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International Journal of Current Research
Vol. 9, Issue, 02, pp.46921-46924, February, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

LAND USE/LAND COVER CHANGE IN RANI-GARBHANGA RESERVE FOREST AREA, KAMRUP, ASSAM

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ARTICLE INFO

Article History:
Received 10th November, 2016
Received in revised form
04th December, 2016
Accepted 25th January, 2017
Published online 28th February, 2017

Key words:

LUCC, Reserve forest, Degradation.

ABSTRACT

Land-use and land-cover change (LUCC) is a key driver of global environmental change and has important implications for many national and international policy issues (Nunes and Auge 1999; Lambin 2001). Rani-Garbhanga Reserve Forest is located in Kamrup East Division of Assam. It has witnessed significant decline in forest cover. The growing population pressure on the forests for timber, fuelwood, fodder and other forest products, poor management on the part of the forest department, smuggling of trees are some of the major factors for accelerating the degradation process. The result of the study shows that land use changes in the study area are primarily responsible for the decrease of forest area and wild habitats in and around the reserve. This study addresses relevant issues on land use and land cover changes and its causes related to degradation of forest cover.

Citation: Inamani Das and Bhagabati, A. K. 2017. "Land use/land cover change in rani-garbhanga reserve forest area, Kamrup, Assam", *International Journal of Current Research*, 09, (02), 46921-46924.

INTRODUCTION

Forest, a community of living trees, helps in maintaining ecological balance, conserving biodiversity and enhancing the quality of environment. But excessive population and livestock pressure and the requirements of forest products for fuel, fodder, timber, lumber, paper etc trigger the forest depletion processes. Forest department sources show that as much as 55% of the forest area shrinkage in Assam has been caused by felling of trees, 25% for encroachment and 20% for shifting cultivation. There were 14,517sq. km dense forest in Assam in 1999, which decreased to 1684 sq. km in 2003 indicating a loss of 12,833 sq. km forest areas(Forest survey of India, 2003). On the other hand, there was 18,060 sq. km reserve forest in Assam in 2003 which came down to 13,869 sq. km in 2007 indicating a decrease of reserved forest area of in four years is 2184 sq. km. in a period of four years. A marked increase has seen in the area under forest villages and fringe villages and built-up land under commercial cultivation inside the Rani-Garbhanga Forest during the period 1977-2010. The total area already encroached in Garbhanga range stands at 410 hectares, while it is 245 hectares in the Rani range.

The Study Area

Rani-Garbhanga Reserve forest located between 26°55′ to 26°0.5′ N latitude and 91°35′E to 91°49′E longitude. It is situated on the south bank of the river Brahmaputra and is adjacent to Guwahati, the capital city of Assam in Northeast India. The total area of Rani-Garbhanga Reserve forest is 232 sq.kms (23,230.58 hectares) and is divided into two ranges- The Garbhanga range having 188.86 sq.kms areas (18,860.58 hectares) and the Rani Range with 43 sq.kms (4370 hectares). For management purposes, the reserved is divided into two forest ranges- the Garbhanga range and the Rani range. The difference in management is due to the variation in the vegetation structure, regeneration of Sal (Shore robusta) and Bamboo (Dendrocalamus hamiltonil), replacement of Teak (Tectona grandio) plantation by indigenous species and involvement of local communities in the sustainable management of land use methods for converting the degraded areas into productive ones. The Reserve is located at an altitude of 170-200 meters above the mean sea level.

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Objectives

The main objectives of the study are-

1. To assess the status of forest cover dynamics and land use changes of the area.
2. To make an assessment of the trend and pattern of land use/land cover change.

Dataset used

For identification of forest boundary: SOI topographical sheet at 1:50000(78N/5, 78N/8, 78N/9, 78N/12, 78N/16)

For Land use/Land cover change detection

1. LANDSAT MSS Image (Path-137, Row-042)
2. IRS-1C-LISS III (Path-137, Row-042)

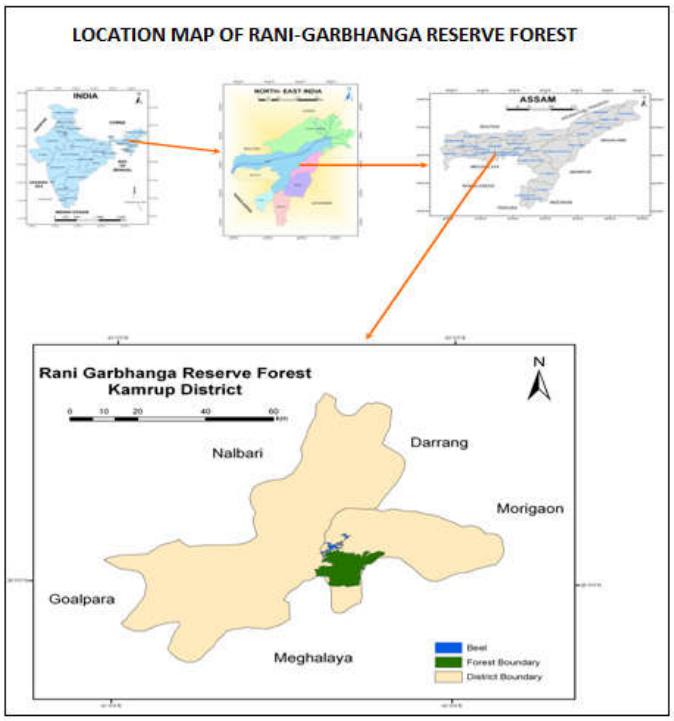

Fig.1. Location map of the study area

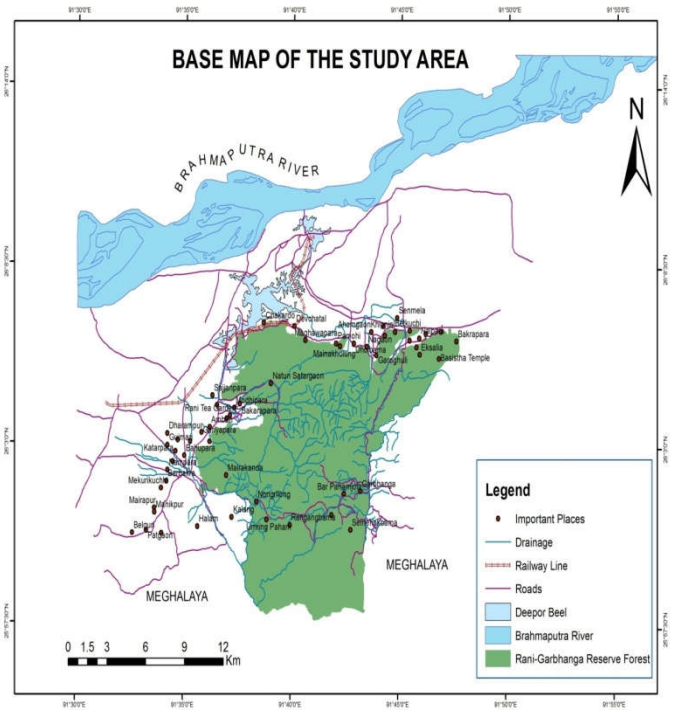

Fig. 2. Base map of the study area

Methodology

* Registration of topographical sheet using UTM/WGS84 projection system.
* Creation of personal Geodatabase comprising feature dataset and feature class for land use.
* Delineation of the reserve forest boundary and the study area from SOI topographical sheet. For this on screen digitization method have been used using Arc GIS software.
* Registration of imageries with UTM/WGS84 projection system taking topographical sheet as a reference.
* The satellite imageries of different resolution are resampled in image processing software.
* Subset of Satellite imagery from the delineated reserve forest boundary in ERDAS Imagine.
* A field visit has been made before the interpretation and some information regarding ground truth has been collected and on the basis of that LU/LC maps have been prepared
* Satellite imageries are classified using unsupervised method with the knowledge about the colour composition of the satellite images for understanding the forest cover change in reserved forest.

RESULTS AND DISCUSSION

The study area has been defined to have six land use land cover categories, which were: dense forest, open forest, agricultural land, settlement, water and wasteland. Under this circumstances, classification for that reserve forest area have been categorized.

LU/LC Map (1977): The land use land cover classification for 1977 from MSS satellite image showed that majority of the study area was under dense forest and agricultural land accounting for 34526.5 ha and 7594.2 ha respectively, while open forest, settlement, water and wasteland amounted to about 7032.6 ha, 5239.8 ha, 1863.72ha, and 4162.68 ha respectively

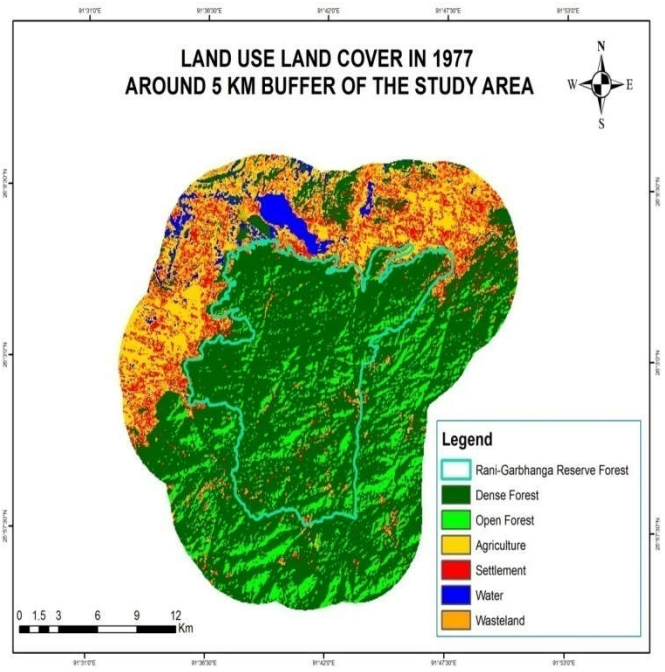

Fig.3. Land Use/ Land Cover map of 1977

LU/LC Map (2010): Further more land use land cover classification for 2000 from LISS-3 satellite image showed that dense forest and open forest accounting for 29070 ha and 11786.7 ha respectively, while agricultural land, settlement, water and wasteland amounted to about 4651.24 ha, 13532.3 ha , 1199.68 ha, and 0 ha respectively.

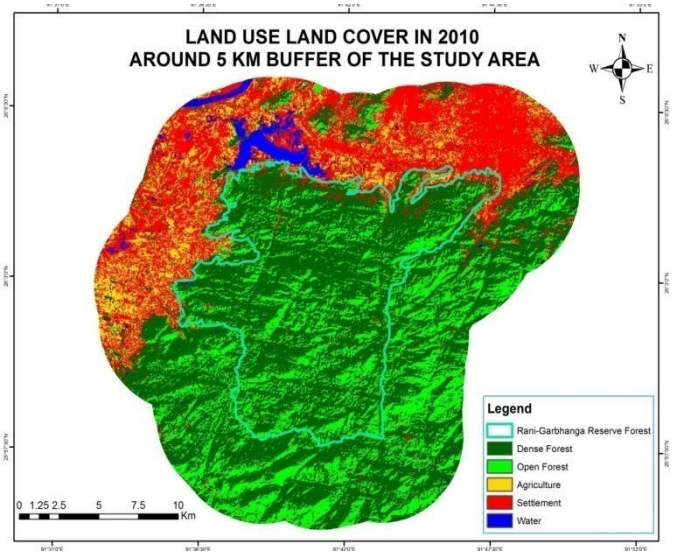

Fig.4. Land Use/ Land Cover map of 2010

Land Use/Land Cover Change Detection

Land use/ Land cover changes in forest ecosystem are always extremely complex due to human interactions that are determined by a whole range of factors. As indicated in the methodology part of this paper, the change detection was made based on the classified maps of 1977 and 2010. When 1977 land use land cover classification compared with 2010 land use land cover classification there is change that shows decrease or increase in particular land use land cover. The land use land cover categories that shows increase are open forest and settlement amounted to 4754.1 ha and 8292.3. ha respectively. On the other hand, the land use land cover categories like dense forest, agricultural land, water and wasteland showed decrease amounted to -5456.5 ha, -2942.96 ha, -664.04 and -4162.68 ha respectively. From the statistics generated from the analysis it is clear that there is a large reduction in the dense forest from 1977-2010. It is mainly due to the unauthorized cutting of large trees inside the reserved forest for timber wood and fire wood. A major portion of this has been going to the nearby areas for various economic activities. Though the area is under protected reserve forest, the government initiative in taking care of the forest is very little. In comparison to the dense forest, the area under open forest has tremendously increased during the period.

Table 1. Land use Land cover classes, their corresponding areas and change for 1977 and 2010

LULC Class		Area in Hectare		
		1977	2010	Net Change
1	Dense Forest	34526.5	29070	-5456.5
2	Open Forest	7032.6	11786.7	4754.1
3	Agriculture	7594.2	4651.24	-2942.96
4	Settlement	5239.8	13532.3	8292.3
5	Water	1863.72	1199.68	-664.04
6	Wasteland	4162.68	0	-4162.68

From the above area statistics table it is well established that there is a remarkable change in the agricultural land because of decreasing the trend of shifting cultivation. Again the area under settlement has also increased during that period and converted the wasteland into built up land and settlement areas. It is due to heavy influx of population from neighbouring areas.

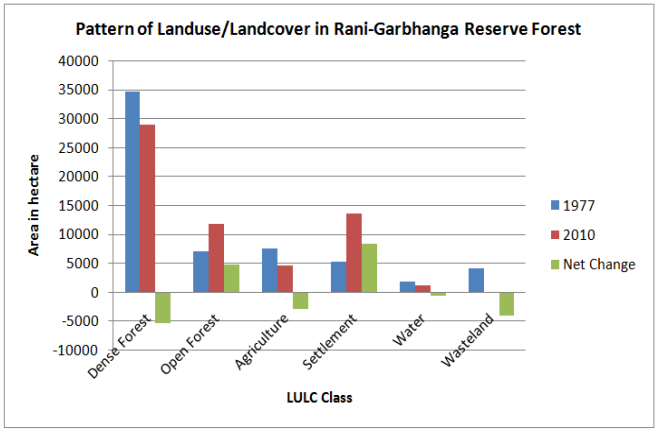

Fig.5. Graph showing Changing Pattern of LU/LC during 1977-2010

Causes responsible for changing Landuse Landcover of the study area

Increase of population pressure: The population growth at faster rate has put enormous pressure on the area. It becomes necessary for the people to clear the virgin forest covers and convert them into settlement areas so that the agricultural production may be increased and sufficient food may be provided to the growing population.

Overgrazing: Overgrazing is another factor of forest degradation. It causes soil compaction and heavy damages to the forest plantations and natural regeneration. With the increase of human population and needs, there have also been increase in the number of domesticated animals for domestic use. So, a wide area of forest is degraded due to overgrazing by large herd of cattle.

Lumbering: Lumbering for domestic and commercial purposes is the real cause of large scale destruction of forest covers. Most of the people used wood from the forest for cooking, house building, boat building, furniture making etc. Ever increasing demand of timber by rapidly increasing population has done great damage to natural forest covers of the reserve forest. Collection of fodder and firewood by the villagers from the depleted forest covers has further degenerated already improvised forest covers.

Forest fires: Forest fires, whether natural or man-made, are effective destroyers of forest covers. It destroys and retard and regeneration of trees but also cause tremendous damage to the biological communities and thus cause ecological imbalance.

Practice of Agriculture: Increase of population in the fringe village and free and easy access inside the forest resulted the conversion of forest to the agriculture. Some photographic evidence can give a precise picture of the problem.

Biological factor: Biological factors are also involved in destroying the natural vegetation. Conversion of forest covers into agricultural farms has resulted into tremendous pressure of animals on existing forests. Further use of chemical fertilizers, pesticides and herbicides in the agricultural field nearer to the forest has driven out micro organisms such as insects and termites towards the adjoining forests where these cause serious damages to the plants. Illegal cutting of hills for stone quarrying also effects on forest ecosystem

Physical factors: Forests are also degraded by the physical factors as through accelerated soil erosion by rill and gully erosion consequent upon rapid rate of deforestation.

Conclusion

The LU/LC pattern of change different categories shows variation during the two periods, 1977 and 2010 that comparison had made. Some LU/LC classes that show increasing change during the period on the other hand, some LU/LC classes show decreasing change pattern. Land Use and Land Cover dynamics is a result of complex interactions between several biophysical and socio-economic conditions. The effects of human activities are immediate and often radical, while the natural effects take a relatively longer period of time. The difference in increase by households and land cover change indicates the pressure on forest land cover and related biodiversity. This implies that population pressure is believed to be one of the major driving forces for the changes in the study area. In order to make relevant conclusions and recommendations of an area, one has to therefore properly consult situations of the past and present, i.e. socio-economic and biophysical aspects of the area. Hence, in the case of this analysis, the major driving force to changes in LULC is increased population change.

Acknowledgements

The author highly acknowledge the University Grant Commission, Government of India for funding the research work through the Basic Scientific Research Award for Doctoral Research. The author is also very much grateful to Forest Department, Government of Assam for providing permission to conduct the work in Rani-Garbhanga RF and also Prof. A.K. Bhagabati, Department of Geography for supervise the research work, manuscript preparation and continuous encouragement of the study.

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