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Measuring Vegetation Cover Change in Kinwat Wildlife Sanctuary, Maharashtra, India Using Normalized Difference Vegetation Index

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Abstract - This study has been undertaken to measure land cover change in Kinwat wildlife sanctuary, Nanded using NDVI. Remote Sensing and Image processing technologies enable us to cope with the objectives of change detection. Most of the changes of vegetation cover are happening in earth in the close proximity of human inhabitations. Study is carried out to analyze the vegetation cover changes to detect the past and present vegetation cover conditions of study area using multi temporal remote sensing data IRS-LISS-III 2008 and IRS-LISS-III 2019 respectively. NDVI (Normalized Difference Vegetation Index) for the study area were determined which is an important indicator and were generated for both images of year 2008 and 2019 respectively. The image pair is acquired in the same season in order to minimize the impacts of seasonal differences of vegetation. Vegetation cover analysis would help the local people to utilize the resources for sustainable development of the study area.

***Key Words*:** remote sensing, NDVI, IRS-LISS-III, vegetation cover, image processing.

1.INTRODUCTION

Remote sensing technology can help us better understand the Earth's environment. Remote sensing is emerging in today's global and local environment research agenda. It is seen as a local activity for a worldwide mission, and hence many fields of study are served by this technology. It is a technique for collecting knowledge and information about any object or body without coming into contact with that object. This technology benefits us in terms of both the quality and quantity of information. Accurate vegetation estimation is required for any improvements and for monitoring drought conditions. It is tough to obtain data for large regions using traditional ways where highly trained personnel with broad knowledge from that area are required. It is time and cost-effective work. Normalized Difference Vegetation Index (NDVI) is the most extensively used vegetation quality (health condition) and spread area (quantity) indices obtained from satellite sensor data have been used to assess vegetation cover. Rousil (1973) established the NDVI method, which is based on vegetation phenology because green vegetation reflects less visible light and more NIR, whereas sparse vegetation reflects more visible light and less NIR. The NDVI value is calculated by multiplying the ratio of these reflectances. The red and NIR spectral wavelengths are employed in this index, and the graphic transformation is involved.

Many researchers employ NDVI because it has a lengthy track record of merit in remote sensing vegetation. Indian Remote Sensing LISS III data was used in this study for computing the NDVI.

2. STUDY AREA AND DATA COLLECTION

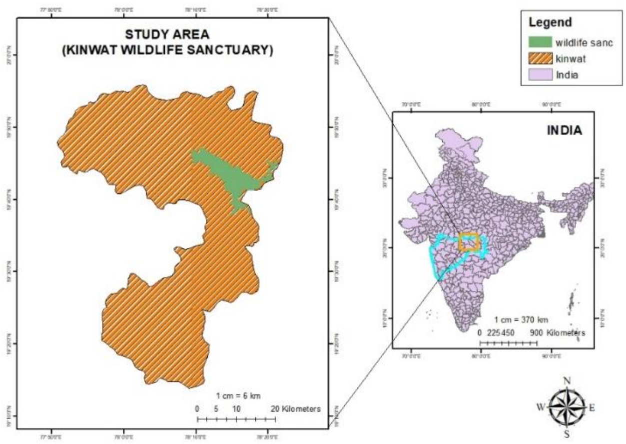

Fig -1: Study area map (Kinwat Wildlife Sanctuary Dist. Nanded)

The study area is in Maharashtra which is a state of India. The area of the Nanded district is 30,713 (sq. km). Geographically kinwat taluka is situated between 19°25’ to 19°55’ north latitude and 77°51’ to 78°19’ east longitude which is shown in Fig.1. The area of Kinwat wildlife sanctuary is 92.85 (sq. km). Kinwat Wildlife Reserve is a protected area in the Nanded district of Maharashtra, India. It is situated on the right bank of the Godavari River, bordering the states of Karnataka, Telangana, and Chhattisgarh. This reserve is home to some of the most endangered wildlife species, including the sloth bear, tiger, leopard, wild boar, barking deer, nilgai, sambar, and chinkara. The forest also has a wide variety of birds, reptiles, and insects. All LISS-III images used in this study were provided by the Bhuvan (Indian Geo-platform of ISRO) and downloaded from the website. The information about LISS-III image specifications is given in Table.1. These products are processed geometric and atmospheric corrections and application-ready data sets.

Table -1: Linear imaging self-scanning sensor 3 (IRS LISS-III)

Spectral Bands	Nominal Spectral Location	Wavelength (μm)	Spatial Resolution (m)
Band-2	Green	0.52-0.59	23.5
Band-3	Red	0.62-0.68	23.5
Band-4	Near Infrared	0.77-0.86	23.5
Band-5	Shortwave Infrared	1.55-1.70	70.5

2.1 METHODOLOGY

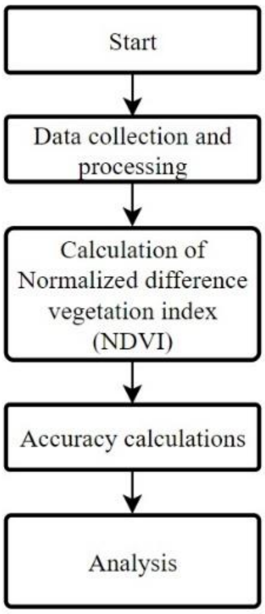

Fig -2: Flow chart of methodology

This study utilized IRS LISS III satellite images of 2008 and 2019. IRS Liss III images each with 23m resolution, are collected from the Bhuvan (Indian Geo-platform of ISRO) website. Liss III images have been registered and geo-corrected from the source. Fig.2 shows the proposed methodology of study, in which satellite data was first gathered and pre-processed, including atmospheric adjustments and georectification, before subsetting the pictures using the Kinwat Wildlife Sanctuary boundaries. The Kinwat wildlife sanctuary boundary map is prepared using Google Earth in .kml format. This boundary map of study area in .kml format is then converted to shapefile (.shp) and then imported to remote sensing software. The IRS LISS-III images were atmospherically corrected. In the following step of the computing process, maps for NDVI 2008 and 2019 were generated using Remote Sensing software.

The NDVI vegetation index is widely used due to its ease of calculation, interpretability, and ability to partially compensate for the impacts of atmosphere, geometry, and other factors. Rouse is the first to apply the Normalized Difference Vegetation Index. The NDVI is a measure of vegetative vigor. NDVI is calculated as:

$$NDVI = (NIR - RED) / (NIR + RED) \quad \text{(Eq.1)}$$

Where NIR stands for Near Infra-Red and RED stands for Red. It is a good predictor of vegetation, crop productivity, forest canopy, and crop season trends. The NDVI ranges from -1 to +1.

3. RESULTS AND DISCUSSION

NDVI value ranges from -0.21 to 0.65 in the 2008 image and from 0.039 to 0.42 in the 2019 image are classified as shown in Fig.3 and Fig.4 for 2008 and 2019 respectively. High NDVI value indicates high vegetation density while low NDVI value indicates low vegetation density. The classified vegetation spread over the study area is shown in Table-2 for 2008 and in Table-3 for 2019. The area covered by vegetation was 90.34km^2 in 2008 and 76.30km^2 in 2019 which indicates a decrease in the vegetation of 14.04km^2 vegetation cover within span of 11 years. In 2008 very high vegetation cover was 29.10km^2 and in 2019 this type of vegetation rapidly decreased with the present coverage area of 3.82km^2 which means 25.55km^2 very high vegetation covered area is totally abolished within 11 years at the rate of 2.32km^2 per year. The high vegetation covered area was 37km^2 in 2008 and it decreased to 14.40km^2 in 2019 which means a reduction in the high vegetation covered area by 22.6km^2.

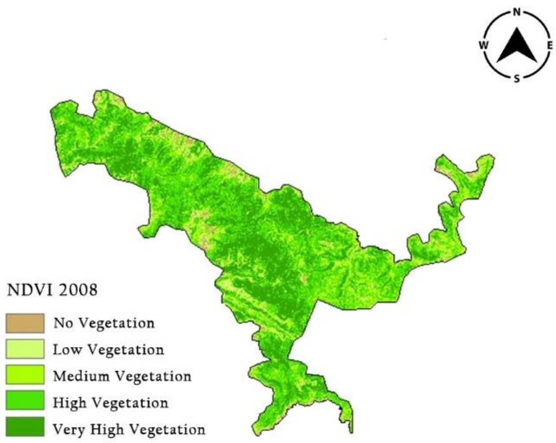

Fig -3: NDVI classification 2008

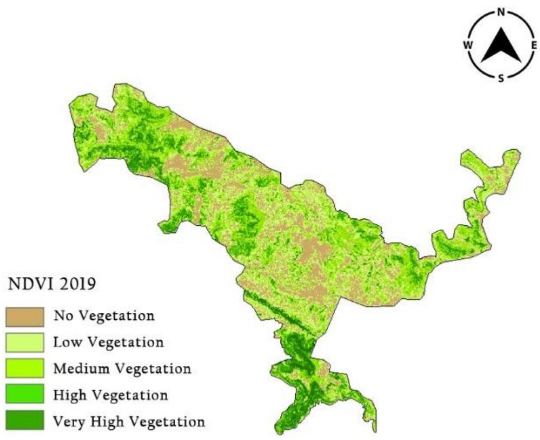

Fig -4: NDVI classification 2019

From the above analysis it is clear that all types of vegetation are affected by the various factors in the study area. In terms of total vegetation area, the maximum change is on very high vegetation covered area. High vegetation covered area is relatively less affected. This change of vegetation is shown in Table 2 for 2008 and in Table 3 for 2019.

Table -2: Result of NDVI 2008 classification

NDVI classes	Count	Area(sq.km)	Area percentage
No vegetation	4612	2.54	2.74
Low vegetation	12742	7.03	7.57
Medium vegetation	31180	17.21	18.53
High vegetation	67004	37.00	39.84
Very high vegetation	52692	29.10	31.32

Table -3: Result of NDVI 2019 classification

NDVI classes	Count	Area(sq. km)	Area percen tage	Percent- -age inc/dec in area (%)
No vegetation	36395	20.13	21.67	+18.93
Low vegetation	49769	27.47	29.58	+22.01
Medium vegetation	49299	27.31	29.40	+10.87
High vegetation	25994	14.40	15.50	-24.34
Very high vegetation	6419	3.55	3.82	-27.52

4. ACCURACY ASSESSMENT

An image classification is not complete until its accuracy has been verified. To evaluate classification accuracy, a sample of testing pixels from the classified images is chosen and their class identification is compared to the reference data. The selection of a proper sampling technique and the calculation of an acceptable sample size for testing data play a key role in determining classification accuracy (Arora and Agarwal, 2002). Overall accuracy is an ordinary measure used to evaluate classification accuracy. The Overall accuracy was defined as the total number of correctly classified pixels divided by the total number of reference pixels (total number of sample points) (Rogan et al. 2002).

The NDVI result is compared to high-resolution Google Earth image to determine its accuracy. For each class, 50 random reference points are selected and digitized. After finishing both the 2008 and 2019 NDVI maps, superimpose them and total of 250 points (50 points for each NDVI class) are identified and their coordinate values are noted down. Then, in a high-resolution Google Earth image from 2023, those coordinates are identified. The accuracy level is derived using reference data, specifically a Google Earth image. The NDVI results have an accuracy of 85% which is shown in Table 4.

Table -4: Overall accuracy calculation (NDVI)

NDVI classes	No. of taken samples	No. of samples match with Google earth image,2023	Average accuracy level in %
No vegetation	50	46	92
Low vegetation	50	42	84
Medium vegetation	50	39	78
High vegetation	50	45	90
Very high vegetation	50	41	82
Overall accuracy level in %			85.2

5. CONCLUSIONS

The NDVI is an important indicator for determining vegetation cover change caused by deforestation, urbanization, and economic development. Changes in vegetation cover can be observed using NDVI map extracted values. According to the results, there is a reduction in high vegetation cover and very high vegetation cover due to a variety of circumstances. The acquired results can be used as indicators for future trends in measuring land cover changes and for distinguishing effective influences on vegetation cover for greater knowledge of the issue by planners and decision makers. And it would help the local people to utilize the resources for sustainable development of the study area.

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REFERENCES

1. Arora, M. K., & Agarwal, K. A program for sampling design for image classification accuracy assessment, Photogrammetry Journal of Finland (2002), 18 (l), pp.33-43.
2. Rogan, J., Franklin, J., & Roberts, D.A. A comparison of methods for monitoring multitemporal vegetation change using Thematic Mapper imagery, Remote Sens. Environ., 80(1), pp.143-156.
3. Meera Gandhi, S. Parthiban, Nagaraj Thummalu, Christy. NDVI: Vegetation change detection using remote sensing and gis – A case study of Vellore District. Procedia computer science, 2015.
4. Reddy, M. Anji. Textbook of Remote Sensing and Geographical Information Systems. BS Publications, Hyderabad, India, 2006.
5. Bhuvan, Indian Geo-Platform of ISRO, Liss3 data https://bhuvan.nrsc.gov.in
6. A.V. Kiranmai, N. Aparna, B. Jyothi Sree, D. Pavan Kalyan, K. Suresh. Normalized Difference Vegetation Index (NDVI) based Land Cover Classification using ArcGIS: Vijayawada, Andhra Pradesh. International Research Journal of Engineering and Technology (IRJET) Volume: 07 Issue: 03 Mar 2020
7. Hamlyn G.Jones and Robin A. Vaughan. Remote sensing of vegetation, Oxford University Press, 2010.
8. Dr. A. P. Nilawar, Dr. M. L. Waikar. RS and GIS approach for prospecting various parameter of small watershed. Journal of Indian water works association. April- June 2015.