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Vegetation change Detection in Delhi using Normalized Difference Vegetation Index (NDVI).

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ABSTRACT

This study presents vegetation change Detection for the analysis of satellite imageries based on NDVI (Normalized Difference Vegetation Index) over the period of Four years from 2011 to 2015. NDVI employs the Multi-Spectral Remote Sensing data technique to find Vegetation Index The Vegetation analysis can be helpful in predicting the unfortunate natural disasters to provide humanitarian aid, damage assessment and furthermore to device new protection strategies. Here,the vegetation greenness (NDVI) has been reduced by 5% over the period of time while various fluctuations has been seen in different areas of Delhi.

KEYWORDS; Vegetation change detection, NDVI, Multispectral, Remote Sensing, Natural Disasters.

INTRODUCTION

The term "remote sensing" generally refers to the use of satellite- or aircraft-based sensor technologies to detect and classify objects on Earth, including on the surface and in the atmosphere and oceans, based on propagated signals (e.g. electromagnetic radiation).

The Multi Spectral Remote Sensing images are very efficient for obtaining a better understanding of the earth environment (Ahmadi & Nusrath,2012).It is the Science and Art of acquiring information and extracting the features in form of Spectral, Spatial and Temporal about some objects, area or phenomenon, such as vegetation, land cover classification, urban area, agriculture land and water resources without coming into physical contact of these objects (Karaburun & Bhandari,2010).

The Remote Sensing data has many application areas including: land cover classification, soil moisture measurement, forest type classification, measurement of liquid water content of vegetation, snow mapping, sea ice type classification, oceanography (Karaburun & Bhandari,2010).

NDVI

The Normalized Difference Vegetation Index (NDVI) is a numerical indicator that uses the visible and near-infrared bands of the electromagnetic spectrum, and is adopted to analyze remote sensing measurements and assess whether the target being observed contains live green vegetation or not. NDVI has found a wide application in vegetative studies as it has been used to estimate crop yields, pasture performance, and rangeland carrying capacities among others. It is often directly related to other ground parameters such as percent of ground cover, photosynthetic activity of the plant, surface water, leaf area index and the amount of biomass.

NDVI was first used in 1973 by Rouse et al. from the Remote Sensing Centre of Texas A&M University. Generally, healthy vegetation will absorb most of the visible light that falls on it, and reflects a large portion of the near-infrared light. Unhealthy or sparse vegetation reflects more visible light and less near-infrared light. Bare soils on the other hand reflect moderately in both the red and infrared portion of the electromagnetic spectrum (Holme et al 1987). Since we know the behavior of plants across the electromagnetic spectrum, we can derive NDVI information by focusing on the satellite bands that are most sensitive to vegetation information (near-infrared and red). The bigger the difference therefore between the near-infrared and the red reflectance, the more vegetation there has to be. The NDVI algorithm subtracts the red reflectance values from the near-infrared and divides it by the sum of near-infrared and red bands.

$$NDVI = (NIR - RED) / (NIR + RED)$$

This formulation allows us to cope with the fact that two identical patches of vegetation could have different values if one were, for example in bright sunshine, and another under a cloudy sky. The bright pixels would all have larger values, and therefore a larger absolute difference between the bands. This is avoided by dividing by the sum of the reflectances.

Theoretically, NDVI values are represented as a ratio ranging in value from -1 to 1 but in practice extreme negative values represent water, values around zero represent bare soil and values over 6 represent dense green vegetation.

Digital image processing of satellite data provides tools for analyzing the image through different algorithms and mathematical indices. Features are based on reflectance characteristics, and indices have been devised to highlight the features of interest on the image (Deep & Saklani,2014). There are several indices for highlighting vegetation bearing areas on a remote sensing scene. NDVI is a common and widely used index (Bhandari & Kumar,2012).It is an important vegetation index, widely applied in research on global environmental and climatic change (Bhandari & Kumar,2012).

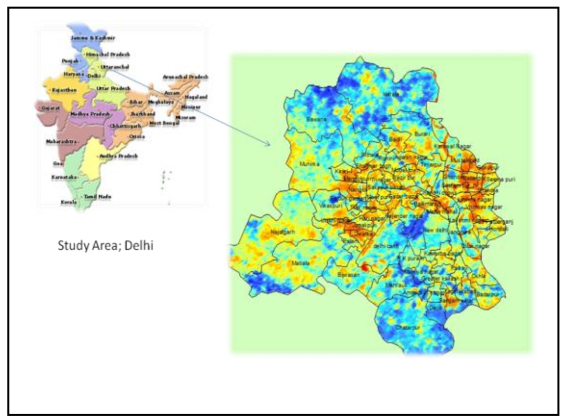
Many researchers have reported the use of NDVI for vegetation monitoring(Yang,Zhu &Liu,2010;Lan et al,2009) assessing the crop cover(Shikha et al,2007) drought monitoring and agricultural drought assessment at national(Kim,Kwak &Y00,2008;Yamaguchi et al,2010) and global level(Smith,2015) Vegetation index (VI) is a simple and effective measurement parameter, which is used to indicate the earth surface vegetation covers and crops growth status in remote sensing field (Smith,2015).

OBJECTIVES-

- NDVI Analysis.
- To perform a vegetation change detection using Landsat TM imagery.
- Interpret change detection results

STUDY AREA AND DATA COLLECTION

The Investigations were performed as a case study on Delhi the capital of the country(1484 sq km).Delhi, located in the interior of the country, is the administrative capital of India and, therefore, is a center of a large number of executive buildings and residential areas Delhi is located between the latitudinal extent of 28°23'17"–28°53'00" N and longitudinal extent of 76°50'24"–77°20'37" E and covers an area of 1483 km2 with an average altitude of 213–305 m above mean sea level (msl) (Figure 1). It is bordered by Haryana in the north, west and south and Uttar Pradesh in the east. It is largely a plain area with the exception of two main physiographic features viz. the Yamuna River and the Delhi Ridge. The Yamuna River divides the city into two parts, popularly known as East and West Delhi. The ridge, which is an extension of Aravalli Range, borders Delhi on southern side and extends up to central Delhi. The ridge is covered primarily by thorny vegetation

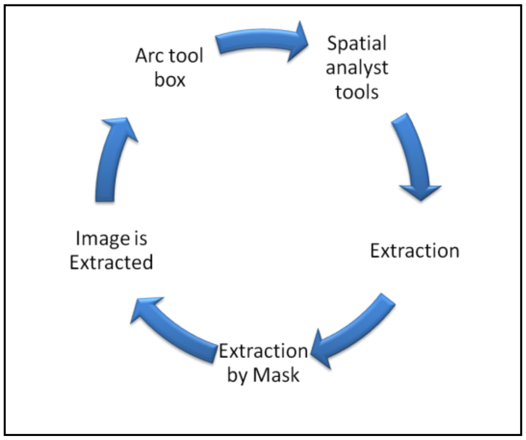


MATERIAL AND METHOD

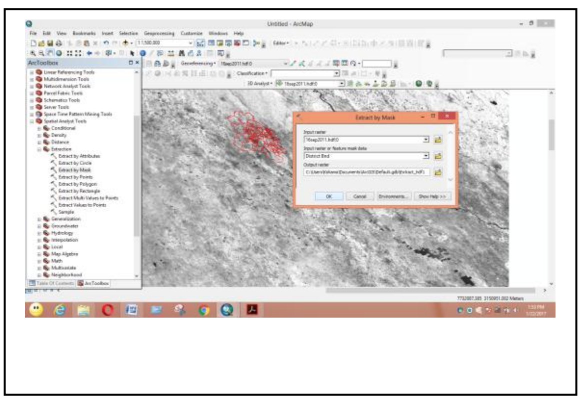
DATA COLLECTION-

The Satellite Imageries were downloaded from USGS (EARTH EXPLORER)/Landset TM. Landsat TM images were extracted for the particular area that is Delhi using spatial analyst tools using ARCMap.

IMAGE INTERPRETATION-

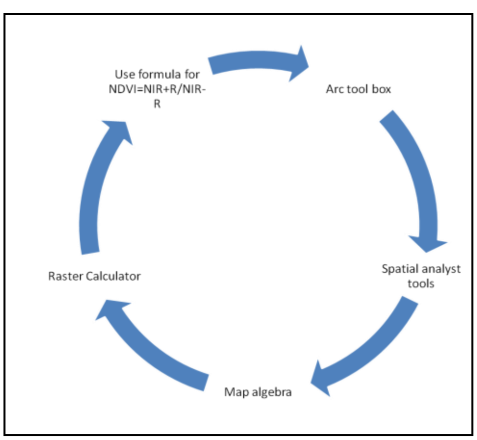


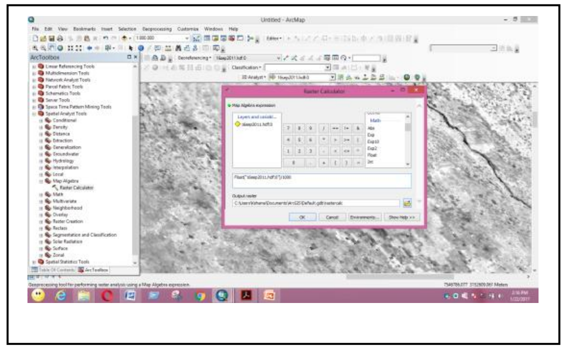
The downloaded image was extracted using arc tool box



CALCULATION OF NDVI-

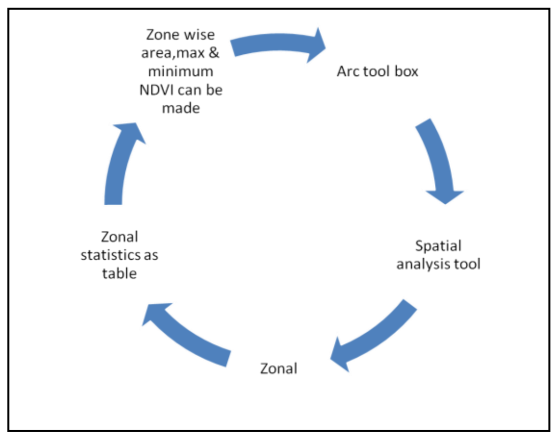
NDVI is calculated using the following steps-

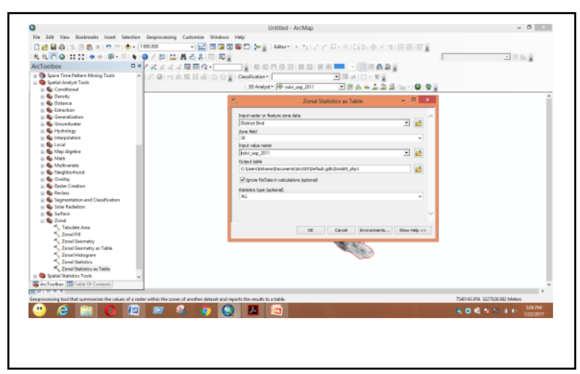


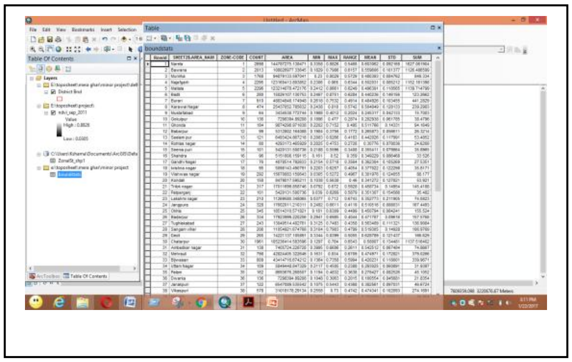


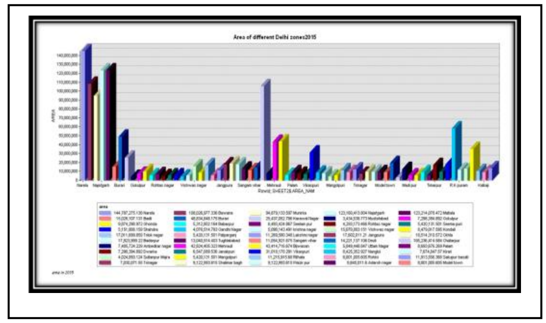
NDVI ANALYSIS-

NDVI statistics can be calculated by the following steps-



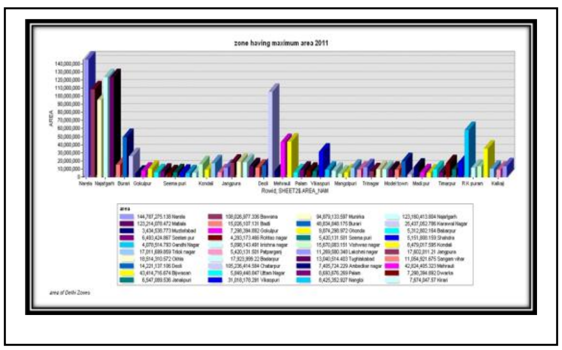






RESULTS AND DISCUSSION-

Different zones analyzed for their area and no changes in the area of different zones are seen over the period of 4 years.



The NDVI have been used widely to examine the relation between the changes in vegetation growth rate. It is also useful to determine the production of green vegetation as well as detect vegetation changes.

	NDVI 2011	NDVI 2015
Maximum NDVI	0.8826	0.8446
Minimum NDVI	0.0305	0.014
Area having maximum NDVI value	0.8826 (Narela)	0.8446 (Burari)
Area having Minimum NDVI	0.3063 (Dwarka)	0.3478 (Mustafabad)

Table 1 represents the changes in NDVI that has been detected over the period of 4 years (from 2011 to 2015)

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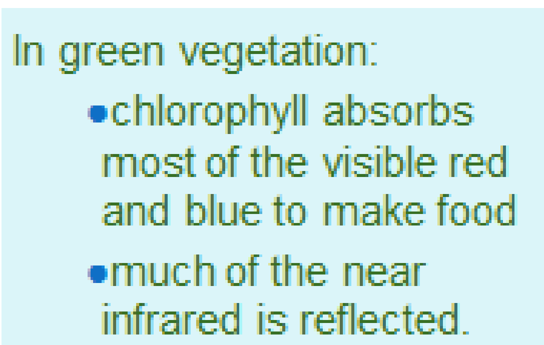
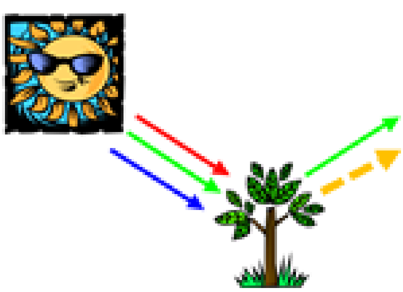
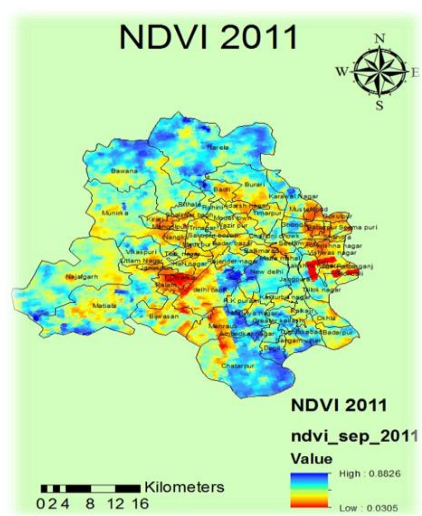
NDVI values range from +1.0 to -1.0 Areas of barren rock,sand,or snow usually show very low NDVI (example,0.1 or less). Sparse vegetation such as shrubs and grasslands or senescing crops may result in moderate NDVI values (approximately 0.2 to 0.5).High NDVI values (approximately 0.6 to 0.9) correspond to dense vegetation (may found at vegetation at their peak stage).

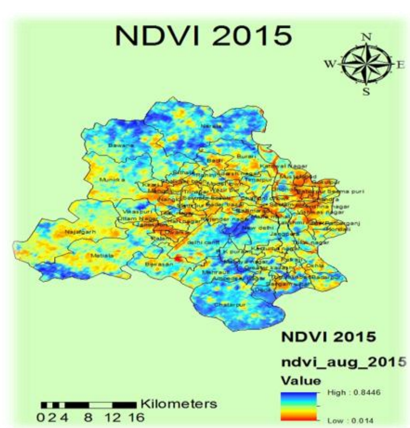


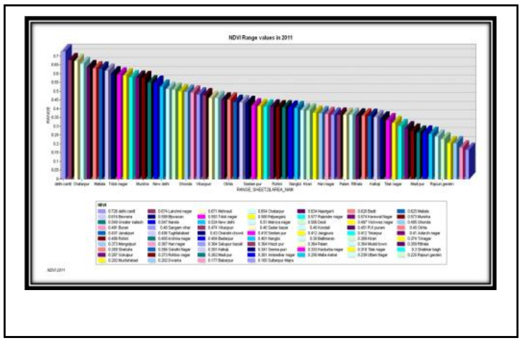


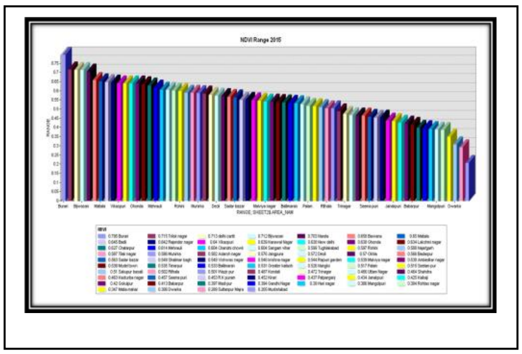
Here,the NDVI values (vegetation health or greenness) shows a little fall in the vegetation health over the period of 4 years while the highest NDVI value has been recorded at Narela(0.826) in 2011 and Dwarka shows the lowest value of 0.3063 which means sparse vegetation.

However, when we have a look at NDVI values of 2015, the highest value has been recorded at Burari (0.8446 means dense vegetation) and lowest value is seen at Mustafabad(0.3478) which means the vegetation is under stress.









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