



Original Article

Analysis of Vegetation Cover in Bogovati River Basin in Kolhapur District, Maharashtra, India, Based On Satellite Image

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Abstract

The normalized differential vegetation index (NDVI) was formed to compute vegetation cover using the reflected bands of satellite data. The Bhogavati River Basin of Kolhapur district for specific month in 2012 is the main focus of the current study. A popular method for tracking changes in land use and land cover, especially in vegetation cover and pattern, is the NDVI. This tool is also helpful for retrieving vegetation-related data from satellite photos. The terrestrial forest ecosystems have suffered as a result of the removal of trees for agriculture and land usage. Hence the vegetation pattern analysis will be plays a key role for development of land and management. In order to categorize the temporal fluctuation of vegetation structure, including related aspects, and the progressive decline of green plant covering in a temporal scale of view on the study area, an NDVI detection approach based on Remotely Sensed data (RS) and Geographic Information System (GIS) was developed. The NDVI is determined by the spectral contrast of reflected Near Infrared (NIR) and Visible (VIS) radiation from a surface.

Keywords: Remote Sensing, GIS, NDVI and Bhogavati River basin etc.

Introduction

Abolition of forests is measured using the NDVI technique. It's also a helpful tool for gathering information about vegetation from satellite images. For tracking changes in land use and land cover, especially in vegetation cover and pattern, the NDVI is a commonly used technique. It is an indicator of the vegetation's health. A deeper comprehension of the earth's ecosystem can be gained with the help of multispectral remote sensing images (1). Land cover classification, soil moisture measurement, forest type classification, vegetation liquid water content measurement, snow mapping, sea ice type classification, and oceanography are just a few of the many application areas for remote sensing data (2). Image analysis soft-wares for analyzing satellite images using various algorithms and mathematical indices are made available by digital image processing. Reflectance characteristics serve as the basis for features, and indices have been developed to draw attention to the image's salient elements (3). On a remote sensing landscape, vegetation-bearing patches can be highlighted using a variety of indices. The NDVI is a popular and often utilized index (4). The difference between the measured canopy reflectance in the red and near-infrared bands, respectively, is used to compute the NDVI (5). This article demonstrates how to detect regions with significant vegetation and other distinct features by comparing the visible red and near-infrared (NIR) bands of a sentinel and LISS III data. At the national and international levels, numerous studies have documented the use of NDVI for vegetation monitoring, crop cover assessment, drought monitoring, and agricultural drought assessment (14, 15). In the realm of remote sensing, the vegetation index (VI) is a straightforward and useful measurement parameter that shows the earth's surface vegetation coverings and crop growth status.

Study Area:

As seen in Figure 1, the Bhogavati River Basin is one of the Panchganga River Basin's sub-basins, draining from the Kolhapur district, Maharashtra, India. The basin contains 1125 km² of basin area.

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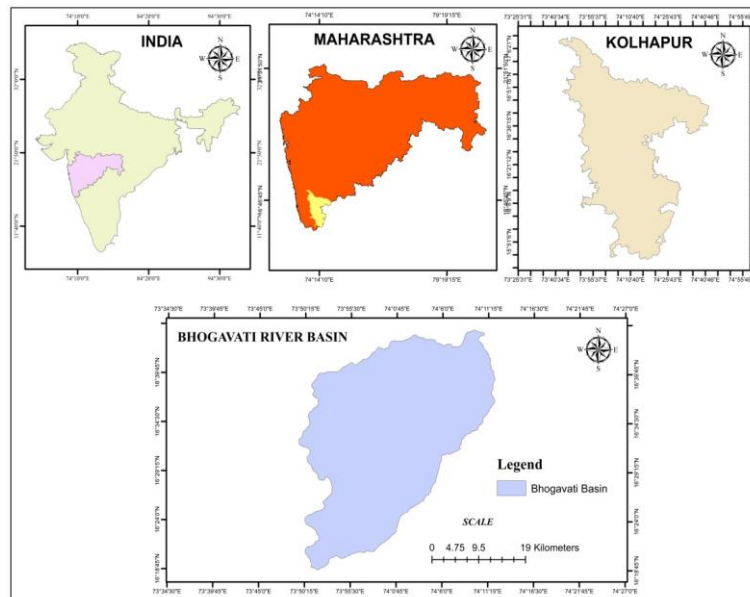
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According to toposheet Nos. 47 H/14, 47 H/15, 47 L/2, and 47 H/3, the geographical coordinates of the

study area are 16° 18' 45" N to 16° 40' 00" N latitude and 73° 27' 00"E to 74° 34' 30" E longitude.



Material and Methodology:

The heart of any information system is its data. Reliability and correctness of data are the primary

determinants of any study or findings. The kind, quality, and accessibility of data have a significant impact on the effectiveness and performance of any information system.

Sr. No.	Data used	Spatial Resolution
1.	LISS III	23.5 m

Table. 1

The source of the LISS III image Zone 43 North of the UTM coordinate system was used to geo-rectify the

image. The data utilized in this study was taken from the aforementioned website and was ortho-rectified.

Band number	Wavelength (nm)	Bandwidth (nm)	Spatial resolution (m)
Band 1- Green	520 - 590	70	23.5
Band 2- Red	630 - 690	60	23.5
Band 3- Near Infrared (NIR)	770 - 860	90	23.5
Band 4- Shortwave Infrared	1550 - 1700	150	23.5

Table.2. Band details of LISS III dataset

Summary of NDVI:

An indicator of photosynthetic activity or plant greenness is the Normalized Difference Vegetation Index (NDVI). It is a widely used and simple-to-calculate proxy for vegetation productivity based on satellite images (Kunkel, 2011 and Scanlon, 2002). According to Schmidt et al. (2000), this measure exhibits a positive connection with biomass, photosynthetic activity, vegetation cover, and the Leaf Area measure (LAI). By subtracting the red reflectance values from the near-infrared and dividing the result by the

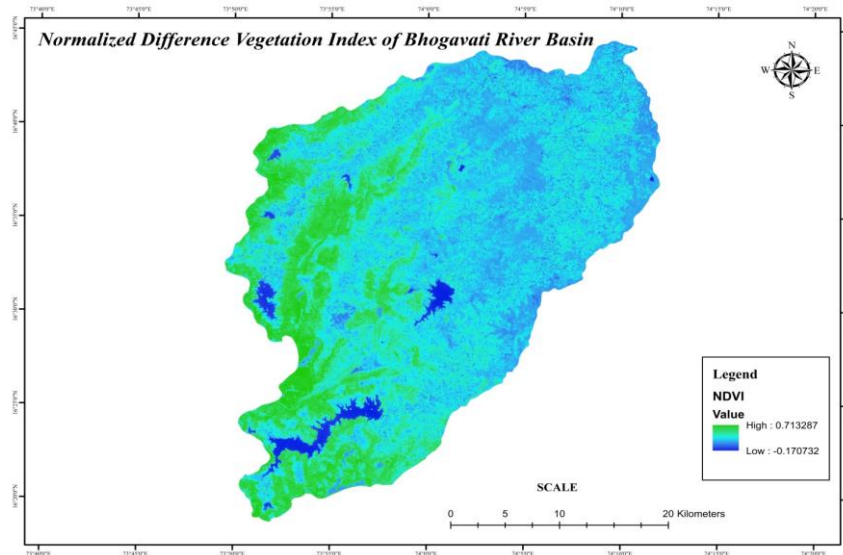
sum of the red and near-infrared bands, the NDVI algorithm is calculated. The following function is used: Tucker (1979).

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

The range of NDVI values is between -1 and 1. NDVI values that are extremely low are associated with arid regions of rock, sand, snow, clouds, etc. The NDVI values that are closest to zero are those of bare soil, whereas those that are negative are those of water bodies (Karaburun, 2010; Chouhan and Rao, 2011; Ramachandra and Kumar, 2004; Xie et al., 2010).

NDVI value ranges	Class Name	Description
(<0.1)	No vegetation (water)	River, streams, lakes, dams and reservoirs are example of no vegetation areas.
(0.1-0.3)	Low vegetation (Barren land)	Unvegetated areas, degraded terrain, and any unused land or settlement areas
(0.3-0.4)	Moderate vegetation (Irrigated land)	Cropping and cultivated regions that are irrigated by rain, cropping that has been planted and irrigated
(0.4<)	High vegetation (Grassland agriculture open forest)	High vegetation refers to land that is primarily planted with crops, woody vegetation, shrubby plants, and other species grow sparsely in the open forest

Table.4 Value Ranges for the NDVI



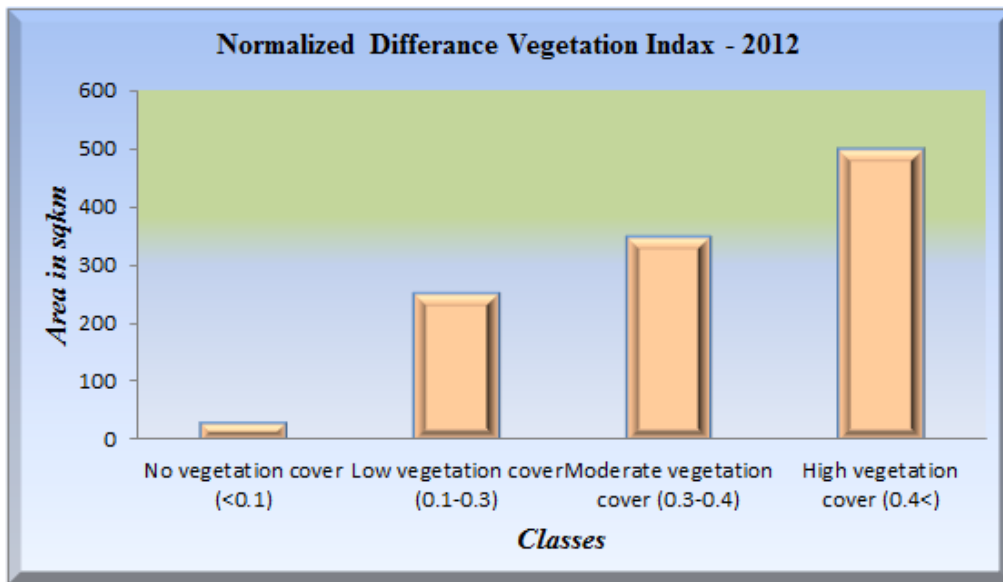
Examining and Interpreting:

The relationship between spectral variability and variations in vegetation growth rate has been extensively studied using the NDVI. The Vegetation Index (VI) compared with actual measurement has benefits like saving time, frequency data, and saving expenses on labor. The classic vegetation indices based on Red and NIR bands, because of their characteristic of reflectance, which has great help in monitoring it. Determining the amount of green vegetation produced and identifying variations in vegetation are also helpful. We discovered that the water body area, such as ponds, reservoirs, and completely dry ground,

exhibits negative values from the generated maps vegetation indices, such as the NDVI. Whereas a low NDVI value implies a low density of vegetation, a high NDVI value suggests a high density. Rainfall runoff is generally slowed down and penetration into the soil is improved when the top soil is shielded from impact. Vegetation, or cover factor, is a significant environmental component that helps to reduce, characterize, and evaluate water-led soil erosion in general. Additionally, it is a dynamic indicator used to examine vegetation density and variation at the watershed level, which aids in identifying soil erosion caused by the loss of protective plant cover.

Vegetation category	Distribution of vegetation cover (km ²) derived from NDVI	
	LISS – III	
	YEAR- 2012	
No vegetation cover (<0.1)	29.12	
Low vegetation cover (0.1-0.3)	249.6	
Moderate vegetation cover (0.3-0.4)	349.5	
High vegetation cover (0.4<)	497	

Table.5 Category wise Vegetations Classes



Conclusion:

An enhanced technique for feature extraction from multispectral remote sensing pictures is provided in this research. Kolhapur district (India) characteristics have been extracted using the normalized difference vegetation index technique with various threshold settings. Study area covered an area of 1125 Km². it is located at Kolhapur District. There is a strong correlation between climate change and NDVI. The NDVI of forests and woodlands responds less to climate change than the NDVI of grasslands, which is more susceptible to changes in precipitation. This paper's simulation findings unequivocally demonstrate that the percentage of vegetation is nearly constant across threshold values. This suggests that vegetation and other factors produce accurate results. GIS makes it simple to handle the synoptic view of the entire watershed. The study is essential to comprehending vegetation indicators that are dependent on slope. Additionally, it proved to be quite helpful in creating maps of the vegetation. An index such as the NDVI may be useful in recommending management strategies for soil preservation. A significant variation in the classification of areas according to vegetation density shows how effective LISS - III imagery is in resolving canopy measurement discrepancy. Additionally, like with LISS III imagery, a moderate resolution cell size provides a better knowledge of canopy density. As a result, vegetation across the terrain was clearly represented by the differentiation of Vegetation Index classes.

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Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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