International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 01 | Jan 2019 www.irjet.net p-ISSN: 2395-0072

APPLICATION OF NDVI IN VEGETATION MONITORING AND DROUGHT DETECTION USING REMOTE SENSING FOR LOWER RAJGHAT CANAL COMMAND AREA

Ankit Kumar[1], Derrick Denis[2], Himanshu Mishra[3], Shashi Indwar[4]

[1]Junior Research Fellow, National Institute of Hydrology, Bhopal-462016
[2]Prof& Head, Dept. of Irrigation and Drainage Engineering, VIAET, SHUATS, Allahabad-211007
[3]Senior Research Fellow, VIAET, SHUATS, Allahabad-211007
[4]Scientist- C, National Institute of Hydrology, Bhopal-462016

Abstract - *Vegetation is a key component of ecosystem and its plays most important role for stabilizing global environmental. Normalized Difference Vegetation Index (NDVI) known as a remote sensing technique which are used to quantifying vegetation cover change. Hence the major objective of this paper is assessment of vegetation monitoring with the help of NDVI using Remote Sensing and Geographical Information System for Lower Rajghat Canal Command Area (LRC) during Kharif (June-October), Rabi (October-March), and Zaid season (April-May).In this study, NDVI analysis for vegetation cover change using June, 2015 to May, 2016 satellite images was analyzed. Four different monitoring points were taken for analyze vegetation cover changes in LRC. Minimum and maximum value of NDVI was calculated for period June, 2015 to May, 2016. The result of the present study showed that the minimum NDVI values are 0.098, 0.14, 0.02, and 0.12 for monitoring point 1,2,3,4 respectively during period June, 2015 to May, 2016. Maximum values were found for monitoring point 1,2,3,4 is 0.35, 0.42, 0.24 and 0.49 respectively period June, 2015 to May, 2016. The result showed that the average vegetation cover was decreased in the month of December (Rabi season) and healthy vegetation was found in month of September (Kharif Season).*

Key Words: **Remote Sensing, GIS, Normalized Difference Vegetation Index, Vegetation**, **Drought**

1. INTRODUCTION

Vegetation plays an important role in providing different ecosystem services and goods so as to adapt and mitigate the global climate change.

If the name of the economy comes to India, then it has the most important role of agriculture sector. The whole economy of India is dependents upon agriculture. Therefore, if agriculture is called a back bone of India, it will not be exaggerated. Agriculture is the primary source of livelihood for about 58 per cent of India's population and India is the world's largest producer of wheat, pulses, rice, spices. Where India is growing steadily in the field of agriculture there is also an increasing demand for vegetation monitoring in agriculture sector. In such a way Vegetation indices plays an important role for vegetation monitoring.

A vegetation index is a vegetation indices or indicator that make apparent or make clear the greenness, the relative density and health of vegetation for each pixel or picture element or in a satellite image. Vegetation indices (VIs) are mathematical combination of ratios of mainly red, green and infrared spectral bands. Although, several vegetation indices are being used but the most widely used vegetation indices is Normalized Difference Vegetation Index (NDVI) which has been used for the last 20 years or more for monitor vegetation stress. The normalized difference vegetation index (NDVI) is a simple graphical indicator that is used to analyze remote sensing measurements. The main objective to calculate NDVI is to quantifying the healthy green vegetation (Green Cover, Grassland, vegetation) on the basis of satellite images. It takes advantage of the differential reflection of green vegetation in the visible and near-infrared (NIR) portions of the spectrum and provides information on the vegetation condition.

In this paper, our objectives are: (I) Quantification of Normalized Difference Vegetation Index (NDVI) on each Satellite pass during Kharif (June-October), Rabi (October-March), and Zaid season (April-May).

2. MATERIALS

2.1 Study Area

The study area is Lower Rajghat canal, near village Rajghat district Lalitpur located at latitude of $24^0$45'30'' to $25^0$6'36"N and longitude of $78^0$14'38" to $78^0$29'15" E and comes under the UTM zone 44N. The climate of the district is sub-tropical, which is characterized by a very hot dry summer and a cold winter. The lowest temperature recorded 9^0C in winter season and highest temperature recorder 4 ^{0}C in summer season.

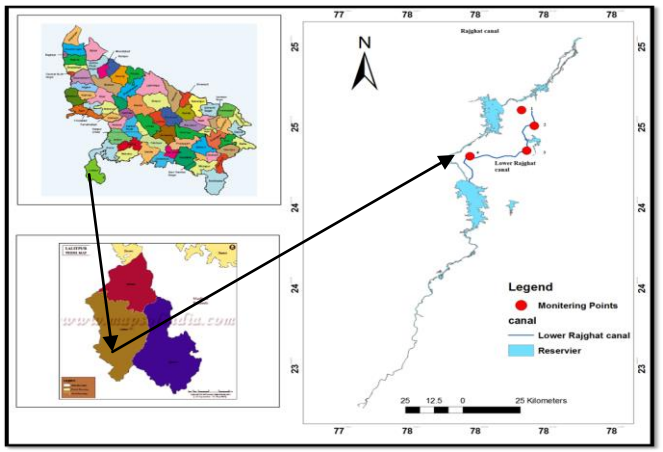


Fig -1: Location Map of the study area

2.2 Data Available

In this study LANDSAT-8 OLI (Operational Land Imager) with a 30m spatial resolution and ground surveyed data is used. The Path/Row of Landsat-8 OLI satellite was found 145/30. The Operational Land Imager (OLI) measures the near infrared, visible and short wave infrared portions of the spectrum. To achieve the objective of the present study the following satellite data for different dates are used the Satellite data used for the study was that of LANDSAT 8 OLI; the specifications are given in table No- 1

Table -1: Landsat 8 data at different days of pass.

Data type	Season	Date of acquisition
Landsat 8 (OLI)	Kharif	13-June- 2015 15-July -2015 1-Sep -2015 3-Oct-2015 19-Oct-2015
	Rabi	20-Nov-2015 6-Dec- 2015 22-Dec-2015 23-Jan-2016 24-Feb-2016
	Zaid	11-March-2016 12-April-2016 14-May-2016

3. METHODOLOGY

In this Section, the NDVI technique is used for extracting the various features presented in the 11-band Satellite image of study area. NDVI is calculated as

NDVI= NIR-RED/ NIR+RED…… (Equation. 1)

Where, RED is visible red reflectance, and NIR is near infrared reflectance. The wavelength range of NIR band is(750-1300 nm), Red band is (600-700 nm), and Green band is (550 nm). The NDVI is motivated by the observation vegetation, which is the difference between the NIR and red band. Very low value of NDVI (0.1 and <0.1) coincide to barren areas of rock, sand, or snow. Moderate values describe shrub and grassland (0.2 to 0.3), while high value indicates temperate and tropical rainforests (0.6 to 0.8). Bare soil is represented with NDVI values, which are closest to 0 and water bodies, are represented with negative NDVI values. The main objective to calculate NDVI is to quantifying the healthy green vegetation (Green Cover, Grass land, vegetation) on the basis of satellite images. The value of NDVI varies between -1 to 1. High values of NDVI show dense vegetation and low values show deep water of the area. We used Landsat 8 to calculate the NDVI for the study area i.e. the Lower Rajghat canal. 4 monitoring points were taken to detect vegetation condition whether there is greenness level is low, high or not.

3.1 Processing of Satellite Data

3.1.1 Software Used

The following GIS software packages are used for data Analysis.

•ARCGIS 10.5 used for data base creation and analysis.
•ERADAS IMAGINGE 9.2 used for image processing.

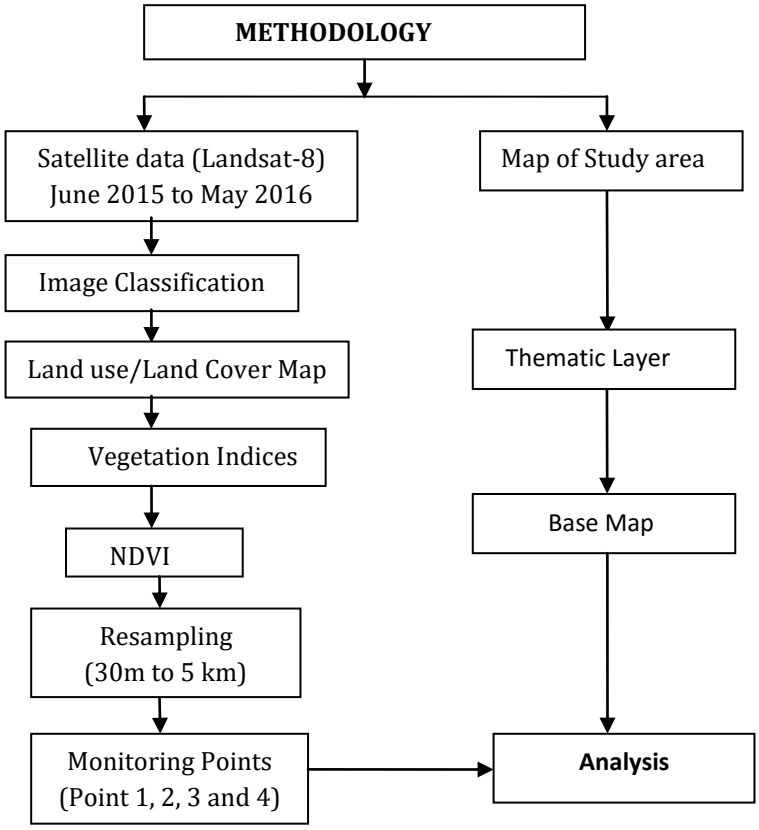


Fig -2: Flow Chart of Methodology

3.2 Remote Sensing Data

There are many sites that can be used to locate and download LANDSAT satellite imagery. The most complete collection of satellite data can be found in Land viewer site. For the present study LANDSAT 8 OLI (Operational Land Imager) sensor from June, 2015 to May, 2016 has been taken. The image is an OLI image having resolution of 30 meters except thermal and PAN band. Satellite image were brought to Universal Transverse Mercator (UTM) projection in Zone 44N.

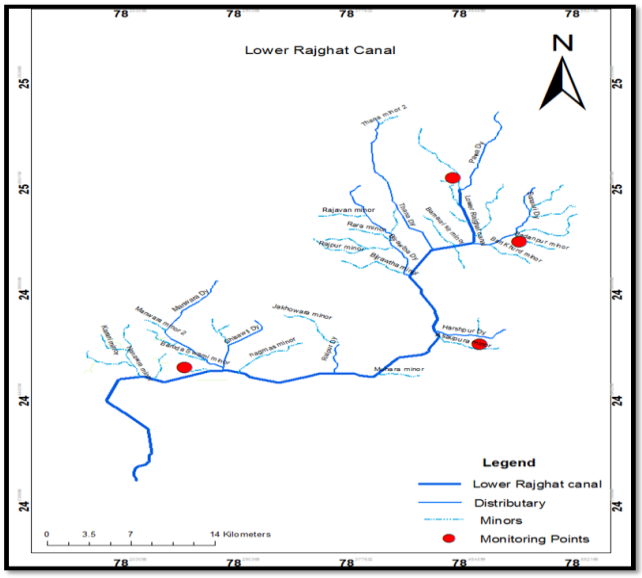


Fig -3: Sample site map of the study area

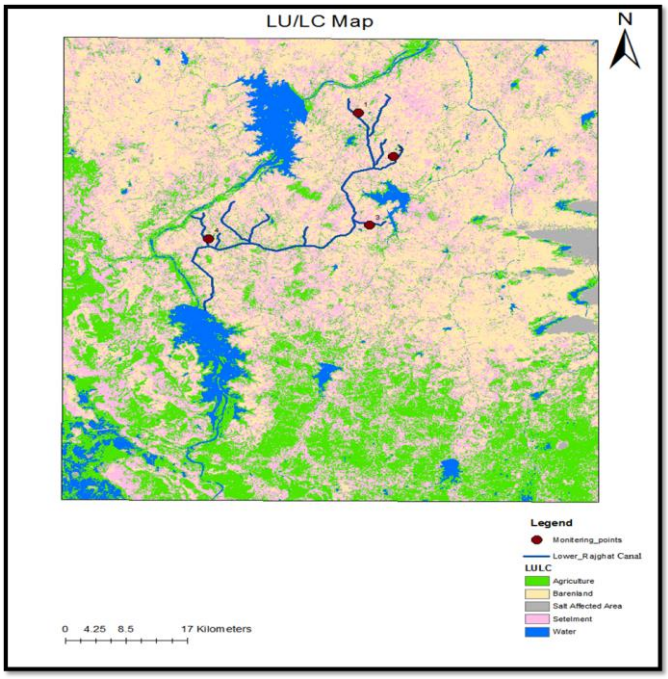


Fig -4: Land Use/ Land Cover map of the study area

The Land Use and Land Cover (LULC) map describe the vegetation, water, natural surface, and cultural features on the land surface. The length of Lower Rajghat Canal is 56.760 Km and Lower Rajghat Canal command area is covered by Water, Agriculture, Barren land, Salt affected area and Settlement.

3.3 Steps to Calculate NDVI

1.Open ArcMap and add the NIR and RED band by using the add button.

2.Now open Arc Toolbox select Spatial Analysis Tool.

3.In the Spatial Analysis tool select Map Algebra and inside this select raster calculator.

4.Now in raster calculator assign the formula of NDVI and select the location where you want to save the file and click ok.

5.NDVI will be generated.

3.4 Resampling

The process of deriving pixel value for new image from existing image is called resampling. Resampling is usually done for the digitizing the pixel values from the existing cell values. It exhibit two type of resolution based on their input and output i.e.

•Input Raster will be a fine resolution
•Output raster will be a coarse resolution

In the present study, to change the image resolution in 30x30 m pixel to 5000x5000 m pixel.

4. RESULTS AND DISCUSSION

4.1 Detection of Vegetation from Satellite Based Indices

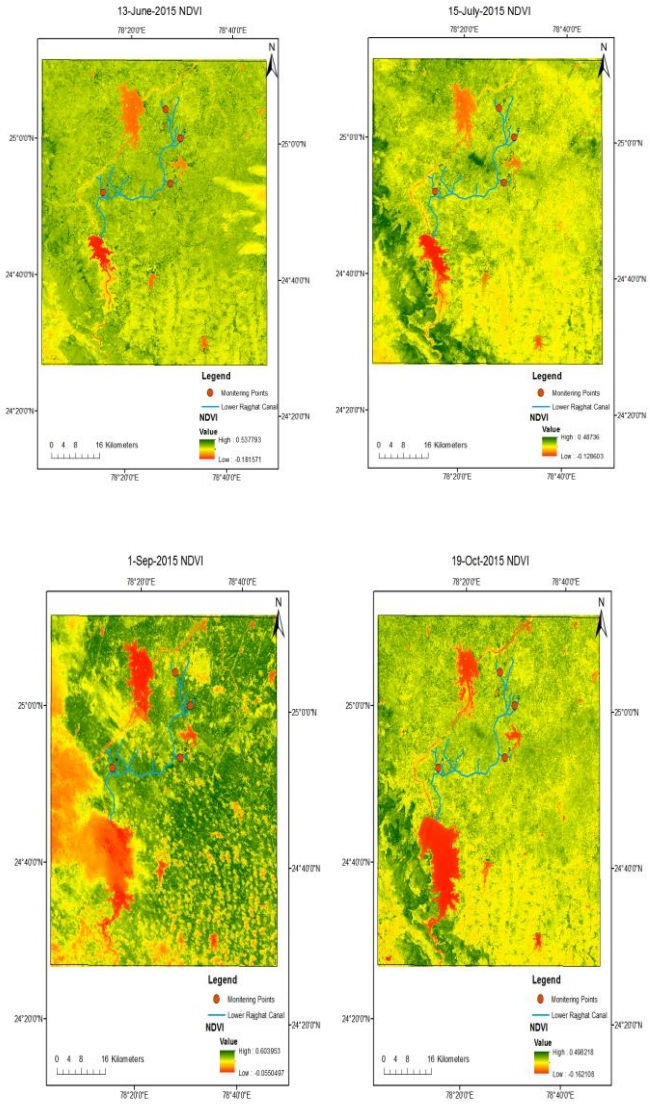
A vegetation index was used to measure biomass, amount of vegetative cover, and vegetation condition. Interaction of incident sunlight with green vegetation is strongly controlled by leaf pigments and leaf structure. Chlorophyll, the dominant leaf pigment, strongly absorbs light in the red and blue portions of the visible spectrum while reflecting green wavelengths, resulting in the green leaf color we see. Near-infrared light penetrates the leaf surface and encounters numerous cell walls and air-water boundaries, resulting in strong upward scattering (diffuse reflection) of this energy.

Table -2: Pixels values of NDVI 2015-16 for Lower Rajghat Canal Command area.

Monitoring Points	Elevation (m)	Latitude	Longitude	13-Jun-15	15-Jul-15	1-Sep-15	3-Oct-15	19-Oct-15	20-Nov-15	6-Dec-15	22-Dec-15	23-Jan-16	24-Fec-16	11-Mar-16	12-Apr-16	14-May-16
1	318	25.0788	78.44978	0.150	0.163	0.350	0.319	0.271	0.120	0.205	0.108	0.098	0.120	0.174	0.130	0.138
2	330	25.0093	78.4998	0.225	0.257	0.415	0.247	0.190	0.179	0.133	1.145	0.210	0.342	0.213	0.160	0.222
3	338	24.89828	78.4697	0.160	0.233	0.221	0.016	0.194	0.145	0.058	0.118	0.142	0.184	0.117	0.112	0.143
4	315	24.8726	78.2476	0.155	0.173	0.492	0.221	0.209	0.120	0.168	0.234	0.394	0.390	0.147	0.129	0.123
Average				**0.173**	**0.207**	**0.369**	**0.200**	**0.216**	**0.140**	**0.140**	**0.150**	**0.212**	**0.289**	**0.163**	**0.133**	**0.150**

Table -3: Max and Min NDVI values of Monitoring Points.

Monitoring Points	Lat	Long	Elevation	Max/ Min	NDVI Value
1	25.07885	78.44978	318 m	Max	0.349162
				Min	0.097876
2	25.00931	78.49982	330 m	Max	0.414318
				Min	0.132633
3	24.89828	78.46977	338 m	Max	0.232768
				Min	0.015571
4	24.87268	78.24765	351 m	Max	0.491117
				Min	0.119873



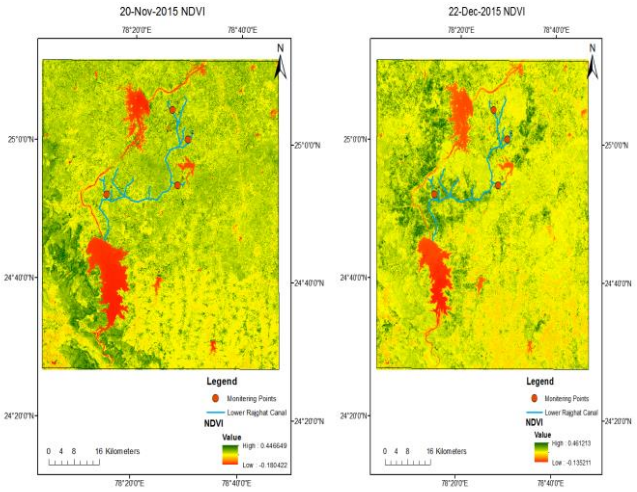
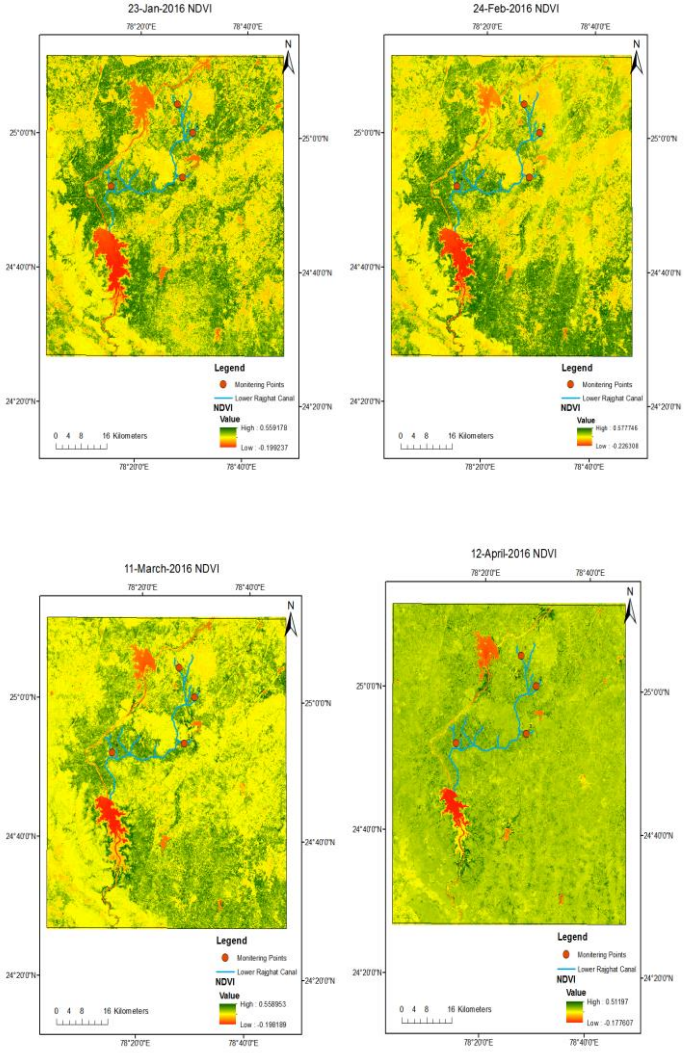
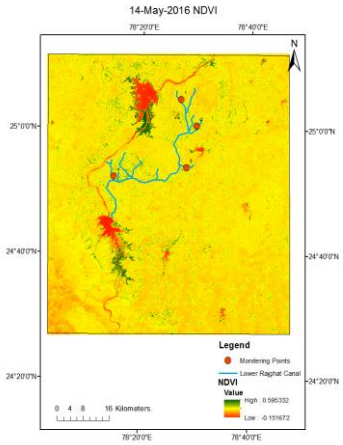
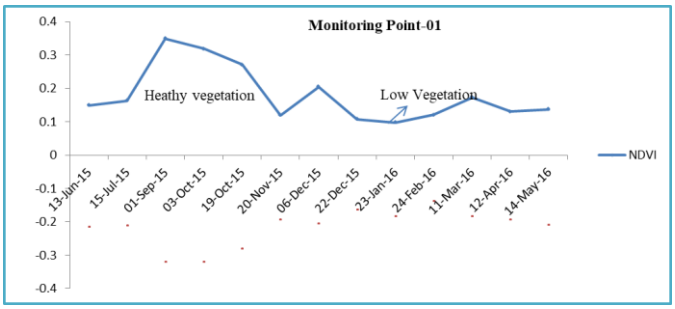
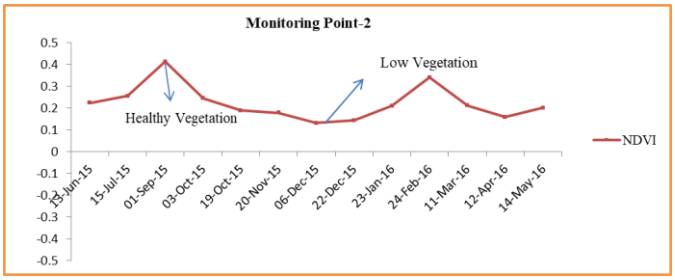


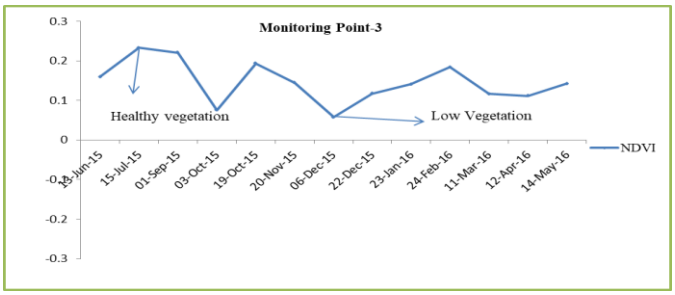
Fig -5: Low and High values of NDVI (June, 2015 to May, 2016) for different monitoring points in Lower Rajghat Canal Command Area.

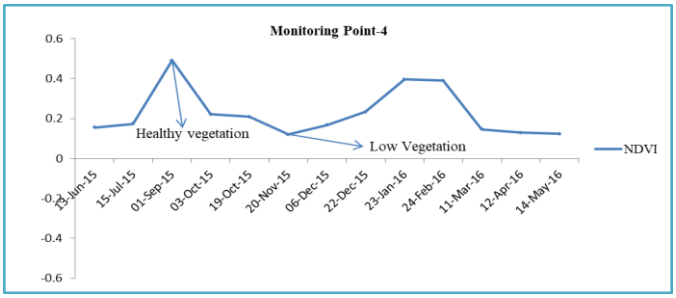












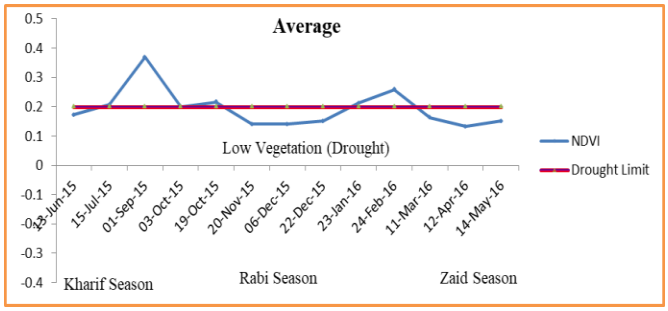


Fig -6: Graphical Representation of NDVI on an annual basis

5. CONCLUSIONS

The study was focused on detecting vegetation condition with the help of satellite base vegetation indices. The study was conducted at Lower Rajghat canal, district Lalitpur (Utter Pradesh) .Landsat-8 data from June 2015 to May 2016 Kharif, Rabi, and zaid season was used in this study.

From this study the following conclusion were made.

1. The drought limit found in NDVI was 0.2. Above 0.2 values indicate healthy vegetation and below 0.2 shows the drought condition (Poor Vegetation) of the area.
2. From the study, the result showed that the average vegetation cover was decreased in the month of December (Rabi season) and healthy vegetation was found in month of September (Kharif Season) in the Lower Rajghat Canal command area.

ACKNOWLEDGEMENT

I consider it a great privilege to have Prof. Dr. ir. D.M.DENIS, Prof & Head, Dept. of Irrigation and Drainage Engineering, VIAET, SHUATS As my advisor, I take this opportunity to express my sincere and profound gratitude to his for generous help, valuable suggestion and painstaking efforts, which served as pillar of support for the success of this study. I am quite unable to find appropriate words as to express my deepest sense of gratitude to my mother Mrs. Reena Devi, my father Mr. P.K. Singh and my lovely younger brother Aman Kumar whose constant encouragement, moral and emotional support rendered throughout my education for which I will remain indebted to them throughout my life.

REFERENCES

[1] Parthibanraja and Purushothaman, "Remote Sensing Based Agricultural Drought Assessment in Krishnagiri District," International Journal of Science and Research, Volume 7 Issue 2, February 2018 DOI: 10.21275/ART20179832.

[2] Nurhussen Ahmed, "Application of NDVI in Vegetation Monitoring Using GIS and Remote Sensing in Northern Ethiopian Highlands," Abyss. J. Sci. Technol. Vol. 1, No. 1, 2016, 12-17.

[3] Aghakouchak, Farahmand, Melton, Teixeira, Anderson, "Remote sensing of drought: Progress, challenges and opportunities",2015, Rev. Geophys,53, 452–480

[4] Bharathkumar, Mohmmed-Aslam, "Crop pattern mapping of Tumkur Taluk using NDVI technique: A remote sensing and GIS approach,"2015, Aquatic procedia 4.

[5] Gandhi, Parthiban, Thummalu, Christy "Ndvi:-Vegetation change detection using remote sensing and GIS- A case study of vellare district",2015, procedia computer science 57.

[6] Kalpana, Arumugam , "A significant review of different drought indices for predicting agricultural drough",2015, International Journals of advances in computer science and technology volume 4 No. 4.

[7] Karlson and Ostwald, "A literature review from 1975-2014 on Remote Sensing of vegetation in the sudano-sahelian,",2015, Journal of Arid Environment

[8] Lawley, Lewis, Clarke, ostendorf, "Site-based and remote sensing methods for monitoring indicators of vegetation condition: An Australian review",2015, Ecological indicators 60.

[9] Agwata, "A Review of Some Indices used for Drought Studies", 2014, Civil and Environmental Research Vol.6, No.2.

[10] Ahmadi H, Nusrath A, "Vegetation change Detection of Neka river in Iran by using remote sensing and GIS", Journal of geography and Geology, 2 (1)., pp. 58-67., 2012.

[11] Nageswara PPR, Shobha SV, Ramesh, KS, Somashekhar RK ,"Satellite -based assessment of Agricultural drought in Karnataka State", Journal of the Indian society of remote sensing , 33 (3), pp. 429-434., 2005.

BIOGRAPHIES

Ankit Kumar holds a degree M.Tech (Water Resource Engineering) in 2017 from SHUATS, Allahabad (U.P). He obtained his B.Tech (Agricultural Engineering) in 2015 from MGCGV, Chitrakoot (M.P). He is currently working as Junior Research Fellow at National Institute of Hydrology, Bhopal Since February, 2018.