



ISSN: 0976-3031

Available Online at <http://www.recentscientific.com>

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 9, Issue, 2(D), pp. 24018-24021, February, 2018

**International Journal of
Recent Scientific
Research**

DOI: 10.24327/IJRSR

Research Article

FLULC ASSESSMENT IN NORTH KHARANG FOREST SUB RANGE OF KATGHORA FOREST DIVISION, CHHATTISGARH THROUGH REMOTE SENSING & GIS

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DOI: <http://dx.doi.org/10.24327/ijrsr.2018.0902.1582>

ARTICLE INFO

Article History:

Received 15th November, 2017

Received in revised form 25th
December, 2017

Accepted 23rd January, 2018

Published online 28th February, 2018

Key Words:

FLULC, Forest tree diversity, Remote Sensing and GIS, North Kharang forest sub range, IRS P6

ABSTRACT

Tropical forests are major repositories of biodiversity. In North Kharang Forest sub range, Chhattisgarh Forest Land Use/ Land Cover (FLULC) has been analysed by using Remote Sensing & GIS. The FLULC analysis for year 2013 through remote sensing technique indicates that dense sal forest has been found in all the compartments of the sub range but maximum in compartment no. P-110 as 1.20 km² (24.39%) and P-109 as 1.09 km² (22.89%). The moderately dense sal forest has been recorded in compartment no. P-111 (1.20 km²; 28.30%), P-130 (1.05 km²; 22.05%) and P-109 (0.88 km²; 18.48%) respectively. The other classes of FLULC has been also recorded in each compartments of the sub range. *Shorea robusta* has found the dominant forest tree species followed by *Terminalia tomentosa*, *anogeissus latifolia*, *Abelia chinensis*, *Lagerstroemia parviflora*, etc. in the study area. The forest condition in the sub range is healthy and untouched.

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INTRODUCTION

Forests are one of the most important terrestrial ecosystem in the Earth. They are the store house of biological diversity. The human interventions in the natural forest reduce the number of trees of per unit area and canopy closure. It affects regeneration leads to uneven age class distribution and invasion of alien weeds [Kumar NR 2007]. Biodiversity is a key element of vegetation dynamics during succession [Falinski JB 1986] and has been recognized as an important component of sustainable development [O'Riordan T 2002]. The ways in which plant species respond to disturbance can lead to recommendations for the recovery of forest ecosystems [Bazzaz FA 1983; Foster DR *et al.*, 1999; Tong Q *et al.*, 2010]. In 1995, there were 3453 mha of forest worldwide [FAO 1999], between 1990 and 1995, the total area of forest decreased by 56.3 mha, result of a loss of 65.1 mha in developing countries and an increase of 8.8 mha in developed countries [FAO 1999].

India is one of the mega-biodiversity countries is rich in biological diversity and associated traditional knowledge. It occupies only 2.4% of the world land area but accounts for 7-

8% if recoded species of the world. Over 45,000 species of plant and 89,000 species of animals have been recorded so far [IUCN 1993]. The total loss of 3.4 mha of forest has been estimated in the country and it is due to new construction of dams, road, industries and new croplands. This means annual rate of deforestation is about 0.15 mha.

During the past decade, the forests have endured high rates of deforestation. These forests are disappearing at alarming rates owing to deforestation for extraction of timber and other forest products. The resulting effects of this process are the loss of biological diversity and damage to wilderness habitats, increase in soil erosion, disturbance to the hydrological cycle and nutrient losses, among others, the pressure on India's forest is very high because of high population. The rapid growth in the economy of the county in the last decade or so has put additional demands on trees for its resources and for infrastructure development, like building dams, road, townships, etc. In such situation where there is demand or more land for such activities and with growing realization of the

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impacts of forests on climate change, the importance of forest cover and its diversity in the country is valued more.

In spite of this, forest resource information has been gathered for planning and management of various ecosystem services at various user-levels. At the national and global scale, the main goal of the inventory is to collect information on forested area such as biomass, stem volume biodiversity and change in these attributes. Conservation and preservation of diversity is often quantified with measurable indices common approaches used to measure diversity. With the invention of remote sensing for land cover mapping is a useful and detailed way to improve the selection of areas designed for agricultural, urban or industrial areas of a region. Application of remotely sensed data made it possible to study changes in land cover in less time, at low cost and with better accuracy in data analysis, update and retrieval. In current study emphasis has been given to analyse land use /land cover of North Kharang forest sub range of Katghora Forest Division in Chhattisgarh by using remote sensing technology.

MATERIALS AND METHODS

Satellite Data used

The satellite data of IRS P6 LISS III (102/56) of 2013 and SOI toposheet no. 64-J/3 (1:50,000 scale) has been used in the present study. The forest stock map has been taken from Pali Forest Range of Katghora Forest Division, Chhattisgarh. The ArcGIS ver. 9.3 and ERDAS Imagine ver. 2010 software have been used for the study.

Vegetation Classification Scheme

North Kharang forest sub range covering a tropical climatic zone. A broad vegetation classification scheme was adopted to get information. In the present study for LULC the following classification scheme was adopted, for forest vegetation: Dense Sal Forest, Open Sal Forest, Mixed Deciduous Forest, Moderately Dense Sal Forest and Sal Mixed Forest. For degraded forest stage: Plantation, Agriculture Land, Water Bodies and Settlement.

Digital Classification of Satellite Data

The raw digital data was enhanced using contrast stretching or ratio based techniques facilitate better discrimination during ground data collection or locating sample points.

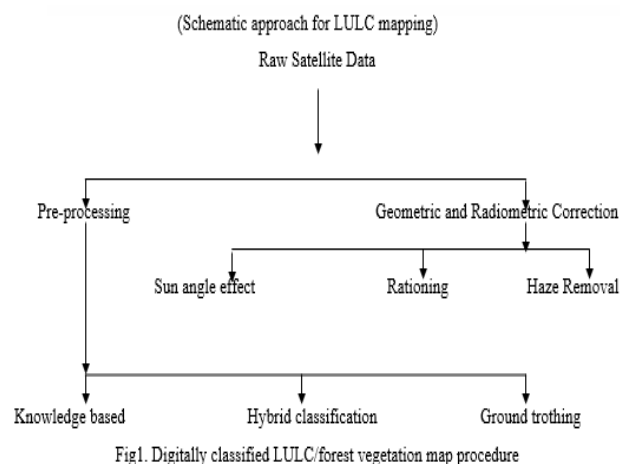
Reconnaissance Survey

The reconnaissance survey was undertaken for getting better acquaintance with the general nature of vegetation of the area. Major vegetation types and few prime localities of characteristic types were noted during reconnaissance survey. The variations and tonal patterns were also observed on existing images /maps. Traversing along major drainage, roads, paths etc for ground frothing, existing literature survey and interaction with forest officials were also made during field survey.

Vegetation characterization using Satellite Data

Satellite data in digital form were used for analysis to characterize the vegetation using interactive digital analysis procedures. The preparation of vegetation map compartment wise assumes a critical step in the biodiversity characterization

procedure. The images of the area was geometrically corrected with reference to Survey of India 1: 250,000 scaled toposheets. The Vegetation classification was performed as per the scheme mentioned earlier. The different scenes were classified using *Maximum likelihood* algorithm. After completing the classification, misclassified areas were checked and reclassified considering small *Area of Interest (AOI)* or through Interactive Editing for improved accuracy. Finally all classified scenes were mosaicked and the edges were smoothed. The area statistics were taken for North Kharang forest sub range using SOI mask. The approach for land cover mapping is as follows (fig 1):



Accuracy assessment

The classification performance was evaluated by redundant training areas and field sample points based on the *commission and omission error matrix* and hence overall classification accuracy was calculated. It should be noted that overall classification accuracy is more than 85percent.

Observation

Study Area

The North Kharang forest sub range is situated in Pali Forest Range of Katghora Forest Division, Chhattisgarh. The study area is located in 22°29'16.03" N latitude and 82°09'37.4"E longitude (fig 2).

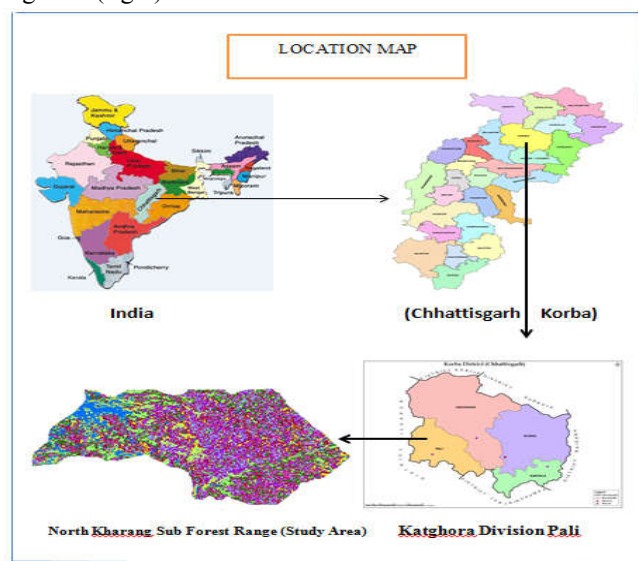


Fig 2 Location map of North Kharang forest sub range

The total area of the North Kharang forest sub range is 26.80 km² and consists of six forest compartments namely; P-108, P-109, P-110, P-111, P-130 and P-131.

The climate of the area is tropical monsoon type and characterized by dry summer and pleasant cold. The year is divided into four distinct seasons. The cold or winter season starts from the mid November to mid of February, followed by the summer season from mid of March to mid of June. The period from mid of June to mid of September have monsoonic rain. The soil found in the area is mostly sandy clay and alluvial. River Kharang is the major river in the area originated near to Lapha mountain of Pali forest range. There are more than dozen of small semis perennial and seasonal tributaries flow in the area and provide water to the river Kharang.

Forest Land Use/Land Cover analysis in various forest compartments of North Kharang forest sub range

The FLULC analysis of North Kharang forest sub range has been done by using ERDAS IMAGINE and ArcGIS software by using IRSP6LISS III imagery of 2013.

The FLULC analysis of forest type has been done. Sal is a dominant tree species found in the forest and one of the valuable tree species in the area so classification has been made according to Sal availability. The FLULC analysis of the study area has been made as following (table 1 & fig 3):

Dense Sal Forest: This type of forest comprised of almost pure stand of Sal trees and occurred on wall drained higher as well as lower terrace with loamy and sandy clay soil. Found mostly in direction of North - South and Westside of the North Kharang forest sub range. The satellite remote sensing analysis for distribution of this type of forest inform that it is found maximum in compartment no. P-110 as 1.20 km² (24.39%) and P-109 as 1.09 km² (22.89%) respectively. The other forest species found besides Sal (*Shorearobusta*) in this type of forest is *Diospyros melonoxylon*, *Semecarpus anacardium*, and *Buchnanian cochinchinensis* and *Abelia chinensis*. The Sal canopy density was found high in most of the forest patches with pure stand of young Sal trees.

Table 1 Forest Land Use/Land Cover analysis of North Kharang Forest Sub Range for year 2013

Class	Forest Compartments of North Kharang Forest Sub Range											
	P-108		P-109		P-110		P-111		P-130		P-131	
	Area (in Km2)	%	Area (in Km2)	%	Area (in Km2)	%	Area (in Km2)	%	Area (in Km2)	%	Area (in Km2)	%
Dense Sal	0.92	18.81	1.09	22.89	1.20	24.39	1.06	25	0.82	17.24	0.77	23.85
Moderately Dense Sal	0.83	16.99	0.88	18.48	0.69	14.02	1.20	28.30	1.05	22.05	0.56	17.33
Sal Mixed	0.38	7.77	0.72	15.14			0.80	18.88	0.79	16.59	0.64	19.81
Open Sal	0.80	16.35	0.70	14.72	0.69	14.02			0.91	19.13	0.56	17.33
Mixed Deciduous	1.19	24.33	0.88	18.48	1.11	22.57	0.38	8.96	0.81	17.01		
Agriculture Land					0.62	12.60	0.43	10.14				
Water Bodies					0.28	5.69			0.38	7.98		
Settlement					0.33	6.71	0.37	8.72				
Plantation	0.77	15.75	0.49	10.29							0.18	5.57
Total	4.89	100	4.76	100	4.92	100	4.24	100	4.76	100	3.23	100

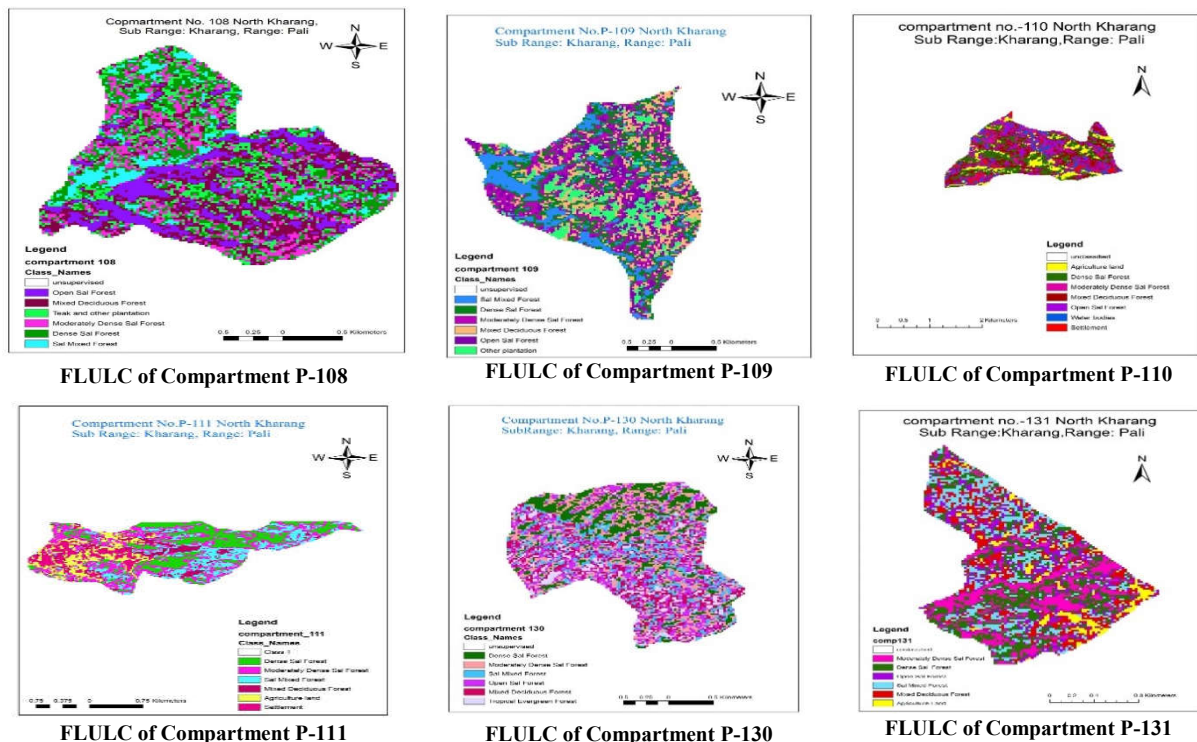


Fig 3 FLULC map of different compartments of North Kharang forest sub range

Moderately Dense Sal Forest: This type of forest was found alongside Dense Sal forest and occupied areas mostly in compartment no. P-109 (0.88 km²; 18.48%), P-111 (1.20 km²; 28.30%) and P-130 (1.05 km²; 22.05%) respectively. It has also distributed in small patches all over the compartment. Sal density was found medium in this type of forest class. Prominent species of this type of forest are *Shorearobusta*, *Diospyrosmelonoxylon*, *Terminalia tomentosa*, *Desmodiumoojeinense* etc. The canopy density of the different species varied between 60% and 80% and the class covered 2.49 km² (57.86%) area of the north Kharang Forest Sub Range.

Sal Mixed Forest: This category of Sal forest occurred in lowland area on river, wall terraces and gentle slopes where soil found hard dry and impermeable stiff loam. This type of forest was mainly distributed along north boundary of compartment no. P-130 (0.79 km²; 16.09%) and Southern part of compartment no. P- 111 (0.80 km²; 18.88%). Sal mixed patches has been found all over of the area in less or high. The mostly middle aged trees of Sal found in this type of forest. Other tree species found in the forest are *Terminaliatomentosa*, *Madhucaindica*, *Desmodiumoojeinens*, *Lanneacoromandelica* and *Diospyrosmelonoxylon*. The canopy density varied between 40% and 60% and the forest class covered 2.165 km² (10.67%) of the study area.

Open Sal Forest: Open Sal forest class offorest land use / land cover has covered maximum area of 3.777 (18.62%) in the North Kharang forest sub range. This type of forestmainly has been found in the periphery of dense sal forest. Open sal forest has been recorded in compartment no. P-130 (0.91 km²; 19.13%) and P-108 (0.80 km²; 16.35%). The over wood in these forests was compared of scattered Sal trees. The density of *Desmodiumoojeinense*, *Terminalia tomentosa* has been found maximum with *Lagerstoemia parviflora*, *Senna Alexandria*, *Miliusatomentosa* and *Anogeissus latifolia* in the forest. The overall tree density in this type forest has been ranging between 20-40%.

Mixed Deciduous Forest: These class of forest occurred in sandy alluvium mostly near small water bodies and streams. The presence of miscellaneous species has made this class highly diverse. Mixed deciduous forest was mainly recorded in P-108 (1.19 km²; 24.33%) and P-111 (1.11 km²; 22.57%). The common tree species found in this class are *Buchanania cochinchinensis*, *Semecarpusanacardium*, *Miliusatomentosa*, *Phyllanthusemblica* and *Madhucaindica*. The canopy density was high and varied between 60-80%. These forest covered 3.705 km² in the study area.

Agriculture land and settlement area: Compartment no. P-110 and P-111 has found some settlement areas and agriculture land. In this patch of the forest, population pressure has been recorded maximally. Most of the area has been illegally encroached by migratory peoples. Only some land has given to indigenous tribals like PahadiKorwa and Gond on Patta by forest department. The grazing pressure has been also recorded high in the area. Most of the people are small farmers cultivating paddy and vegetables.

Water bodies: The major river flowing in the area is Kharang. The river originates from Lapha mountain near the vicinity of North Kharang forest sub range comes under gondwana

metamorphic rocks, nature of the Kharang river is seasonal type. The shortage of water has been generally recorded in summer. Water bodies has been recorded only in compartment no. P- 110 and P- 130 in the form of river part, dug and natural springs.

Plantations: Most of the area has found natural forest but due to natural disasters like forest fire every year a big part of tree species have been destroyed and blank. Forest department make plantation every year to fill the gap. Compartment no. P-108, P-109 and P-131 have been effected severely from fire. So plantation of different tree species has been made in these compartments.

CONCLUSION

The satellite remote sensing technique has been used to analyse the dense forest area of North Kharang Forest sub range in Katghora Forest Division of Chhattisgarh. The data interpret from the study states that *Shorearobusta* (valuable tropical tree species) is a dominant tree species found in the region. The other tree species like *Terminalia*, *Semecarpusanacardium*, *Madhucaindica*, *Diospyrosmelonoxylon* etc has been found as associates. There is no heavy encroachment has been found in the forest range. One of the reason behind it is low population. Forest department has actively participated in forest management activities in the region. So the condition of the forest in this area found healthy.

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