

Study on Implementation of FRA and Climate Change Vulnerability of Forests and Forest Dwelling Communities in Maharashtra

Submitted to
State Government of Maharashtra

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Study on Implementation of FRA and Climate Change Vulnerability of Forests and Forest Dwelling Communities in Maharashtra

Background

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, popularly known as the Forests Rights Act (FRA), was enacted in 2007 through the Ministry of Tribal Affairs to undo the 'historic injustice done to forest-dwelling communities'. These communities were cultivating / occupying forest land and using forest produce since ages but had no tenurial security. Broadly speaking, this Act recognizes and vests individual forest-dwellers with forest rights to live in and cultivate forest land that was occupied before 13 December 2005 and grants community forest rights to manage, protect, regenerate the forest under section 3(1)(i) and to own and dispose minor forest products from forests where they had traditional access. Many states and Union Territories (UTs) which have such forest dwelling communities started implementing FRA immediately after the notification of the FRA Rules on 1st January 2008, generally through their Departments of Tribal / Social Welfare. The Ministry of Tribal Affairs is the nodal agency for implementing the provisions of the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006. The FRA also seeks to recognize and vest the forest rights and occupation in forest land in forest dwelling Scheduled Tribes and other traditional forest dwellers who have been primarily residing in such forests for generations but whose rights could not be recorded. The Act was notified for operation with effect from 31.12.2007. The Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Rules, 2008 for implementing the provisions of the Act were notified on 1.1.2008. As per the provisions of the Act and the Rules framed there under, the onus of implementation of the Act lies at the level of the State/ UT Governments. The Ministry of Tribal Affairs, to ensure that the intended benefits of this welfare legislation flow to the eligible forest dwellers, has also issued comprehensive guidelines to the State/ UT Governments on 12.7.2012 for better implementation of the Act. Further, to strengthen the Forest Right Rules, 2008, the Ministry of Tribal Affairs has also notified the Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Amendment Rules, 2012 on 6.9.2012. The purpose for the implementation of FRA is to recognize the occupation and habitation rights of forest dwelling tribes and other traditional forest dwellers, and also conserve the biological resource. The preamble of the act is to undo the historical injustice for those tribals and other traditional forest dwellers whose rights could not be recognized during the consolidation of the state forests. The key element for the recognition of forest rights is that eligible right holder must have the possession of the forest land on or before 13th December, 2005 and also have possession on 31st December, 2007 when this act came into force. The possession on forest land and dependence of right holder for their bona-fide livelihood are another qualifying element for the recognition of forest rights to avoid the abuse of the legislation.

Objectives of the study

The primary objective of this study is to bring out the critical linkage between implementation of FRA especially for the individuals rights and the vulnerability of the natural resources associated due to the impacts of the climate change. The RS-GIS based analysis of FRA rights in Maharashtra proves that people have cleared forests and have converted barren lands into agricultural lands. At the state level there is an evidence of deforestation leading to lost opportunity for carbon sequestration and thus, increasing the vulnerability of the people dependent on the forests. Hence, the present study has following objectives:

1. To assess the impact of FRA rights on reducing the carbon sequestration capacities of forests
2. To assess the impact of land use change in increasing the vulnerability of the ecosystems and the people

Methodology

Maharashtra State has recognized 108112 (105506 individual and 2606 community) titles containing 899469 acres (241070.31 individual and 658398.75 community) which is 96428.12 and 263359.5 hectare respectively. The status report of Maharashtra for the implementation of Forest Right Act, 2006 has been analysed in the context of study conducted by Logicstacks Solutions, Pune and the provisions of the FRA, 2006 and its rules. The Forest Right Act, 2006 and its rules permits the recognition of forest rights of those right holders who were in the possession of forest land on or before 13th December, 2005 in case of tribals and three generations before 13th December, 2005 in case of other traditional forest dwellers, and also in possession on 31st December, 2007 for deriving their bona-fide livelihood. It has been observed during the analysis of the implementation of FRA in Maharashtra that rights have been recognized for those claimants who were not eligible right holders as per the provisions of FRA, 2006. The following observations emerged after the analysis:

1. The maximum limit of the forest area to be recognized as individual forest right is 4 hectare. There are 1466 cases where the area recognized was more than 4 hectare which is against the provision of FRA, 2006. A total of 1527 hectare area has been recognized which could have been developed as forests through afforestation and assisted natural regeneration for the future potential area to sequester the carbon di oxide from the atmosphere.
2. A total of 1748.45 hectare forest area was recognized as individual forest right which was under tree cover in 2005 according to satellite imagery analysis of Logicstacks, Pune. This recognition of individual forest right is against the provision of FRA, 2006 which has been deforested and emitted carbon di oxide in the atmosphere and also lost the opportunity for future carbon sequestration.
3. A total of 433.38 hectares of forests have been recognized as individual forest right which was under tree cover in 2012. This again against the provisions of Forest Right Act, 2006. This area would have been deforested or will be deforested soon and emit carbon dioxide in the atmosphere and also will lose the future carbon sequestration opportunity.
4. A total of 10960.13 hectare of forest land have been recognized as individual rights for cultivation but this area was neither under cultivation in on or before 13th

December ,2005 nor under cultivation on 31st December,2007 and later. It is against the provision of FRA, 2006. This forest land could be the potential for future carbon sequestration after afforestation and natural regeneration. A total of 14668.96 hectare forest land has been recognized against the provisions of Forest Right Act, 2006.

For the estimation of emissions due to deforestation, a pilot study was conducted in Gondia district of Maharashtra to assess the biomass loss due to deforestation. The Gondia Forest Division has 173180 hectare area, of which 18617.50 hectare falls under the Sadak Arjuni forest range. Around 630 hectare area covering three strata in Sadak Arjuni forest range was selected for biomass assessment in FRA areas. Within these three strata around 225 forest rights were surveyed covering 135.66 hectare area. The biomass assessment was carried out for the year 2002, which is before the FRA implementation and considered as a baseline year and compared with the year 2011, after the FRA implementation. The estimation of carbon stock is based on remote sensing technology coupled with ground truthing. Comparisons of the current carbon stock (2011) have been made with that of the baseline year (2002). For the study, of the total five carbon pools recognized by IPCC viz. Above Ground Biomass, Below Ground Biomass, Woody litter, Dead wood and Soil organic carbon. For this study only first two (above ground and below ground biomass) have been considered. These two carbon pools have been used to compute the carbon stock increment from the base year. However, it is not possible to have estimate of the latter three for the base year; moreover these account for a relatively small share of the total biomass.

To prepare base map for each patch, geo coordinates were collected from the forest division and base maps were prepared. The patches were clubbed into three separate strata, based on the similar forest type and terrain. The area of each patch along with the stratum was calculated and further verified in the field during the ground truthing process.

Demarcation of clusters of FRA claim area

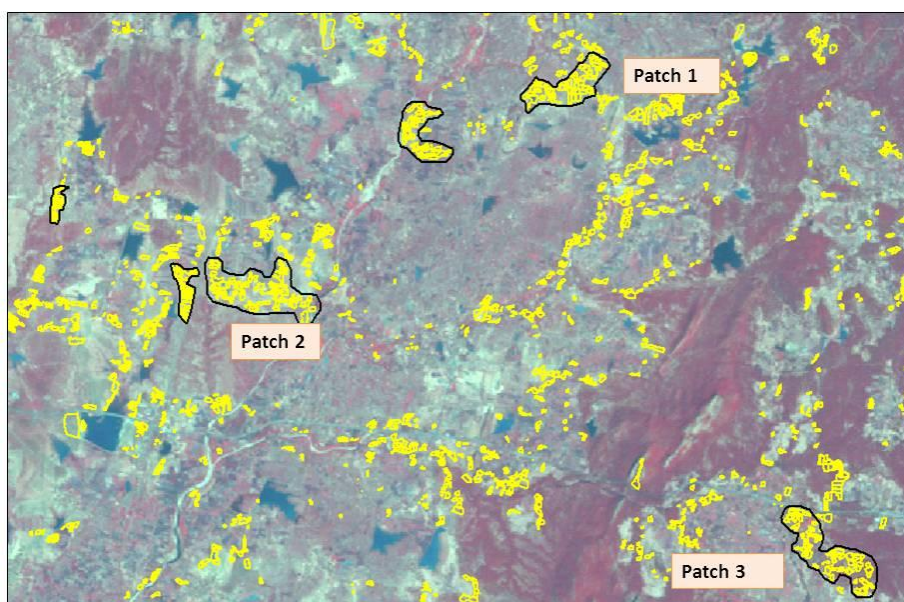


Figure 1 Demarcation of clusters for sampling

To lay out the sample plots, stratified random sampling was followed for all the three strata as depicted in figure 2. In all, total 27 quadrates were laid out covering all the three strata. The geo coordinates of each sampled plot were recorded with the help of Global Positioning System (GPS) and digitized in the satellite imageries of each site. The size of the sample plot was 20m x 25m at all the sites. Measurement with precision and accuracy were maintained by the field expert to minimize any systematic or random errors during measuring the tree lying within the sample plots. Height of the tree was measured directly by Ravi multi meter. Before taking the height, slope correction was taken into account. Botanical names and local names were recorded for each tree species lying within the plot. The tree species which were ≤ 10 cm in girth at breast height was considered and saplings were measured separately.

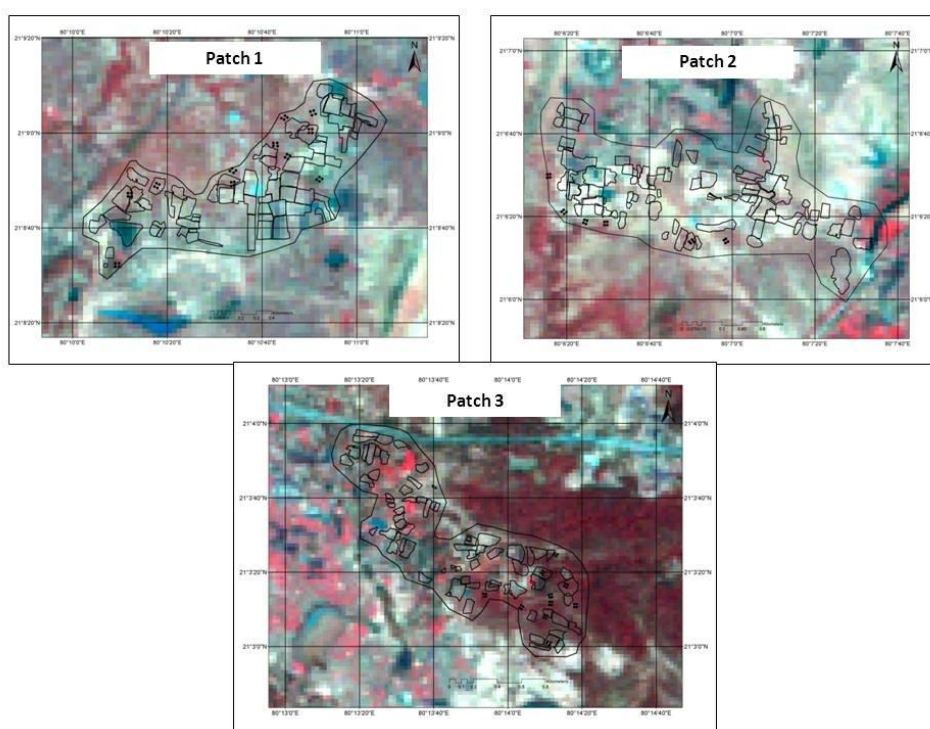


Figure 2 Sampling design followed in three strata

The selection of the appropriate allometric equation is a crucial step in estimating the aboveground tree biomass (AGTB). Allometric equations for biomass usually include information on trunk diameter at breast height, total tree height and basic wood density. Thus, to assess the AGTB, species specific allometric equations were applied for all the tree species. Volume equations were mainly referred from the Forest Survey of India's publication published in 1996, which comprised volume equations of major tree species of India, Nepal and Bhutan (FSI, 1996). Besides, research articles, forest working plan and forestry journals were also reviewed thoroughly to get the volume equations of the tree species that were not available in the FSI publication. General volume equations or volume of cylinder was considered for those tree species whose allometric volume equations were not available, assuming cylindrical bole of the tree (Chaturvedi and Khanna, 1982). Once height and girth of the tree species were measured, then data analysis was done through analytical techniques using softwares such as MS excel and volume tables of species. Data

extraction was done species wise in every quadrat for all the project sites. Wood density of all the tree species observed in all the project sites was taken from the Good Practices Guidelines of IPCC (IPCC, 2006).

After applying the volume equations to each tree species, volume of the tree bole was calculated. Once volume of the tree bole was calculated, it was multiplied with the basic wood density for each tree species to convert the volume into dry mass in tons. Further, this dry mass was multiplied with Biomass Expansion Factor (BEFs) of each species which provide the AGTB. BEFs for all the tree species were taken as 3.4 from the IPCC, Good Practices Guidelines (IPCC, 2006). In this way dry biomass content of all the tree species in each quadrat was calculated and their summation was used. With this approach total above ground tree biomass for each project site was estimated, which was then used for assessing carbon stock at each site. The formula used for calculating the carbon stock in above ground tree biomass at each of the project site was:

$$CAB, j, p, i = V_j * D * BEF_j * CF$$

Where,

CAB, j, p, i = Carbon stock in above ground biomass of tree species j , in sample plot p of stratum i . Units: tC

V_j = Merchantable volume of tree species type j (calculated from volumetric equation of each species type.) Units: m^3

D = Basic wood density of species type j . Units: t d.m. m^{-3}

BEF = Biomass Expansion Factor for conversion of merchantable biomass to above ground tree biomass. (A default value of 3.4 is taken for all the tree species type) Units: Dimensionless

CF = Carbon fraction of dry matter for species type j . Units: t C (t d.m.)⁻¹

Similarly, the Below Ground Tree Biomass (BGTB) was calculated by multiplying the AGTB with a default value of 0.27, provided by Intergovernmental Panel on Climate Change (IPCC, 2006). It has been assumed that 27% of the total above ground tree biomass is equivalent to below ground tree biomass. The formula used for calculating the carbon content in below ground tree biomass at each of the project sites was:

$$CBB, j, p, i = CAB, j, p, i * R_j$$

Where;

CBB, j, p, i = Carbon stock in below ground biomass of tree species j , in sample plot p of stratum i . Units: tC

CAB, j, p, i = Carbon stock in above ground biomass of tree species j , in sample plot p of stratum i . Units: tC

R_j = Root shoot ratio appropriate for biomass stock for species j . (A default value of 0.27 is taken). Units: Dimensionless.

Carbon stock from AGTB and BGTB was calculated by multiplying with a default value of 0.5. Since, it is assumed that 50% of dry biomass is a carbon content. Further, total carbon is multiplied with 3.67, which provides the values of Carbon dioxide (CO₂). One tonne of CO₂

is equivalent to one Certified Emission Reduction (CER), which is considered as a trading unit in the international carbon market.

In the research study, remote sensing technology was applied by using LANDSAT imageries that were available freely on Internet. Two LANDSAT data sets - 2002 as a baseline year and 2011 as current year were employed for developing vegetation and biomass change detection through Normalized Difference Vegetation Index (NDVI). Landsat TM datasets of 2002 as the base line year and 2011 as a current year were used to estimate the past and current status of forest biomass and land use distribution in the three sites. For estimating the carbon stock through RS/ GIS technique, the entire project area was divided into the grids of 1 ha each in a Landsat TM datasets with a resolution of 30 m x 30 m. Each grid cell comprised around 11 pixels and then Normalized Difference Vegetation Index (NDVI) value of each pixel was calculated with the help of GIS/ RS software. Average NDVI value was calculated from each grid. The NDVI is often used to stratify vegetation and non-vegetation areas and is calculated using following formula -

$$\text{Normalized Difference Vegetation Index (NDVI)} = \frac{(IR-R)}{(IR+R)}$$

Further, linear fit equation was developed through correlating the biomass values obtained from the field survey with the NDVI values of same coordinates (pixel) in 2011 satellite imageries for the sampled plots. Using the linear fit regression equation, biomass for all three study clusters as depicted in figure 1 was calculated for 2011. Similarly, with the help of this regression equation, biomass values of the same site for 2002 were estimated. The difference in the biomass values from 2002 and 2011 was calculated. The present interpretation scale of 1:50,000 along with improved spatial resolution have made it possible to capture forest cover patches up to 1 hectare area. The detail of the regression for the site is provided below.

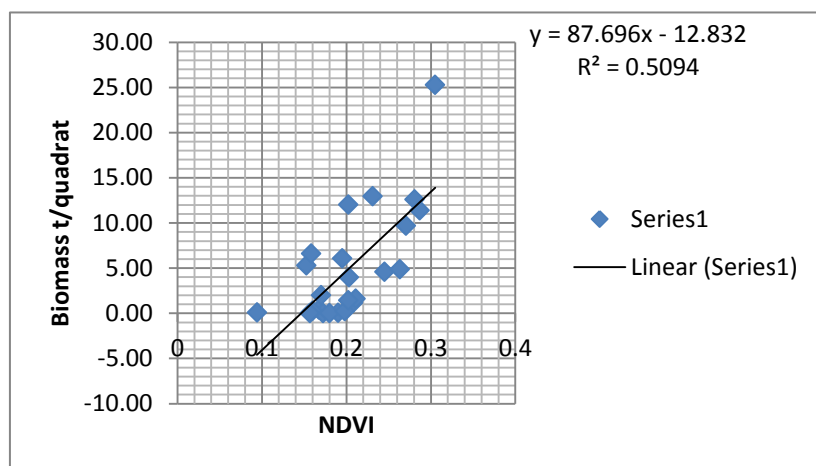


Figure 3 Correlation of Biomass and NDVI values for the sampled plots

Thus, RS/ GIS based methodology helped in estimating carbon stock of the benchmark year as well as in estimating current stock. The output generated through this tool helped us in understanding the impact of on-going management practices. Annual increment data of dominant species from secondary sources such as working plan documents were used to refine the estimate. The loss of above ground biomass due to deforestation is 112.28 T per

hectare as mentioned in following table. The primary data was collected and validated with the help of GIS technology.

Table 1 Details of biomass in surveyed area of Sadak Arjuni Range, Gondia Forest Division

| Details of biomass based on survey | |
|--|---------|
| Total above ground forest biomass in 2002 for the surveyed area (tonnes) | 2358.19 |
| Total above ground forest biomass in 2011 for the surveyed area (tonnes) | 346.97 |
| Total loss of biomass between 2002 and 2011 (ton) | 2011.22 |
| Per hectare loss of biomass between 2002 and 2011 (ton) | 112.28 |

The loss of above ground biomass is 112.28 tonnes per hectare and with the use of default value of IPCC guidelines (0.27 of AGB), below ground biomass is estimated which comes to 30.31 tonnes. The total loss of biomass due to deforestation thus is 142.59 tonnes per hectare.

Forest Right Act

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, popularly known as the Forests Rights Act (FRA), was enacted in 2008 through the Ministry of Tribal Affairs to undo the 'historic injustice done to forest-dwelling communities'. Since ages, these communities have occupied and cultivated forest land for forest produce, but had no tenurial security. This Act recognizes and vests individual forest-dwellers with forest rights to live and cultivate forest land that was occupied before December 13, 2005.

The Act was notified for operation with effect from December 31, 2007. The Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Rules, 2008 for implementing the provisions of the Act were notified on January 1, 2008. As per the provisions of the Act and the Rules framed there under, the onus of implementation of the Act lies at the level of the State/ UT Governments. To further strengthen the Forest Right Rules, 2008, the Ministry has also notified The Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Amendment Rules, 2012 on September 6, 2012. The purpose for the implementation of FRA is to recognize the occupation and habitation rights of forest dwelling tribes and other traditional forest dwellers, and also conserve the biological resource. A comprehensive guideline has also been issued by the Ministry of Tribal Affairs to the State/ UT Governments on July 12, 2012 for better implementation of the Act and to ensure that the intended benefits of this welfare legislation flow to the eligible forest dwellers.

Status of Implementation of FRA in Maharashtra

As per the progress report of Ministry of Tribal Affairs till 31st May 2014, in India in all 37,64,315 claims for individual and community rights on forest have been filed at national level out of which 30,57,126 claims have been disposed off. In all a total of 14,36,290 titles have been distributed to the right holders containing 22.38 lac hectare forest lands.

As of July 2014, in Maharashtra 349271 claims (343729 individual and 5542 community) have been filed. The total number of titles distributed is 108112 consisting of 305561.9 ha of forest land in 22 districts in the state (Monthly Progress Report, July 2014, Commissionerate of Tribal Development).

Analysis

The analysis is based on the scrutiny of 66300 FRA rights on 107897.9 ha of land spread over 19 districts in the state surveyed in 2005-06, 20007-08 and 2011-12 by the Logicstacks Solution, Pune. Maharashtra Forest Department is already using GIS-Remote Sensing technology to check the recognition of forest rights under FRA, 2006.

The analysis of the two objectives based on the case study from Gondia Forest Division is mentioned below.

Objective 1: To assess the impact of FRA rights recognized against the provision of FRA on GHG emission and loss of carbon sequestration opportunity

A total of 1748.45 hectare forest area recognized as individual forest right was under tree cover in 2005 according to satellite imagery analysis of Logicstacks, Pune. The biomass assessed through pilot study for such areas is 142.59 tonnes per hectare keeping two pool of carbon (above ground and below ground) into consideration. The total biomass for 1748.45 hectare have been converted into GHG emissions equivalent to 457486.6 tonnes. A total of 433.38 hectare forest land recognized under FRA was under tree cover in 2012. Assuming that it would also be deforested, and hence would contribute 113395 tonnes of GHG emission. So 570881.6 tonnes of GHG emission emitted in the atmosphere due to deforestation from the recognition of rights under FRA, 2006. A total of 14668.96 hectare forest land has lost the opportunity of carbon sequestration. The average mean annual increment for Indian forests is 0.5 cubic meter per hectare per annum. The loss of opportunity for annual carbon sequestration is 9017 tonnes of carbon di oxide due to wrong recognition of individual rights under FRA in Maharashtra. Since, analysis is only for the rights recognized till 2011-12, the quantum of GHG emission and loss of carbon sequestration opportunity could be more if rights recognized till 31st July, 2014 are studied.

TERI has conducted a study on the assessment of vulnerability due to the climate change for the state of Maharashtra. The study report indicates that Nandurbar, Jalgaon, Gondia and Gadchiroli districts are highly vulnerable to the climate change. The vulnerability due to the climate change becomes more critical in these districts due to the impacts of wrong recognition of forest rights against the provisions of FRA, 2006.

Objective 2: Assessing impact of land use change in increasing the vulnerability of the ecosystems and the people

Maharashtra Government implemented FRA,2006 for individual and community Forest rights. A total of 108112 (105506 individual and 2606 community) rights have been recognized which contains 305561.9 hectare forest land. It has been observed that 14668.96 hectare has been recognized against the provision of FRA, 2006 including 1748.45 hectare forest land with tree cover which has been deforested and recognized as individual rights. It caused the loss of many ecosystem services such as carbon sequestration, soil and water conservation and non-timber forest produce. The report of Logicstacks solution suggests the decrease in water bodies by 50% and increase of barren lands by 50% in the surveyed area in

Gondia Forest Division between 2002 and 2011. This is indicative of increased vulnerability of forests and the forest dependent communities due to land use change due to wrong recognition of rights under FRA, 2006.

Results

1. Rights recognized on 1748.45 hectare forest land was under tree cover in 2005 and before which was deforested and emitted 457486 T of CO₂ in the atmosphere adversely impacted local and global climate.
2. Rights recognized on 433.38 hectare forest land was with tree cover in 2012 which could be deforested beyond 2012 and may contribute 113395 tonnes of CO₂ in the atmosphere adversely impacted local and global climate.
3. Loss of opportunity of future carbon sequestration in 14668.96 hectare area at the rate of 9017 T of CO₂ per year which further adversely impacted local and global climate.
4. The Forest dependent community became vulnerable to the adverse impact of GHG emission for soil and water conservation, ecosystem services and access of MFPs due to wrong recognition of rights under FRA especially in the districts such as Nandurbar, Jalgaon, Gondiya and Gadchiroli.
5. The evaluation is on the basis of analysis done for the rights recognized till 2011-12. The adverse impact could be more if rights recognized till 31.07.2014 could be analysed.
6. State Forest Report 2013 indicates loss of 37 sq. km forest cover in Maharashtra and net loss is 14 sq.km. It is largely due to encroachment and recognition of forest rights violating the provisions of FRA, 2006.

Recommendations

1. The Maharashtra state Government should write to the Ministry of Tribal Affairs, Government of India for revisiting the process of the recognition of forest rights on 14668 hectare area which has been recognized against the provisions of FRA, 2006.
2. The mitigation activities should be implemented to combat the GHG emission due to against the provisions of FRA, 2006.

Limitations

1. The primary data for the loss of biomass due to deforestation has been taken in one range of Gondia Forest Division which has the statistical limitation for extrapolating to whole of Maharashtra. Hence, the results remain indicative but can be refined with a state level project with robust sampling design spread all over the FRA implemented districts in the State.
2. The analysis has been done for the rights recognized till 2011-12.

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