

## Executive Summary

### i Background

The forest resources have an important bearing on the environmental/ecological security and well being of the country and its people. The importance of this natural resource was recognized by our policy makers who placed great emphasis on the conservation and development of this resource as also set a target of bringing one third of the country's land mass under forests and tree cover. Later day legislations like the Forest Conservation Act, 1980 which serves to check the diversion of forest land for non-forestry purposes, has become the cornerstone for conservation of the forests. The country has a long history of scientific management of its forest resources. However, a periodic objective assessment of this natural resource is required to know the quantitative and qualitative changes occurring on the ground in view of the increasing population pressures and developmental demands.

India is one of the few countries of the world to have a robust and scientific system of periodic forest cover assessment. Forest Survey of India (FSI), an organization under the Ministry of Environment and Forests, has been carrying out forest and tree cover mapping of the entire country. The forest cover mapping was started over two decades back in the year 1987 and subsequent to this, eleven cycles of forest cover mapping have been carried out on a biennial basis. The present report pertains to the twelfth cycle of forest cover mapping. Since the year 2001, the assessment of tree cover which includes smaller patches and scattered trees, was commenced and is being carried out ever since. The forest and tree cover together give a holistic picture of the forest/tree resources of the country.

The forest and tree cover mapping is carried out using remote sensing technology which captures the unique spectral reflectance of the electro-magnetic radiation. This is then used for the characterization of vegetation and other land covers. This technology also helps in providing a synoptic coverage of the country's forests and their status which can be monitored on a periodic basis. Over the years, there has been continuous refinement in the methodology that has kept pace with the technological advancements. The current report is based on IRS P6 LISS III data which has a resolution of 23.5 m. The forest cover mapping has been carried out at a scale of 1:50000. GIS technology has also been used in the analysis of the data.

### ii Salient findings

The key results of India SFR 2011, based on interpretation of satellite data (October 2008-March 2009), Forest/TOF Inventory, and socio-economic survey carried out by FSI are as follows:

### Forest/Tree Resources

- Forest and Tree Cover of the country as per this assessment is **78.29** m ha. which is **23.81%** of the geographical area. This includes **2.76%** of tree cover.
- The forest and tree cover would work out to **25.22%** after exclusion of **183135** km<sup>2</sup> area above the altitude 4,000m from the total geographical area of the country as these areas do not support tree growth.
- There is a decrease of 367 km<sup>2</sup> in the forest cover in comparison to 2009 assessment. However, after accounting for interpretational changes in the assessment of 2009, there is a net increase of 1128 sq. km in the forest cover as compared to 2009 assessment.
- In hill and tribal districts of the country, a decrease in forest cover of **548** km<sup>2</sup> and **679** km<sup>2</sup> respectively has been reported as compared to the previous assessment.
- The north eastern states of India account for one-fourth of the country's forest cover. There is a net decline of **549** km<sup>2</sup> in forest cover as compared to the previous assessment.
- Mangrove cover has increased by **23.34** km<sup>2</sup> during the same period.
- The total growing stock of India's forest and trees outside forests is estimated as **6047.15 m cum** which comprises **4498.73 m cum** inside the forests and **1548.42 m cum** outside the forests.
- The total bamboo bearing area in the country is estimated to be **13.96** m ha.
- The total carbon stock in the country's forests is estimated to be **6663** m tonnes.

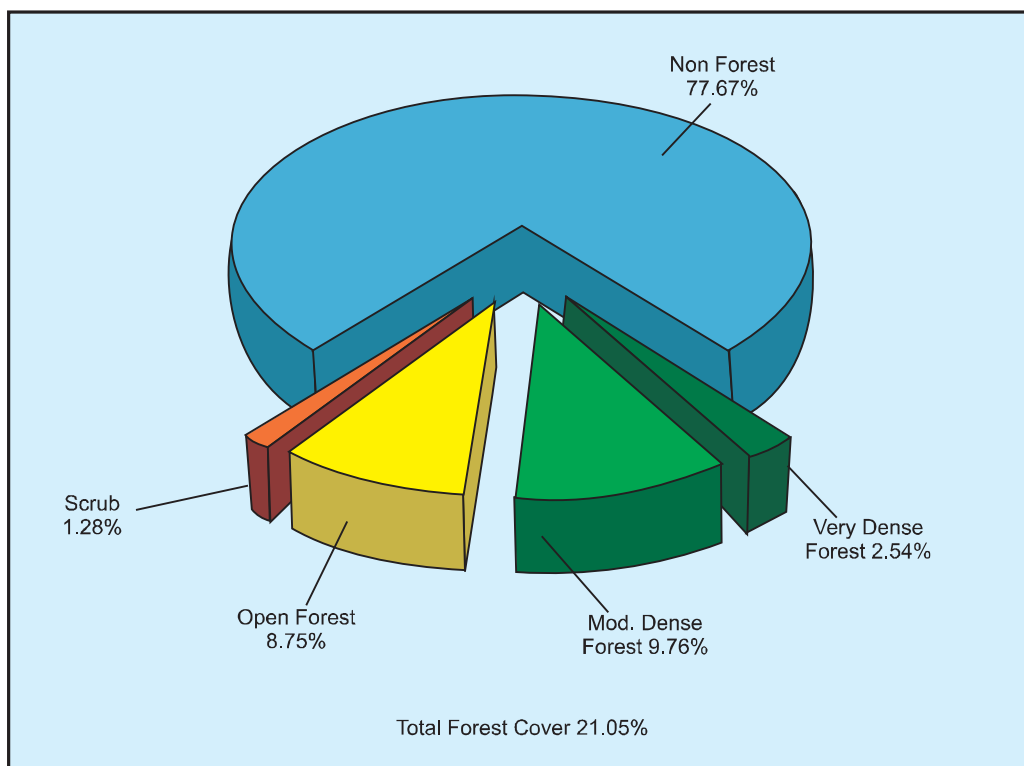
### Production & Consumption

- The annual estimated production of wood from forests is estimated to be **3.175** m cum.
- The annual potential production of wood from TOF is estimated to be **42.77** m cum.
- The annual estimated production of fuelwood from forest is estimated to be **1.23** m tonnes.
- The potential production of fuelwood from TOF is estimated to be **19.25** m tonnes.
- Total annual consumption of wood in household construction and furniture, industrial construction and furniture and agricultural implements is estimated to be **48.00** m cum.
- The total fodder consuming livestock dependent partially or completely on forest is **38.49%**. The adult cattle unit (ACU) completely dependent on forest is **22.63%**.
- The total annual consumption of fuelwood for the country is estimated to be **216.42** m tonnes out of which **58.75** m tonnes comes from forests.
- Of the total population using fuelwood, 23% population is obtaining fuelwood from forests

iii Forest Cover in Different Density Classes

Table 1: Forest and Tree cover of India in 2011		
Class	Area (km <sup>2</sup> )	% of Geographical Area
<b>Forest Cover</b>		
a) Very Dense Forest	83,471	2.54
b) Moderately Dense Forest	320,736	9.76
c) Open Forest	287,820	8.75
<b>Total Forest Cover*</b>	<b>692,027</b>	<b>21.05</b>
<b>Tree Cover</b>		
	<b>90,844</b>	<b>2.76</b>
<b>Total Forest and Tree Cover</b>	<b>7,82,871</b>	<b>23.81</b>
Scrub	42,177	1.28
Non-forest	2,553,059	77.67
<b>Total Geographical Area</b>	<b>3,287,263</b>	<b>100.00</b>

(\*Includes 4662 km<sup>2</sup> area under mangroves)



## iv New Features of ISFR 2011

The present SFR has been enriched with information pertaining to Bamboo resources, Carbon stock in India's forests, Production and Consumption of Wood, Fuel wood and Fodder. These are based on special studies carried out by Forest Survey of India in the recent past. Separate chapters incorporated in this ISFR, provide comprehensive information on aforesaid issues which are crucial from planning perspective. In addition, information on coral reefs and forest fire monitoring being carried out by FSI, has also been provided. The new features/additions are briefly described below:

### iv.a Bamboo Resources

Bamboo is an important non-wood forest resource found in forest as well as non-forest areas in the country. In India, 125 indigenous and 11 exotic species of bamboo belonging to 23 genera have been reported. As per the FAO report on world forest resources, India is the second richest country of the world after China in terms of bamboo genetic resources.

The total bamboo bearing area of the country is estimated to be 13.96 million hectare. **Arunachal Pradesh** has maximum bamboo bearing area (1.6 m ha) followed by **Madhya Pradesh** (1.3 m ha), **Maharashtra** (1.1 m ha) and Orissa (1.05 m ha). The total number of culms at national level has been estimated to be **23297 million**. The corresponding estimated green weight of bamboo culms at national level is 169 million tonnes of which green sound bamboos contribute 73% and dry sound bamboos contribute remaining 27%. In TOF areas, total number of culms estimated at national level is 2127 million with an equivalent weight of 10.20 m tonnes. Physiographic zone of Eastern Plain contributes maximum no. of culm (943 million), followed by North East Ranges 289 million culms and East Deccan physiographic zone contributes 212 million culms.

### iv.b Carbon Stock in India's Forests

FSI has been one of the major contributors on forest biomass estimation and carbon stock change. In India's Initial National Communication (INC) submitted to the UNFCCC in 2004, FSI estimated forest carbon of only woody growing stock. In 2010, FSI has completed estimation of forest carbon stock and change between two time periods viz. 1994 and 2004 as part of Second National Communication (SNC) to the UNFCCC. Result of the study are compared in Table 2.

**Table 2: Change in carbon stock in forest land between 1994 and 2004. (million tonnes)**

Component	Carbon Stock in forest land in 1994	Carbon stock in forest land in 2004	Net change in Carbon stock
Above ground biomass	1784	2101	317
Below ground biomass	563	663	100
Dead wood	19	25	6
Litter	104	121	17
Soil	3601	3753	152
<b>Total</b>	<b>6071</b>	<b>6663</b>	<b>592</b>

### iv.c Production and Consumption of Wood

As per the recommendations of the Technical Advisory Committee, FSI carried out a detailed study on Production and Consumption of Wood at the national level. The data generated from this study would fill the information gap on these parameters. The same can be made good use of by the planners/policy maker for critical policy interventions at national/sub-national levels. The summarized information has already been given under salient findings.

### iv.d Forest Fire Monitoring

Forest Survey of India (FSI) started the monitoring of forest fires since the year 2004 using data from web fire mapper. The coordinates of active fire locations from this site are projected on the forest cover map of India to select active forest fire locations lying within the forest cover. The information is then disseminated to the State Forest Departments. From 2009 onwards the information is being sent through SMS to the registered users. Presently, there is a time lag of 12 to 24 hrs in the reporting of these fires owing to late availability of this data. Efforts are on to reduce this time lag so as to provide information on near real-time basis. A total of 13,898 fire incidences were reported by FSI to different states in the year 2010-11.

### iv.e Mapping of Coral Reefs Using Remote Sensing Data

Coral reefs are underwater structures made from calcium carbonate secreted by corals. Most coral reefs are built from stony corals, which in turn consist of polyps that cluster in groups. Reefs grow best in warm, shallow, clear, sunny and agitated waters. Often called 'rainforests of the sea', coral reefs form some of the most diverse ecosystems on earth. Coral reefs deliver ecosystem services to tourism, fisheries and shoreline protection. However, coral reefs are highly fragile ecosystems. They are under threat from climate change, ocean acidification, blast fishing, cyanide fishing for aquarium fish, overuse of reef resources and harmful land-use practices.

Coral reef mapping in the four regions of the country was carried out by FSI in a project mode using LISS III data on a 1:50,000 scale. Digital maps of coral reefs along Andaman & Nicobar Islands on a higher scale have been prepared by FSI using Quick Bird satellite data.

## v. National Forest Inventory

The information on forest growing stock has traditionally been considered as a key indicator of forest health and productivity. Periodic estimation of forest growing stock is essential to develop national policies and strategies for a sustainable use of the forest resources. In the current climate change scenario, the growing stock assessment is also used for estimation of carbon stored in the forests. For the purpose of this report, estimation of growing stock has been based on the forest cover, forest type and sample plots laid out during field inventory from 2002-2008.

The total growing stock in the country both in forests and TOF is estimated to be 6047.15 m cum of which forests contribute to 4498.73 m cum and TOF accounts for 1548.42 m cum. Among the

States/UTs, the maximum growing stock in forests is reported from **Arunachal Pradesh** (493 m cum) followed by **Uttarakhand** (460 m cum) and **Chhattisgarh** (334 m cum).

**Table 3: Growing Stock of Forests and Trees Outside Forests of India**

Category	Growing Stock ( m cum)
Forests	4498.73
TOF	1548.42
Total	6047.15

