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APPLICATION OF REMOTE SENSING AND GIS OF VARIOUS INDICES: A REVIEW OF MANGALWEDHA TAHSIL, DISTRICT SOLAPUR, MAHARASHTRA

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Abstract:
There is a high potential for the use of GIS and RS techniques on indices calculation using spatial analysis techniques. While the satellite data provides the subjective opinions of people about the convenience to public processing, services and analyzing the geospatial technologies based information provides essential contributions in considerate the objective dimension of the accessibility to health, emergency and transportation facilities. The present research work, indices are calculated from satellite imageries such as Normalized Difference Vegetation Index (NDVI), Normalized Difference Built Index (NDBI), Normalized Difference Water Index (NDWI), Normalized Difference Soil Index (NDSI), Normalized Burn Ratio (NBR), Visible Atmospherical Resistant Index (VARI), Normalized Difference Moisture Index (NDMI) and Soil Adjusted Vegetation Index (SAVI). The NDVI, NDBI and NDWI have indices value ranges from -1 to 1.

Keywords: Indices, RS and GIS, Spatial boundary, Mangalwedha, etc.

Introduction

There is a high potential for the use of GIS and RS techniques on indices calculation using spatial analysis techniques. Remote sensing materials in the form of aerial photographs and satellite images are usually converted into useful information such as land cover maps using two conventional methods: manual interpretation and computer-assisted digital processing. During manual interpretation analogue photographs or satellite images are visually interpreted and the results delineated directly on the photographs or images or on tracing paper placed over them (Jha, et al., 2003). Similar to other cities in the developing world, Mangalwedha city has been progressively increasing both physically as well as in terms of its population (Xu et al., 2000).

The various indices are discussed below

Normalized Difference Vegetation Index (NDVI)

The NDVI is easy graphical indicator that can be used to evaluate remote sensing measurements, usually but not essentially from a space platform, and evaluate whether the target being observed contains live green vegetation or not. The importance of NDVI comes from the fact that it gives information about a primary production (vegetation) over time (Francesco, et al., 2014). NDVI is a vegetation index to monitor the condition of vegetation or vegetation health. The chlorophyll content of vegetation absorbs strongly the red wavelength of sunlight and reflects in near-infrared wavelengths. In red band (620 – 750 nm) there is maximum absorption of sunlight and in near-infrared (750 to 1400 nm) maximum of sunlight is reflected back.

Mathematically NDVI is calculated using the below formula:

NDVI = (NIR - Red) / (NIR + Red)

Normalized Difference Water Index (NDWI)

NDWI may refer to one of at least two remote sensing -derived indexes related to liquid water. The Normalized Difference Water Index (NDWI) (Gao, 1996) is a satellite-derived index from the Near-Infrared (NIR) and Short Wave Infrared (SWIR) channels. The amount of water available in the internal leaf structure largely controls the spectral reflectance in the SWIR interval of the electromagnetic spectrum. SWIR reflectance is therefore negatively related to leaf water content (Tucker 1980).

Mathematically NDWI is calculated using the below formula:

NDWI = (GREEN - NIR) / (GREEN + NIR)

Normalized Difference Builtup Index (NDBI)

One of the main problems in mapping urban areas is assessing the change in land usage from non-residential to residential. Mapping the built-up and bare land in urban areas is important because the existence of these types of land can be used as an indicator of urban development and environmental quality [Weng, Q., 2008]. The mapping process applies different remotely sensed data and spectral values based on the land use category [Xu, H., 2008].

Mathematically NDBI is calculated using the below formula:

NDBI = (SWIR – NIR) / (SWIR + NIR)

Normalized Difference Soil Index (NDSI)

The developments of soil indices, are challenging due to several reasons. Firstly, soil is a complex material with various physical and chemical compositions, and the spectra of soil

are very complex that prevents direct connections between soil properties and its spectral responses (Ben-Dor, 2002).

Mathematically NDSI is calculated using the below formula:

NDSI = (SWIR1 – NIR) / (SWIR1 + NIR)

Normalized Burn Ratio (NBR)

The Normalized Burn Ratio (NBR) was designed to highlight burned areas and estimate fire severity. The formula is similar to NDVI, except that it uses near-infrared (NIR) and shortwave-infrared (SWIR) wavelengths. Healthy vegetation has very high near-infrared reflectance and low reflectance in the shortwave infrared portion of the spectrum. Recently burned areas on the other hand have relatively low reflectance in the near-infrared and high reflectance in the shortwave infrared band.

Mathematically NBR is calculated using the below formula:

NBR = (NIR – SWIR2) / (SWIR2 + NIR)

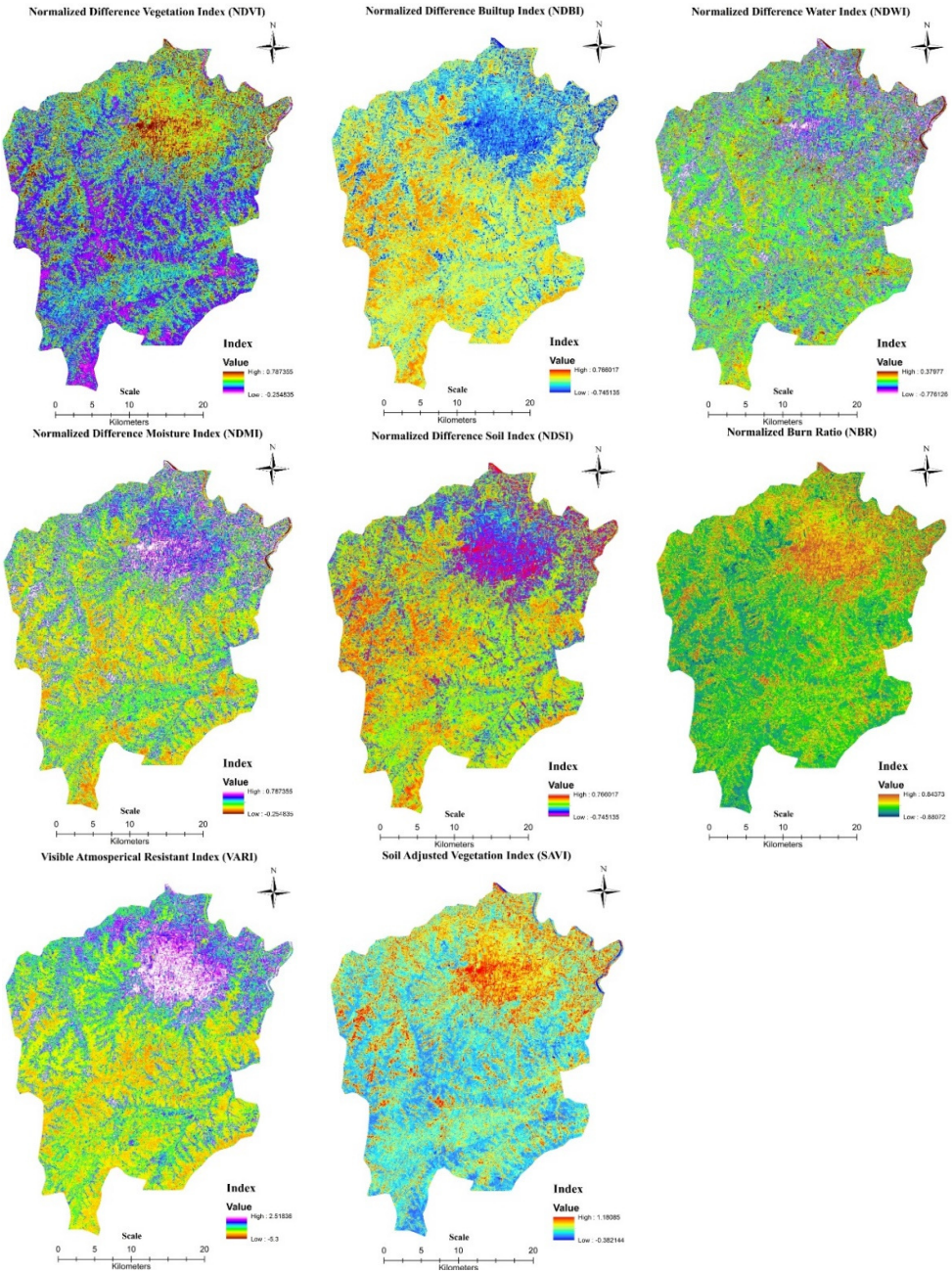

Figure 1: Various Indices of the study area.

Visible Atmospherical Resistant Index (VARI)

Most recently, indices based completely on the visible part of the spectrum have been recommended, such as the Visible Atmospherically Resistant Index (VARI) (Gitelson et al., 2002).

Mathematically VARI is calculated using the below formula:

VARI = (Green – Red) / (Green + Red - Blue)

Normalized Difference Moisture Index (NDMI)

The Normalized Difference Moisture Index (NDMI) estimates levels of moisture in vegetation. Wetlands and other vegetated areas with high levels of moisture appear as blue whereas deserts appear as tan to brown. This index contrasts the near-infrared (NIR) band 4, which is sensitive to the reflectance of leaf chlorophyll content to the mid-infrared (MIR) band 5, which is sensitive to the absorbance of leaf moisture.

Mathematically NDMI is calculated using the below formula:

NDMI = (NIR – Red) / (NIR + Red)

Soil Adjusted Vegetation Index (SAVI)

Empirically derived NDVI products have been shown to be unstable, varying with soil colour, soil moisture, and saturation effects from high density vegetation. In an attempt to improve NDVI, Huete (1988) developed a vegetation index that accounted for the differential red and near-infrared extinction through the vegetation canopy. The index is a transformation technique that minimizes soil brightness influences from spectral vegetation indices involving red and near-infrared (NIR) wavelengths.

Mathematically SAVI is calculated using the below formula:

SAVI = (NIR - Red) * (1+L) / (NIR + Red + L)
(Where, L = 0.5)

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