Quest Journals
Journal of Research in Environmental and Earth Sciences
Volume 8 ~ Issue 10 (2022) pp: 01-05
ISSN(Online) :2348-2532
www.questjournals.org

Research Paper

Assessment of Vegetation Cover in Karimganj District, Assam Using Earth Observation Data

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ABSTRACT
Remote sensing is an important tool for analyzing land cover transitions, particularly in vegetated areas. The Normalized Difference Vegetation Index (NDVI) aids in the assessment of a vegetated area in the spatiotemporal dimension. Present study is mainly focusing on to assessing vegetation coverage in Karimganj district in specified period of time i.e. 1988-2021. The NDVI calculation reveals that the vegetated area has decreased by -118.19 km^2 between 1988 and 2021. Non-vegetation area, on the other hand, grows. The leading cause of decreasing vegetation area is increased population growth, tree removal, use of forest resources, and so on. As a result, this study will be beneficial to policymakers and land planners in determining a solution to the burning issue in the study area.
***KEYWORDS**: Remote Sensing, Normalized Difference Vegetation Index, Spatiotemporal, Non vegetation area*

***R**eceived 19 Sep, 2022; **R**evised 01 Oct., 2022; **A**ccepted 03 Oct., 2022 © The author(s) 2022.*
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I. INTRODUCTION

Vegetation is a vital natural component. It preserves environmental and ecological balance by preventing climate change and maintaining ecosystem balance among humans, plants, animals, and other abiotic components [1] [2]. External factors, particularly man-made development activities, have a general influence on the forest and vegetation of a specific ecosystem. Remote sensing is an important tool for analyzing changes in land coverage over time and space [3] [4] [5]. The normalised difference vegetation index (NDVI) was created to estimate vegetation cover from satellite data's reflective bands [6]. It is used to develop estimating vegetation cover from satellite data reflective bands. The NDVI is determined using the Near Infrared (NIR) and Red bands. A higher NDVI value indicates more NIR band reflection and less red band absorption.

The vegetation in India is diverse. The country's forests and grasslands have evolved in response to the various climatic types. The country's total forest and tree cover is 775288 km^2 (ISFR, 2021). Assam is a land with a variety of vegetation types and plant species. The state is mostly made up of evergreen and deciduous plants, as well as various orchid species. The forest cover of the state is 28312 km2, or 36.09 percent of its total land area, 3.89% is covered by very dense forest, 12.74% comes under moderately dense forest and other forest is 19.05%.

Assam's Karimganj District is located in the state's south. This area has a lot of vegetation. The district has an 856 km^2 forest cover, of which 3 km2 is very dense forest, 299 km2 is moderately dense forest, and 553 km^2 is open forest [7].

The primary goal of this paper is to assess vegetation cover in Karimganj District from a spatiotemporal viewpoint. To achieve the study's objectives, three satellite images were used to create NDVI maps.

Study Area

Karimganj is an important district in Assam's Barak valley. It is located in the southernmost part of Assam and borders the Bangladesh divisions of Tripura and Sylhet. Karimganj town is located on the district's northern border. The district covers an area of approximately 1811 square kilometres. The district is bounded on the north and east by Cachar, on the east and south by Hailakandi, on the south by Mizoram, on the southwest by Tripura, and on the west and northwest by Bangladesh. According to the 2011 census, the district has a population of 12,28,686 people and a population density of 673 people per square km. The district is divided into one sub-district, five tahsils, and three towns.

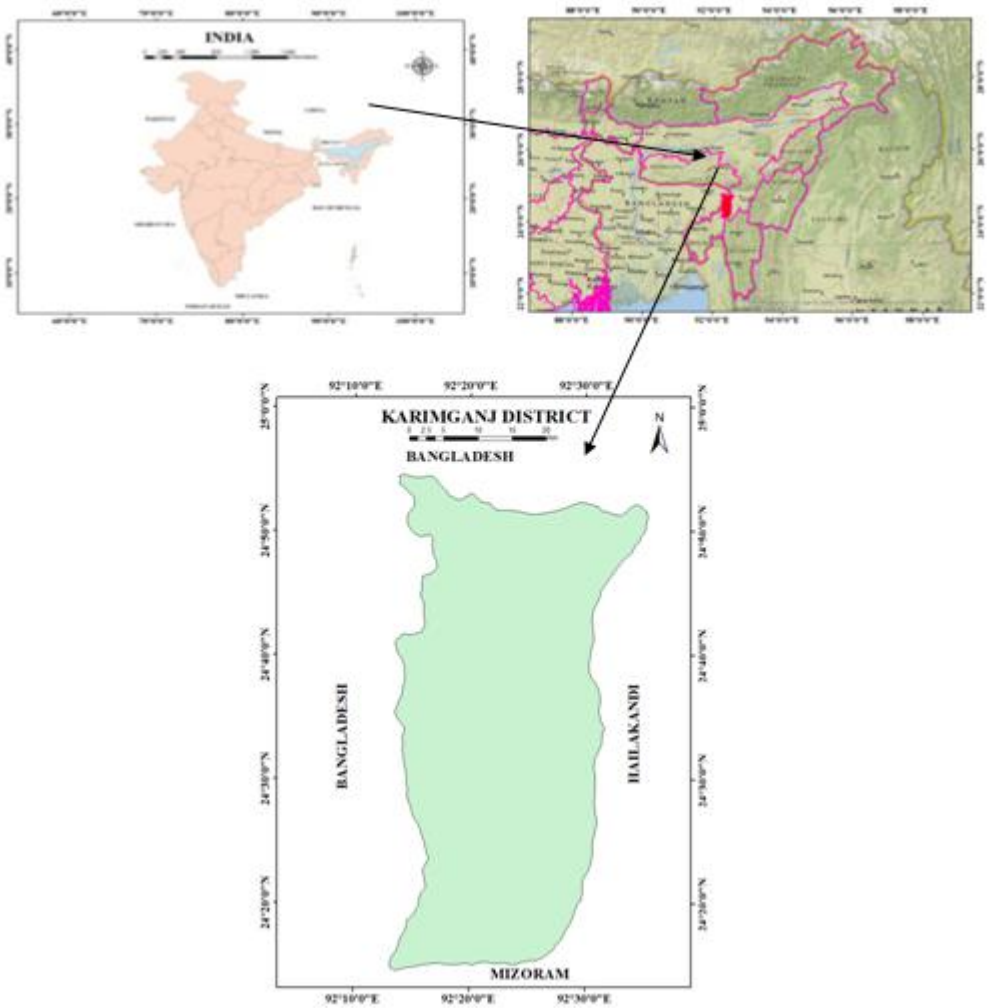

Figure 1: Study area map

II. Database and Methodology

The research relies on secondary data. Three cloud-free Landsat images were obtained for the study from the United States Geological Survey (USGS) EarthExplorer web service. Images were taken during the same season in order to assess the vegetation cover in the study area. Table 1 contains information about the images.

Table 1: Satellite data characteristics

Satellite	Sensor	Year of Acquisition	Path/ Row	Spatial Resolution(mts)
Landsat 5	Thematic Mapper(TM)	1988-01-16	136/43	30
Landsat 5	Thematic Mapper (TM)	2004-02-10	136/43	30
Landsat 8	Operational land Imager(OLI) and Thermal Infrared Sensor(TIRS)	2021-01-05	136/43	30

Source: USGS EarthExplorer

Normalized Difference Vegetation Index

The NDVI can assess the amount of vegetation. If the NDVI value is higher than others, it implies that the vegetation coverage is better. The closer the NDVI value is to 1 the more related it is to vegetation cover. The NDVI value range of -1 to 1 has a different presentation of its land use. NDVI can be expressed as

$$NDVI = \frac{NIR - RED}{NIR + RED}$$

For Landsat 5,

$$\frac{band4\ (NIR) - band3(\ RED)}{band4\ (NIR\ ) + band3\ (RED)}$$

For Landsat 8,

$$\frac{band\ 5\ (NIR) - band\ 4(\ RED)}{band\ 5\ (NIR\ ) + band\ 4\ (RED)}$$

III. Results and Discussion

The Normalized Difference Vegetation Index (NDVI) is a popular tool for estimate green vegetation production and detects vegetation changes. In this context, three vegetation maps with varying vegetation cover have been formed for 1988, 2004, and 2021.

A critical analysis of the maps reveals a significant difference in vegetation cover between 1988, 2004 and 2021. NDVI value for Non vegetation cover for 1988 is -0.617--0.282, -0.659--0.336 for 2004 and -0.659-0.336 for 2021. For vegetation cover NDVI value in 1988 is -0.282-0.277, -0.336-0.333 for 2004 and -0.336-0.333 for 2021.

Table 2: Area under different NDVI classes for 1988, 2004 and 2021

	1988		2004		2021	
NDVI classes	Area in sq. km	Area in per cent	Area in sq. km	Area in per cent	Area in sq. km	Area in per cent
Non Vegetation Cover	1126.10	62.18	1102.73	60.89	1244.41	68.71
Vegetation Cover	685.02	37.82	708.39	39.11	566.71	31.29
	1811.12		1811.12		1811.12	

Source: calculated by author

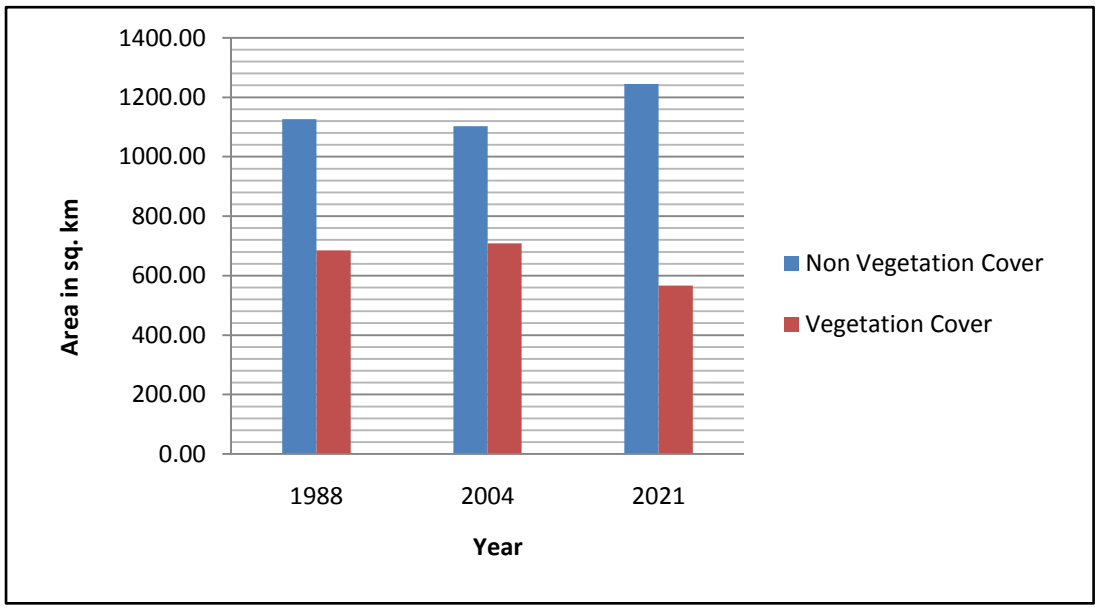

Figure 2: Area in different NDVI classes

Table 3: Changes in different NDVI classes

NDVI classes	Change in sq. km (1988-2004)	Change in per cent(1988-2004)	Change in sq. km (2004-2021)	Change in per cent(204-2021)	Change in sq. km (1988-2021)	Change in per cent(1988-2021)
Non Vegetation Cover	-23.37	-1.29	141.68	7.82	118.31	6.53
Vegetation Cover	23.37	1.29	-141.68	-7.82	-118.31	-6.53

Source: calculated by author

Table 4 depicts the area allocated to each category. In 1988, the area under Non Vegetation cover was 1126.10 km^2, or 62.18% of total area; in 2004, the area was 1102.73 km^2 or 60.89% of total area; and in 2021, the area was 1244.41 km^2, or 68.71% of total area. The area covered by Vegetation Cover in 1988, 2004, and 2021 was 685.02 km^2 (37.82%), 708.39 km^2 (39.11%), and 566.71 km^2 (31.29%), respectively.

The changing area is calculated from the table 3. Non vegetation cover has been changing from1988-2021 by 118.31 km^2 or 6.53% and for area under Vegetation cover has been decreasing by -118.31 or -6.53% during 1988-2021.

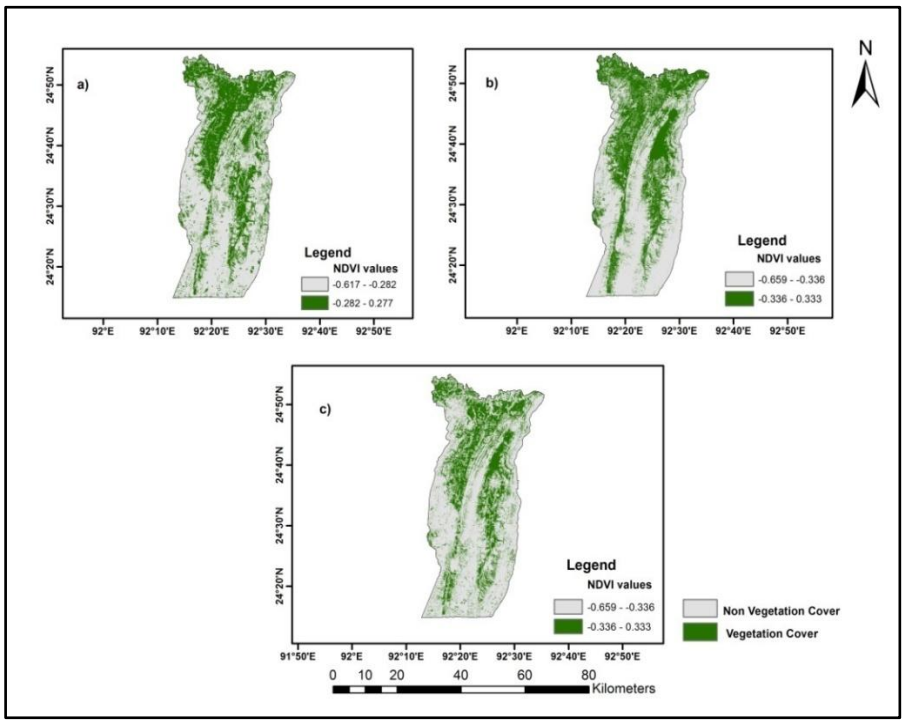

Figure 3: NDVI map for a) 1988, b) 2004 and c) 2021

Given the preceding discussion, it is clear that rapid population growth and increasing demand for various activities have a generative effect on the vegetation cover in the study area. The changing landscape of the study area is also due to the rapid growth of urbanization. Furthermore, the vegetation in the study area has been challenged by a rise in the number of industries in the area. Recurrent human intervention for fuel-wood, fodder, litter, and minor forest products collection, as well as grazing, browsing, and trampling, can significantly degrade species habitats.

The NDVI analysis shows the transition from vegetation to non-vegetation. As a result, it is critical to protect these forests from various anthropogenic disturbances in order to ensure proper management and conservation. Knowing the consequences of changing land cover allows public managers to make more agile decisions to mitigate the effects of urban heat and the formation of heat islands through vegetation insertion in densely populated areas. Paying attention to the construction of green space and green roads, reducing urban land use, rationally distributing land resources, as well as reinforcing environmental management and protection is all important ways to improve the vegetation's ecological environment.

IV. CONCLUSION

Based on the findings, it is ascertained that the study area is being impacted by reduced vegetation area as a result of man-made activities. Vegetated area is transferred to non-vegetated area within the definite period i.e. 1988-2021. So, the current study emphasized the importance of focusing on curtailing land clearing and slowing the rate of land cover change, as well as suggest new resource conservation and restoration. It also helps policymakers to design future vegetation area management directions, environments adjustment, and rehabilitation techniques.

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