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Accuracy Assessment of Land Cover Classification in Jodhpur City Using Remote Sensing and GIS

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Abstract: A This study examines the accuracy assessment of land use land cover (LU-LC) classification mapping using remote sensing and Geographic Information System (GIS) carried out in Jodhpur city. Landsat-8 OLI image of year 2015 was used and analyzed using image processing software. The land use and land cover classes area Built-up area, Vegetation, Mining area, Water bodies and Other area (crop land & shrub land) were studied. Supervised classification method was used to classify the image. The accuracy assessment model was used to measure of how many ground truth pixels are properly classified. The adequate accuracy assessment of the Land cover classification requires that a number of random location in the study area to be chosen that represent the classes in the classified map. These locations are visited and GPS data are collected so that they can be accurately classified. The classified locations are then compared with the land cover map to generate the overall accuracy. The result shows that overall accuracy of land use and land cover is 89.69% and Kappa (K) is 0.84 which is acceptable in both accuracy overall and Kappa accuracy.

Keywords: Accuracy Assessment, GIS, Kappa, Land Use Land Cover.

I. INTRODUCTION

Studies of land use and land cover structure change usually needs development and definition of more or less homogeneous land use land cover units before the analysis is started. The LU-LC features in the region comprises of various types, referred as classes. The features derived from the satellite image after validation by the ground observations, have been presented as five classes. These classifications types are as per the 'level classification' categories followed by National Remote Sensing Center (NRSC). In the field LU-LC features were obtained in conjunction with imagery and derived five prominent land cover features. After mapping of land use land cover classification, the accuracy of classified map should be defined. Accuracy assessment or validation is an important step in the processing of remote sensing data which determines the information value of the resulting data to a user (Abubaker et al. 2013). In present, researchers lean to use high spatial resolution data in order to obtain more accurate and precise result.

II. STUDY AREA

Jodhpur, one of the largest district of Rajasthan states is centrally situated in western region of the state. Jodhpur city is located at 26ºN 18' latitude and 73º E 04' longitude and at an average altitude of 224m above mean sea level. In general the contours are falling from North to South and from North to Southeast with maximum level of 370m and minimum of 210m. The present population is about 1.05 million and has been functioning as one of the engines powering the Indian economy. The location map of the study if given in Fig.1.

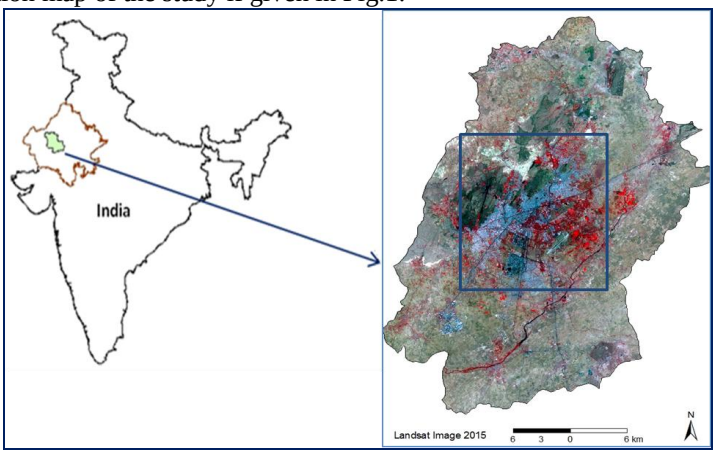

Fig.1. Location Map of The study Area

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III. DATA AND RESEARCH METHODOLOGY

The Landsat data scene of False Colour Composite (FCC) and true color composite (TCC) were used on scale 1:50,000 for year 2015 in the present study (Table-1). The data that has been used for studying the land use/land cover classification accuracy analysis. Along with satellite data SoI maps, district gazette & resource map and ground truth data were also used for this study. Arc GIS software is used for Preparation of Location of the study area, ERDAS Imagine software is used for Image classification. Kappa can be used as a measure of agreement between model predictions and reality (Congalton 1991) or to determine if the values contained in an error matrix represent a result significantly better than random (Jensen 1996). The research methodology adopted is given in Fig.2.

TABLE-1: The Satellite Data used in the Study Area.

RS Data	Resolution	Path/Row	Date of Acquisition
Landsat OLI	30 m	149/42	2-May- 2015

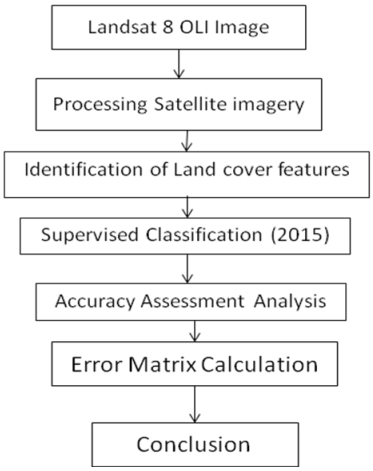

Fig.2. Methodology Adopted.

IV. RESULTS AND DISCUSSION

In order to use the supervised classification the training samples were created using FCC Landsat imagery (Fig.3), then the supervised classification based on maximum likelihood algorithm has been used for classification because the other algorithms result was not satisfactory. The results of the land cover classification is observed in the Fig.4. The percentage of areas of classified land cover classes are given in Table-2 are; Vegetation (14.28%), water body (0.24%), built up areas (22.09%), other area (58.68%), and mining area(4.7%).

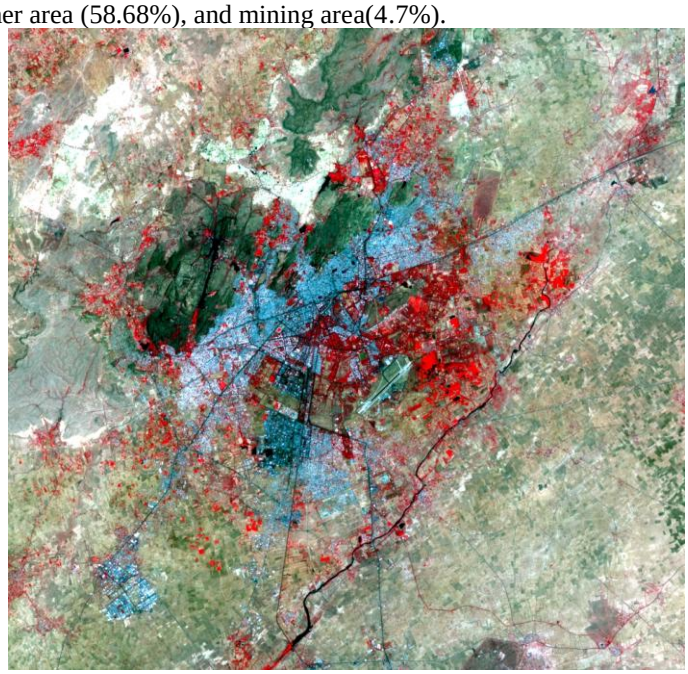

Fig.3. FCC Landsat Imagery (2015) of The Study Area.

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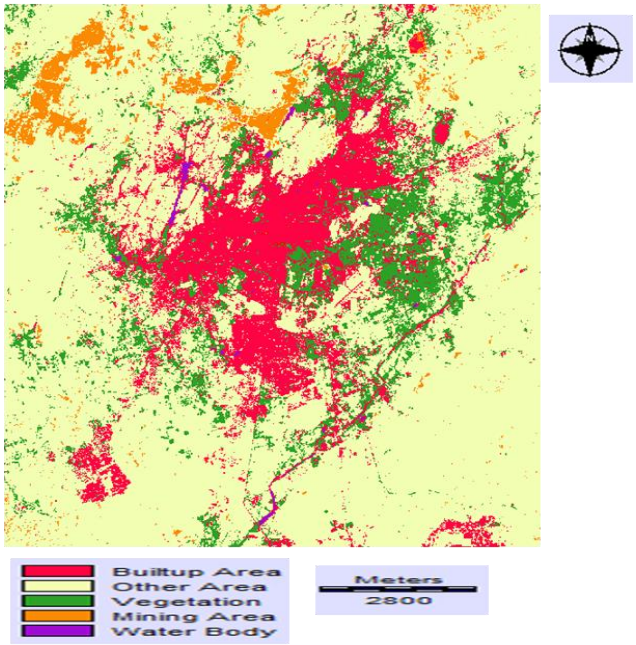

Fig. 4. LU-LC Map of the Study Area.

Table-2. LU-LC Classification Statistics

Land Cover Classes	**Year -2015**	
	Area (km^2)	**% Area**
Built up Area	131.25	22.09
Other Area	348.57	58.68
Vegetation Land	84.85	14.28
Mining Area	27.93	4.70
Water bodies	1.40	0.24
Total Area	**594**	**100**

For this process we need ground truth data for testing sites, and user interpretation has been used for selecting the testing sites. For each LU-LC class 34 random points were created and compared with the satellite images. For each class the general requirement is 50 points (Lillesand & Kiefer, 2004), since the water bodies don't cover a huge area only 14 points were created for water bodies in LU-LC map. The method used for accuracy assessment is a comparison technique which is comparing the testing points with the classified image for the each land cover class. The result of classifications for Landsat image (2015) was evaluated through the accuracy assessment process. The indices used for the evaluation were overall accuracy, overall Kappa (κ) as well as producer's and user's accuracy for individual land classes. There are different qualitative classifications of degree of agreements for Kappa values(Table-3).

TABLE-3. Strength of Agreement for Kappa Statistic

Kappa Statistic	**Strength of Agreement**
<0	Poor
0.00-0.20	Slight
0.21-0.40	Fair
0.41-0.60	Moderate
0.61-0.80	Substantial
0.81-1.00	Almost Perfect/Perfect

The producer's and User's accuracy for individual land cover classes is given in Table-4. The Overall accuracy and Kappa (κ) statistics for the classifications given in Table-5.

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TABLE-4: Producer's and User's Accuracy land cover classes

Class Name	Accuracy (%)	
	Producer's Accuracy	User's Accuracy
Built up Area	94.85	96.87
Other Area	74.97	98.13
vegetation	92.39	72.92
Mining Area	97.84	92.76
Water Body	100.0	89.79

TABLE-5: Overall accuracy and Kappa (κ) statistics for the classification

	Accuracy
Overall classification accuracy (%)	89.69
Overall Kappa (κ) statistics	0.8413

V. CONCLUSION

Remote sensing is very important for the production of LU-LC classification mapping which can be done through a method called image classification. In addition classified image need to be assessed for accuracy, before the same could be used as input for any applications. The results show that the achieved overall classification accuracy was 89.69% and overall Kappa (κ) statistics were 0 0.8413 respectively for the classification of 2015 image. The ranges attained for producer's accuracy was 74.97% - 97.84% whereas user's accuracy was 72.92% - 98.13% respectively for the classification of 2015 image. The kappa coefficient is rated as considerable and hence the classified image found to be fit for further research.

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BIOGRAPHIES

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