

A Comparative Study of Vegetation Change Detection Methods NDVI and LULC with use of Satellite Images

Manoj E. Patil, Snehal A. Bhole

Abstract: - Vegetation term refers to ground covered by plants. Now day's vegetation cover and their change detection are very important as there are changes in environment. All the environmental changes are mostly depends on quantity of vegetation. Remote sensing technology and Geographical Information system helps to get information about landscape geometry, vegetation type and structure. The paper explains the use of NDVI and LULC methods for vegetation change detection with a comparative study of both methods. The methodology is explained with help of Satpuda forest remote sensing images.

Keywords: Geographical Information system (GIS), Land Use Land Cover (LULC), Normalised difference vegetation Index (NDVI), Remote sensing (RS).

I. INTRODUCTION

In remote sensing technology change detection refers to the process of identifying differences in the state of land features by observing them at different times. Remote sensing technology in combination with Geographic Information System (GIS) can render reliable information on vegetation cover. The Normalized Difference Vegetation Index (NDVI) method was used for vegetation change detection in this study because of its acceptable accuracy and ability to detect the vegetation. Land Use Land Cover (LULC) method provides us to detect vegetation under the observation of expert i.e. this method use supervised classification procedure for vegetation detection. In this paper we are calculating the value of NDVI and LULC and comparing them to find out which method gives proper accurate result for vegetation detection.

II. BACKGROUND

Normalized Difference Vegetative Index (NDVI) method:- The "Normalized Difference Vegetative Index (NDVI,) is a calculation, based on several spectral bands, of the photosynthetic output (amount of green stuff) in a pixel in a satellite image. It measures, in effect, the amount of green vegetation in an area. NDVI calculations are based on the principle that actively growing green plants strongly absorb radiation in the visible region of the spectrum (the 'PAR' or 'Photo synthetically Active Radiation') while strongly reflecting radiation in the Near Infrared region. The NDVI method calculates the difference between near infrared radiation and red colour radiation. Formula for calculation of NDVI is given below:

$$NDVI = \frac{NIR - Red}{NIR + Red}$$

The value of NDVI is high for vegetation and low for other land surface. To calculate NDVI from satellite image we use LISS III satellite image. LISS III image include different land cover classes like vegetation, roads, buildings etc. NDVI calculate absolute value of vegetation which is stored in a table format. Land Use **Land Cover (LULC) method:** - Land Use Land Cover (LULC) classification is a technique of remote sensing image classification. In this technique there are two methods 1st Supervised Classification and 2nd Unsupervised Classification. In supervised classification user recognizes the LULC class by his experience. In unsupervised classification software clusters the image with classes.

III. METHODOLOGY

The methodology for detection of vegetation change using RS image is shown in the following block diagram. The first block of the diagram shows processing of RS images.

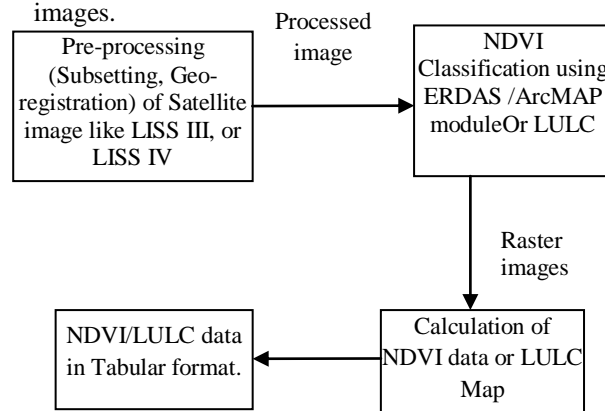


Fig 1. Block Diagram of Vegetation Change detection

We need to do projection and clipping of the RS image as per our concern area. Then RS images are used to do NDVI analysis of LULC. Both the methods are used for classification of image for vegetation detection. NDVI is more correct and fast. It is automated process so the time required is very less. NDVI directly detect vegetation where from LULC classified image we need to separate vegetation class from entire image. The last block shows tabular format of the vegetation data. In this process we tabulate the image data against the vector cell like taluka, district or village. The tabulation gives vegetation in area.

The difference between the areas calculated from different image gives us vegetation change.

IV. CASE STUDY

The case study is done using RS images of Satpuda hill forest of Jalgaon district of Maharashtra. The RS images are November -1998 and December-2007. The Fig. 2 shows the ERDAS module which detects NDVI. This module creates output map in raster file shown in Fig 4

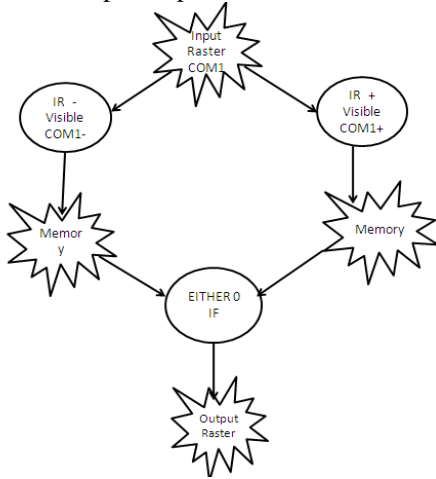


Fig.2 NDVI Module

In Fig .3 we can see the original satellite LISS III image of year December-2007. This figure shows is result of step 1. i.e. pre-processing in which we can see the geographical borders. Figure 4 is result of step 2 in which we can process the Fig.1 to get the raster file from which we can easily calculate the NDVI. Figure 5 is a LULC map generated from figure 3 using supervised classification.



Fig. 3.Original Satellite LISS III Image December-2007

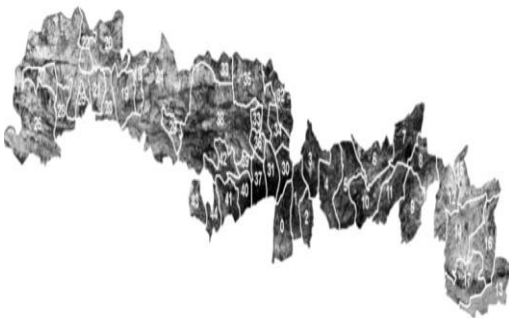


Fig .4 NDVI output of Image December-2007



Fig .5 LULC Output of Image December-2007

The images of figure 4 and figure 5 generate vegetation area using tabulated area method of ArcMap software. We show analysis of both the tabulated area and change detection by the following graphs. In following fig.6 we can see the results of NDVI method year wise, in which we can see the area of vegetation decreases from years 1998 to 2007.

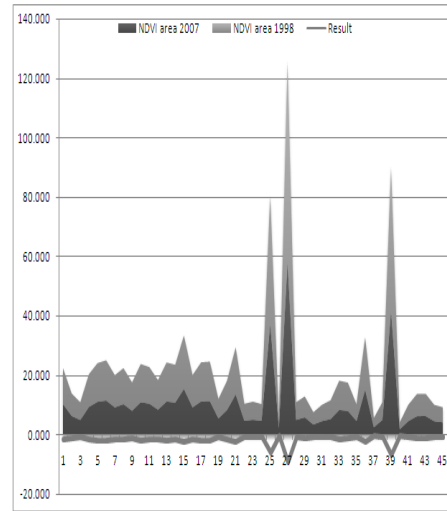


Fig .6 NDVI Method Result From Years 1998 To 2007

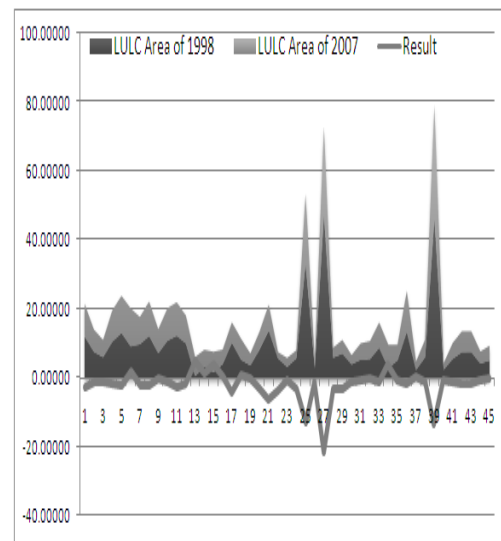


Fig .7 LULC Method Result From Years 1998 To 2007

In above both figure we can see that X axis shows the area sectors selected for study and Y axis area in Km. also it shows difference in decrease of vegetation.

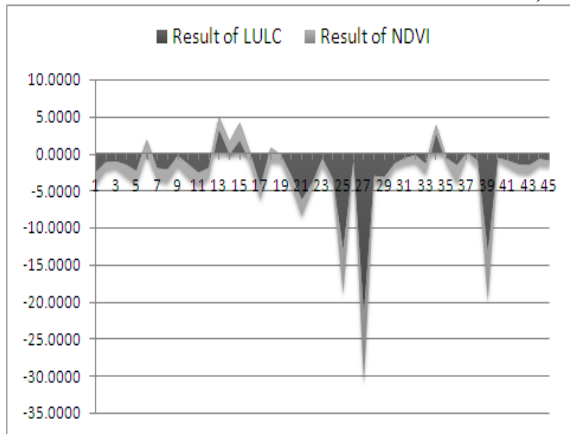


Fig .8 Comparisons of NDVI and LULC Method for Area of Vegetation from Years 1998 to 2007

From above fig 8 we can see difference between LULC and NDVI. In column number 7 and 19 we can see there is vegetation shown by LULC method but NDVI method does not show any appearance of vegetation that means there is error in calculation of vegetation by LULC method because LULC method calculates vegetation manually i.e. there may be or may not be vegetation which makes difference in complete analysis. Also we can see in column 25, 27 and 39 there is more than 50% difference in results which NDVI method calculates result from considering each and every pixel value where LULC gives results manually. This makes mistakes in results while NDVI method gives proper and accurate results from images.

V. CONCLUSION

We propose here the NDVI as method of vegetation change detection. The case study concluded that NDVI is more accurate and automated process of vegetation change detection. The paper also describe in detail the NDVI model developed and used to obtain the actual information of vegetation change detection and how it is more beneficial than other vegetation change detection method. If we combine this method with other change detection methods then we it will also help to detect vegetation of different types like grassland, shrub land, agricultural field etc.

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