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Environmental Monitoring Of Green Cover by Using Geospatial Technology- A Case Study from Dimoria Development Block of Assam, India

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Abstract: *Small forest fragments are common in the landscape of Assam. These have conservation value as they provide habitat for wildlife and maintain connectivity between large habitats. Moreover these areas are support system for various floral biodiversity. But the rules of protected forest do not apply in these tree clad areas as the people living in and around these historically maintained their livelihoods depending on various forest products, through timber and non-timber forest products. In present study an attempt has been made to exploit the importance of forests outside reserved forest and detect the green cover change of Dimoria Developmetal Block of Kamrup (M) District of Assam using RS and GIS techniques. Unsupervised and Supervised classification method of image classification was adopted for generating green cover change. The results show that there is a considerable decline in green cover from 1999-2013 and the decline value is about 11 percent. This enhances in increasing non-forest land in the entire unreserved forests in the study area. Moreover rapid urbanization and lack of proper implementation of laws has greatly reduced forest cover of the block.*

Keywords: *Green cover changes, Remote sensing, GIS, unreserved forests.*

I. Introduction

Forest is a biological unit having a vast social organization of living communities at work. These forest communities have a vital role in maintaining balanced eco-system of the world. North-east India has been endowed with an immense variety of forest resources. However, with continuing pressures of an exploding population and the subsequent growing needs of industries, food, fuel wood, fodder, small timber etc., depletion and degradation of forests and subsequent adverse changes in ecosystem are taking place. At an extent the depletion of forest cover is indirectly linked with the socio-economic conditions of the community surrounding the forest cover and awareness of the stakeholders of that particular area. The forest cover in the state of Assam, based on interpretation of satellite data of Nov.2008 and Jan. 2009 is 27,673 km^2 which is 35.28% of the state's geographical area. In terms of forest canopy density classes, the state has 1,444 km^2 supporting very dense forest, 11,404 km^2 moderately dense forest and 14,825 km^2 open forest.

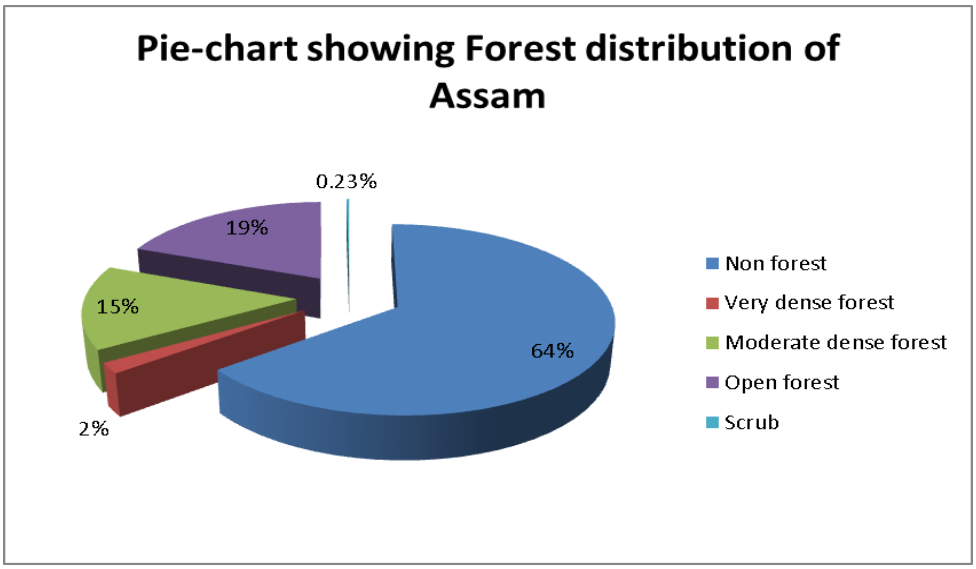

Fig-1: Pie -chart showing forest distribution of Assam

GIS is designed for the collection, storage, and analysis of objects, and phenomena where geographic location is an important characteristic or critical to the analysis. The ability to use GIS technology as a tool to monitor habitat change, track wildlife demographics, and predict future land and resource use is essential to conservation goals and practices. The spatial and thematic aspects of GIS technology enable users to overlay various data to delineate and predict the future of our resources, land, ocean, plant life, and wildlife. This geo-processing enables decision makers to implement laws and programs that will protect and sustain the environment and its resources. Sustaining biodiversity and preventing fragmentation, extinction, and natural resource depletion are crucial to conservation of the environment. In this regard GIS technology can help us organize the data about problems and understand their spatial relationship associations and provides a powerful means for analyzing and synthesizing information about them" (Aronoff, 1989). Land use and vegetation assessment is one of the most important parameters, which can be done very efficiently using remote sensing (Tiwari et al., 1996). Remote sensing system can provide information about the location, availability and changing conditions of natural resources, in specific areas, information that is essential for establishing appropriate priorities and effective planning for land management (Adrien and Baumgarduer, 1977). The areas of Asia are under heavy threat of land cover clearing in contrast to the European and American counterparts (Nagendra, 2008). Human forest interaction in India is particularly intense and large population increase, forest dwelling communities and livestock grazing from communities living adjoining forest areas has resulted in significant forest cover loss and degradation (Pontius et al. 2008). The use of remote sensing studies in sustainable management of forest is important (Dadhwal et al., 2008). The rapid deployment of remote sensing (RS) satellites and development of RS analysis techniques in the past three decades have provided a reliable, effective, and practical way to characterize terrestrial ecosystem properties. Moreover recent development in remote sensing and GIS has made monitoring and management effective and easy.

1.2 Study area

The Dimoria Developmental Block is situated in South-Eastern part of the Kamrup Metro District of Assam and on the south bank of river Brahmaputra. It is bounded by Meghalaya on the south, by Morigaon District on North-East and by greater Guwahati City on the west upto Jorabat Amrigog. Dimoria Developmental Block lies between 26° N and 26°14′ N latitudes and 91°51′ E and 92°10'E longitude.

The climate of this region is extensively and heavily influenced by the monsoon climate. The area falls under sub tropical monsoon climate. The average annual temperature is 27^0c and the average annual rainfall is about 200cm. So, rainfall is abundant and widespread. Forest type of Dimoria developmental block are semi evergreen and mixed deciduous with the presence of occasional sub-tropical broad-leafed forest. The vegetation types of the block bear a similarity to the vegetation grown in foothills of Meghalaya. The block is under well growth of vegetation. These forests are predominantly occupied by deciduous forest. The important trees grown in these areas are Dipterocarpus macrocarpus, Shorea robusta, Cassia fistula, Gmelina arborea, Poma, Acacia catechu, Areca catechu, Tectona grandis, Dalbergia sisso, etc.

1.3 Objectives of the study

The main aim of the research work is to study the value of the forest area outside reserved forest as well the gradual change in the forest cover. The objectives are based on the following: -

• Delineation of land use land cover of the study area by GIS.
• Green cover change of the study area by GIS.

II. Methodology

The methodology for the assessment of green cover using digital image processing has been followed. Using ArcGis 10.2 software, the data was loaded onto the computer and selected band combination were stacked. Then the image was transferred to Erdas Imagine 2013 software where radiometric correction was applied for removing radiometric defects and improving the visual impact of satellite data. Geometric rectification of the data was carried out with the help of scanned Survey of India (SOI) toposheets for assigning geographical coordinates to keep pixel of the image. The image was then loaded in ArcGis 10.2 and supervised classification of the imagery was done. Supervised image classification is a method in which the analyst defines small areas, called training sites, on the image which are representative of each desired land cover category. The delineation of training areas representatives of a cover type is most effective when an image analyst has knowledge of the geography of a region and experience with the spectral properties of the cover classes. The image analyst then trains the software to recognize spectral values or signatures associated with the training sites. After the signatures for each land cover category have been defined, the software then uses these signatures to classify the remaining. Percentage of change was calculated and compared changes for both images.

Formula for calculating percentage in ArcGis:
([Count] / Sum of count)*100

III. Results And Discussion

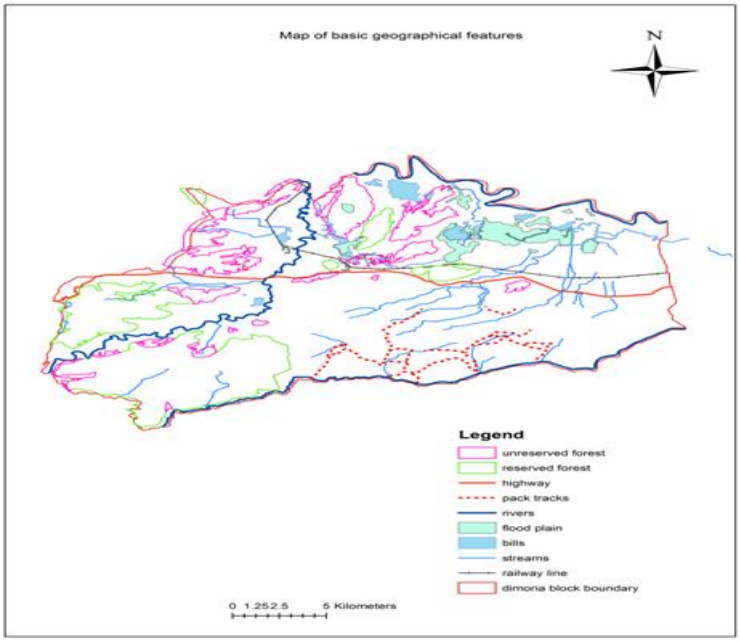

Fig-2: General geographic features of Dimoria Block

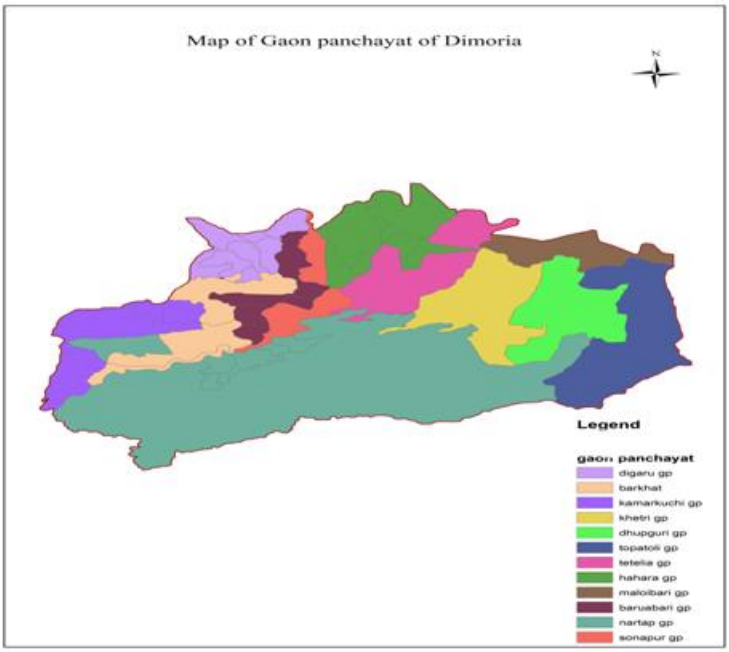

Fig- 3: Map of Gaon panchayat of Dimoria Block

SL. No.	FEATURES	AREA/ LENGTH
1	Highway	33 km
2	Railway	36.3 km
3	Lake	8.7 sq.km
4	River	
	Kolong	27 km
	Digaru	36 km
5	Flood plain	12.7 km.sq
6.	Reserved forest	78 sq.km
7	Unreserved forest	156.3 km.sq

Table- 1: General geographic features of Dimoria Block

Green cover Change Of Dimoria Developmental Block

Three major classes of land use and land cover categories were delineated using Landsat data for change detection viz., Vegetation, plain & settlement and water. The area under various class and their corresponding values for the year 1999 and 2013 for Dimoria developmental block are shown in Table 2.

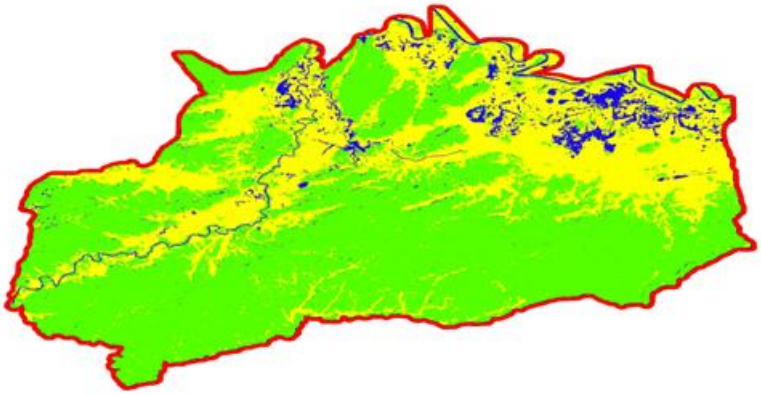

Fig- 4: Vegetation, plain and water cover in 1999

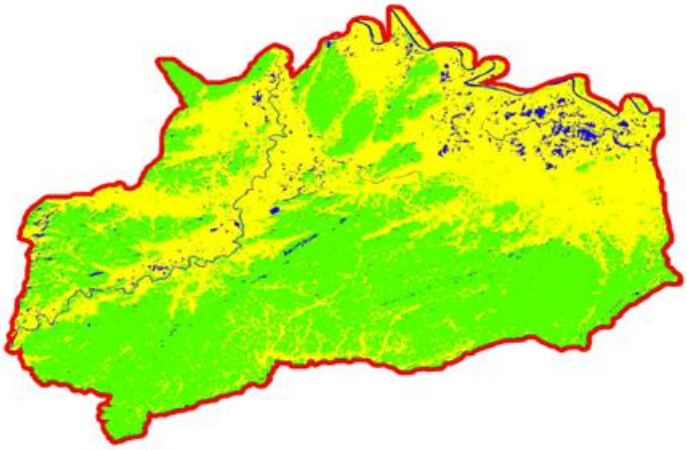

Fig- 5: Vegetation, plain and water cover in 2013

YEAR	SUM OF COUNT(PIXEL)	VEGETATION COUNT	PLAIN AND SETTLEMENT COUNT	WATER COUNT
1999	503295	310307	169141	23847
2013	503295	259730	227745	15820

Table- 2: Pixel count of features

YEAR	VEGETATION COUNT	PLAIN AND SETTLEMENT	WATER
1999	61%	34%	5%
2013	51%	45%	4%

Table-3: percentage availability of vegetation cover

Vegetation change = -10%
Plain and settlement change = +11%
Water cover change = -1%

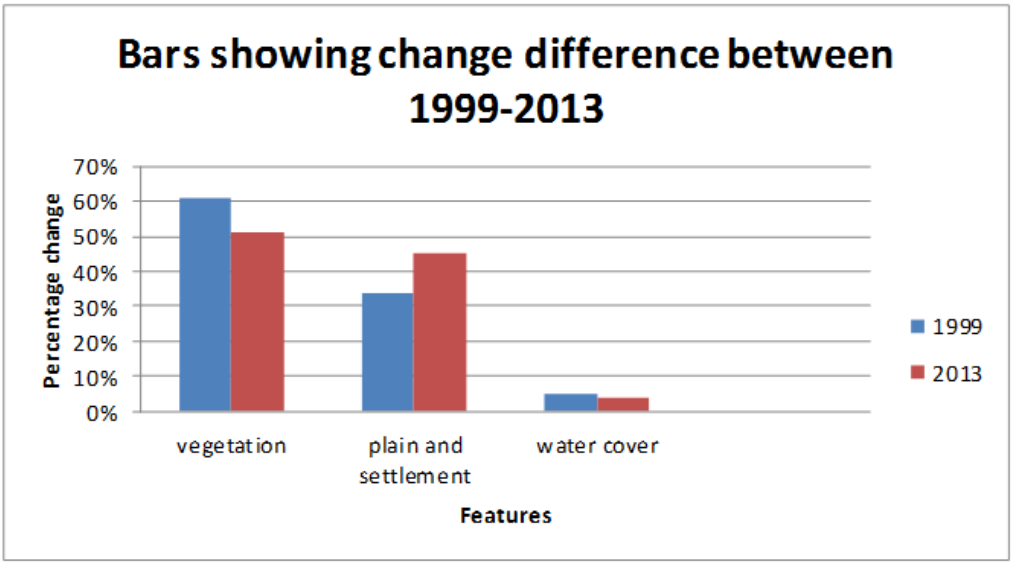

Fig-6: Bars showing change difference between 1999-2013.

In the similar way there have been considerable changes in green cover within the boundary of reserved forest and outside reserved forest which are shown in the following table.

YEAR	VEGETATION(% approx)	PLAIN AND SETTLEMENT (% approx)	WATER (% approx)
1999	97.33%	2.32%	0.35%
2013	90.08%	9.2%	.90%

Table- 4: Percentage change of features in reserved forest

Vegetation change = -7.25%
Plain and settlement change = +7%
Water cover change = +0.55%

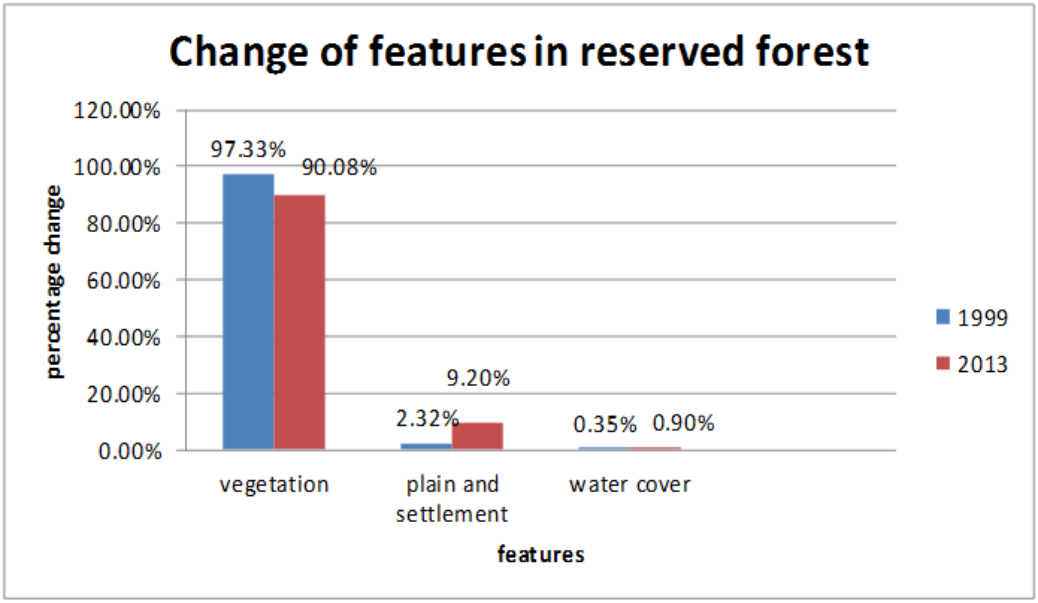

Fig-7: Bar diagram showing Change of features in reserved forest

YEAR	VEGETATION(% approx)	PLAIN AND SETTLEMENT(% approx)	WATER(% approx)
1999	61.65%	33.6%	4.73%
2013	51.6%	45.2%	3.2%

Table- 5:- Percent change of features outside reserved forest.

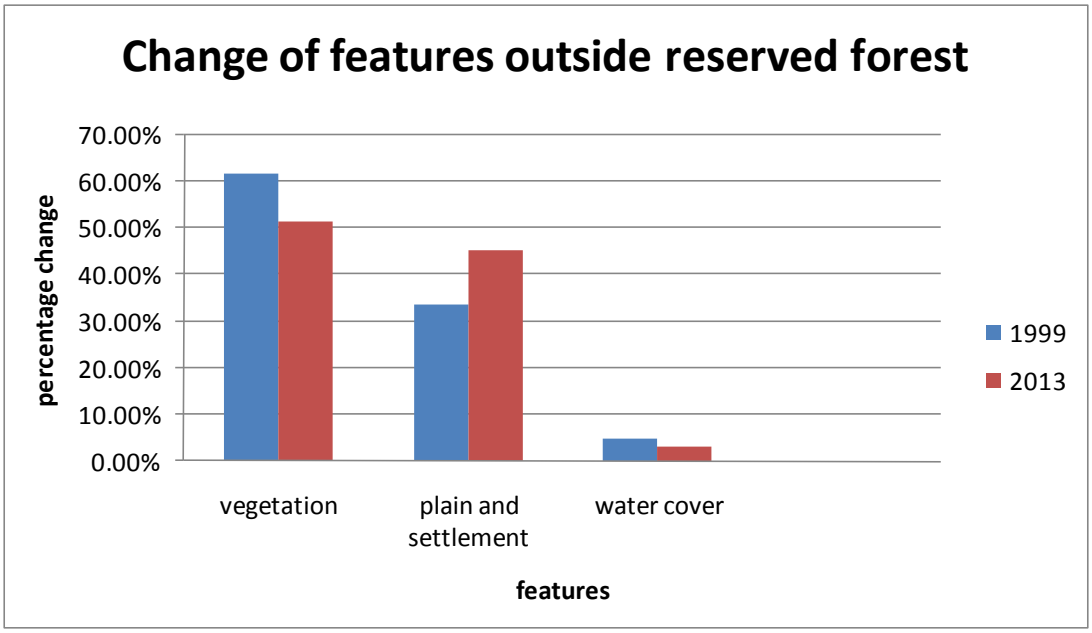

Fig-8-: Comparison of change of features outside reserved forest

IV. Conclusion

Geospatial study of green cover change revels that there is an alarming change in the green cover of Dimoria Developmental Block. According to it there is a 10% (approx.) decrease in green cover from 1999 to 2013. Parallely there is an 11% increase in plain and settlement area. In the reserve forest the change in green cover is comparatively less in comparison to other unreserved forest of the Block. From the ground verification of some places it was found that the change in forest covers is mainly due to rapid encroachment and clearing of forest for cultivation, commercial plantation and lack of community law. Hence it needs immediate attention.

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