Report

NDVI Based Assessment of Land Use/ Land Cover Using Remote Sensing and GIS

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ABSTRACT

Assessment of Land use/ Land cover dynamics is critical for conservation, sustainable use and development of natural resources in rain fed regions. In the present study Sehore district mp, India, the annual rainfall of 1217.7 mm and dry land crops has been considered for the evaluation of land use/land cover changes. Normalized Difference Vegetation Index (NDVI), an indicator of vegetation growth and coverage, has been employed to describe the spatiotemporal characteristics of land use land cover, including percent vegetation coverage. Using multi spectral remote sensing. The Land use/Land cover (LULC) classification was done based on Normalized Difference Vegetation Index (NDVI) using remote sensing landset 3 data each of October(post monsoon) and March(pre monsoon) for 2011 and 2013. The LULC assessment based on NDVI for seasons of 2011 and 2013 has resulted that crop land has been increased by 1717.5047(hac). Changes were noted in the aerial extents of water bodies and barren land, exposed land etc. It can be concluded of all the available methods of image classification with regard LULC, NDVI formed the basis for a better classification especially suitable in such cases where the analysis was carried out using either past imageries or present imageries with no ground truth data.

INTRODUCTION:

Land use/Land cover inventories are essential for the optimal utilization. Land cover refers to different features covering the earth's surface including vegetation cover, water bodies, open scrub etc. It integrates the sum of human activities having an influence on the environment. With the development of Geographic Information System (GIS) and Remote Sensing technologies and its applications facilitates the adoption of new methodologies which prove to be highly efficient in mapping and visualizing Land use/Land cover inventories. From the remote sensing data, the USGS has devised a land use/land cover classification system.

The spatial data sets such as land use and land cover maps are derived through Remote Sensing data using image classification methods. Digital image classification is the process of categorizing of all pixels in an image into land cover classes or themes. Usually, multi-spectral data are used for these purposes. The spectral pattern within the data for each pixel is used as the basis of categorization. Different feature types show different combination of digital numbers (DNs) based on their inherent spectral reflectance and emittance properties. Digital image classification techniques are used to classify the image into different land uses; commonly supervised and unsupervised classification techniques are employed. In recent years, Normalized Difference Vegetation Index (NDVI), an indicator of vegetation growth and coverage, has been widely employed to describe the spatiotemporal characteristics of land use land cover, including percent vegetation coverage. The visible and near infrared bands on the satellite multi spectral sensors allow monitoring of the greenness or vigor of vegetation. Long duration vegetation like trees, shrubs and grasses were identified using the year long data based on NDVI.

STUDY REGION:

The region, Sehore lies b/w North Latitudes 22°33'30" and 23°40'25" and East Longitudes 78°26'00" and 78°02'00" and the study region rural area (Sehore district) include 12 villages catchment lies in which lies between latitudes 23°7'5.724"– 23°12'1.342" North and longitudes 77°8'41.978" – 77°15'14.806" East.

Climatology

The Climate of Sehore district can be divided into four seasons. The winter season commences from end of November and lasts till the end of Feb. The period from March to about the middle of June is the hot season. The south west monsoon season from middle of June to end of September, October & end of November constitute the post monsoon or retreating monsoon season.

Rainfall and temperature

The average annual rainfall of 1217.7 mm. The average normal maximum temperature is 40.7°C. The individual day temperature as high as 45° or 46°C. On the arrival of monsoon the weather became pleasant. In October, the retreating of monsoon the temperature rises slightly during the day time and nights become pleasant. The average annual normal temperature of Sehore district is 31.4°C. During the southwest monsoon the relative humidity are generally high exceeding about 88% in August. Humidity decreases in the post monsoon season. In the cold season it is fairly good over the district. The driest part of the year is the summer season with the humidity going down to 26% or less. The annual normal relative humidity of the district is 57%. The normal average and wind velocity of the district is about 8.3 Km/hr.

In this context, identification of landuse/land cover dynamics within the watershed is having high importance to formulate appropriate strategies for suitable conservation and management practices.

DEFINITION OF TERMS

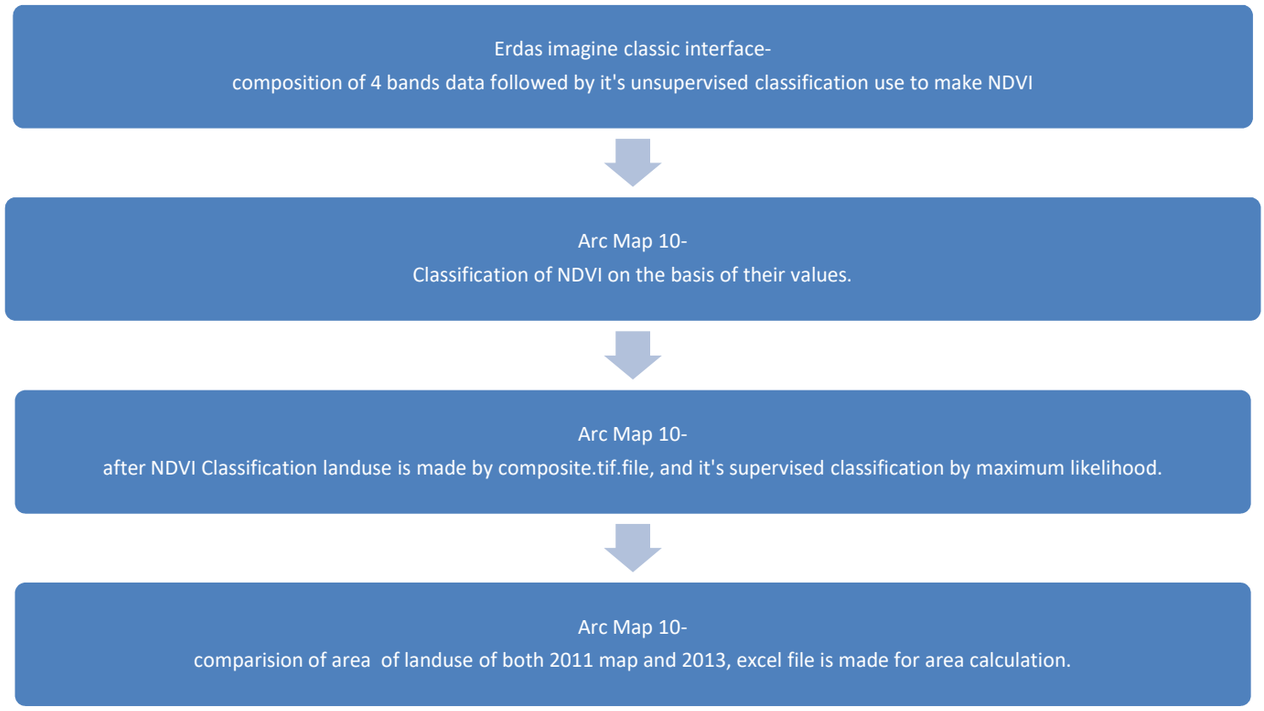
- **Remote sensing**: Can be defined as any process whereby information is gathered about an object, area or phenomenon without being in contact with it. Given this rather general definition, the term has come to be associated more specifically with the gauging of interactions between earth surface materials and electromagnetic energy
- **Geographic Information system**: A computer assisted system for the acquisition, storage, analysis and display of geographic data
- **Land use:** This is the manner in which human beings employ the land and its resources.
- **Land cover**: Implies the physical or natural state of the Eath's surface.

DATA USED

23 m resolution, 4 Band Remote Sensing Data from Land Sat 3 Satellite was used, also toposheet no- 55-E-4 was used.

RESEARCH METHODOLOGY

The procedure adopted in this research work forms the basis for deriving statistics of land use dynamics and subsequently in the overall, the findings.



Software Used

(a) ArcMap10 – This was used to compliment the display and processing of the data, Landuse and NDVI Classification

(b) Microsoft word – was used basically for the presentation of the research.

(c) Microsoft Excel- was used in area calculation and producing the bar graph

(d) Erdas- Was used for composition of data and NDVI

Development of classification scheme

LANDUSE
1.vegetation
2.water
3.Exposed land
4.barren land
5.fallow ag with high moist
6.fallow ag with low moist
7.agriculture

Methods of Data Analysis

Main methods of data analysis were adopted in this study.

(i) Calculation of the Area in hectares of the resulting land use/land cover types for each study year and subsequently comparing the results.

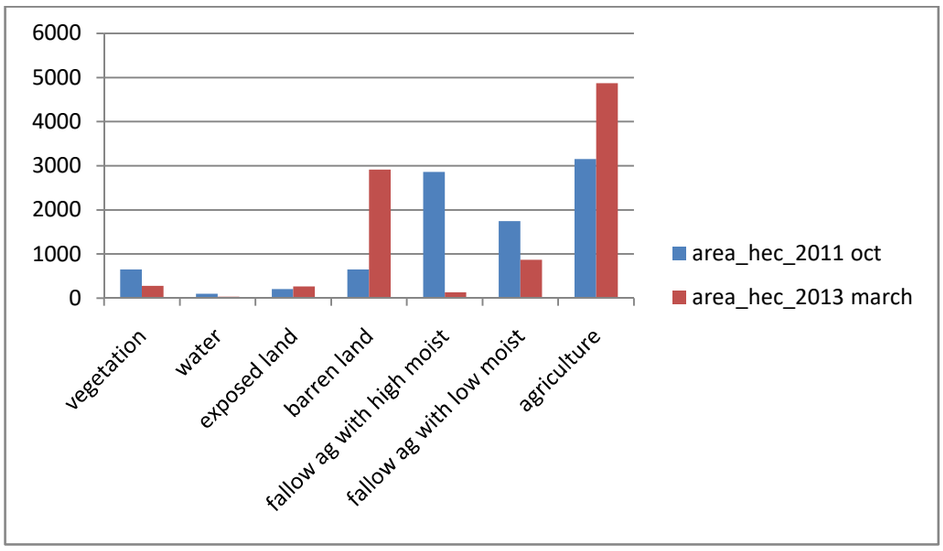
(ii) Overlay Operation

(iii) Maximum Likelihood Classification

Land Use Land Cover Distribution

The land use land cover distribution for each study year as derived from the land use maps based on supervised classification are presented in the table below :-

S.NO	Landuse	area_hec_2011 oct	2011(%)	area_hec_2013 march	2013(%)	difference (hec)
1	vegetation	648.395300	6.92%	277.407600	2.96%	(dec by)370.9877
2	Water	99.822300	1.06%	33.908900	0.36%	(dec by)65.9134
3	exposed land	205.675200	2.19%	262.754300	2.80%	(inc by)57.0791
4	barren land	647.496000	6.91%	2913.732000	31.11%	(inc by)2266.236
5	fallow ag with high moist	2862.049000	30.56%	132.937700	1.41%	(dec by)2729.1113
6	fallow ag with low moist	1746.970000	18.65%	872.162300	9.31%	(dec by)874.8077
7	agriculture	3154.215000	33.68%	4871.719700	52.02%	(inc by)1717.5047
8	Total	9364.622800	100.00%	9364.622500	100%	



Graph 1:- area in hectors of October 2011 and March 2013

Chart 1:- area in percent of October 2011

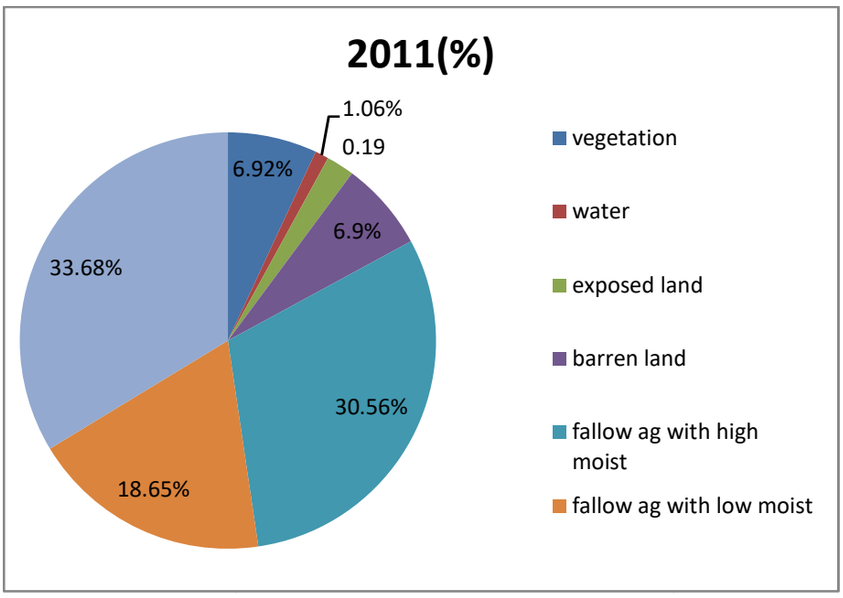
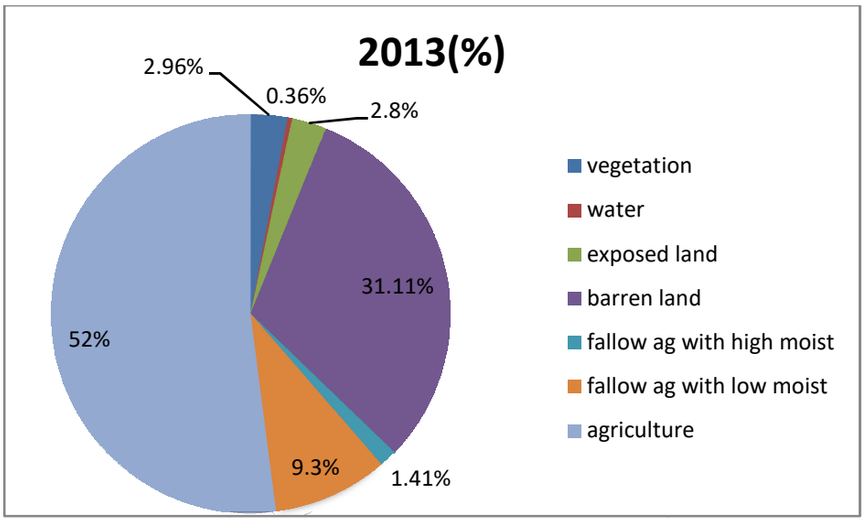


Chart 2:- area in percent of March 2013



Analysis

Land use/ land cover based on **'supervised classification'** and '**NDVI classification'** was made, with the date of imagery 2011 October and 2013 march; data was compared on the basis of Land use/land cover classification. The major difference in supervised classification was observed in area of **'agriculture'** which is increased by 18.32% , **barren land** is increased by 24.2%, **fallow ag land with high moist** was decreased by 29%, in year 2013 which shows that October 2011 imagery is highly vegetative because of post monsoon season and march 2013 is low vegetative because of pre monsoon (difference mentioned in land use table.)

Land Use/Land Cover Map Of Sehore District Madhya Pradesh

(Based on NDVI and supervised classification)

FIG1 LOCATION MAP OF STUDY REGION

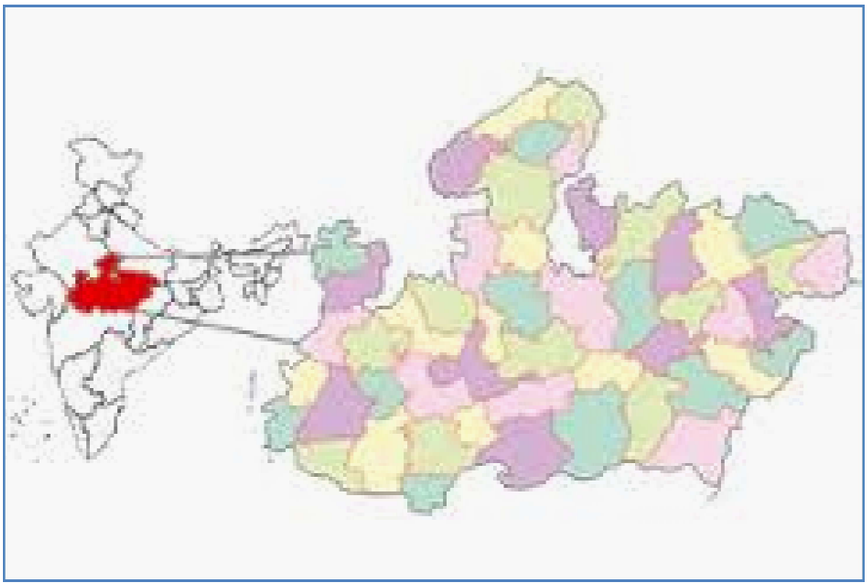
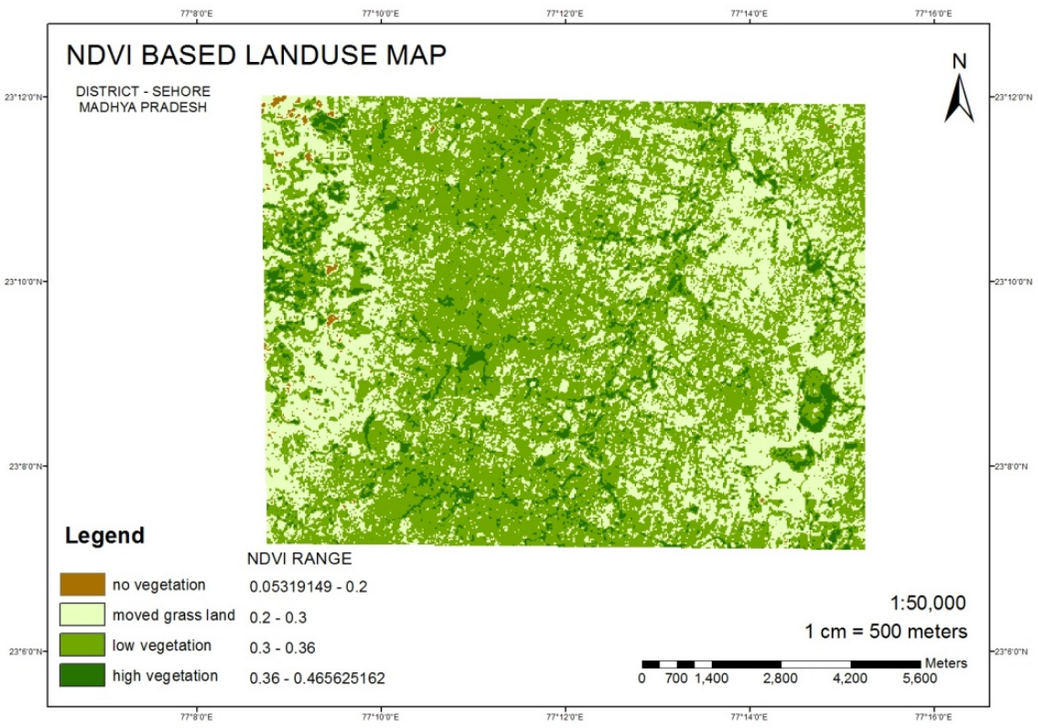
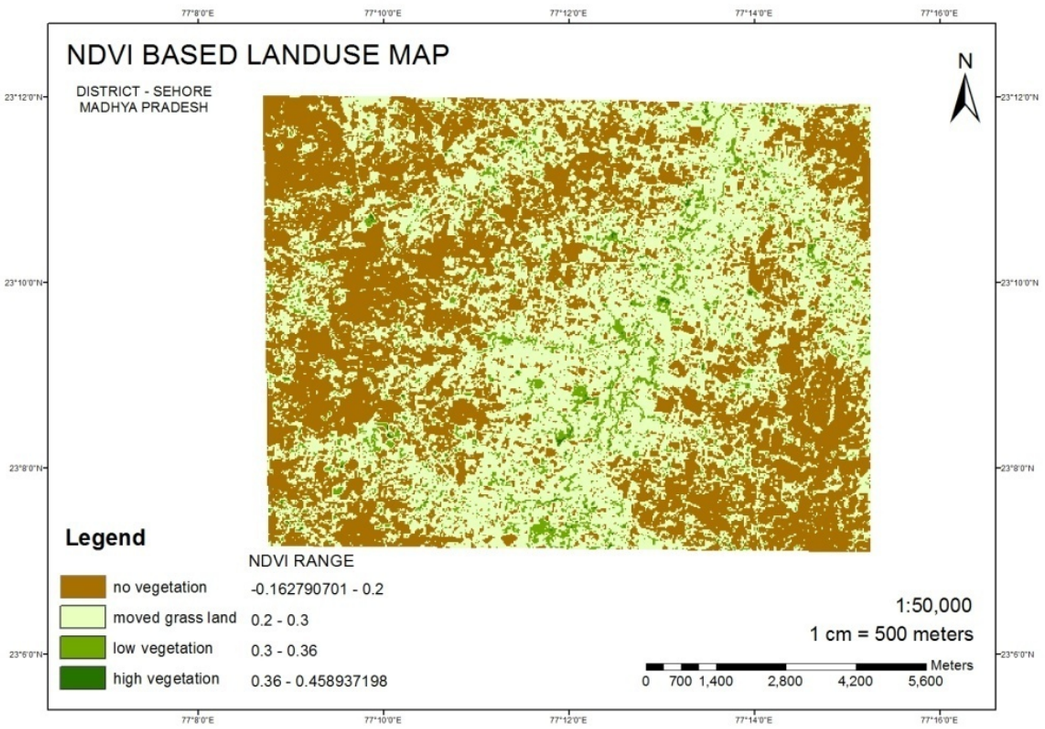


Fig. 2 Land use/Land cover map based on NDVI;

(A) Date Of Imagery: October 2011
(B) Date Of Imagery: March 2013



FIG(A)

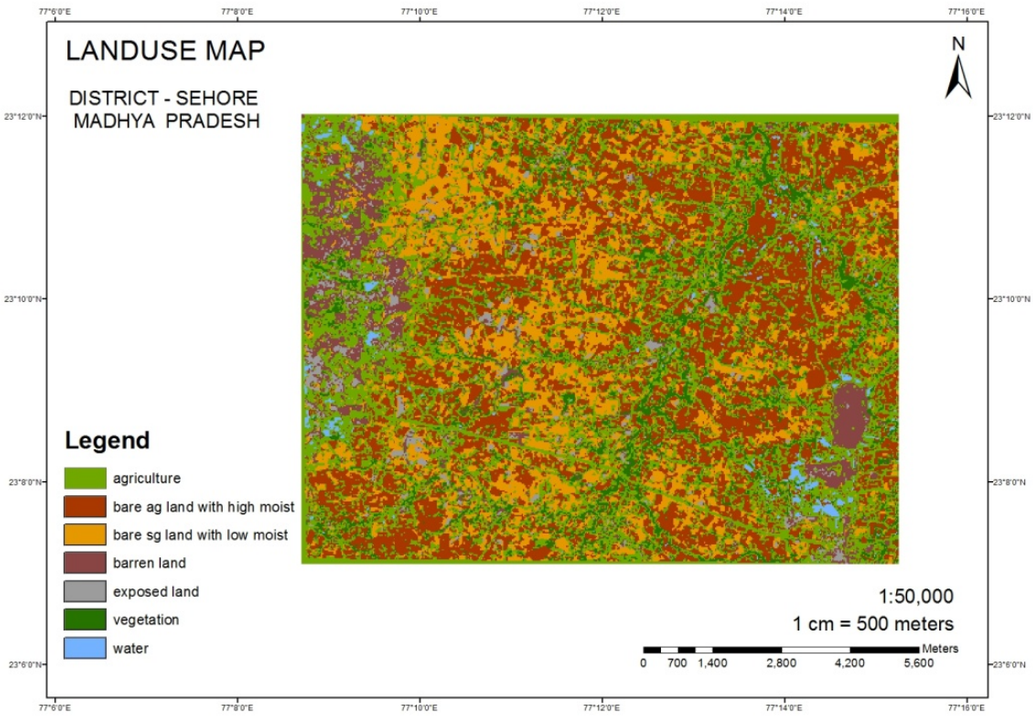


FIG(B)

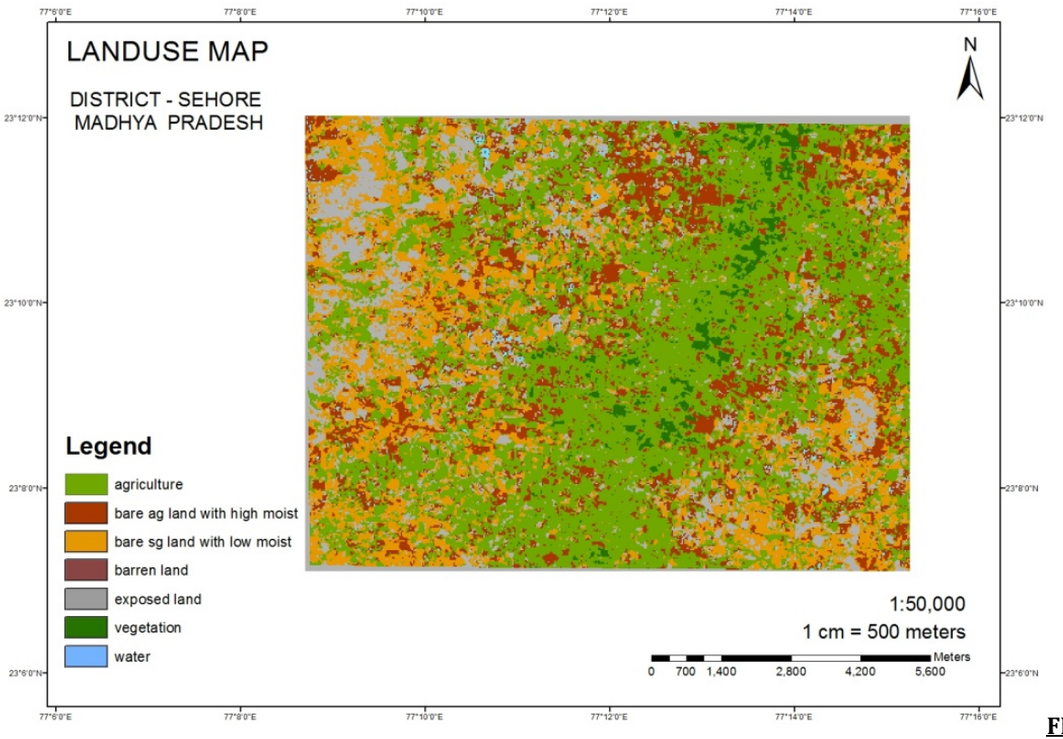
Fig. 3 Land use/Land cover map based on supervised classification;

(A) Date Of Imagery: October, 2011

(B) Date Of Imagery: March 2013



FIG(A)



FIG(B)

Conclusions

The study illustrates the application of Normalized Differential vegetative Indices to measure the vegetative vigor and assess land use/land cover in the study region. It can be concluded of all the available methods of image classification with regard to vegetation and LULC, NDVI formed the basis for a better classification especially suitable in such cases where the analysis was carried out using either past imageries or present imageries with no ground truth data.