EFFECT OF SEASONAL RAINFALL ON VEGETATION DYNAMICS IN KARBI ANGLONG DISTRICT OF ASSAM: A GEO SPATIAL STUDY

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ABSTRACT

Productivity of vegetation in Karbi Anglong district is mainly dependent on climatic parameters like rainfall and temperature of the region. The Normalized Difference Vegetation Index (NDVI) has been the most commonly used index in vegetation dynamics. The growth and distribution of natural vegetation were significantly affected by rainfall. This study focuses on the relationship between NDVI and rainfall in Karbi Anglong district. Another objective of this paper is to study about the vegetation dynamics of the study area using NDVI. The NDVI values were computed from LANDSAT 5 (TM) and LANDSAT 8 (OLI) satellites and rainfall data were collected from website of IMD. Correlation-coefficients between NDVI and rainfall have been calculated with the help of MS Excel. In the study area there exist strong positive relation between rainfall and NDVI. In Karbi Anglong district vegetation degradation are mainly caused by human induction.

Keywords: Rainfall, Vegetation and NDVI

INTRODUCTION

Vegetation is an important element of ecosystem. Vegetation cover is important to understand land- atmosphere interaction and their effects on climate and agricultural or shifting cultivation practiced on hilly areas. Vegetation change plays a crucial role in the environmental process. NDVI is one of the most important and commonly used satellite based vegetation index for monitoring land cover changes and its interaction with various climatic variables

ISSN (Print): 2204-0595
ISSN (Online): 2203-1731

like rainfall to interpret the impact on agriculture and crop production in a region. Rainfall is most important parameters for vegetation growth. Image processing tool like NDVI is the beneficial process used in land cover classification, vegetation identification, finding water bodies, identifying forest, barren land, agricultural fields etc. The image processing with NDVI is helps to detect variation in vegetation cover in the study area. The Normalized Difference Vegetation Index (NDVI) is one of the most widely used numerical indicator of using the visible and near- infrared bands (NIR) of electromagnetic spectrum and is to utilized to analyze remote sensing images and assesses the target contains green vegetation and crops production from shifting cultivation in a region. This paper analyses the utility of NDVI for mapping the land cover characteristics in Karbi Anglong District and its relation to the rainfall characteristics in the region. For land cover classification, various bands of the remote sensed data are treated and the spatial distribution such as water bodies, built up area, grassland and temperate or dense vegetation are easily examined by computing their NDVI index. However, Agriculture is the main source of livelihood of Karbi Anglong district. Therefore the economic development of the district highly depends on shifting cultivation. The topography of this district contains mostly hilly areas and some parts of plain and valleys and it has its own peculiarities in the system of cultivation. According to the variation of relief and altitude, the types of crop cultivation varies from place to place and the vegetation coves also changes with the different elevations of this hilly area. This paper deals with the variability of Normalized Difference Vegetation Index (NDVI) and its association with rain rate over Karbi Anglong District during the period of 1991-2017.

OBJECTIVES

Based on the background outlined above, the main objectives for the study are

(i) To study about the vegetation dynamics of the study area using NDVI (Normalized Difference Vegetation Index)

(ii) To analyze the relationship between seasonal rainfall and NDVI in Karbi Anglong district

STUDY AREA

Karbi Anglong district lies in between $25^0 30' 00''$ and $26^0 37' 00''$ North latitudes and $92^0 08' 00''$ and $93^0 50' 00''$ East longitudes. It is bounded on the North by the Morigaon,

ISSN (Print): 2204-0595
ISSN (Online): 2203-1731

Nagaon and Golaghat districts of Assam on the east by the Golaghat district of Assam, on the south by the state of Nagaland and Dima Hasao district of Assam and on the south-west by the state of Meghalaya. Karbi Anglong district is genetically belongs to Meghalaya plateau.

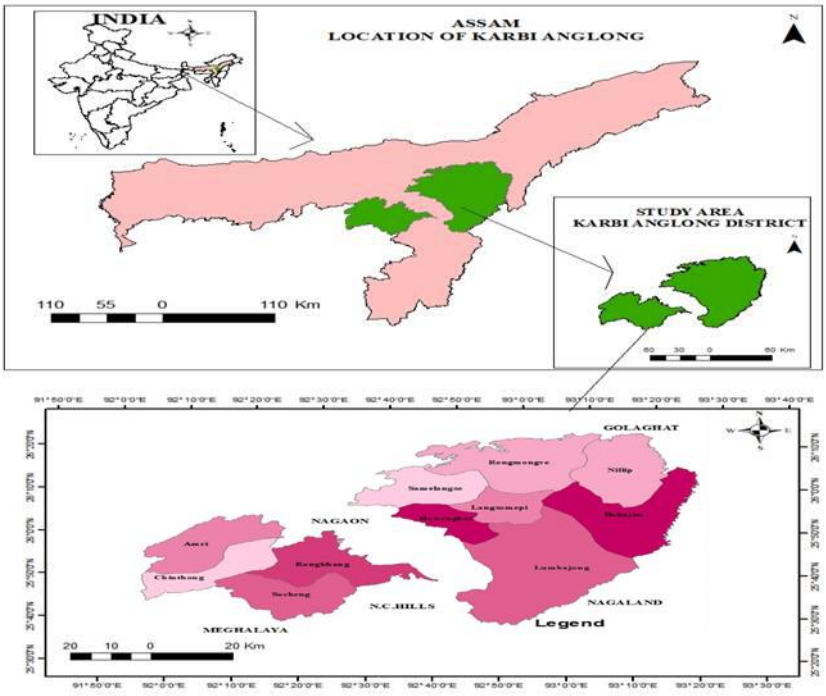

Figure 1: Location of Karbi Anglong district

METHODOLOGY

Satellite data used in the present study was LANDSAT images. LANDSAT 5 (TM) and LANDSAT 8 (OLI) images for the year 1991, 2001 and 2017 were downloaded from website and subjected to GIS environment. The formula NDVI= (NIR-RED)/ (NIR+RED) when applied in ArcGIS software can transmit the image to normalized difference vegetation indexes with values ranging between -1 to +1.

The data on rainfall were obtained from the IND website. Precipitation from November of the last year to October of the ensuring year is consider as annual effective precipitation and precipitation from April to October as growing season precipitation. Mean annual effective precipitation and mean growing season precipitation was calculated from monthly rainfall of Karbi Anglong district.

Correlation-coefficient between maximum NDVI and mean annual effective

ISSN (Print): 2204-0595
ISSN (Online): 2203-1731

precipitation and between maximum NDVI and mean growing season precipitation were calculated to know relation between rainfall and vegetation health of the region.

RESULT AND DISCUSSION

Vegetation dynamics of the study area using NDVI

Normalized Vegetation indices are generally calculated by rationing, differencing, summing, linearly combining, etc. data from two or more spectral bands. They are dimensionless and radiometric measures that are intended to minimize the solar irradiance and soil background while enhancing the signal from vegetation. The use of vegetation index can normalize the effects of differential illumination of features in an area and can also help in extracting specific vegetation classes in an area. NDVI is highly correlated to the photosynthetic activity and indicates the greenness of the vegetation and NDVI can significantly separate various spectral classes of LULC. The NDVI image enhances the vegetation class in the images and helped in distinguishing it from other non-vegetation classes.

ISSN (Print): 2204-0595
ISSN (Online): 2203-1731

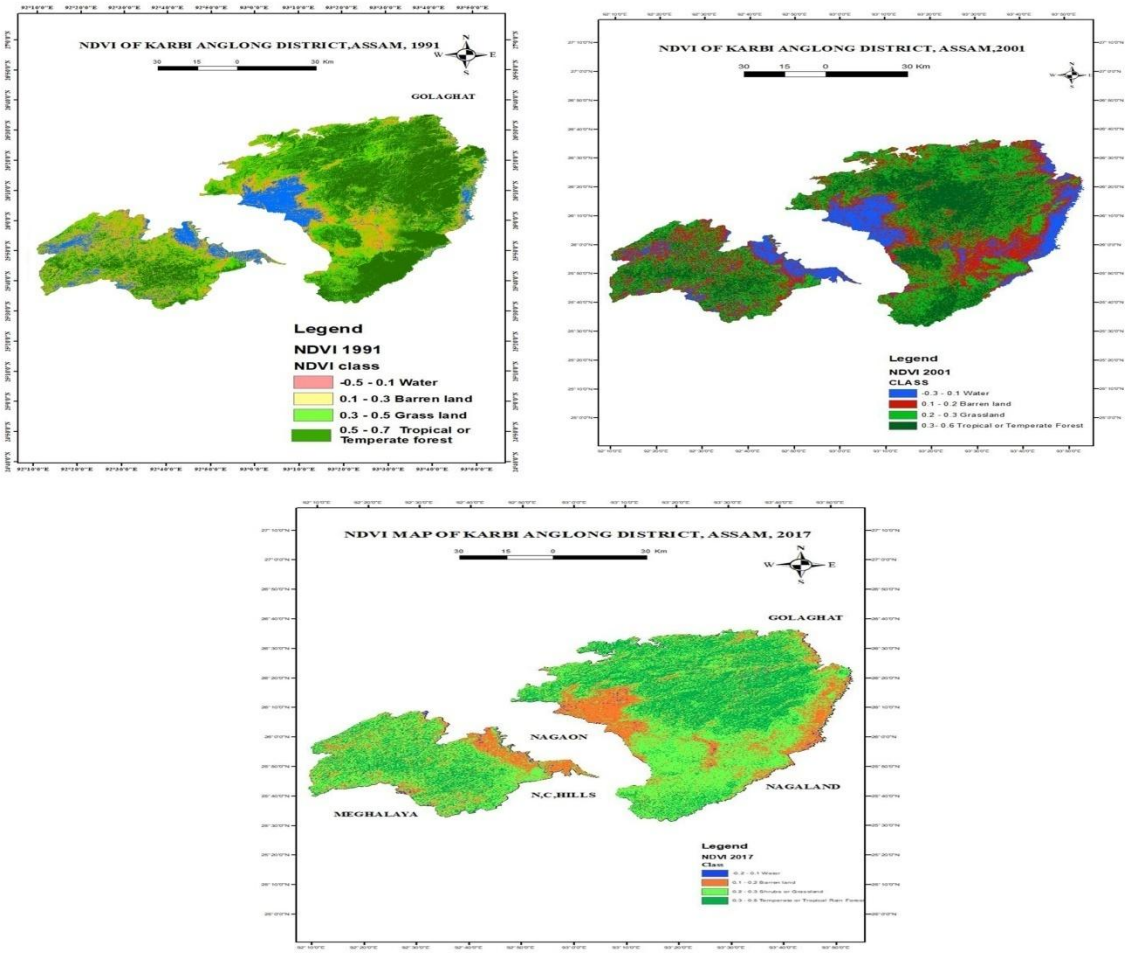

Figure 2: NDVI of Karbi Anglong District, Assam

Table 1: NDVI variation of Karbi Anglong District (1991-2017)

NDVI Class	1991	2001	2017
Water	-0.5-0.1	-0.3-0.1	-0.2-0.1
Barren land	0.1-0.3	0.1-0.2	0.1-0.2
Grass land	0.3-0.5	0.2-0.3	0.2-0.3
Tropical or temperate forest	0.5-0.7	0.3-0.6	0.3-0.5

In 1991 minimum NDVI value was -0.1 and maximum NDVI value was 0.7. According to 2001 maximum value for NDVI was 0.6 and minimum NDVI value was -0.1. In 2017 maximum NDVI value was -0.5 and minimum NDVI value was -0.1.Negative values of NDVI represents overall non-vegetated areas, thus its variation is of less concern for the present study. However,

ISSN (Print): 2204-0595
ISSN (Online): 2203-1731

variations in positive values demonstrate the difference in vegetation health of the region for each year and thus are very important. Maximum and minimum values of NDVI are derived from the NDVI maps generated for respective years.

Relationship between seasonal rainfall and NDVI in Karbi Anglong district

In order to determine relationship between average annual effective rainfall and maximum NDVI, correlation-coefficient among them was calculated. From the calculated value we found that there is positive correlation between the two parameters.

Year	Max.NDVI	Average effective Rainfall (mm)	Year	Max.NDVI	Average growing season rainfall
1991	0.7	287.235	1991	0.7	498.12
2001	0.6	247.972	2001	0.6	412.532
2017	0.5	139.248	2017	0.5	213.514
Correlation-coefficient=0.75			**Correlation-coefficient=0.79**		

Table: Maximum NDVI, average effective rainfall and average growing season rainfall

Vegetation health of the region is greatly influenced by the rainfall pattern, i.e. when precipitation is high, NDVI values are also high and when there is a decrease in average precipitation, NDVI value also diminishes. The land use and land cover mapping of the region is also found to support of the above result which showed a decreasing trend of vegetation cover in the area over the years.

CONCLUSION

NDVI demonstrates strong correlation with rainfall (growing season rainfall slightly higher than effective rainfall) in regard to Karbi Anglong district. Temporal response of vegetation to precipitation is found to have a linear relationship i.e. when there was an increase in precipitation, simultaneously the vegetation indices also showed elevated values and vice-versa. This study helps us to better understand how vegetation growth is temporally affected by rainfall in the study area. Hence, for this agriculture dependent region, government

ISSN (Print): 2204-0595
ISSN (Online): 2203-1731

authorities must take some effective measures towards improving irrigation facilities as well as to improve the vegetation health of the study area.

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ISSN (Print): 2204-0595
ISSN (Online): 2203-1731