International Journal of Interdisciplinary and Multidisciplinary Research (IJIMR)
ISSN 2456–4567

Monitoring the Quality of Life in Urban Area Using TDVI- Case Study of Kalaburagi City

Dr. Abhilasha Kumari
Patna Metropolitan Area
Authority Patna
Bihar

Abstract

Many vegetation indices have been proposed over last decades made specialists search for the most suitable vegetation index for a given remote sensing application. Measuring the Quality of Place (QOP) is a hard task since it involves both physical and socio-economic dimensions. Being one of the major land use categories, urban vegetation plays a significant role in one"s judgment for QOP in a neighborhood. Both quantity and quality of the community parks and recreation areas are major determinants of neighborhood attraction. For these reasons, detection of urban vegetation cover has been one of the important implication areas of urban image classification techniques. "Transformed Difference Vegetation Index (TDVI) developed by Bannari et al. (2002), is tested in a previous work where the index has performed better than NDVI and SAVI. In that work, a comparative study between TDVI, SAVI and NDVI for estimating vegetation cover in urban environment from the Indian Remote Sensing Satellite (IRS-1D) imagery has been conducted. The validation of the obtained results according to the ground truth showed that the TDVI is an excellent tool for vegetation cover monitoring in urban environment. It does not saturate like NDVI or SAVI, it shows an excellent linearity as a function of the rate of vegetation cover. This paper adds on the previous work by analyzing the performance of TDVI in urban image classification. Results indicate that, the performance of TDVI in urban image classification is better than NDVI and SAVI. The new index not only differentiates the urban vegetation cover better but also helps to minimize the error in classifying other unclassified pixels of urban categories.

Introduction

KALABURAGI' which mean stony land in Kannada isadeveloping city situatedin the north eastern part of Karnataka State. And for the development of this city, vegetation is influenced by a decade of intensive urbanization which is of great interest but rarely studied. In this paper, we used satellite derived different vegetation index like Normalized Difference Vegetation Index (NDVI), Transferred Vegetation Index and Soil Adjusted Vegetation Index (SAVI) to study the current status of quality of life in urban with respect to greenery.

The quality of place in the urban environment is highly influenced by the physical properties of the urban mosaic across a wide range of spatial and temporal scales. Vegetation abundance and distribution are fundamental determinants of quality of place in urban environmental conditions. Vegetation applies a strong impact on mass and energy fluxes through the urban environment by curbing evapotranspiration and solar radiation absorption. Mapping and monitoring of vegetation distribution and condition is central to the upkeep of parks and urban ecosystem, but it can also facilitate analyses of urban areas that can inform policy decision and future development of urban environment. Mapping and monitoring urban vegetation in individual cities is important in its own way, but comparative analysis can provide a vital compliment to city specific analyses. By defining intra-urban and inter-urban vegetation distribution it is possible to quantify uniformities and variances that determine which properties must be measured. However, relatively few comparatives analysis of urban vegetation distribution has been conducted todate.

There is a great potential for the use of GIS and RS techniques on QOP measurements using spatial analysis techniques and land use information accumulated from remotely sensed data. While the survey data delivers the subjective opinions of people about the availability to public services, processing and analysing the GIS and RS based information makes important in understanding the objective of the QOP such as the actuality and propinquity of the green spaces or the approachability to health, emergency and transportation facilities. This paper shows the land use classification of QOP which is derived from remotely sensed data in RS environment. To improve the classification accuracy, using, Transformed Difference TDVI is tested in order to detect the urban vegetation better.

In the last decade, over forty vegetation indices are familiarised in the remote sensing literature, to quantity the green cover in different applications (Bannari*et al.*, 1995a). Since soil brightness, effects of environment, soil color, moisture and shadow are major composite mixture of vegetated areas; vegetation indices make an effort in reducing the effect of those sources and improve the vegetation response. A new vegetation index, “Transformed Difference Vegetation Index (TDVI) established by Bannari*et al.* (2002), is confirmed in a previous work where the index has reached better than NDVI and SAVI. In that study (Bannari, Ozbakir and Langlois, 2006), authors gives a relative study between TDVI, SAVI and NDVI for evaluating green cover in urban environment from the *Indian Remote Sensing Satellite* (IRS-1D) imagery has beendirected.

5.1.2 StudyArea

„KALABURAG"whichmeanstonylandinKannadaisanimpendingcitysituatedinthenorth eastern part of Karnataka State. It is the administrative headquarters of Kalaburagi District. Kalaburagi city has an area of 64.00 sq.km and population of 5.3 lakhs (Census of India, 2011). The city is mostly unstructured and has disorganized growth without proper planning &development.

So, it is important to consider the quality of urban in Kalaburagi city with respect to vegetation, So that planning commission can give structure to city according to their need and demand of the environment of the city.

5.1.3 Methodology

LISS-IV images of the year 2007 & 2013 are the basic data of this paper and band combination should be process before data use in order to extract NDVI of the study area. It is necessary to do the geometric correction after band combination, so that the
object on the image can associated with its actual location, providing location information for the analysis of thedata.

LISS-IV is a high resolution multi-spectral in three spectral bands (B2, B3, B4). It provides a ground resolution of 5.8 m (at Nadir) and can be operated in either of the two modes. In the multi-spectral mode (Mx), a swath of 23.5 Km (selectable out of 70 Km total swath) is covered in three bands, while in mono mode (Mono), the full swath of 70 Km can be covered in any one single band, which is selectable by ground command (nominal is B3 – Red band). The LISS-IV camera can be tilted up to ± 26° in the across track direction thereby providing a revisit period of 5 days.

In this research three different class of vegetation index have been studied, namely Normalized Vegetation Index (NDVI), Transformed difference Vegetation Index (TDVI) and Soil Adjusted Vegetation Index (SAVI). All these indices have been introduced in Table: 1

Table: 5.1.1 the used indices

Name	Equation	References
Normalized difference vegetation Index(NDVI)	NDVI=	Rouse et al. (1973)
Transformed Difference VegetationIndex (TDVI)		Broge and Leblanc (2000)
Soil Adjusted Vegetation Index (SAVI)		Huete (1988)

Result

For this study, the supervised classification technique is applied to the calculated NDVI, TDVI & SAVI images. The reason for selecting the “supervised classificationtechnique”
is that it enables the image analyst to decide on the classes and to specify the training areas. For this research, the following three land use classes were taken in consideration:

1. Urban with weak vegetation (which is an indicator of high dense urbanareas).
2. Urban / vegetation (which is an indicator of medium dense urbanareas).
3. Urban with dense vegetation (which is an indicator of low dense urbanareas.

These five classes were taken for understanding the quality of places with respect to the vegetation factor of the city. In other word, the motive of the training area selection is to identify the homogenous samples of different surface cover types in the image and to compare the image of two years i.e., 2007 and2013.

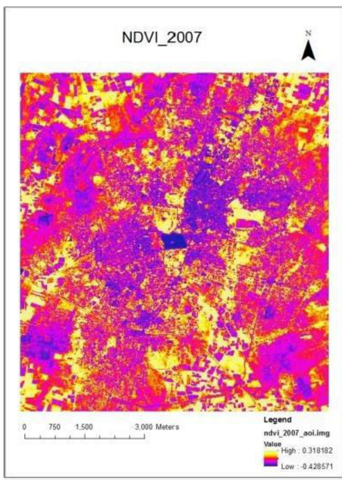


Fig:5.1.1

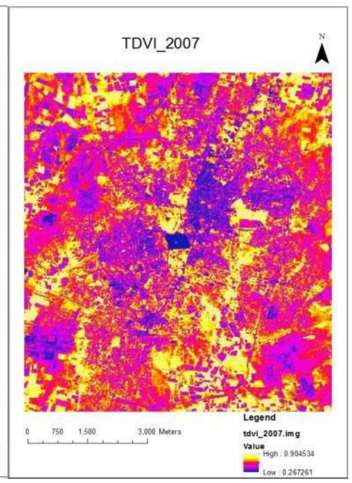


Fig:5.1.2

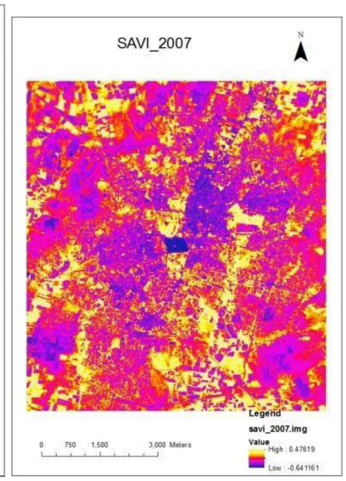
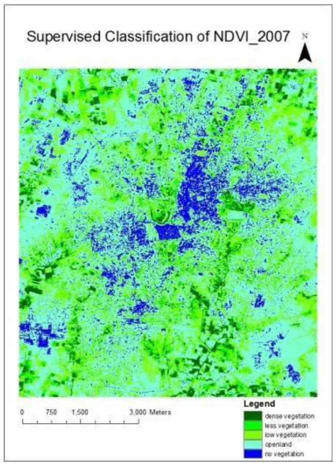
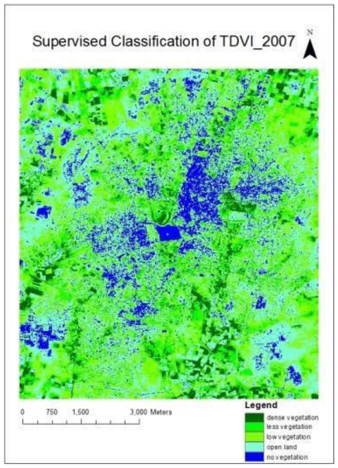


Fig:5.1.3

By comparing the TDVI & NDVI of the study area





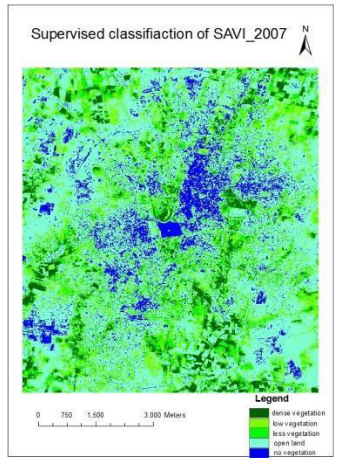


Fig:5.1.4 **Fig:5.1.5** **Fig:5.1.6**

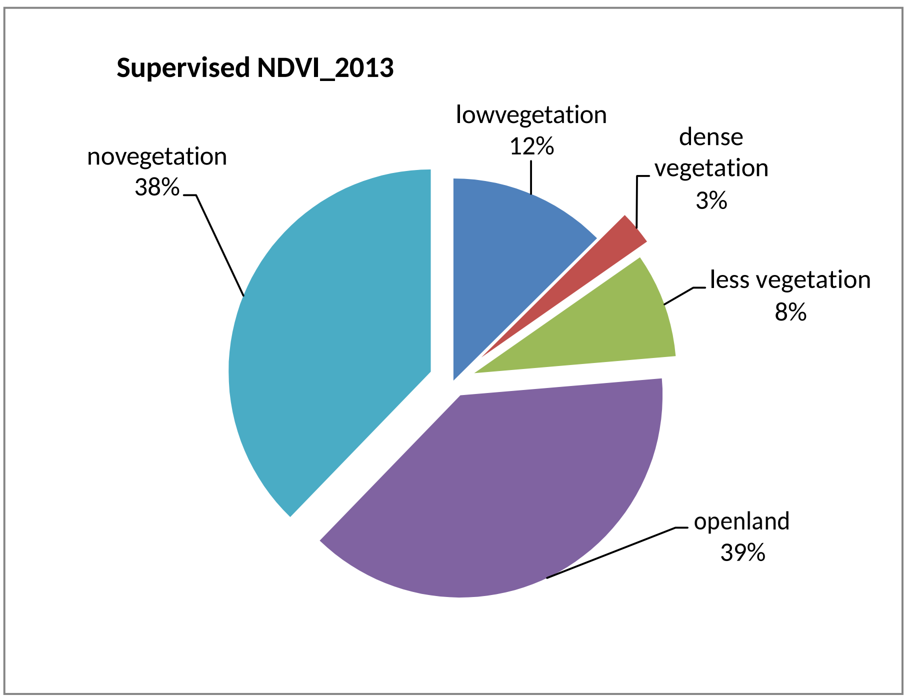


Fig: 5.1.8 Pie-chart showing percentage of NDVI of each class in 2013

Conclusion

As it was before showed, the differentiation among the green areas plays an imperative role in urban QOP studies. Since planning policies and urban management differ in forestry areas or parks and amusement areas, this study has provided promising results in separating the different categories successfully through the application of TDVI. In this work, the presentation of TDVI is tested in urban image classification. Results oftheKappa Coefficient which is an indicator of good classification. With the help of these results, urban areas with vegetation cover were separated into three subcategories such as:

1) Urban with densevegetation
2) Urban/vegetation
3) Urban with weakvegetation.

The ratification of the obtained results according to the ground truth showed that the TDVI is a first-rate tool for vegetation cover monitoring in urban environment. It does not steep like NDVI, it shows an excellent linearity as a function of the rate of vegetation cover.

References:

1. Broge, N.H., Leblanc, E., 2000. Comparing prediction power and stability of broadband and hyperspectral vegetation indices for estimation of green leaf area index and canopy chlorophyll density.RemoteSensing of Environment 76, 156–172.
2. Cabral, P., Augusto, G., Tewolde, M., & Araya, Y. (2013).Entropy in urban systems.Entropy, 15(12), 5223–5236.
3. Dole, J. (1989). Greenscape 5: Green Cities. Architects' Journal, (May), 61–69.
4. Groenewegen, P. P., van de Berg, A. E., De Vries, S., &Verheij, R. A. (2006). Vitamin G: Effects of green space on health, well-being, and social safety. BMC Public Health, 6, 149.
5. Kshama Gupta, Pramod Kumar, S.K. Pathan, K.P. Sharma "Urban Neighborhood Green Index – A measure of green spaces in urban areas".elsevier Landscape and Urban Planning
6. Maas, J., Spreeuwenberg, P., Van Winsum-Westra, M., Verheij, R. A., de Vries, S.,&Groenewegen, P. P. (2009). Is green space in the living environment associated with people's feelings of social safety? Environment and Planning A, 41(7), 1763–1777.
7. Ruangrit, Vittaya,&Sokhi, B. S. (2004). Remote sensing and GIS for urban green space analysis- A case study of Jaipur city, Rajasthan, India. Journal of Institute of Town Planners India, 1(2), 55–67.