Landuse/Landcover Mapping of Achanakmar Amarkantak Biosphere Reserve, India Using Unsupervised Classification Technique

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Abstract

Achanakmar Amarkantak Biosphere Reserve located at the junction of hill ranges of Madhya Pradesh and Chhattisgarh state, India. Occupying total area of 3835.51sq.km. with topography ranging from high mountains, shallow valleys and plains. The core region of Achanakmar Amarkantak Biosphere Reserve falls in Chhattisgarh state lies between $22^0$15' to $22^0$58'N and $81^0$25' to $82^0$50'E ,falls under the survey of India toposheet No. 64 F5,6,7,9,10,11,1314,15,64J1,J3.The Biosphere is bounded by Anuppur, Dindori and Bilaspur district.

Landuse and Landcover is an important parameter for developmental planning. In the present study an attempt has been made to generate the landuse landcover map from IRS satellite image using unsupervised classification. The study is based on secondary data, and using ERDAS IMAGINE software for all processing of the study area. The satellite imagery has used to prepare the land use and land cover map using unsupervised classification. The land use and land cover map clearly shows that area of Forest land is higher than others.

The main objective of this research paper is to analyzing the disturbance gradient in the Biosphere and development of wildlife information base including inventory data on habitats and species.

Keywords: Landuse, Landcover, LISS-3 Data, Biosphere reserve, Wildlife, Satellite imagery, Secondary Data Unsupervised classification technique.

I. Introduction

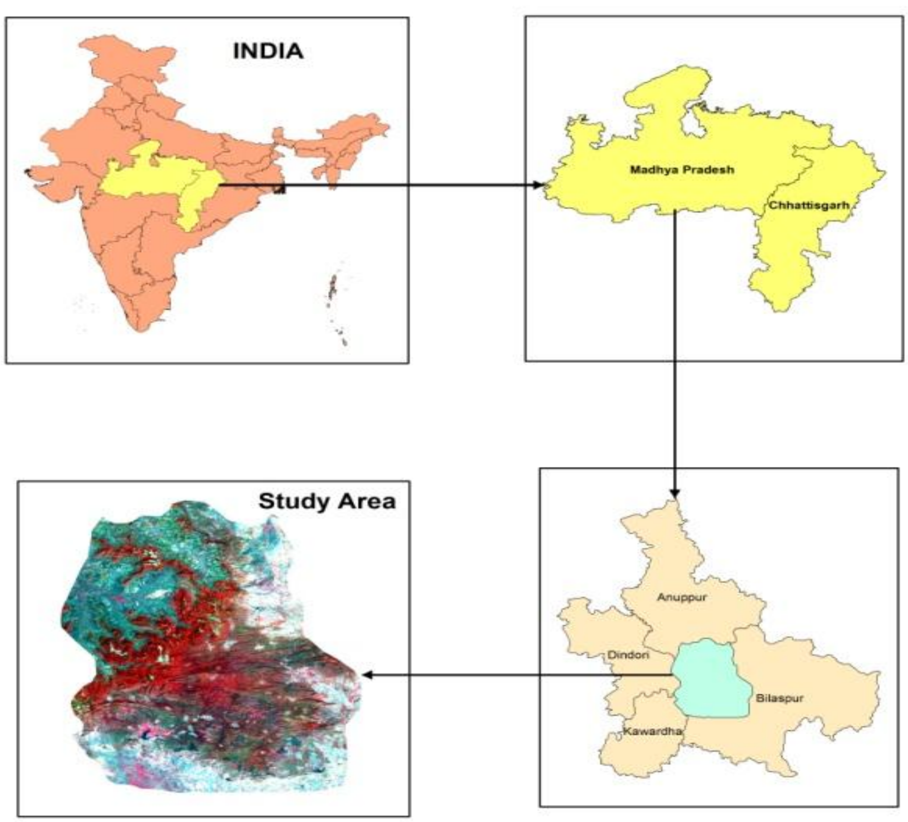
Satellite Remote Sensing has become an important tool for monitoring and management of natural resources and the environment. Remotely sensed data are widely used in landuse/landcover classification. Landcover relates to the discernible Earth surface expressions, such as vegetation, soil, water or anthropogenic features, and thus describes the Earth's physical state in terms of the natural environment and the man-made structures (Xavier Baulies and Gerard Szejwach, 1998). Essentially, land cover can have only one class or category at a given time and location, and can be mapped using suitable remote sensing data with spectral signatures. Land use is an expression of human uses of the landscape, e.g. for residential, commercial, or agricultural purposes, and has no spectral basis for its unique identification. Thus it cannot be explicitly derived from image data, but only inferred by visual interpretation or assessed in the framework of object-based contextual analysis Landuse is obviously constrained by environmental factors such as soil characteristics, climate, topography and vegetation. But it also reflects the importance of land as a key and finite resource for most human activities including agriculture, industry, forestry, energy production, settlement, recreation, and water catchment and storage. Land is a fundamental factor of production, and through much of the course of human history, it has been tightly coupled with economic growth. Often improper Landuse is causing various forms of environmental degradation for sustainable utilization of the land ecosystems, it is essential to know the natural characteristics, extent and location, its quality, productivity, suitability and limitations of various landuses. Landuse is a product of interactions between a society's cultural background, state, and its physical needs on the one hand, and the natural potential of land on the other (Balak Ram and Kolarkar 1993). In order to improve the economic condition of the area without further deteriorating the bio environment, every bit of the available land has to be used in the most rational way.

As a result of technological advancements, changes of the earth's surface have become visible by satellite imagery as a result remote sensing has become the most effective tool for assessing and monitoring all these transition (Deer,1995) Therefore satellite remote sensing has become a major data source for different change detection applications, because of the repetitive data acquisition capabilities, digital format suitability for computer processing and lower cost than those associated with traditional methods (Coppin et al. 2002; Deer 1995; Lu et al. 2004)

II. Study Area

The Achanakmar-Amarkantak Biosphere Reserve Located in the states of Madhya Pradesh and Chhattisgarh, the Achanakmar-Amarkantak Biosphere Reserve is one of the premium biosphere reserves in India. The reserve covers a huge area of 3835.51 sq. km. and it falls in almost northern part of Bio-geographic zone. About 68.10% out of the total area of this reserve lies in the Bilaspur district in Chhattisgarh. The other major portions of the reserve fall in the Anuppur (16.20 %) and Dindori (15.70 %) districts of Madhya Pradesh. The protected area, Achanakmar Sanctuary is located in Bilaspur district, within the area of the Biosphere Reserve. The sanctuary has a total geographical area of 551.15 sq. km. The Achanakmar-Amarkantak Biosphere Reserve has been divided into core and buffer zone. The entire area of the Achanakmar Sanctuary is designated as the core zone of the reserve and the rest of the 3284.36 sq. km. are serving as the buffer zone, of this reserve. Out of the total area of the buffer zone, an area of 1224.98 sq. km. falls in the state of Madhya Pradesh and the remaining area of 2059.38 sq. km. falls in the Chhattisgarh state. The topography of the Biosphere reserve varies from the rice fields below in Bilaspur and Anuppur and the wheat fields in Dindori, to the hills of Maikal range of Satpuras. The topography of the soil in the Amarkantak plateau is of bauxite rocks. Several streams and Nallas are flowing through the reserve and many of them are perennial. The area of the Achanakmar-Amarkantak Biosphere Reserve is considered as one of the major watershed of peninsular India. It separates the rivers that drain into the Arabian Sea and Bay of Bengal. The reserve is also unique or being source of three major river systems like Narmada, Johilla and Sone of the Ganga basin, and also the Ama Nalla stream. The junction of the hill ranges like Vindhya and Satpura, the Maikal hill ranges lie within the Achanakmar-Amarkantak Biosphere Reserve.

Location Map of the Study Area



Data Used

1. SOI Toposheet
2. Satellite Data

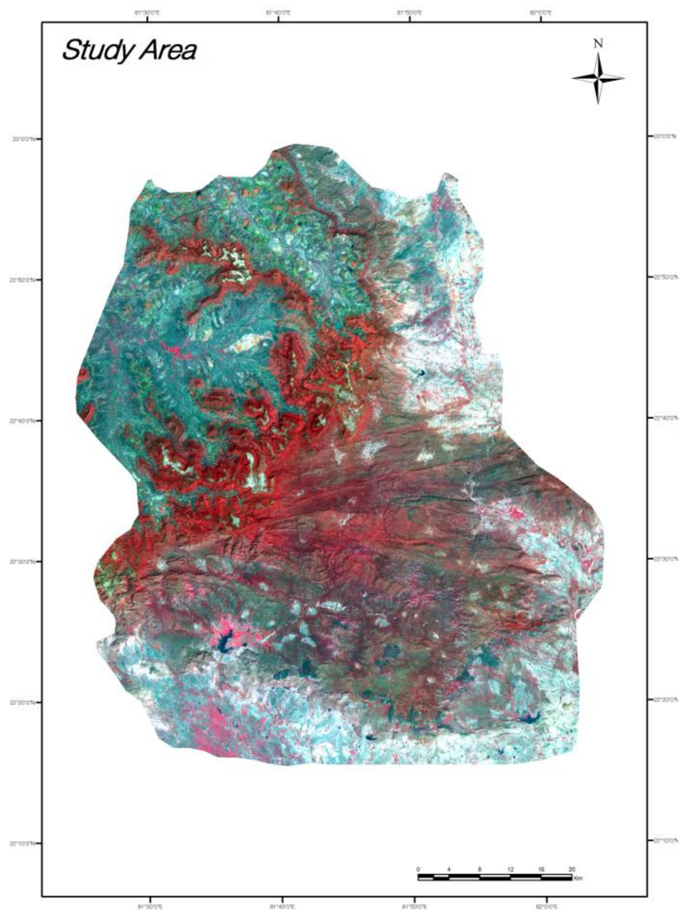


Figure 1: IRS LISS-III satellite image of the study area

III. Aim and Objective

- Preparation of various thematic data such land use and Land cover using LISS-3 Data.
- Create a land use land cover map from satellite imagery using unsupervised classification.
- To analyzing the disturbance gradient in the Biosphere and development of wildlife information base including inventory data on habitats and species.

IV. Methodology

- Geometric corrections of IRS-1C LISS-III data using survey of India (SOI) Toposheet at 1:50,000 scales.
- Selection of study area
- Land use/Land cover classification using unsupervised classification
- The extraction of thematic layers.
- Comparison of overall accuracies of each method with respect to performance Evaluation /Accuracy assessment.
- Output generation

Data Processing

- Analysis and interpretation of satellite data will be done by digital image processing as depicted the process generally includes 3 steps:

1. IMAGE PRE-PROCESSING
2. IMAGE ENHANCEMENT
3. IMAGE CLASSIFICATION

Field Surveys

Field surveys will be conducted within the study areas to determine the major types of landuse and landcover. Such data would be used in two aspects of the mapping of land use land cover. Firstly it will aid in land use and land cover classification, by associating the ground features of a specific type of land use and land cover with the relevant imaging and spectral characteristics. Secondly, ground data will be used for accuracy assessment of the developed land use and land cover maps.

V. Result

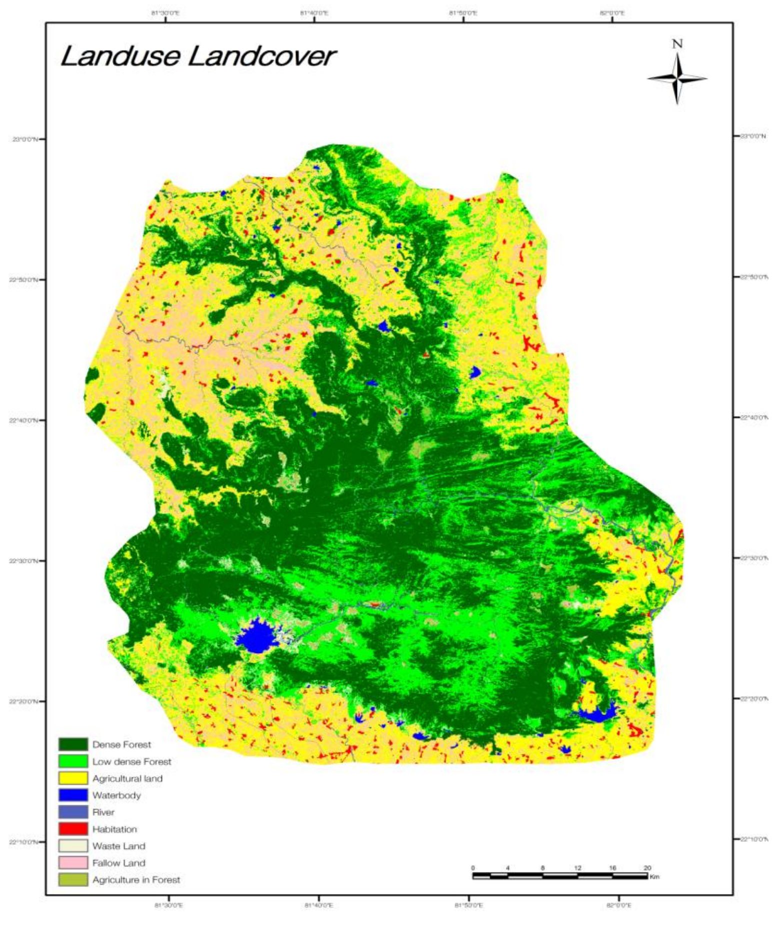


Figure2: Land use and Land cover details of the study area

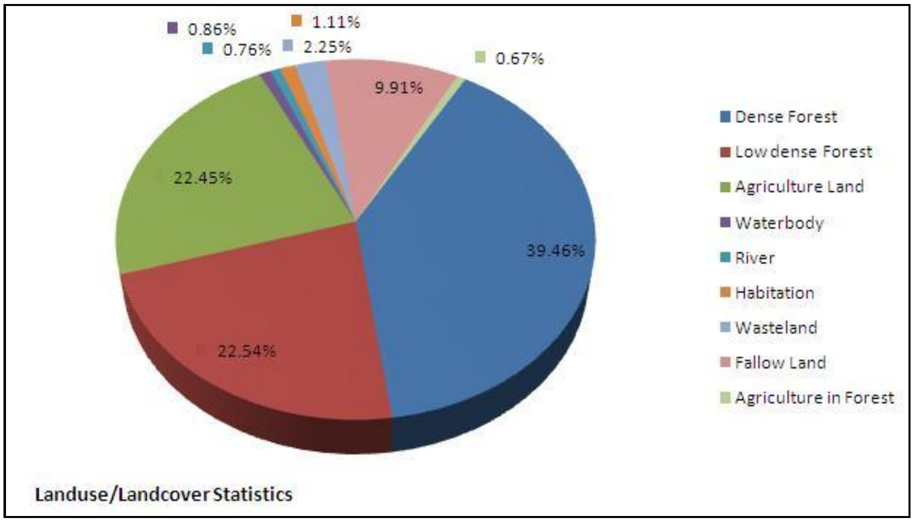


Figure 3: landuse landcover Statistics of Area

The land use and land cover map clearly shows that area of Forest Land is higher than others. Agriculture Land occupies second while fallow land hold the third place in given map.

Class	**Area (ha)**
Dense Forest	151555.14
Low dense Forest	86574.24
Agriculture Land	86223.87
Water body	3291.39
River	2900.61
Habitation	4270.14
Wasteland	8656.92
Fallow Land	37500.72
Agri. in Forest	2581.2
Total Area	383554.23

VI. Accuracy Assessment

The classification accuracy is most important aspect to assess the reliability of maps, especially when comparing different classification techniques. During this study the accuracy assessment method were used. Accuracy assessment, automatic random point to be selected by software. This method shows above 90% accuracy of map.

VII. Conclusion

This study shows how to classify land use and land cover map from Multispectral satellite imagery using unsupervised classification technique. In this method we calculated land use and land cover classes and their area using image interpretation keys and their unique spectral signature, the land use and land cover map clearly shows that area of Forest is higher than others. The present study supports their results by achieving highest accuracy even in case of Land use land cover mapping.

The classification accuracies were interpreted in terms of

(a) Effect of spatial resolution with same bandwidth.
(b) Comparison of three band set with MIR as either an additional Band or a replacement,
(c) Effect of date of acquisition

VIII. References

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