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Status of Forests in Jharkhand, India: A Geo-Spatial Approach to Forest Appraisal

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Abstract

The state of Jharkhand was the 28th state in India created after the bifurcation of the state pf Bihar on 15th Nov 2001. The name of the state denotes it as the land of forests. It is one of the richest state in terms of mining resources in India. This paper is an effort to understand the status of forests in Jharkhand as usually, the land use across the state is for mining and urbanisation purposes. The status was derived by using geospatial technologies and the GIS environment to create interpret the satellite imageries that would tell of the development of the forests in the state after gaining statehood.

Keywords: Forests status, Jharkhand, India, Geospatial Technologies,

Introduction

Forests provide a number of environmental services, including protection of catchment areas, nutrient cycles, and environmental pollution, regulate climate, carbon sequestration, flood mitigation, protection against soil erosion and much more. Degradation of forest resources can have adverse economic and environmental consequences both locally and globally. However, high rate of unplanned urbanization, expansion of agriculturallands, rapid growth of non-forest activities like mining, hydro-electric power project and other human-induced changes have caused widespread damage to the global forests cover. The total global loss of forest cover was estimated to be 0.6% per year between 2000 and 2005 (Hansen et al. 2010). The tropics are the only climatic region to show trends, with forest losses increasing by 2101 square kilometers annually. India's annual forest loss for the decade from 1990 to 2000 was estimated by the Food and Agriculture Organization (FAO) to be 380.89 km^2. Remote Sensing (RS) and Geographic Information System (GIS) are extensively used for estimating forest cover change around the globe.

The state of Jharkhand by its very name means the land of forests. In Jharkhand (then part of Bihar), 79% of the forest was private land until the Zamindar system was abolished under the Land Reform Act of Bihar in 1950. The Government owns forests for management and protection and issued an interim notice under Section 29 of the Indian Forest Act 1927 between 1952 and 1967. These lands include privately-owned protected forest areas and other unclassified forest areas under the Bihar Private Forest Act of 1947. The survival of the majority of poverty-stricken rural and tribal populations relies heavily on forests to provide them with a variety of non-timber forest products (NTFPs). Therefore, the present study makes a comparative assessment of forest cover distribution and change using district level data since 1995.

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Study area

Jharkhand, the 28th state of the Indian Union, was established on November 15, 2000 by the Bihar Reorganization Act. Most of the state is located on the Chota Nagpur Plateau, 25 ° 30'N to 22 ° N and 83 ° E to 88 ° E, covering an area of 79,714 km^2 (figure 1) a north eastern extension of the peninsular Gondwana plateau region in India . It is the source of many rivers: the Koel, Damodar, Brahmani, Kalkai and Subarnarek rivers.The soil of the state are: Red soil and Black soil, mostly concentrated in the Damodar valley and Rajmahal hill area; Micacious soil found in Koderma, Jhumri Telaiya, Barkagaon, etc; Sandy soil in Hazaribagh and Dhanbad area; and Laterite soil in western part of Ranchi, Palamu, and parts of Santhal Parganas and Singhbhum. The climate of Jharkhand varies from humid subtropical in the north to tropical wet and dry in the south-east; and has three well-defined seasons: the winters from November to February, hot summer from March to mid-June; and July to October is the rainy seasons. May, the hottest month, records a daily maximum temperature of about 37°C. And December records a low temperature of about 10°C(www.jharkhand.gov.in). The state receives rainfall in the range 1200-1500 mm per year. Forests and woodlands occupy nearly 28% of the state.The forest vegetation of the State varies from rich Sal forests to miscellaneous forests andsparsely covered grasslands. The main species of Jharkhand are Sal, Asan, Dhaura, Gamhar,and Mahua etc. Jharkhand is also rich in mineral resources like Uranium, Mica, Bauxite, Granite, coal etc.The tribal population constitute26% of the totalpopulation of 32.98 million (Census, 2011). These populations have symbiotic relations with forests and also practices agro-pastoralism over the years.

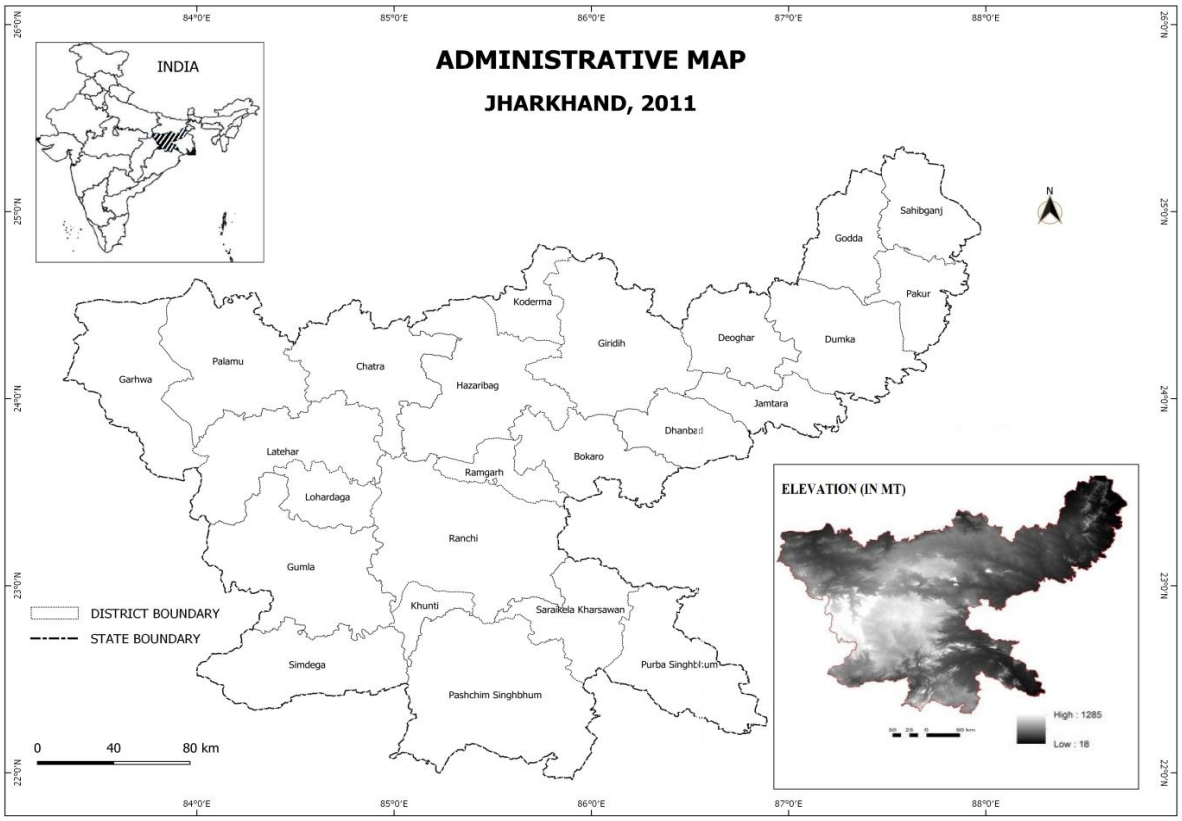

Figure 1. Study area: Jharkhand state

Data and methods

The present study hasmapped and analysedthe forest cover distribution and types for last two decades spanning between 1995 and 2015. The Land Use Land Cover (LULC) maps for 2005-06 and 2015-16 were extracted from the ISRO Bhuvan portal using its Web Map Services (WMS). This thematic service uses multi-temporal satellite data of 2005-06 and 2015-16 from Resourcesat-1 LISS III and Resourcesat-2 LISS III sensors, respectively, to generate the LULC maps on 1:50000 scale. According to the thematic service, the overall accuracy of different LULC classes varies from 79 per cent (like Agro-horticulture) to 97 per cent (like waterbodies). 1995 LULC data was extract from the ISRO project "Development of Decadal (1985–1995–2005) Land Use and LandCover Database for India" (NASA grants No: NNX414AD94G) available at http://bhuvan.nrsc.gov.in. The data was derived from Landsat 4 and 5 Thematic Mapper (TM), Enhanced Thematic Mapper (ETM +), and IRS-1B LISS I data.Ground truth surveysand visual interpretation of satellite data were included to improve the accuracy. The forest layers were extractedand compiled using the QGIS software. Further, India State of Forest Report (ISFR) 2005 and 2015 were referred for generating the forest cover types: Very Dense forest, Moderate dense forest and Open forest.

Result and discussion

LULC Change of Jharkhand state

Land cover represents the observed physical cover of a region i.e. - vegetation,water bodies, bare soil etc., and land use is the function the observed physical cover performs i.e. recreation, wildlife habitat, or agriculture, and in most cases land use and land cover are interrelated. Human activity has changed the Earth's environment over the last few centuries by changing LULC (Hurtt et al., 2006; Liu and Tian, 2010). Changes in LULC are important drivers of climate change, biogeochemical cycles, and regional to global food production (Feddema et al., 2005; Jain and Yang, 2005; Zhang et al. 2016).Compared to traditional field-based surveying methods, remote sensing methods have the advantage of being able to classify large area of land use and land cover in a practical, economical and repetitive way.Land use and land cover application includes both baseline mapping and subsequent monitoring. This is because we need timely information to know what type of use the current amount of land is and to identify year-to-year changes in land use. This knowledge helps develop strategies to balance conservation, and avoid conflicting uses.

Figure 2 shows the LULC situation of Jharkhand during 1995, 2005 and 2015. A significant increase in built-up area can be visible from the spatial distribution of the LULC maps over the time period. Similarly presence and increase in scrub/barren/waste land can also be seen in 2005 and 2015 when compared to 1995. Such lands have come up in place of forest and agriculture lands. This can further be supported by the "Landuse statistics" by Ministry of Agriculture, GOI, 2005 and 2015 (figure 3). According to the report between 2005 and 2015, the share of forest landto the total geographical area has decreased from 29 per cent to 28 per cent, and agricultural landhas decreased from 22 per cent to 17 per cent; while the share of fallow land to the total geographical area has increased from 10 per cent to 13 per cent; culturable waste land from 4 per cent to 5 per cent; and current fallow from 16 per cent to 18 per cent.

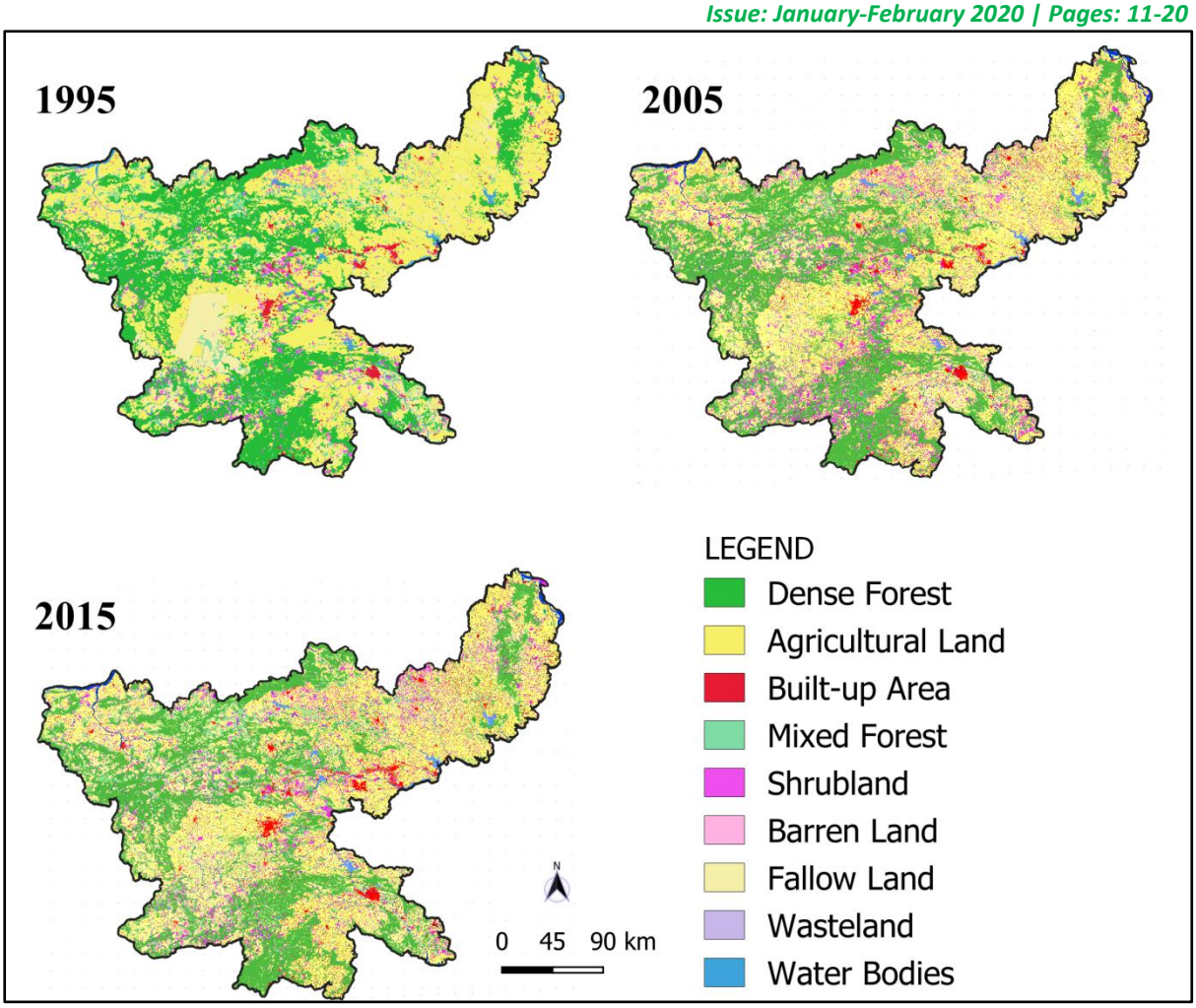

Figure 2. LULC of Jharkhand state since 1995.

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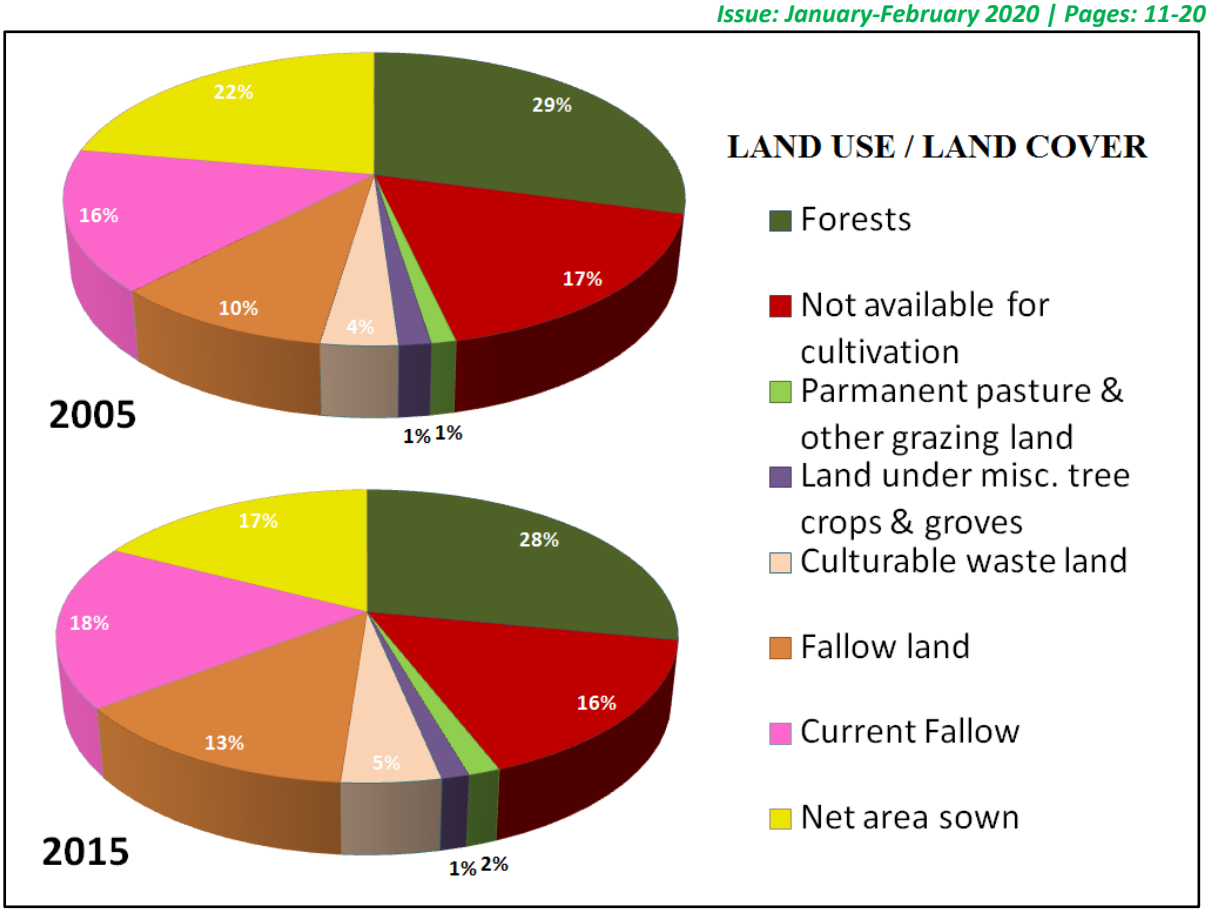

Figure 3. LULC distribution (Data source: Landuse statistics. Ministry of Agriculture, GOI, 2005 and 2015)

Forest cover changeanalysis of Jharkhand state

The recorded forest area of Jharkhand state is 23605 sq. Km, which is 29.61% of the geographical area of the state. The Chhotanagpur plateau is rich in both mineral and forest resources. As per ISFR, 2005 by legal status, Reserve forest constitutes 18.83 per cent (4387 sq km), Protected forest constitute 81.14 per cent (19185 sq km) and Unclassed Forests constitute 0.3 per cent (33 sq km).Forest cover includes all lands, one hectare and more in area, with a tree canopy density of 10 percent or moreirrespective of ownership and legal status. Such lands may not necessarily be a recorded forestarea. It also includes orchards, bamboo and palm (ISFR, 2013). The spatial forest distribution maps of 1995, 2005 and 2015 were overlayed on each other to identify areas that have recorded major forest loss during this time period (figure 4).

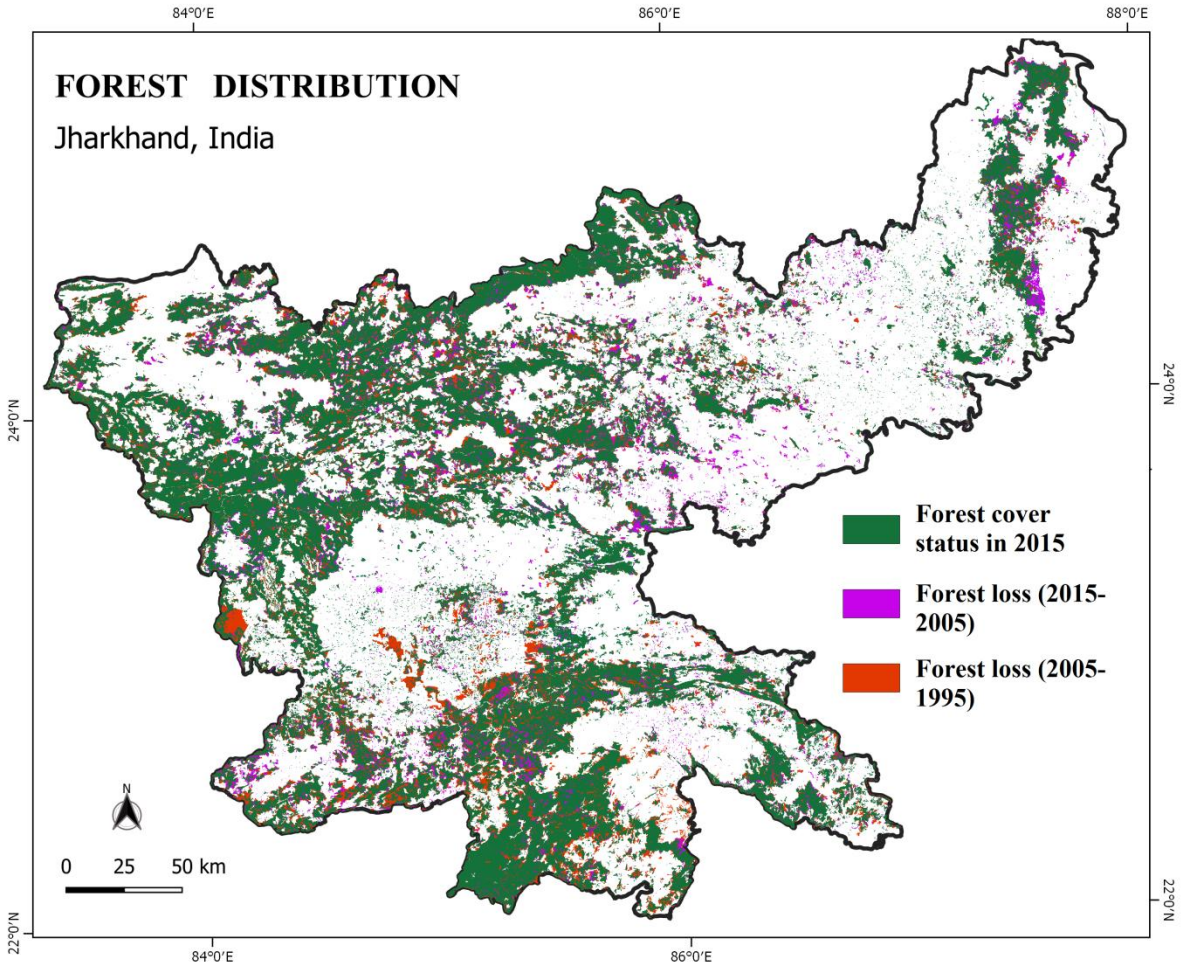

Figure 4. Forest cover change and loss between 1995 and 2015.

Districts of Ranchi, Gumla, Paschim Singhbhum , Simdega and Pakur has recorded significant forest cover loss in the study period. There are several reasons that can be attributed for the forest cover losses. Diversion of forest land for non-forest activities like roads, railways, transmission lines, irrigation lines and pipe lines as well as mining (Pendency of Forest Diversion cases report available at https://forest.jharkhand.gov.in), built-up area expansion and forest fires are some of the major problems. Under the Forest Conservation Act, 1980, since January 2015 till date, more than 600 hectares of forest land was diverted for various non-forestry purposes. A study on the district wise analysis of entire forest fire frequency between 2005 and 2016 revealed that Paschim Singhbhum,Palamu and Garhwa districts are subjected to 30.48%, 18.39% and 8.98% forest fires respectively of total forest fire cases in the state (Ahmed et al. 2017).

Forest cover type: distribution and changeanalysis

Forest cover typesare categories into: a. Very Dense Forests:Lands with forest cover having a canopy density of 70 percent and above; b. Moderately DenseForests:All lands with forest cover having a canopy density 40 percent or more and less than70 percent; and c. Open Forests:Lands with forest cover having a canopy density of 10 percent or more and less

than40 percent. Table 1 shows the distribution of forest types of Jharkhand state between 2005 and 2015:

Table 1: Forest cover types

ISFR Year	Geo-graphical Area (sq km)	Very Dense Forest (sq km)	Mod. Dense Forest (sq km)	Open Forest (sq km)	Total (sq km)
2005	79,714	2544	9078	10969	22591
2015		2588	9663	11227	23478

The improvement in forest cover in all three categories is recorded. A further detail analysis suggests that the forest cover increase is not uniformly spread across the districts across all forest types (figure. 5). Under the Very Dense forest category, Deoghar has recorded 100 per centloss followed by Godda, Pakur, Koderma and Sahibjang. Districts of Palamu, Latehar, Lohardaga, Simdega, Paschim Singhbhum, Purba Singhbhum, Bokaro and Saraikela Kharsawan have recorded increase in the Very Dense forest cover, with maximum increase in Gumla (23.8 per cent). Rest have recorded minor 'Very Dense forest cover' loss. Under the Moderate Dense forest category, Deoghar, Dhanbad, Hazaribag, Garhwa, Lohardanga, Paschim Singhbhum and Saraikela Kharsawan have recorded decrease. However, districts like Pakur, Godda Dumka and Jamtara have recorded tremendous increase in Moderate Dense forest cover. Under the Open forest category, Deoghar has recorded highest increase, while Godda and Pakur highest fall. Districts like Dumka, Dhanbad, Palamu, Latehar, Lohardaga, Chatra, Bokaro, Koderma and Jamtara has registered reduction in forest loss under this category. The total forest cover change provides a holistic view on the forest cover change at the district level. Although Deoghar has registered forest loss under Very Dense and Moderate Dense forest categories, on overall forest change category it has recorded maximum gain in land under forest (70%) between 2005 and 2015. Similarly, Dumka and Jamtara have recorded forest area gain, however the proportion of forest cover under Moderate Dense forest and Open forest categories has reduced.

The result can further be corroborated with respect to change in the share of these three categories within forest area. Figure 6 shows the proportional share of forest cover types between 2005 and 2015. Lahordanga is the single district where the proportion of Very Dense forest cover is nearly 30 percent of total forested area in 2005, which has further increased by 5 per cent during 2015.In Sahebganj, Ranchi, Pakur, Koderma, Godda and Giridih.have recorded decrease in share of Very Dense forest cover between the 2005 and 2015. Pakur and Godda are two districts where the share of Moderate Dense forest cover has increased tremendously between the study periods.

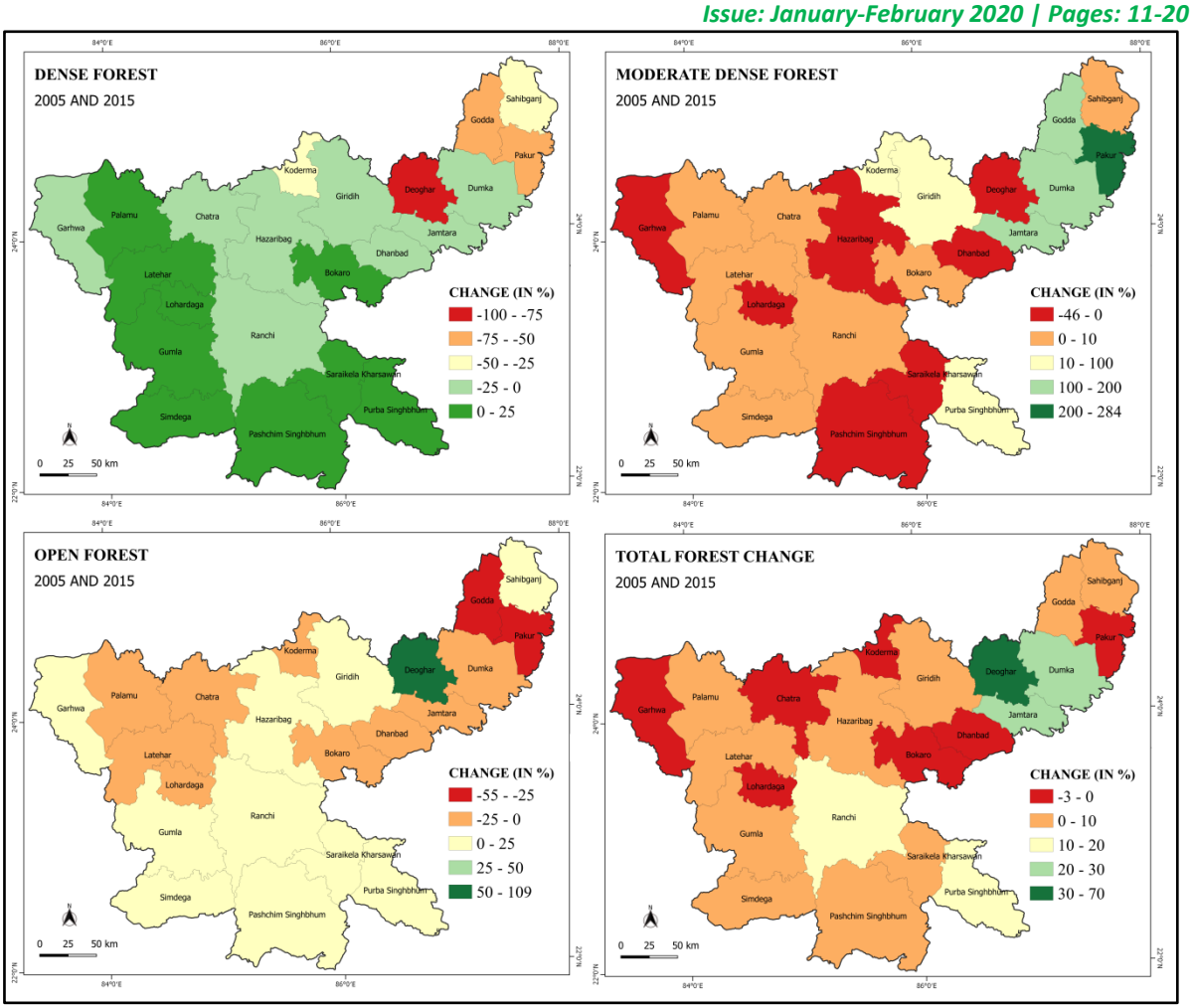

Figure 5: Changes in forest cover types between 2005 and 2015

The increase in area under forest cover can be attributed to the conservation and plantation efforts by community and government. The state began Joint Forest Management in 1990. According to ISFR 2005, there are 10903 JFM committees managing 2.19 million hectares of forest area which is about 93 per cent. Forest Conservation Act, 1980 was enacted with a view to check further degradation of forests which ultimately results in ecological imbalance.However, the implementation of Forest Rights Act, 2006which was meant to securetenured and traditional rights over forest land, forest resources among forest dwellersand establish democratic communitybasedforest governance, is in pity state when compared to surrounding states like Odisha and Chhattisgarh.State governments need to understand that FRA has the potential to democratize forest management. By recognizing the right of the community, it can enhance not only the conservation and protection of the forest, but also can achieve Sustainable Development Goals by ensuring livelihood security, gender equality and reduce poverty.

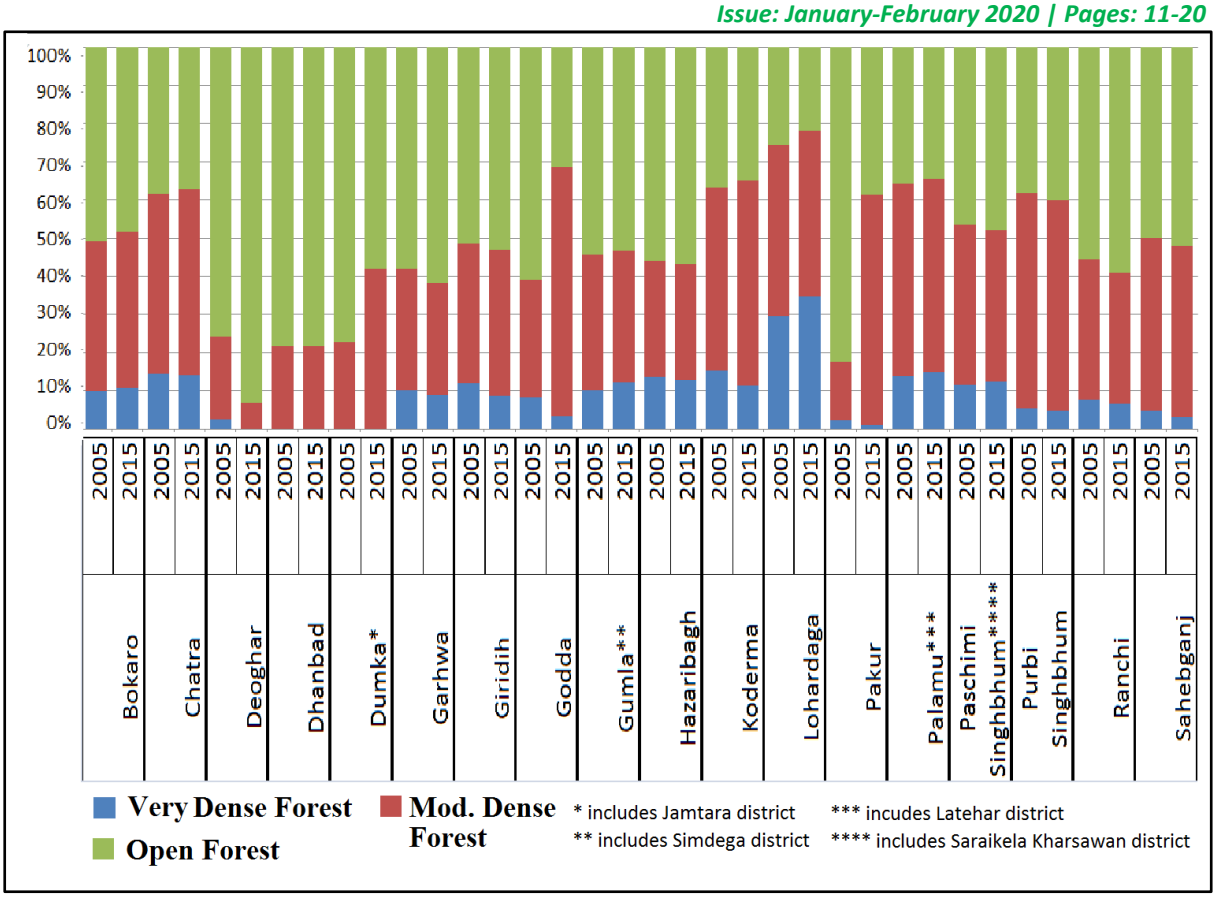

Figure 6: Proportional share of forest cover types between 2005 and 2015

Conclusion

Forests of Jharkhand are home to a variety of rare and endangered flora and fauna taxa and a life support system for the tribal communities. Therefore, it requires appropriate conservation strategies. Increasing non-forest activities, recurrent forest fires and intense grazing pressure are putting great pressure on the state's forest resources. The present study has attempted to map and analyse the change in forest cover in Jharkhand state. Such analysis helps bridge the knowledge gaps needed to prioritize in the areas of forest management, conservation and biodiversity policies.

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