

Monitoring and Visualization of Land cover Features and Mining area of Jodhpur city using Band Ratio Techniques.

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ABSTRACT: The sandstone mining in Jodhpur city provides employment to local people and revenue to the government. Over the years advanced instruments and some skilled personnel also enhance the mining activities. New leases are also allocated for the barren area near the existing quarry's. In recent years, remote sensing (RS) and Geographic Information System (GIS) technology has emerged as a powerful tool for monitoring and visualization the mining areas over the time. The objective of the study is to find various band combination and band ratio for visualisation of mining and surrounding land cover features. Results revealed significant tone and texture of various surface features in band ratio images.

KEYWORDS: Mining, GIS, Remote Sensing, Band Ratio, Land Cover Features.

I. INTRODUCTION

Sandstone mining in the Jodhpur city is one of the important activities which provides numerous earning capacities to local inhabitants, helps in development of infrastructure facilities and provides additional employment for other person indirectly. In addition to this quarrying activity also affects the surrounding environment of the area. GIS today involves sophisticated software and can be integrated with Remote Sensing (RS) technologies to provide monitoring of land cover features. The key element of GIS is that attributes are related spatial and some system is utilized to process and analyze these relationships. In the present study, Landsat data which is having spatial resolution 30m was used to generate baseline information of land cover types of Jodhpur city and surrounding area.

II. STUDY AREA

Jodhpur city is located at a latitude of 26° 18' North and longitude of 73° 1' East and is located in the middle of the Thar Desert tract of western Rajasthan (Fig.1). Its general topography is characterized by the hills located in the North and North-west. Jodhpur city is located at an average altitude of 241 m above Mean Sea Level at railway station with fort and old city being much higher at 367.83 m and between 277.21m to 245.50 m respectively. The city has a natural drainage slope from North-North East to South-South East towards Jojari River. The economy of Jodhpur thrives on industrial goods and cultural heritage.

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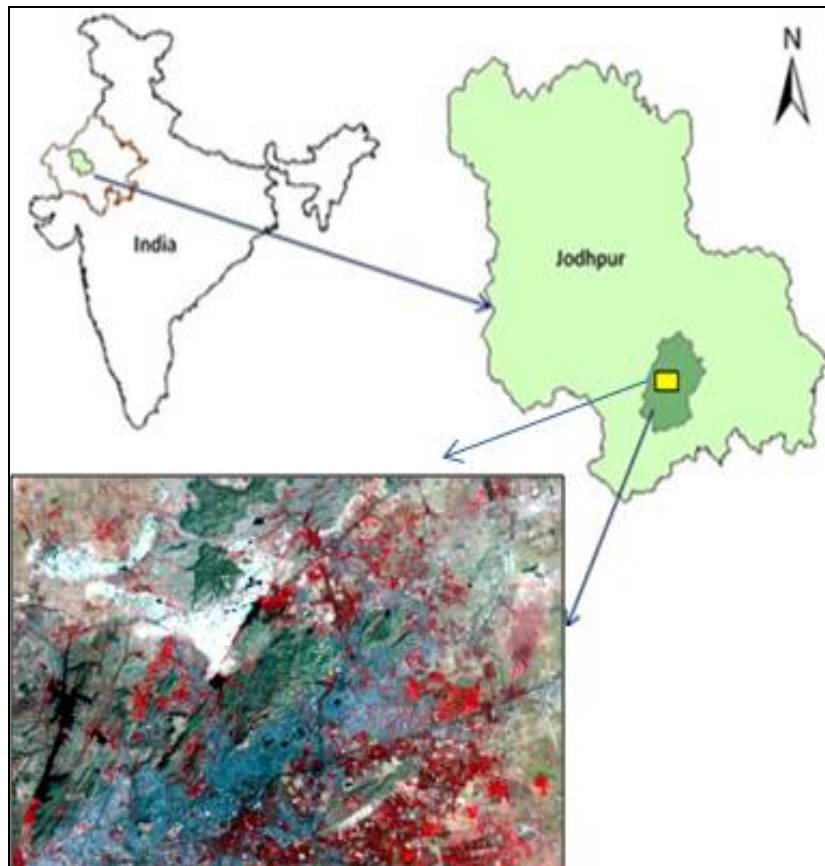


Fig.1. Location Map of the Study Area.

III. DATA USED

Geocoded False Colour Composite scene of LANDSAT data (2010 and 2015) with Survey of India (SoI) maps are used in the present study. The Characteristics of satellite data is given in Table-1.

Table-1. Characteristics of Satellite Data

Reference year	Satellites/ Sensors	Resolution	Path/Row
2010	Landsat TM	30m	149/42
2015	Landsat-8 OLI	30m	149/42

IV. METHODOLOGY

A systematic approach involving multiple steps was followed to carry out the present work (Fig.2). The Area of Interest was demarcated on the satellite imagery of the study area. Various image processing techniques and interpretation was performed using ERDAS Imagine. Land cover classes were identified by means of visual

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interpretation and ground truth data using handheld GPS. Major classes in the study area are mining area, urban area, vegetation and water bodies.

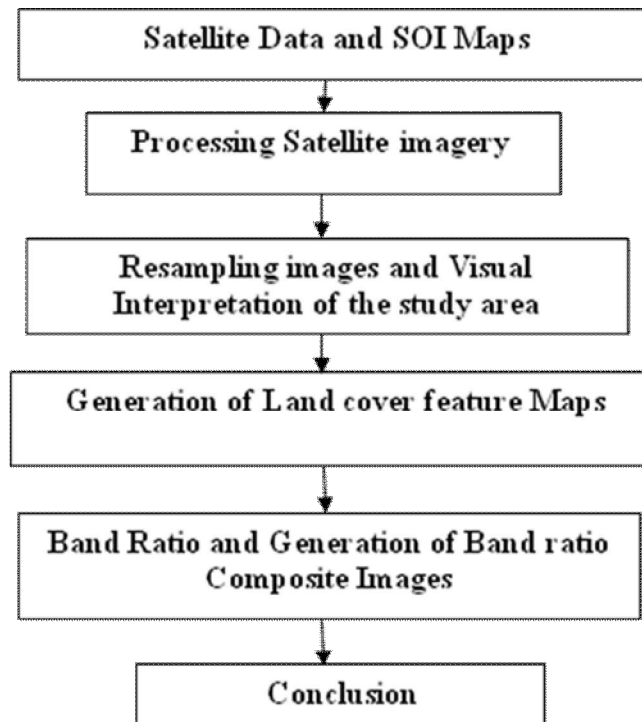


Fig. 2. Methodology Flow Chart

V. RESULTS AND DISCUSSION

The objective of present study was to visualize land cover features of mining area and land cover features using various band ratio techniques and generation of band ratio composite images for visualization of various land cover features.

(A) Land Cover Classes around Mining Area of the Jodhpur City:

There are four important classes around mining area these identified on satellite imagery (fig.3 & 4) and their attribute information with field photograph is given in Table-2.

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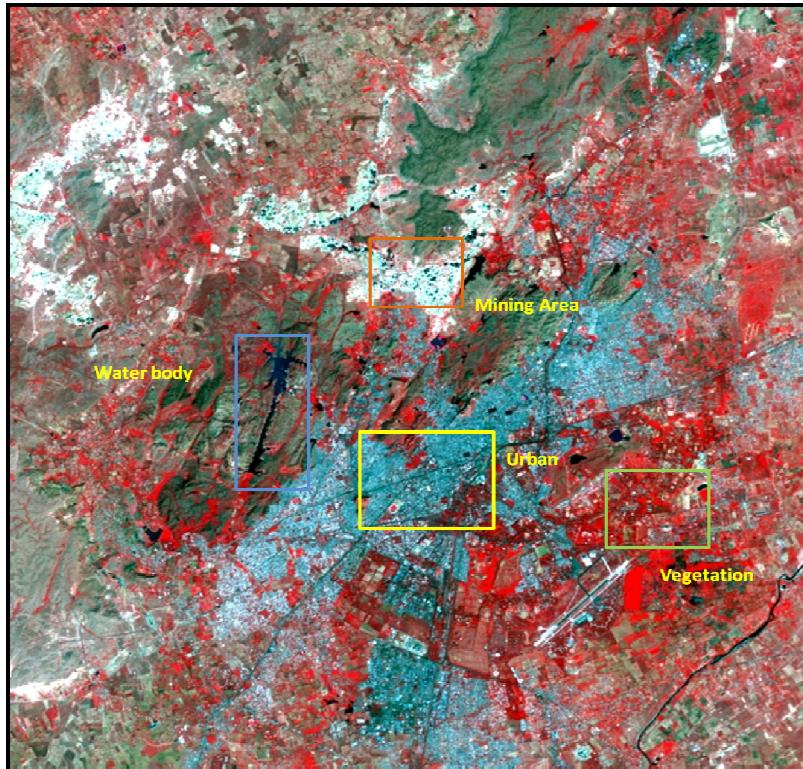
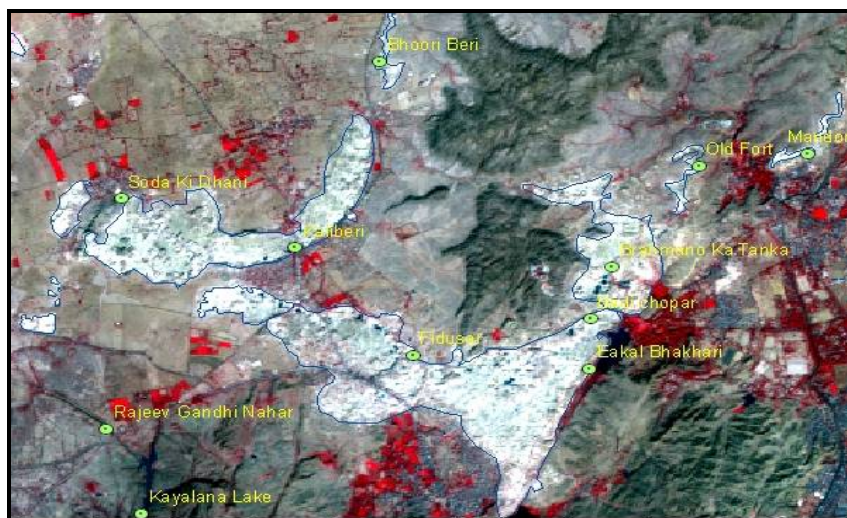


Fig.3 Identification of Land cover features on Landsat Imagery (2015).



Legend

● Location □ Mining Area 0 0.5 1 2 3 Km

Fig.4 Satellite imagery of Mining Area of Jodhpur City





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Table-2: Attribute Information of Land cover Classes

Land cover Classes	Descriptions
	Urban Area: Includes urban fabric, industrial, commercial, transport units and other related built up area.
	Vegetation Land: Crop, pasture, irrigated land, forest area, shrub, plants, local vegetation and cultivated fields.
	Mining Area: Rhyolite, Pyroclastic, Sandstone hills and Quarry.
	Water bodies: Lakes, ponds and water streams.

(B) Visualizations of LULC feature using Band Ratioing Technique

Band ratioing is an enhancement technique mainly used in the field of remote sensing. Band ratioing images are prepared by dividing the DN value in one band by the corresponding DN value in another band value for each pixel. A major advantage of ratio images is that they convey the spectral or colour characteristics of the image features, regardless of variation in scene illumination condition. Ratioed images are also used for discriminating the subtle spectral variations in a scene that are masked by the brightness variation in the image from individual spectral bands or in standard color composite. For the purpose of this study four band ratios of Landsat data of 2010 were visualized to identify the LULC features. The four band ratio with detail interpretation area discussed below.

- a) In green/red (band 2/3) ratio image, mining area represents dark tone and water body represents light tone(Fig.5a).
- b) In red/green (band 3/2) ratio image, open forest along the plantation and settlement has been enhanced and prominently displayed with light tones (Fig.5b).
- c) In SWIR-1/ NIR (band 5/3) this ratio enhances barren lands and urban built-up or cemented areas. Barren land and urban-up areas have appeared as lighter tone and water body and appeared as dark tone (Fig.5c).
- d) In SWIR-1/ TIR (band5/6): It has separated water body from forest, fallow lands and vegetation (Fig.5d).

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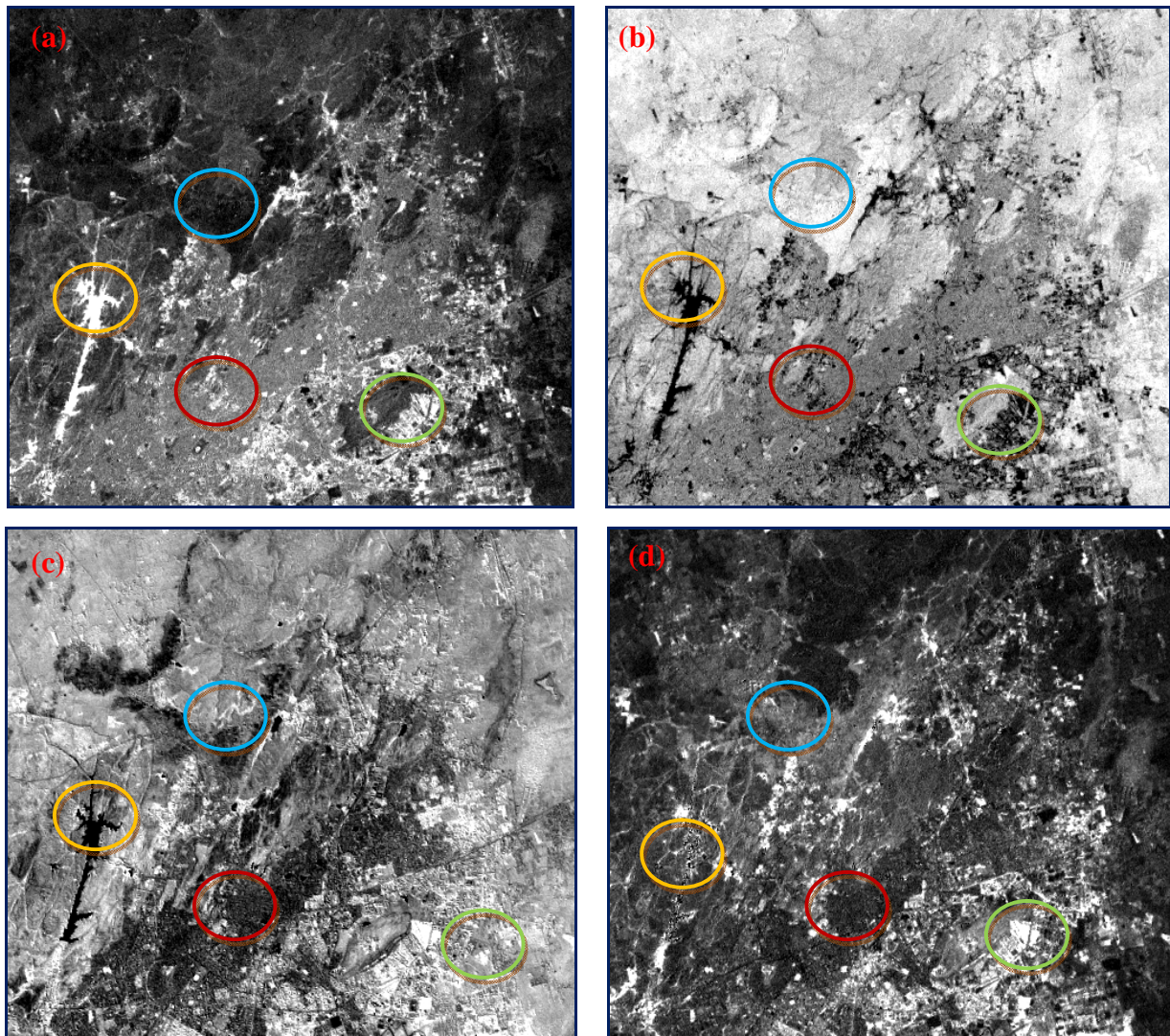


Fig.5. Ratio image(Landsat-2010) obtained using band ratio of (a) Band 2/3(b) Band 3/ 2 (c) Band 5/ 3 (d) Band 5/ 6. Legend: Mining Area-- Water Body---Settlement ----Vegetation.

(i) **Single color-composite combinations of three band ratios:** To identify the LULC features using band ratioing technique three different band ratios have been selected. Each of the three ratios has been assigned to a particular color gun of RGB composite. Selecting the three ratio combination for color compositing (RGB) that will allow for the discrimination of LULC features and material classes in a scene. In some cases, albedo information lost in the ratioing process can be restored by color-combining a single spectral band image with ratioed images. Thus, three color-composite band ratio images have been selected for this study. The colour composite assign for three band ratio are 1) Band 3/2 as red, 2) Band 5/3 as green and 3) Band 5/6 as blue.

(ii) **Observations in Composite Image:** The bluish-green color has revealed vegetation area and green revealed croplands. Mining and Rocky outcrops area appears in reddish-pink. Barren & Fallow lands appear in yellowish orange color. Urban or built-up areas, streets and highways have appeared as Dark Brown color. Black or dark blue color has

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revealed the water body. This ratio combination of color composite has discriminated water body, vegetation, croplands, mining area, urban area and highways uniquely (Fig.6).

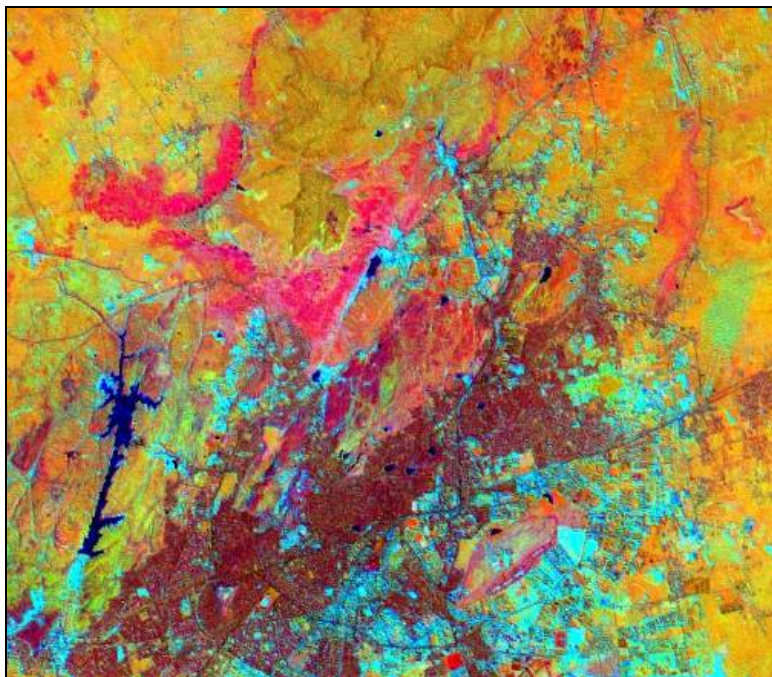


Fig.6. Colour Composite Image obtained by assigned red colour to (Band 3/ 2), green colour to (Band 5/ 3) and blue colour to (Band 5/6).

VI. CONCLUSION

Band Ratio is an emerging technique from Remote Sensing and GIS technology to visualization of Land cover features. Ratioed images are also used for discriminating the subtle spectral variations in a scene that are masked by the brightness variation in the image from individual spectral bands or in standard color composite. Ratio images can also be used to generate false colour composite by combining three monochromatic ratio data sets for better interpretation of land cover features.

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