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NORMALIZED DIFFERENCE VEGETATION INDEX (NDVI) ANALYSIS USING REMOTE SENSING AND GIS – A CASE STUDY OF AKOLE TAHSIL, AHMEDNAGAR, MAHARASHTRA (INDIA)

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ABSTRACT:

This paper presents an enriched technique of Landsat 8 where used for the analysis of Normalized Difference Vegetation Index (NDVI). The method works the multi-spectral remote sensing data and GIS technique to catch spectral signature of different objects such as vegetation index, land cover classification, physical structure, settlement areas, rocky areas, crop areas and remaining areas presented in the image. For land cover classification, some band amalgamations of the remote sensed data are exploited and the spatial distribution such as settlement area, agriculture land and water resources are easily interpreted by computing their normalized difference vegetation index. Different standards of threshold of NDVI are used for producing the false colour composite of the classified objects. The model consequences show that the NDVI is highly useful in detecting the surface features of the visible area which are extremely beneficial for planning and management. The Akole tahsil is situated in hilly region and riches by biodiversity. The vegetation index used for current situation of tahsil.

Key words: - *Remote Sensing, GIS, NDVI, land cover classification, false color composite.*

INTRODUCTION:

The MSS remote sensing satellite images are very efficient for obtaining a better understanding of the earth surface and its environment.[1] remote sensing is the science and art of acquiring data and take out the features in form of spectral, spatial and temporal about some substances, area or phenomenon, such as flora, land cover classification, settlement area, agriculture land and water assets without coming into physical contact of these things.[2] The remote recognizing information has many application areas including: land cover classification, soil moisture measurement, forest type classification, measurement of liquid water content of vegetation (chlorophyll), snow mapping, sea ice type classification, oceanography etc.[2] The multispectral remote sensing images bring essential adding spectral and spatial landscapes of the objects.[3] The current paper, the multispectral image of Akole region is used to calculate the proportion of multipurpose features such as vegetation, water bodies, land cover classification, barren area, settlement areas and remaining area presented in this image, and to subsequently make these extracted features available to the public for further analysis in order to avoid any sort of natural disasters like flood.

The National Aeronautics and Space Administration of USA (NASA) uses 8-band data for feature extraction, and it is called as LANDSAT 8 image. The multispectral remote sensing data image of Akole region is received from the National Remote Sensing Agency. It consists 3-band data and the information is skilled by the help of these 3 bands named near infrared band, red band and green band. Each band contains some specific information and with the help of these three bands, the features can be extracted. On the basis of wavelength, remote sensing is classified into three types as: visible and reflective infrared remote sensing, thermal infrared remote sensing, and microwave remote

sensing.[4] NDVI strategy was produced by the NASA researcher usually known as Normalized Difference Vegetation Index (NDVI). By taking a ratio of two groups drop the qualities between - 1 to +1. Table beneath shows the red and infrared groups reflectance estimations of elements and their NDVI values. Water has NDVI esteem lower than 0, bare soils somewhere around 0 and 0.1, and agriculture as well as vegetation more than 0.1. Addition in the positive NDVI esteem indicates greener the vegetation.

MATERIALS AND METHODS:

Landsat 8 Satellite Data and Erdas Imagin 9.2 and Arc GIS 10.1 software were used in the study.

1.1 *Calculating Reflectance value from the Satellite data*

OLI spectral radiance data can also be transformed to TOA planetary reflectance using reflectance rescaling coefficients provided in the landsat8 OLI metadata file. The following equation is used to convert DN values to TOA reflectance for OLI image:

$$\rho\lambda' = M\,\rho Qcal + A\,\rho$$

Where:

ρλ' = TOA planetary reflectance, without correction for solar angle. Note that ρλ' does not contain a correction for the sun angle.

M ρ = Band-specific multiplicative rescaling factor from the metadata (Reflectance Multi Band x, where x is the band number)

A ρ = Band-specific additive rescaling factor from the metadata (Reflectance Add Band x, where x is the band number)

Q cal = Quantized and calibrated standard product pixel values (DN).

1.2 Correcting the Reflectance value with sun angle

Reflectance with a correction for the sun angle is then

Where:

$$\rho\lambda = \rho\lambda'/\cos\theta SZ = \rho\lambda'/\sin\theta SE$$

ρλ = TOA planetary reflectance

θSE = Local sun elevation angle. The scene center sun elevation angle in degrees is provided in the metadata (Sun Elevation).

θSZ = Local solar zenith angle; θSZ = 90° – θSE.

1.3 Calculating NDVI from 4th and 5thbands

As we discussed earlier to find NDVI we use the formula of

$$NDVI = \frac{(\mathbf{NIR} - \mathbf{RED})}{(\mathbf{NIR} + \mathbf{RED})}$$

Here band 4= RED and band 5=NIR

STUDY AREA:

Akole is one of the Tahasil in Ahmednagar district of Maharashtra state. It is well surrounded with the highlands of Sahyadris. Its latitudinal extent is between 19⁰ 15' 14" North to 19⁰ 44' 59" North while the longitudinal extent is from 73⁰ 37' 00" East to 74⁰ 07' 24" East. It is surrounded by Sangamner tahasilto the east, Thane district to the west, the northern part covered by Nashik district and to the southern part Pune district. Tahsil having 191 Villages and 4 (Four) **Revenue Circles** namely **Rajur, Akole, Samsherpur** and **Kotul**. Total Geographical area of tahsil is approximately **1,50000 hector**. Akole Tahsil was highly development of socio-economicaly.[7] The study area occupies 8.73 percent areas of the total district area. Under the area of forest is about 42,000 hectors, Agriculture land is 98,712 hectors.

RESULT AND DISCUSSION:

The NDVI have been used widely to look at the kin between spectral variability and the vegetation strength or growth rate. It is also useful to

determine the invention of green vegetation as well as detect flora changes. Table.2 shows typical reflectance values in the red and infrared channels, and the NDVI for typical land use and land cover varieties. Water typically has an NDVI value less than 0, barren land and soils among 0 and 0.1 and vegetation over 0.1. Here we are using the Landsat image acquired from USGS Earth Explorer web site. The data is in format of GeoTiff with having 16 bit radiometric resolution (ranges from 0-65535). Landsat 8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS) images made up of nine spectral bands with a spatial resolution of 30 meters for Bands 1 to 7 and 9. The spatial resolution for Band 8 (panchromatic) is 15 meters. Before calculating the NDVI the DN data must be converted to reflectance using the equations given in their website. Here the IR and NIR bands are 4 and 5 respectively.

CONCLUSION:

NDVI (Normalized Difference Vegetation Index) was computed for orchard classes from NIR and Red bands. NDVI is dimensionless indicator and ranges between -1 to 1. NDVI indicates the vigor of vegetation and is higher for dense healthy vegetation and lower for sparse vegetation. The range of NDVI obtained for vegetation of Akole Tehsils was used to generate three ranges viz. dense, moderate, and sparse indicating density of vegetation. The “Dense” class is assigned for which the NDVI is higher than 0.6, “moderate” 0.6-0.5 and “sparse” to NDVI lower than 0.5 crop production forecasting consists of identification of crops, acerage estimation and forecasting their yield. Crop identification is based upon the fact that each crop has a unique spectral signature. The typical spectral response of crop shows absorption due to pigments in the visible region (0.4-0.7µm), high reflectance in the near infrared region because of internal cellular structures of the leaves and absorption at 1.45,1.95 and 2.6 µm spectral bands due to the water content.

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Table-1:- Shows the Spectral characteristics of Landsat 8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS)[5]

Bands	**Wavelength**	**Resolution**
Band 1 – Coastal aerosol	0.43 – 0.45	30
Band 2 – Blue	0.45 – 0.51	30
Band 3 – Green	0.53 – 0.59	30
Band 4 – Red	0.64 – 0.67	30
Band 5 – Near Infrared (NIR)	0.85 – 0.88	30
Band 6 – SWIR	1 1.57 – 1.65	30
Band 7 – SWIR	2 2.11 – 2.29	30
Band 8 – Panchromatic	0.50 – 0.68	15
Band 9 – Cirrus	1.36 – 1.38	30
Band 10 – Thermal Infrared(TIRS)	1 10.60 – 11.19	100 * (30)
Band 11 – Thermal Infrared(TIRS)	2 11.50 – 12.51	100 * (30)

(Source: Obtained from USGS)

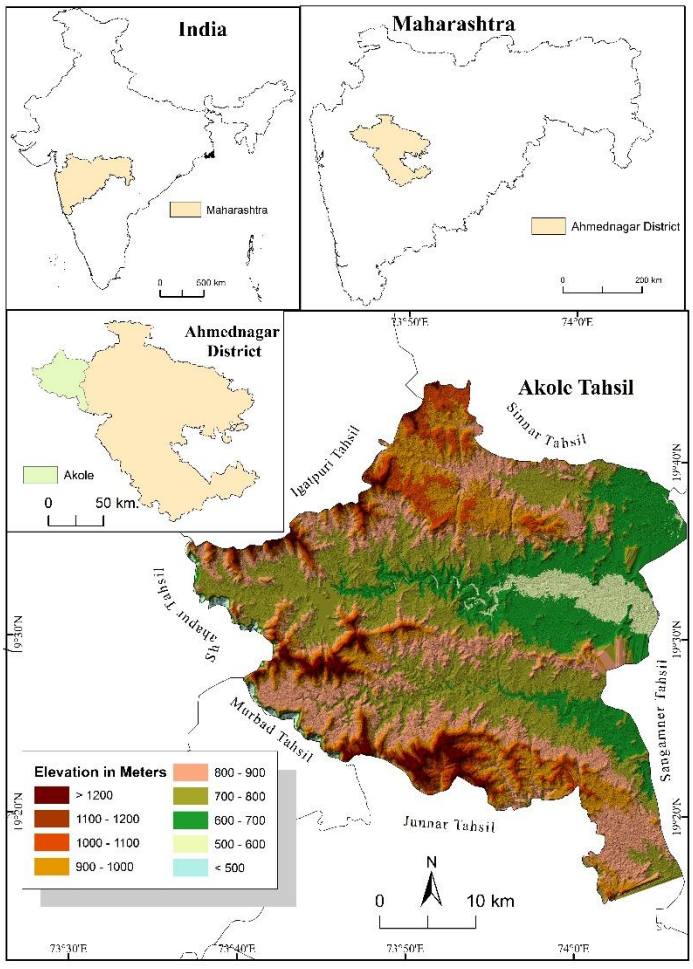
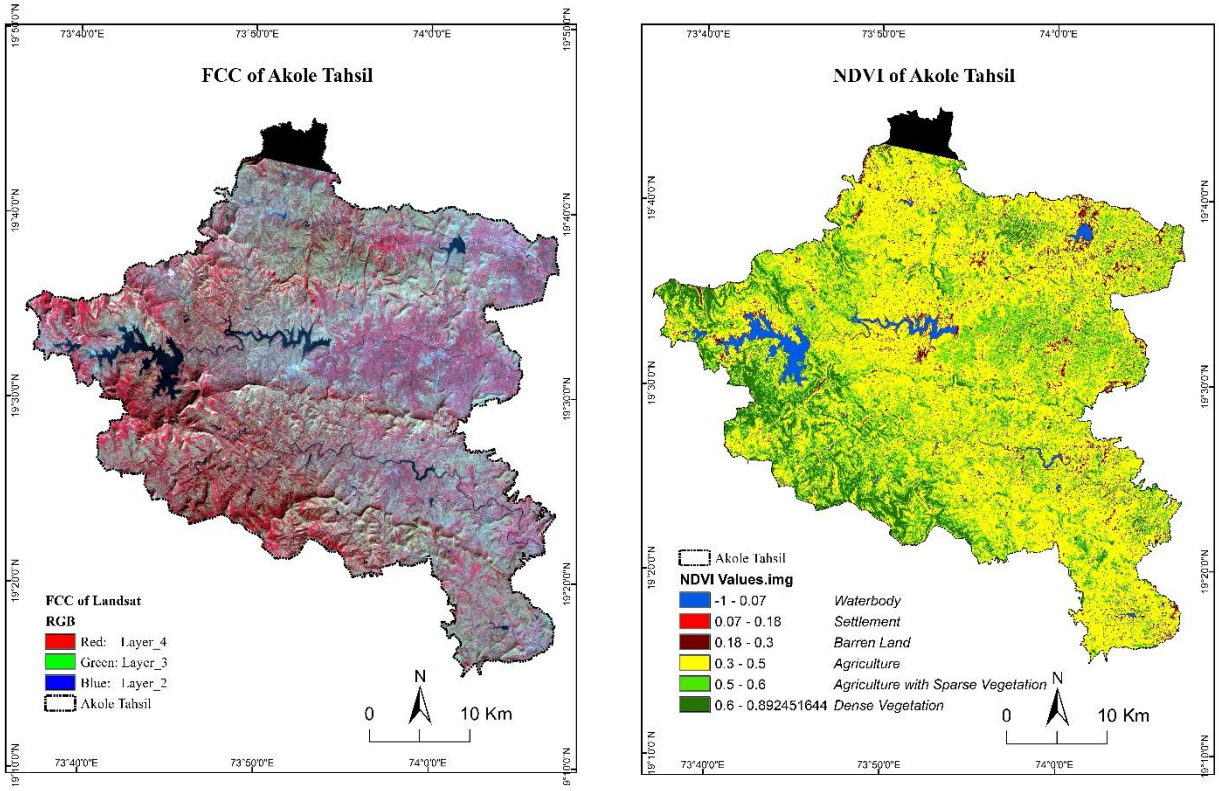


Figure1: Location Map of Study Area

Table.2 typical reflectance values in Red, NIR and NDVI

COVER TYPE	RED	NIR	NDVI
Dense vegetation	0.1	0.5	0.6
Dry Bare soil	0.269	0.283	0.25
Water	0.022	0.013	0.07



a) b)

Figure 2 a) Standerd FCC of Akole Tahsil, b) NDVI Classification of Akole Tahsil