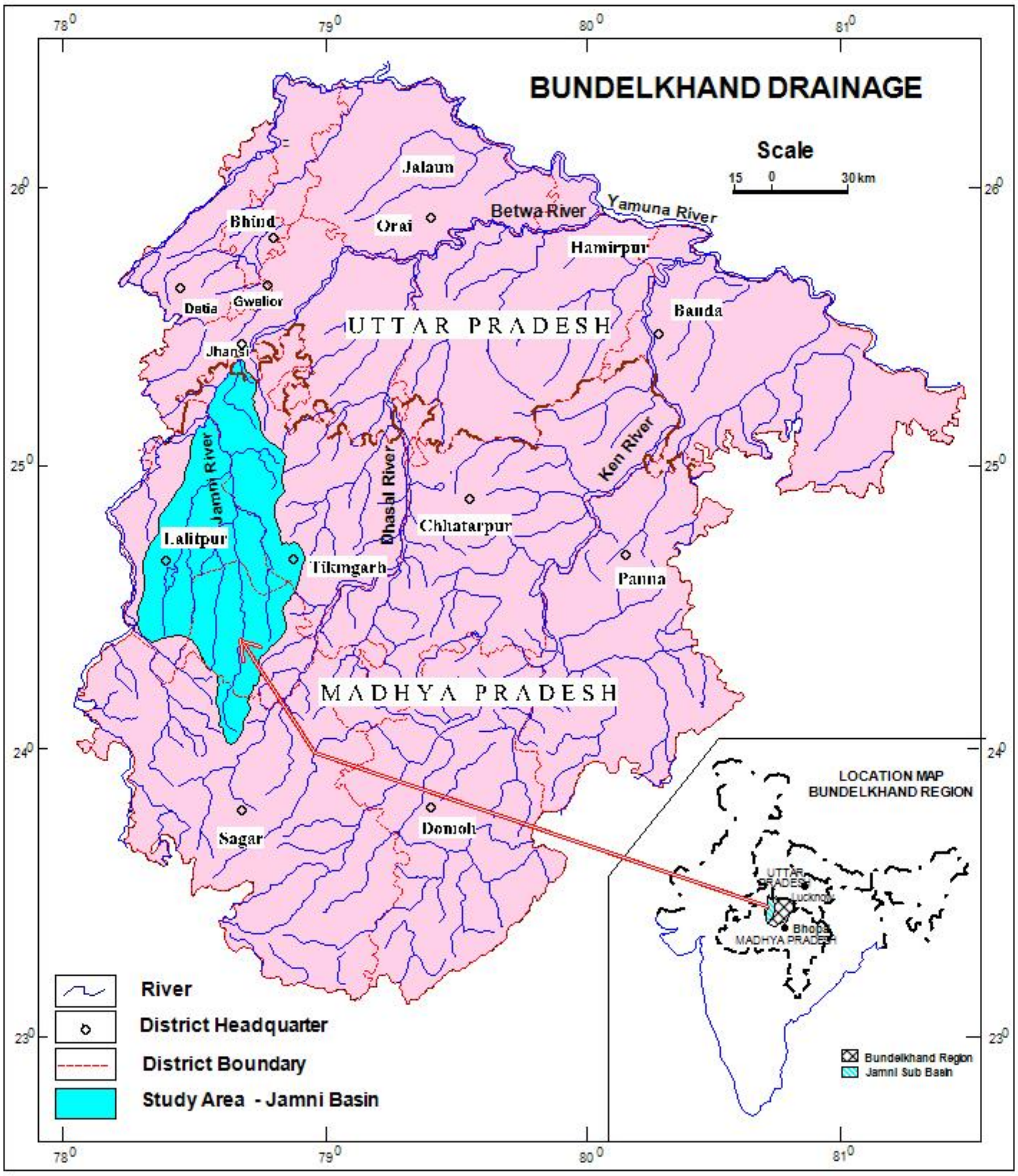

Figure (2.1)

MATERIALS AND METHODS

Image interpenetration can be carried out in two most popular ways e.g. digital analysis. In the digital classification process, training areas for different classes are defined on to the satellite imagery on spectral response pattern in different spectral bands. Based on these training areas satellite imagery is classified into different classed using parametric or non parametric classifiers. Digital analysis is fast and output image is raster, which is simpler in structure but big in size. Masks are often used for improving the classification of known areas (LU et al., 2007).

Accurate registration of multi-spectral remote sensing data is essential for analyzing land use and land cover conditions of a particular geographic location. In this study, geometric correction of remote sensing data is done for the distortions and degradation's caused y the errors due to variation in altitude, velocity of the sensor platform, variations in scan speed and in the sweep of the sensors field of view, earth curvature and relief

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displacement. The satellite data (IRS D) has been geometrically corrected ad geocoded to the Universal Transverse Mercator (UTM) coordinate system by using a reference image of SOI toposheet. A minimum of 25 regularly distributed ground control points were selected from the images. The information provided by the satellites in combination with other sources to quantify the various parameters of land use of the basin has been evaluated by applying various image processing steps through the use of ERDAS Imagine and ARC GIS software.

Land use- land cover (LU/LC) classification is based on the scheme developed by National Remote Sensing Agency (NRSA, 1995). A supervise classification scheme for remote sensing data have been reported by many previous studies for land cover classification using the maximum likelihood classifier.

RESULTS AND DISCUSSION

Land is one of the most vital accepted natural resource. The landuse pattern and its spatial distribution are the major rudiments for the foundation of a successful landuse strategy required for the appropriate development and organization of any area. The land use map prepared through remote sensing data and their spatial distribution is shown in figure 2 and their area is given in table 1. Land cover mapping serves as a basic inventory of land resources for all levels of organization, environmental agencies and private industry throughout the world. The various land use patterns are depicted in the study area using the supervised classification of satellite imagery of IRS ID.

Image classification:

Resources sat – I satellite imagery and Survey of India topographical map (1:50,000) scales have been used for image processing Erdas Imagine (Version - 13) has been used for digital land use classification.

Images Processing (Supervised classification):

According to supervised classification of Jamni sub river basin the maximum area is covered by agriculture land (crop area) is 36.21%. Although agricultural crop land is found in whole basin but it is dominated in northern and mid central part of the basin. Fallow land is just adjoining area of the crop land but it is dominated in the central and southern part of the basin. Fallow land area is 18.81% of the basin area.

Wastelands especially open scrubs area is the 33.12% of the basin. It is mostly found in central and southern part of the basin.

Forest area which is very important part of the basin is found only 4.72%. This is Reserved Forest area (RF). Unreserved forest area is 5.10%. Grazing activity is dominated in this part. In this way there is similarity between digital landuse and census data landuse(Table 2)

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Fig.2: Land use pattern of Jamni river basin

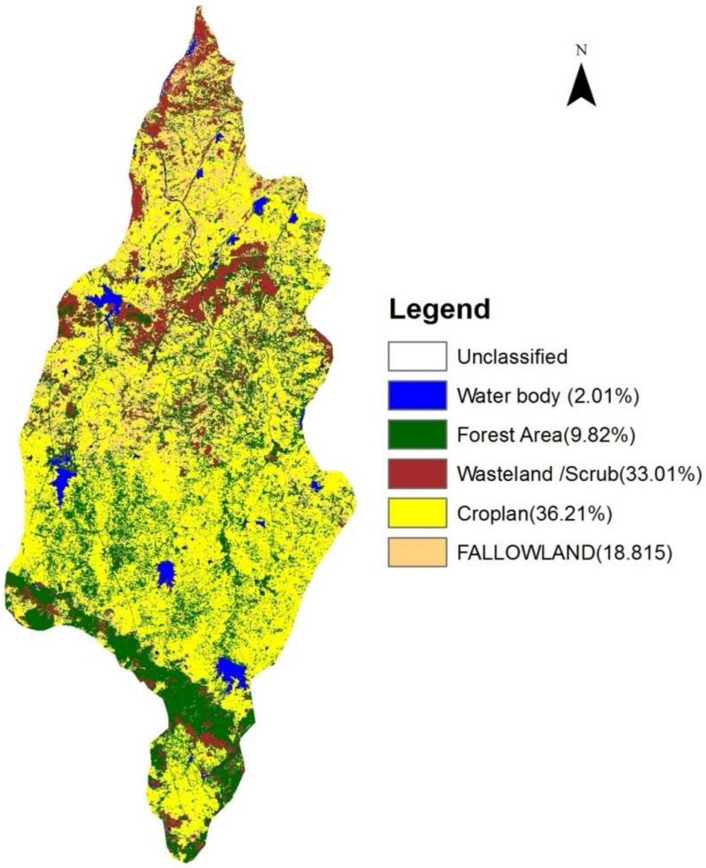

Table (1)
Landuse/ landcover of Jamni sub river basin through supervised classification (2011).

Types of landuse/landcover	**Area in ha.**	**Area in percentage**
Water Bodies	9400.35	2.016%
Reserved Forest area	22018.14	4.72%
Unreserved forest area	23804.66	5.10%
Agricultural crop land	168837.82	36.21%
Fallow land	87714.22	18.81%
Wasteland / open scrub area	154463.32	33.12%
Total	**466238.77**	**100.00**

Table (2): Land use Categories of the River Basin

Type of land use	% of the total Geographical area (1981)	% of total geo area in (2001)	Changes Between (1981and 2001)in%
I. Forest area	10.2	6.21	-3.99
II. Irrigated area	13.00	42.00	+29.00
III. Unirrigated area	29.46	19.37	-10.00
IV. Culturable wasteland	40.00	23.00	-17.00
V. VI. Area not available for Cultivation	10.22	8.49	-1.79
Total:	**101.03**		

If we see the census data 1981(table2) where Agriculture land area is very less and it has been increased in 2011. Forest area is degraded. Wasteland area was more in 1981 and it

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is decreased in 2011. Due to watershed project implementation irrigated area is increased so the crop land area is increased.

CONCLUSION

The present study revealed that remote sensing and GIS techniques can be effectively used for development of land use/land cover plan map. The present study also found that remote sensing coupled with GIS can be effectively used for real time and long term 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 of the area.

Land use /land cover mapping and changes are depending on the physical conditions, which are mainly driven by socio-economic factors. They can be mainly characterized by the changes of cultivated land wasteland and forest area in the basin. Which are strongly inter-related with human construction behavior.

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