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Food and Agriculture Organization of the United Nations

**GLOBAL FOREST RESOURCES
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The Forest Resources Assessment Programme

Sustainably managed forests have multiple environmental and socio-economic functions important at the global, national and local scales, and play a vital part in sustainable development. Reliable and up-to-date information on the state of forest resources - not only on area and area change, but also on such variables as growing stock, wood and non-wood products, carbon, protected areas, use of forests for recreation and other services, biological diversity and forests' contribution to national economies - is crucial to support decision-making for policies and programmes in forestry and sustainable development at all levels.

FAO, at the request of its member countries, regularly monitors the world's forests and their management and uses through the Forest Resources Assessment Programme. This country report forms part of the Global Forest Resources Assessment 2010 (FRA 2010).

The reporting framework for FRA 2010 is based on the thematic elements of sustainable forest management acknowledged in intergovernmental forest-related fora and includes variables related to the extent, condition, uses and values of forest resources, as well as the policy, legal and institutional framework related to forests. More information on the FRA 2010 process and the results - including all the country reports - is available on the FRA Web site (www.fao.org/forestry/fra).

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The Global Forest Resources Assessment Country Report Series is designed to document and make available the information forming the basis for the FRA reports. The Country Reports have been compiled by officially nominated country correspondents in collaboration with FAO staff. Prior to finalisation, these reports were subject to validation by forestry authorities in the respective countries.

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About the Report

Forest Survey of India (FSI) is a national organisation under the Ministry of Environment and Forests and mandated to assess the India's forest resource periodically. Forest cover and its characteristics are assessed every two year using remote sensing technology with wall to wall approach. Growing stock and its distribution into diameter class and species, biomass stock and carbon stock are estimated through National Forest Inventory (NFI) using sample based approach. During NFI the field parties also observe the incidence of forest fire ocularly within and around sample plot in two ha area. Detection of forest fire through remote sensing technology, web based rapid response system, has also started sine November 2004. The studies of FSI are published every two year coinciding with forest cover assessment in State of Forest Report. In last two decades 10 such reports have been published which forms the most reliable basis of information about India's forest resource. The first nine (9) tables presented in this report are mainly based on the FSI's studies.

The Indian Council of Forestry Research and Education (ICFRE), a national organisation mandated for forestry research and education has been given the responsibility by the Ministry of Environment and Forests to produce reports on forestry statistics of India periodically. Such reports are compiled by collecting data from the state forest departments. Forestry Statistics India of ICFRE has formed the second important source of information for this report and data in the tables 11, 12, 13 and 17 has largely come from such report.

In addition, the state forest departments who own and manages the forests of the country were also contacted to provide data on the employment, human other disturbances to forests etc of their states. The Ministry of Environment and Forests and Indian Institute of Forest Management (IIFM) were also contacted to provide information on policy, area under sustainable forest management (SFM) and other issues.

The quality of data on biomass and carbon stock is likely to improve in the final report with the conclusion of the new study undertaken by FSI. The information on fuelwood and human resource and employment is being further improved.

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1 Table T1 – Extent of Forest and Other wooded land

1.1 FRA 2010 Categories and definitions

Category	Definition
Forest	Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds <i>in situ</i> . It does not include land that is predominantly under agricultural or urban land use.
Other wooded land	Land not classified as “Forest”, spanning more than 0.5 hectares; with trees higher than 5 meters and a canopy cover of 5-10 percent, or trees able to reach these thresholds <i>in situ</i> ; or with a combined cover of shrubs, bushes and trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use.
Other land	All land that is not classified as “Forest” or “Other wooded land”.
Other land with tree cover (Subordinated to “Other land”)	Land classified as “Other land”, spanning more than 0.5 hectares with a canopy cover of more than 10 percent of trees able to reach a height of 5 meters at maturity.
Inland water bodies	Inland water bodies generally include major rivers, lakes and water reservoirs.

1.2 National data

1.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s) (Data Period)	Additional comments
State of Forest Report 1997. Forest Survey of India, MOEF, GOI, India.	H	Extent	1990, 1994	
State of Forest Report 1999. Forest Survey of India, MOEF, GOI, India.	H	Extent	1997	
State of Forest Report, 2001. Forest Survey of India, MOEF, GOI, India.	H	Extent	2000	
State of Forest Report, 2003. Forest Survey of India, MOEF, GOI, India.	H	Extent	Oct 2002-Jan 2003	
State of Forest Report, 2005. Forest Survey of India, MOEF, GOI, India.	H	Extent	Oct 2004-Jan 2005	

(Note MOEF= Ministry of Environment and Forests and GOI= Government of India)

1.2.2 Classification and definitions

The following table (SFR, 2005) provides the classification and sub-classification and their definitions in use at Forest Survey of India, Ministry of Environment and Forests, India. The “Forest Cover” includes very dense forests, moderately dense forests and open forests including mangroves cover.

National class	Definition
Forest Cover	All lands, more than one hectare in area, with a tree canopy density of more than 10 percent. (Such lands may not be statutorily notified as forest area).
Very Dense Forest	All lands, with a forest cover with canopy density of 70 percent and above.
Moderately Dense Forest	All lands, with a forest cover with canopy density of 40-70 percent
Open Forest	All lands, with forest cover with canopy density of 10 to 40 percent.
Mangrove Cover	Mangrove forest is salt tolerant forest ecosystem found mainly in tropical and sub-tropical coastal and/or inter-tidal regions. Mangrove cover is the area covered under mangrove vegetation as interpreted digitally from remote sensing data. It is a part of forest cover and also classified into three classes viz. very dense, moderately dense and open.
Non Forest Land	Lands without any forest cover.
Recorded Forest Area	Geographic areas recorded as forests in Government records.
Scrub	All lands, generally in and around forest areas, having bushes and or poor tree growth chiefly small or stunted trees with canopy density less than 10 percent.
Tree Cover	It comprises tree patches (blocks and linear) outside the recorded forest area exclusive of forest cover and less than the minimum mapable area of 1 ha. The areas of scattered trees are computed notionally.
Trees Outside Forests	Trees growing outside Recorded Forest Areas

1.2.3 Original data

The following table presents the national data on forest cover in India compiled from biennial “State of Forest Report (SFR)” of FSI as updated and revised in the last report (SFR 2005).

Category	Sub-Category	Extent in “000” ha						
		1990	1992	1994	1997	2000	2002	2004
Forest Cover	Very dense						5 452	6 457
	Moderately Dense	38 514	38 532	36 726	37 736	39 517	33 406	33 265
	Open	24 999	24 903	26 131	25 506	25 873	28 924	28 987
	Mangrove	426	453	483	487	448*	445*	445*
	Sub-Total	63 939	63 888	63 340	63 729	65 390	67 782	67 709
Non Forest	Tree Cover	-	-	-	-	8 147	9 990	9 166
	Scrub	5 894	6 052	5 270	5 190	4 732	4 027	3 848
	Other NF ¹	258 893	258 786	260 116	259 807	250 457	246 927	248 003
	Sub-Total	264 787	264 838	265 386	264 997	263 336	260 944	261 017
Country Total Area	TOTAL	328 726	328 726	328 726	328 726	328 726	328 726	328 726

(Note: 1. NF= Non Forest. It includes 31407 (000 ha) of Inland water bodies .

* the areas of mangroves though separately shown are already included in very dense ,moderately dense and open forest categories. In the sub-total of forest cover of 2000, 2002 and 2004, the areas of mangroves have to be excluded.

Until 1997, the mangrove was a separate category of forest cover and it was not possible to classify it into dense and open categories. Since 2000, the mangrove cover was classified into three categories namely very dense, moderately dense and open and hence the same was merged with forest cover. The figure of mangrove cover shown for 2000, 2002 and 2004 has already been included under, VDF, MDF and OF. Hence sub-total and total will not match for these years. Since mangrove is an eco-system and hence separately shown.

The “total area” of the country reported in SFRs matches completely with the total area figure in FAOSTAT and at the UN Statistical Division. The difference between the “Land Area” and the “Total Area” for a year in the FAOSTAT leads to the following figures of the area of “Inland water bodies”.

Categories	Extent in “000”ha.
Total Country Area	328 726
Land Area	297 319
Inland Water bodies	31 407

1.3 Analysis and processing of national data

1.3.1 Calibration

The land area figures for the whole country match with the land area figure with UN Statistical Division at New York USA. therefore, there is no need to calibrate the national data.

1.3.2 Estimation and forecasting

The information about forest cover as given in SFR 2005 pertains to data period Oct, 2004 to Jan, 2005. The same data has been assumed for 2005 in table T1. For projecting estimates of forest and other wooded land for 2010, annual growth rate during 1990 to 2000 has been taken as there has been change in the methodology thereafter. For tree cover annual growth rate during 2000 to 2005 has been taken to forecast tree cover for 2010.

National Category	Forecasted for 2010 Extent in “000”ha
Forest Cover	68 434
Tree Cover	10 185
Scrub	3 267

For estimation of tree cover for 1990, the estimate of tree cover for 2000 has been extrapolated backward by average annual change during 2005 & 2000.

1.3.3 Reclassification into FRA 2010 categories

The national definitions have been used for re-classification into the FRA categories. To report the area of “Tree Cover” outside the forests, the area of tree cover falling between 0.5 ha to 1.0 ha as obtained from NFI has been estimated to be 1,335,000 ha area, which constitutes about 15% of the total and has been reclassified as “Other land with tree cover” for FRA purpose.

Table: Reclassification (Percentage allocation) into FRA classes (excluding Inland water)

National Categories	National Classes	Percentage of a National class belonging to a FRA Class or category			
		Forests	Other Wooded Land	Other Land with Tree Cover	Other Land
Forest Cover		100			
Non Forest					
	(i) Scrub		100		
	(ii) Tree Cover			15	85
	(iii) Other Non Forest ¹				100

(Note:1.. Area of Other Non-Forest includes area of “Inland water bodies”)

FSI does not separately provide the area of “Inland Water bodies” but includes it in the Non-Forest Area. The figures of the total area of India reported by FSI and the UN Statistical Division and FAOSTAT match, therefore, the area of “Inland Water bodies” (31.407 million ha.) as reported by UN Statistical division is being used as national data as well as FRA data.

The area figure for Inland water bodies in the UN Statistical database is the same for 1990 and 2000, and the same is being assumed for 2005 and 2010.

1.4 Data for Table T1

FRA 2010 categories	Area (1000 hectares)			
	1990	2000	2005	2010
Forest	63 939	65 390	67 709	68 434
Other wooded land	5 894	4 732	3 848	3 267
Other land	227 486	227 197	225 762	225 618
...of which with tree cover	916	1 222	1 375	1 528
Inland water bodies	31 407	31 407	31 407	31 407
Total	328 726	328 726	328 726	328 726

1.5 Comments to Table T1

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Forest	The national definition of forest cover has two deviations from FRA definition namely, the minimum area of forest cover is 1 ha instead of 0.5 and the forest cover is irrespective of the land use.	Since 2001 assessment there has been change in the methodology. The interpretation for the entire country became digital from visual and scale of mapping became 1:50,000 from 1:250,000 with minimum mapping area 1 ha. The areas less than 25 ha and up to 1 ha not mapped earlier were also included.
Other wooded land		
Other land		
Other land with tree cover	The area of tree cover falling between 0.5 ha to 1.0 ha as obtained from NFI.	
Inland water bodies		

Other general comments to the table

The Forest Survey of India (FSI) is a Government of India organization under the Ministry of Environment & Forests. Since 1987, it has been regularly assessing the extent of forest at an interval of 2 years and publishing this information in the “State of Forest Report” (SFR). The SFRs form the basis of information for this reporting table.

The first SFR was published as SFR 1987 using 1981-83 remotely sensed images. The SFR are generally known by their assessment year and contains information on forest resources of the country. Following table presents the assessment year, data periods of the satellite imageries, sensors, their spatial resolution and scale of interpretation.

Assessment Year	Data Period	Sensor	Resolution	Scale of Interpretation	Method of interpretation
1987	1981-83	Landsat – MSS	80 m	1:1 million	Visual
1989	1985-87	Landsat - MSS	30 m	1:250000	Visual
1991	1987-89	Landsat - MSS	30 m	1:250000	Visual
1993	1989-91	Landsat - MSS	30 m	1:250000	Visual
1995	1991-93	IRS-1B LISS II	36.25 m	1:250000	Visual/digital
1997	1993-95	IRS-1B LISS II	36.25 m	1:250000	Visual/digital
1999	1996-98	IRS-1C/1D LISS III	23.5 m	1:250000	Visual/digital
2001	2000	IRS-1C/1D LISS III	23.5 m	1:50000	digital
2003	2002	IRS-1C/1D LISS III	23.5 m	1:50000	digital
2005	2004	IRS-P6 LISS III	23.5 m	1:50000	digital

2 Table T2 – Forest ownership and management rights

2.1 FRA 2010 Categories and definitions

Category	Definition
Public ownership	Forest owned by the State; or administrative units of the public administration; or by institutions or corporations owned by the public administration.
Private ownership	Forest owned by individuals, families, communities, private co-operatives, corporations and other business entities, private religious and educational institutions, pension or investment funds, NGOs, nature conservation associations and other private institutions.
Individuals (<i>sub-category of Private ownership</i>)	Forest owned by individuals and families.
Private business entities and institutions (<i>sub-category of Private ownership</i>)	Forest owned by private corporations, co-operatives, companies and other business entities, as well as private non-profit organizations such as NGOs, nature conservation associations, and private religious and educational institutions, etc.
Local communities (<i>sub-category of Private ownership</i>)	Forest owned by a group of individuals belonging to the same community residing within or in the vicinity of a forest area. The community members are co-owners that share exclusive rights and duties, and benefits contribute to the community development.
Indigenous / tribal communities (<i>sub-category of Private ownership</i>)	Forest owned by communities of indigenous or tribal people.
Other types of ownership	Other kind of ownership arrangements not covered by the categories above. Also includes areas where ownership is unclear or disputed.
Categories related to the holder of management rights of public forest resources	
Public Administration	The Public Administration (or institutions or corporations owned by the Public Administration) retains management rights and responsibilities within the limits specified by the legislation.
Individuals/households	Forest management rights and responsibilities are transferred from the Public Administration to individuals or households through long-term leases or management agreements.
Private institutions	Forest management rights and responsibilities are transferred from the Public Administration to corporations, other business entities, private co-operatives, private non-profit institutions and associations, etc., through long-term leases or management agreements.
Communities	Forest management rights and responsibilities are transferred from the Public Administration to local communities (including indigenous and tribal communities) through long-term leases or management agreements.
Other form of management rights	Forests for which the transfer of management rights does not belong to any of the categories mentioned above.

2.2 National data

2.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
State of Forest Report 1993. Forest Survey of India, MOEF, GOI, India.	H	Recorded forest area	1990	
State of Forest Report 1997. Forest Survey of India, MOEF, GOI, India.	H	Extent, Recorded forest area	1990	
State of Forest Report, 2005. Forest Survey of India, MOEF, GOI, India.	H	Extent, Recorded forest area, Management rights	2000, 2005	
National Forest Inventory Database of FSI	H	Ownership	2005	

2.2.2 Classification and definitions

The Forest Survey of India (FSI) is a Government of India organization under the Ministry of Environment & Forests. Since 1987, it has been regularly assessing the extent of forest at an interval of 2 years and publishing this information in the “State of Forest Report” (SFR).

The SFR also contains information on legal status of forests which has three categories (a) Reserved forests, (b) Protected forests and (c) Un-classed forests. The first two categories of forests are “owned by government”. The ownership of un-classed forests varies from state to state and includes forest owned by private individuals, communities and local bodies besides government.

National class	Definition
Reserved Forest	An area notified under the provisions of the Indian Forest Act or other State Forest Acts, having full degree of protection. Explanation: In reserved forests all activities are prohibited unless permitted. Their ownership belongs to government.
Protected Forests	An area notified under the provisions of the Indian Forest Act or other State Forest Acts, having limited degree of protection. Explanation: In protected forest all activities are permitted unless prohibited. Their ownership belongs to government.
Un-Classed Forests	An area recorded as forest in government land records but not notified as reserved or protected forest under Indian Forest Act or Other State Forest Acts. Explanation: Level of protection and Ownership status of such forests varies from state to state.

2.2.3 Original data

The figures of reserved, protected and un-classed forests has been taken from the published SFRs. These figures are provided by the provinces which are compiled at the Forest Survey of India. These areas may or may not consist of tree or forest cover but in the government

records they fall in the category of forests. The trees outside the boundaries of these forests are known as TOF.

2.3 Analysis and processing of national data

2.3.1 Calibration

Not required.

2.3.2 Estimation and forecasting

Forest Survey of India started national forest inventory in 2001 which has formed basis of estimating the area under ownership categories.

National Category (NFI)	2005 (in 000 ha.)	%
Public ownership	58 007	86
Private ownership	9 702	14
Total	67 709	100

On the basis of proportion of public and private ownership, area corresponding to year 2000 has been estimated. For the year 1990, the proportion of 2005 has been applied.

2.3.3 Reclassification into FRA 2010 categories

Since the FRA categories and national categories are same there is no need of reclassification.

2.4 Data for Table T2

Table 2a - Forest ownership

FRA 2010 Categories	Forest area (1000 hectares)		
	1990	2000	2005
Public ownership	54 777	56 020	58 007
Private ownership	9 162	9 370	9 702
...of which owned by individuals	n.a.	n.a.	n.a.
...of which owned by private business entities and institutions	n.a.	n.a.	n.a.
...of which owned by local communities	n.a.	n.a.	n.a.
...of which owned by indigenous / tribal communities	n.a.	n.a.	n.a.
Other types of ownership	0	0	0
TOTAL	63 939	65 390	67 709

Note: If other types of ownership are reported, please specify details in comment to the table.

Does ownership of trees coincide with ownership of the land on which they are situated?	<input type="checkbox"/>	Yes
	<input checked="" type="checkbox"/>	No
If No above, please describe below how the two differ:		
In some cases the ownership of land has been given but tree ownership is not given. There are situation where ownership of tree given to an individual but not that of land.		

Table 2b - Holder of management rights of public forests

FRA 2010 Categories	Forest area (1000 hectares)		
	1990	2000	2005
Public Administration	n.a.	45 771	36 453
Individuals	n.a.	0	0
Private corporations and institutions	n.a.	0	0
Communities	n.a.	10 249	21 554
Other	n.a.	0	0
TOTAL	n.a.	56 020	58 007

2.5 Comments to Table T2

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Public ownership		
Private ownership	There are some tribal communities mainly in north eastern regions which own forest. However, information on the extent of such areas are not reliably available.	
Other types of ownership		
Management rights	In 2000 and 2005, the areas under communities management are those which are managed under Joint Forest Management (JFM). The JFM was initiated in 1990. Hence estimates of 1990 are not available.	

3 Table T3 – Forest designation and management

3.1 FRA 2010 Categories and definitions

Term	Definition
Primary designated function	The primary function or management objective assigned to a management unit either by legal prescription, documented decision of the landowner/manager, or evidence provided by documented studies of forest management practices and customary use.
Protected areas	Areas especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.
Categories of primary designated functions	
Production	Forest area designated primarily for production of wood, fibre, bio-energy and/or non-wood forest products.
Protection of soil and water	Forest area designated primarily for protection of soil and water.
Conservation of biodiversity	Forest area designated primarily for conservation of biological diversity. Includes but is not limited to areas designated for biodiversity conservation within the protected areas.
Social services	Forest area designated primarily for social services.
Multiple use	Forest area designated primarily for more than one purpose and where none of these alone is considered as the predominant designated function.
Other	Forest areas designated primarily for a function other than production, protection, conservation, social services or multiple use.
No / unknown	No or unknown designation.
Special designation and management categories	
Area of permanent forest estate (PFE)	Forest area that is designated to be retained as forest and may not be converted to other land use.
Forest area within protected areas	Forest area within formally established protected areas independently of the purpose for which the protected areas were established.
Forest area under sustain-able forest management	To be defined and documented by the country.
Forest area with management plan	Forest area that has a long-term (ten years or more) documented management plan, aiming at defined management goals, which is periodically revised.

3.2 National data

3.2.1 Data sources

The National Forestry Action Plan of India (1999) classifies the forests of country into the following four functional categories. It does not classify “Other Wooded Lands”.

- Protection Forests (for biological stability)
- Production Forests (for meeting timber requirements)
- Social Forests (for meeting daily needs of the community)
- Protected Area Network (National Parks and Sanctuaries)

Information on areas on protected forests is mainly from the database maintained by the Wildlife Institute of India and Annual Reports of Ministry of Environment and Forests, Government of India. The details of these data sources are as follows:

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
State of Forest Report 1993. Forest Survey of India, MOEF, GOI, India.	H	Recorded forest area	1990	
State of Forest Report 1997. Forest Survey of India, MOEF, GOI, India.	H	Extent, Recorded forest area	1990	
State of Forest Report, 2005. Forest Survey of India, MOEF, GOI, India.	H	Extent, Recorded forest area, Management rights	2000, 2005	
Forestry Statistics, India 1995 Indian Council of Forestry Research and Education, Dehradun, Uttaranchal, India	M	Production	1990	
NFAP, 1999. National Forestry Action Plan, 1999. Ministry of Environment and Forests, Government of India, India	M	Designation	1993	
National Wildlife Database. Wild Life Institute of India, India. www.wii.gov.in/nwdc/paststatistics.htm	H	Protected Areas	1990 -2000	
State of Forest Report, 2005. Forest Survey of India, MOEF, GOI, India.	H	Extent, Recorded forest area, Management rights	Oct 2004-Jan 2005	

3.2.2 Classification and definitions

The NFAP (1999) classifies and defines forests based on designation.

National class	Definition
Protection forests	Forest managed for biological stabilities and defined as “An area wholly or partly covered with woody growth, managed primarily for its beneficial effects on water, climate or soil rather than for forest products or services, and involving fragile lands, critical soil, catchment areas, steep slopes, and land at high altitudes. Controlled sustainable extraction of non-wood forest products are often allowed in protection forests”
Production forests	Forests managed for meeting timber requirements of the country and defined as “Forest designated for the sustained production of timber and other forest products, often with protection and/or nature conservation as recognised secondary objectives, chosen because of their potential to provide a yield of high quality timber(or other products) in perpetuity. This category may also include degraded areas appropriate for reforestation. In general usage that term covers natural forests, forest plantations, woodlots, agroforestry plots, homestead forest etc.
Social Forests	Forests managed for meeting daily needs of local communities.
Protected Area	Forests managed as Protected Area (National Parks and Sanctuaries etc.) also termed as “Conservation area” in NFAP and defined as “Land such as national parks, reserves, protected areas, or other categories gazetted under the appropriate legislation.”

3.2.3 Original data

In India the national forest statistics is not maintained by the designation of forests. However, NFAP, 1999 has provided following broad information on designation of forests for 1993. The NFAP does not provide similar information for scrub areas (other wooded lands) etc.

National data for Table 3a.

National Classification of Forests	Area in million hectares		
	1993	2000	2004
Protection forests (for biological stabilities)	10		
Production forests (for timber Requirements of the country)	15		
Social Forests (for meeting daily needs of local communities)	25		
Protected Area (National Parks and Sanctuaries etc.)	14	15.4	15.6
Total Forest	64		
Scrub (Other Wooded Lands)			

For protected area, a better estimate is available from the database of other resources indicated below :

Item	Area of PA in 000 ha		
	1990*	2000**	2005***
Total Area of Protected Area Network	12 740	13 029	19 551

* Forest Statistics India, 1995,** Database of WII,*** SFR 2005.

National data for Table 3b.

National Category	Forest area (000 ha)		
	1990	2000	2005
Reserved Forest	41 492	42 331	41 903
Protected Forest	23 308	21 725	21 661
Un-classed Forest	12 208	12 788	13 399

3.3 Analysis and processing of national data

3.3.1 Calibration

No calibration is required.

3.3.2 Estimation and forecasting

For different categories under primary designated function, the estimates for 1990, 2000 and 2005 were obtained by distributing total forest area in the same proportion as provided in the NFAP except 'conservation of biodiversity'. For conversation of biodiversity category, the actual figures of protected area of 1990, 2000 and 2005, have been taken and increase/decrease in protected area was compensated by decrease/increase in multiple-use category. For projecting estimates for 2010 under these categories the total forest area projected for 2010 was distributed in the proportion of estimates of 2005.

FRA 2010 Categories	Forest area (1000 hectares)		
	1990	2000	2005
Production	16 260	16 629	17 219
Protection of soil and water	10 000	10 227	10 590
Conservation of biodiversity	12 740	13 029	19 551
Social services	0	0	0
Multiple use	24 939	25 505	20 349
Other (please specify in comments below the table)	0	0	0
No / unknown	0	0	0
TOTAL	63 939	65 390	67 709

The area of permanent forest estate has been obtained by taking a proportion of forested area within recorded forest area as obtained from NFI to the area under reserved and protected forest. The same proportion has been applied to other years as well. The forest area with management plan for 2000 was taken from Forestry Statistics India, 2003. For other years, proportion of area with management plan to recorded forest area was applied. The area of permanent forest estate and with management plan for 2010 was projected on the basis of average annual growth rate during 2000-2005.

3.3.3 Reclassification into FRA 2010 categories

National Class	Percentage of a National Class to a FRA Classes of Primary Function					
	Production	Protection	Conservation of Biodiversity	Social Service	Multiple Function	Unknown Function.
	%	%	%	%	%	%
Production Forest	100					
Protection Forest		100				
Social Forest					100	
PA Network			100			

3.4 Data for Table T3

Table 3a – Primary designated function

FRA 2010 Categories	Forest area (1000 hectares)			
	1990	2000	2005	2010
Production	16 260	16 629	17 219	17 403
Protection of soil and water	10 000	10 227	10 590	10 703
Conservation of biodiversity	12 740	13 029	19 551	19 761
Social services	0	0	0	0
Multiple use	24 939	25 505	20 349	20 567
Other (please specify in comments below the table)	0	0	0	0
No / unknown	0	0	0	0
TOTAL	63 939	65 390	67 709	68 434

Table 3b – Special designation and management categories

FRA 2010 Categories	Forest area (1000 hectares)			
	1990	2000	2005	2010
Area of permanent forest estate	45 909	46 051	46 123	46 194
Forest area within protected areas	12 740	13 029	19 551	19 774
Forest area under sustainable forest management	n.a	n.a	n.a	n.a
Forest area with management plan	28 482	28 570	29 584	30 597

3.5 Comments to Table T3

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Production		
Protection of soil and water		
Conservation of biodiversity		
Social services		
Multiple use		
Other		
No / unknown designation		
Area of permanent forest estate	On the basis of NFI data 2005, the area under reserved and protected forest having forest cover is estimated and has been put under this category. For other years, the ratio developed from 2005 data has been applied.	
Forest area within protected areas		
Forest area under sustainable forest management		
Forest area with management plan	This area has been estimated on the basis of data available on this variable and recorded forest area as given in Forestry statistics India, 2001.	

Other general comments to the table

National statistics in India are not maintained by designation of Forests. However, National Forestry Action Plan (NFAP), 1999 attempted to provide broad information on designation of forest. The same proportion has been used to derive the estimates of other years.

4 Table T4 – Forest characteristics

4.1 FRA 2010 Categories and definitions

Term / category	Definition
Naturally regenerated forest	Forest predominantly composed of trees established through natural regeneration.
Introduced species	A species, subspecies or lower taxon, occurring outside its natural range (past or present) and dispersal potential (i.e. outside the range it occupies naturally or could occupy without direct or indirect introduction or care by humans).
Characteristics categories	
Primary forest	Naturally regenerated forest of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed.
Other naturally regenerated forest	Naturally regenerated forest where there are clearly visible indications of human activities.
Other naturally regenerated forest of introduced species (<i>sub-category</i>)	Other naturally regenerated forest where the trees are predominantly of introduced species.
Planted forest	Forest predominantly composed of trees established through planting and/or deliberate seeding.
Planted forest of introduced species (<i>sub-category</i>)	Planted forest, where the planted/seeded trees are predominantly of introduced species.
Special categories	
Rubber plantations	Forest area with rubber tree plantations.
Mangroves	Area of forest and other wooded land with mangrove vegetation.
Bamboo	Area of forest and other wooded land with predominant bamboo vegetation.

4.2 National data

4.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
State of Forest Report 1997. Forest Survey of India, MOEF, GOI, India.	H	Extent,	1990	
State of Forest Report 1999. Forest Survey of India, MOEF, GOI, India.	H	Planted forests	1997	
State of Forest Report, 2005. Forest Survey of India, MOEF, GOI, India.	H	Mangrove	2005	
National Forest Inventory Database of FSI	H	Primary forests, other naturally regenerated forest, planted forests and bamboo	2005	
Rubber Board of India (official website)	H	Rubber plantations	2005	

4.2.2 Classification and definitions

National class	Definition
Mangrove cover	Mangrove forest is salt tolerant forest ecosystem found mainly in tropical and sub-tropical coastal and/or inter-tidal regions. Mangrove cover is the area covered under mangrove vegetation as interpreted digitally from remote sensing data. It is a part of forest cover and also classified into three classes viz. very dense, moderately dense and open.
Bamboo	A forest having bamboo crop in more than 25 % of its area is treated as bamboo forest as per the crop classification used for NFI.

4.2.3 Original data

Categories	Area (1000 hectares)		
	1990	2000	2005
Rubber plantations (Forest)		563	597
Mangroves	426	448	445
Bamboo			5418

Categories	2005
Primary Forest	15701
Other naturally regenerated forest	42522

4.3 Analysis and processing of national data

4.3.1 Calibration

No calibration is required

4.3.2 Estimation and forecasting

The estimate of primary forest, other naturally regenerated forest and planted forest have been generated from NFI data. The primary and other naturally regenerated forest for 2010 has been assumed to be same as in 2005. The increase in the forest cover in 2010 will be attributed to planted forest only. The area of introduced species in planted forest has been estimated from plantation data as given in SFR 1999. For other years the data of 2005 is assumed to be valid.

FRA 2010 Categories	Forecasted area (1000 hectares)
	2010
Primary forest	15 701
Other naturally regenerated forest	42 522
...of which of introduced species	
Planted forest	10 258
...of which of introduced species	1 344
TOTAL	68 481

Rubber plantation area is available for 2000 and 2005. For estimating area for 2010, annual growth rate during 2000 to 2005 has been taken. The same growth rate has been applied backward to estimate area under rubber plantations for 1990. Area under mangroves is available from SFR 2005. For estimating area of mangroves for 2010, annual growth rate during 1990 to 2000 has been taken. The area under bamboo for 2005 has been estimated on

the basis of NFI data. The ratio of bamboo to forest cover obtained in 2005 has been applied to estimate the area under bamboo for the year 1990, 2000 and 2010.

FRA 2010 Categories	Forecasted area (1000 hectares)
	2010
Rubber plantations (Forest)	631
Mangroves (Forest and OWL)	456
Bamboo (Forest and OWL)	5 476

4.3.3 Reclassification into FRA 2010 categories

The FRA and national definitions for rubber, mangrove and bamboo are same. For information on categories of FRA has been estimated from NFI data and therefore, there is no requirement of reclassification.

4.4 Data for Table T4

Table 4a

FRA 2010 Categories	Forest area (1000 hectares)			
	1990	2000	2005	2010
Primary forest	15 701	15 701	15 701	15 701
Other naturally regenerated forest	42 522	42 522	42 522	42 522
...of which of introduced species	n.a.	n.a.	n.a.	n.a.
Planted forest	5 716	7 167	9 486	10 211
...of which of introduced species	749	939	1 243	1 338
TOTAL	63 939	65 390	67 709	68 434

Table 4b

FRA 2010 Categories	Area (1000 hectares)			
	1990	2000	2005	2010
Rubber plantations (Forest)	502	563	597	631
Mangroves (Forest and OWL)	426	448	445	456
Bamboo (Forest and OWL)	5 116	5 232	5 418	5 476

4.5 Comments to Table T4

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Primary forest		
Other naturally regenerating forest		
Planted forest		
Rubber plantations		
Mangroves		
Bamboo	National statistics in India are not maintained by characteristic of Forests. The same have been estimated on the basis of NFI data.	

Other general comments to the table
National statistics in India are not maintained by characteristic of Forests. The same have been estimated on the basis of NFI data.

5 Table T5 – Forest establishment and reforestation

5.1 FRA 2010 Categories and definitions

Term	Definition
Afforestation	Establishment of forest through planting and/or deliberate seeding on land that, until then, was not classified as forest.
Reforestation	Re-establishment of forest through planting and/or deliberate seeding on land classified as forest.
Natural expansion of forest	Expansion of forests through natural succession on land that, until then, was under another land use (e.g. forest succession on land previously used for agriculture).

5.2 National data

5.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
State Forest Departments and Ministry of Environment and Forests, Govt of India	M	Plantation	2000, 2005	
State of Forest Report 1999. Forest Survey of India, MOEF, GOI, India.	M	Introduced species	1997	

5.2.2 Classification and definitions

The classification and definitions are same as in the FRA.

5.2.3 Original data

The national data on afforestation and reforestation is not separately maintained. Ministry of Environment and Forests compiles the information on afforestation and reforestation as reported by State Forest Departments. There are two components in the reporting by the state forest departments, area under block plantation and number of seedlings distributed. The number of seedlings distributed are converted into area by a notional number where 2000 seedlings are considered equal to 1 ha.

Categories	Annual forest establishment (hectares/year)		
	1990	2000	2005
Afforestation	1 688 600	1 500 000	1 480 000
Reforestation			

5.3 Analysis and processing of national data

5.3.1 Calibration

No calibration is required.

5.3.2 Estimation and forecasting

5.3.3 Reclassification into FRA 2010 categories

Available data and information does not allow re-classification of the plantation area into area under afforestation and reforestation.

5.4 Data for Table T5

FRA 2010 Categories	Annual forest establishment (hectares/year)			...of which of introduced species ¹⁾ (hectares/year)		
	1990	2000	2005	1990	2000	2005
Afforestation	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Reforestation	1 688 600	1 500 000	1 480 000	n.a.	n.a.	n.a.
...of which on areas previously planted	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Natural expansion of forest	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

5.5 Comments to Table T5

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Afforestation		
Reforestation	The statistics on afforestation and reforestation are not separately maintained in India. However, the combined estimates of forestation and reforestation are given at 5.3.2 in the original data. These are reported figures of plantations which could be at variance with actual figures.	
Natural expansion of forest	No national statistics is maintained for this category.	

Other general comments to the table

Note: The estimates are on the basis of five years average and inclusive of both afforestation and reforestation. Ministry of Environment and Forests compiles the information as reported by State Forest Department. Other information of table 5 is not available. Introduced species includes Eucalyptus spp., Populus spp., Acacia auriculiformis and Acacia mearnsii etc.

6 Table T6 – Growing stock

6.1 FRA 2010 Categories and definitions

Category	Definition
Growing stock	Volume over bark of all living trees more than X cm in diameter at breast height (or above buttress if these are higher). Includes the stem from ground level or stump height up to a top diameter of Y cm, and may also include branches to a minimum diameter of W cm.
Growing stock of commercial species	Growing stock (see def. above) of commercial species.

6.2 National data

6.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
FSI, 1989. State of Forest Report 1989. Forest Survey of India, Ministry of Environment and Forests, Government of India.	M	Extent, Growing Stock	1984	
FSI, 1995. State of Forest Report 1995. Forest Survey of India, Ministry of Environment and Forests, Government of India.	M	Extent, Growing Stock	1994	
FSI, 2001. State of Forest Report, 2001. Forest Survey of India, Ministry of Environment and Forests, Government of India.	M	Extent	2000	
FSI, 2003. India Pilot Study. Forest Survey of India, Ministry of Environment and Forests, Government of India. (Unpublished report).	M	Extent, Growing Stock	2003	
FSI, 2005. State of Forest Report, 2005. Forest Survey of India, Ministry of Environment and Forests, Government of India.	H	Extent, growing stock	2005	

6.2.2 Classification and definitions

The following table provides the definition of growing stock as used by Forest Survey of India, Ministry of Environment and Forest, India.

National class	Definition
Growing Stock	The sum-total of all trees, by number or volume (under bark) or biomass, growing within a particular area of interest.

(Source: SFR205)

6.2.3 Original data

Following table contain national data on growing stock which is volume (under bark) of all living trees more than 10 cm in diameter at breast height (or above buttress if these are higher). It includes the stem volume from ground level or stump height up to a top diameter of 10 cm, and branches up to a minimum diameter of 5 cm.

Categories	Year		
	1990	2000	2005
Growing Stock in million m ³	4 363	4 662	5 129
Extent of Forest in “000”ha	63 939	65 390	67 709

The relative ranking of these species is presented below.

FRA 2010 category / Species name			Growing stock in forest (million cubic meters)
Rank	Scientific name	Common name	2005
1 st	<i>Shorea robusta</i>	Sal	377
2 nd	<i>Tectona grandis</i>	Teak	190
3 rd	<i>Pinus roxburghii</i>	Chir Pine	145
4 th	<i>Terminalia crenulata</i>	Saja	127
5 th	<i>Abies smithiana</i>	Spruce	112
6 th	<i>Anogeissus latifolia</i>	Dhauda	111
7 th	<i>Quercus semecarpifolia</i>	Kharsu Oak	96
8 th	<i>Abies pindrow</i>	Silver fir	89
9 th	<i>Mangifera indica</i>	Aam	90
10 th	<i>Schima wallichii</i>	Makrisal	83
Remaining			3 709
TOTAL			5 129

6.3 Analysis and processing of national data

6.3.1 Calibration

Calibration is not required.

6.3.2 Estimation and forecasting

The estimate of growing stocks for 2005 has been generated on the basis of NFI data conducted during 2002 to 2006. This estimate also includes estimates of growing stock in TOF of patches having area 1.0 ha or more. For forecasting estimates for 2010, the per hectare increment in growing stock was calculated on the basis of per hectare growing stock of 2000 and 2005 and applied on the projected forest area of 2010. The breakup of coniferous

and broadleaves of 2005 based on the previous table in 6.2.3, has been applied on 1990, 2000 and 2010.

6.3.3 Reclassification into FRA 2010 categories

No reclassification is required.

6.4 Data for Table T6

Table 6a – Growing stock

FRA 2010 category	Volume (million cubic meters over bark)							
	Forest				Other wooded land			
	1990	2000	2005	2010	1990	2000	2005	2010
Total growing stock	4 363	4 662	5 129	5 489	n. a.	n. a.	n. a.	n.a.
... of which coniferous	437	467	513	550	n. a.	n. a.	n. a.	n.a.
... of which broadleaved	3 926	4 195	4 615	4 940	n. a.	n. a.	n. a.	n.a.
Growing stock of commercial species	1 139	1 217	1 338	1 433	n. a.	n. a.	n. a.	n.a.

Table 6b – Growing stock of the 10 most common species

FRA 2010 category / Species name			Growing stock in forest (million cubic meters)		
Rank	Scientific name	Common name	1990	2000	2005
1 st	<i>Shorea robusta</i>	Sal	321	345	377
2 nd	<i>Tectona grandis</i>	Teak	162	173	190
3 rd	<i>Pinus roxburghii</i>	Chir Pine	124	133	145
4 th	<i>Terminalia crenulata</i>	Saja	108	114	127
5 th	<i>Abies smithiana</i>	Spruce	95	103	112
6 th	<i>Anogeissus latifolia</i>	Dhauda	94	102	111
7 th	<i>Quercus semecarpifolia</i>	Kharsu Oak	82	88	96
8 th	<i>Abies pindrow</i>	Silver fir	76	81	89
9 th	<i>Mangifera indica</i>	Aam	77	81	90
10 th	<i>Schima wallichii</i>	Makrisal	71	76	83
Remaining			3 155	3 367	3 709
TOTAL			4 363	4 662	5 129

Note: The Year 2005 is the reference year for classifying the species list and the order of the species. For other years, the specie wise estimates have been assumed to be in the same proportion as of 2005.

Table 6c – Specification of threshold values

Item	Value	Complementary information
Minimum diameter (cm) at breast height ¹ of trees included in growing stock (X)	10 cm	
Minimum diameter (cm) at the top end of stem for calculation of growing stock (Y)	10 cm	
Minimum diameter (cm) of branches included in growing stock (W)	5 cm	
Volume refers to “above ground” (AG) or “above stump” (AS)	AG	

6.5 Comments to Table T6

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Total growing stock	The estimates for 2005 does not tally with the figure of SFR-2005 because this estimate also includes estimates of growing stock in TOF areas of patches having area 1.0 ha or more.	The methodology for estimating growing stock in 2000 an before was based on district inventory data of past several years, thematic maps and updated forest cover maps.
Growing stock of broadleaved / coniferous	Original data is available only for 2005. For other years , the same proportion is used .	
Growing stock of commercial species	Original data is available only for 2005. For other years , the same proportion is used .	
Growing stock composition		

Other general comments to the table

Inventory of forest resources of different part of the country has been a regular activity of FSI since its inception in 1965. However the estimates of growing stock were confined only at district/catchments or state level. In 2001, the National forest inventory (NFI) was launched as a regular activity. The sampled districts are selected to generate the national level estimates of growing stock both for forest and Trees Outside Forests (TOF). The results of growing stock are being published in SFR biennially. The estimates of growing stock keeps improving as more samples are added in each cycle. Prior to 2000, FSI has estimated and published the growing stock figures only for two years: 1984 and 1994 using past field inventory data, thematic maps and forest cover maps of the concerned years.

¹ Diameter at breast height (DBH) refers to diameter over bark measured at a height of 1.30 m above ground level or 30 cm above buttresses if these are higher than 1 m.

7 Table T7 – Biomass stock

7.1 FRA 2010 Categories and definitions

Category	Definition
Above-ground biomass	All living biomass above the soil including stem, stump, branches, bark, seeds, and foliage.
Below-ground biomass	All biomass of live roots. Fine roots of less than 2mm diameter are excluded because these often cannot be distinguished empirically from soil organic matter or litter.
Dead wood	All non-living woody biomass not contained in the litter, either standing, lying on the ground, or in the soil. Dead wood includes wood lying on the surface, dead roots, and stumps larger than or equal to 10 cm in diameter or any other diameter used by the country.

7.2 National data

7.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
FSI, 1991. State of Forest Report 1989. Forest Survey of India, Ministry of Environment and Forests, Government of India.	M	Extent, Growing Stock	1984	
FSI, 1995. State of Forest Report 1995. Forest Survey of India, Ministry of Environment and Forests, Government of India.	M	Extent, Growing Stock	1994	
FSI, 2003. State of Forest Report, 2001. Forest Survey of India, Ministry of Environment and Forests, Government of India.	H	Extent	2000	
FSI, 2007. State of Forest Report, 2005. Forest Survey of India, Ministry of Environment and Forests, Government of India.	H	Extent, growing stock	2005	
Timber Mechanics: Strength, Classification and grading of timber, ICFRE Publication 38, 1996	H	Specific gravity	1996	

7.2.2 Classification and definitions

National class	Definition
Above-ground biomass	All living biomass above the soil including stem, stump, branches, bark, seeds, and foliage.
Below-ground biomass	All biomass of live roots. Fine roots of less than 2mm diameter are excluded because these often cannot be distinguished empirically from soil organic matter or litter.
Dead wood	All non-living woody biomass not contained in the litter, either standing, lying on the ground, or in the soil. Dead wood includes wood lying on the surface, dead roots, and stumps larger than or equal to 10 cm in diameter.

7.2.3 Original data

Categories	Year		
	1990	2000	2005
Growing Stock in million m ³	4 363	4 662	5 129
Extent of Forest in “000”ha	63 939	65 390	67 709

7.3 Analysis and processing of national data

7.3.1 Calibration

No calibration is required.

7.3.2 Estimation and forecasting

The above ground biomass has been calculated by multiplying estimates of growing stock as given in table 6 b with the specific gravity of corresponding species for 2005. For calculating below ground biomass, the default values given by FAO/IPCC has been used. For this purpose, total estimates of above ground biomass was divided into biomass of moist and dry forest areas. Thereafter the default values for each area was multiplied to estimate the below ground biomass.

Ratio of below ground biomass to above ground biomass

<i>Tropical moist deciduous forest</i>	<i>0.22 (it is an average of 0.20 and 0.24 because in India, some part of the forest have above ground biomass more than 125 tonns/ha and some part below it.)</i>
<i>Tropical dry forest</i>	<i>0.42 (it is an average of 0.28 and 0.56 because in India, some part of the forest have above ground biomass more than 20 tonns/ha and some part below it.)</i>

7.3.3 Reclassification into FRA 2010 categories

Not required

7.4 Data for Table T7

FRA 2010 category	Biomass (million metric tonnes oven-dry weight)							
	Forest				Other wooded land			
	1990	2000	2005	2010	1990	2000	2005	2010
Above-ground biomass	2 616	2 796	3 076	3 291	n.a	n.a	n.a	n.a
Below-ground biomass	825	882	970	1 038	n.a	n.a	n.a	n.a
Dead wood	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a
TOTAL	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a

7.5 Comments to Table T7

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Above-ground biomass	The estimates of growing stock used for biomass calculation are under bark only. Hence the same is under estimated. In addition, the above ground biomass reported is only woody biomass and the limits of measurements of woody biomass has been mentioned in table 6c of growing stock. FSI has taken a study for estimating missing component of the above ground biomass, the results of which will be used to complete the total above ground biomass. Alternately, biomass expansion factor as provided by IPCC/FAO shall be used in the final report.	
Below-ground biomass	In the light of the comments on above ground biomass, the below ground biomass is also under estimated.	
Dead wood	FSI has undertaken a study for estimating biomass of dead wood. The results of which are not yet available.	

8 Table T8 – Carbon stock

8.1 FRA 2010 Categories and definitions

Category	Definition
Carbon in above-ground biomass	Carbon in all living biomass above the soil, including stem, stump, branches, bark, seeds, and foliage.
Carbon in below-ground biomass	Carbon in all biomass of live roots. Fine roots of less than 2 mm diameter are excluded, because these often cannot be distinguished empirically from soil organic matter or litter.
Carbon in dead wood	Carbon in all non-living woody biomass not contained in the litter, either standing, lying on the ground, or in the soil. Dead wood includes wood lying on the surface, dead roots, and stumps larger than or equal to 10 cm in diameter or any other diameter used by the country.
Carbon in litter	Carbon in all non-living biomass with a diameter less than the minimum diameter for dead wood (e.g. 10 cm), lying dead in various states of decomposition above the mineral or organic soil.
Soil carbon	Organic carbon in mineral and organic soils (including peat) to a specified depth chosen by the country and applied consistently through the time series.

8.2 National data

8.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
FSI, 1991. State of Forest Report 1989. Forest Survey of India, Ministry of Environment and Forests, Government of India.	M	Extent, Growing Stock	1984	
FSI, 1995. State of Forest Report 1995. Forest Survey of India, Ministry of Environment and Forests, Government of India.	M	Extent, Growing Stock	1994	
FSI, 2003. State of Forest Report, 2001. Forest Survey of India, Ministry of Environment and Forests, Government of India.	H	Extent	2000	
FSI, 2005. State of Forest Report, 2005. Forest Survey of India, Ministry of Environment and Forests, Government of India.	H	Extent, growing stock	2005	
Timber Mechanics: Strength, Classification and grading of timber, ICFRE Publication 38, 1996	H	Specific gravity	1996	

8.2.2 Classification and definitions

National class	Definition
Carbon in above-ground biomass	Carbon in all living biomass above the soil, including stem, stump, branches, bark, seeds, and foliage.
Carbon in below-ground biomass	Carbon in all biomass of live roots. Fine roots of less than 2 mm diameter are excluded, because these often cannot be distinguished empirically from soil organic matter or litter.
Carbon in dead wood	Carbon in all non-living woody biomass not contained in the litter, either standing, lying on the ground, or in the soil. Dead wood includes wood lying on the surface, dead roots, and stumps larger than or equal to 10 cm in diameter or any other diameter used by the country.
Carbon in litter	Carbon in all non-living biomass with a diameter less than the minimum diameter for dead wood (e.g. 10 cm), lying dead in various states of decomposition above the mineral or organic soil.
Soil carbon	Organic carbon in mineral and organic soils (including peat) to a specified depth chosen by the country and applied consistently through the time series.

8.2.3 Original data

Category	Biomass (million metric tonnes oven-dry weight)		
	Forest		
	1990	2000	2005
Above-ground biomass	2 616	2 796	3 076
Below-ground biomass	825	882	970

8.3 Analysis and processing of national data

8.3.1 Calibration

Not required

8.3.2 Estimation and forecasting

For estimation of carbon above ground, the carbon content of different species as available from literature was used. For below ground carbon estimation, default value as given by FAO/IPCC was applied. The Carbon in litter (excluding branch) and soil was estimated on the basis of NFI database of FSI inventoried during 2002 to 2006.

8.3.3 Reclassification into FRA 2010 categories

Reclassification is not required.

8.4 Data for Table T8

FRA 2010 Category	Carbon (Million metric tonnes)							
	Forest				Other wooded land			
	1990	2000	2005	2010	1990	2000	2005	2010
Carbon in above-ground biomass	1691	1808	1989	2129	n.a.	n.a.	n.a.	n.a.
Carbon in below-ground biomass	532	569	626	671	n.a.	n.a.	n.a.	n.a.
Sub-total: Living biomass	2223	2377	2615	2800	n.a.	n.a.	n.a.	n.a.
Carbon in dead wood	25.	25	26.	26.	n.a.	n.a.	n.a.	n.a.
Carbon in litter	75	77	80	80	n.a.	n.a.	n.a.	n.a.
Sub-total: Dead wood and litter	100	102	106.	106	n.a.	n.a.	n.a.	n.a.
Soil carbon	3 751	3 836	3 972	4 017	n.a.	n.a.	n.a.	n.a.
TOTAL	6074	6315	6693	6923	n.a.	n.a.	n.a.	n.a.

Soil depth (cm) used for soil carbon estimates	30 cm
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8.5 Comments to Table T8

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Carbon in above-ground biomass	The carbon estimate relates to woody biomass only. Carbon content is significantly higher than the IPCC default value provided by FRA 2010 Guidelines	
Carbon in below-ground biomass	Default value as provided by IPCC/FAO has been used.	
Carbon in dead wood	FSI has under taken a study for estimating biomass of dead wood. The results of which were not yet available at the time of compilation of this country report.	
Carbon in litter	The carbon in litter relates to humus only and excludes carbon in fallen branches of 5 cm and below. FSI has under taken a study for estimating carbon in the fallen branches. The results of which were not yet available at the time of compilation of this country report.	
Soil carbon		

Other general comments to the table
A special study for estimating the missing components of forest biomass including deadwood and litter was started by FSI in August 2008. Nationwide field data collection was completed by May 2009 but analysis of data was only partial till the time of the compilation of this country report. Current data has been used to make backward estimation of 2005, 2000 and 1990.

9 Table T9 – Forest fires

9.1 FRA 2010 Categories and definitions

Category	Definition
Number of fires	Average number of vegetation fires per year in the country.
Area affected by fire	Average area affected by vegetation fires per year in the country.
Vegetation fire (supplementary term)	Any vegetation fire regardless of ignition source, damage or benefit.
Wildfire	Any unplanned and/or uncontrolled vegetation fire.
Planned fire	A vegetation fire regardless of ignition source that burns according to management objectives and requires limited or no suppression action.

9.2 National data

9.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
ICFRE, 1997. Forestry Statistics, India, 1988-95. Indian Council of Forestry Research and Education, Dehradun, India.	L	Area damaged	1988 -1993	
ICFRE 1998. Forestry Statistics, India, 1996. Indian Council of Forestry Research and Education, Dehradun, India.	L	Area damaged	1994 -1995	
ICFRE, 2002. Forestry Statistics, India, 2000. Indian Council of Forestry Research and Education, Dehradun, India.	L	Area damaged	1996 - 1997	
National Forest Inventory Database of FSI	M	Area damaged	2005	
Data on forest fire from National Forest Database Management Centre (NFDMC) of FSI	M	No. of fires	2005 2006 2007	

9.2.2 Classification and definitions

The national definition is fully compatible with FRA definition.

Category	Definition
Number of fires	Average number of vegetation fires per year in the country.
Area affected by fire	Average area affected by vegetation fires per year in the country.
Vegetation fire (supplementary term)	Any vegetation fire regardless of ignition source, damage or benefit.
Wildfire	Any unplanned and/or uncontrolled vegetation fire.
Planned fire	A vegetation fire regardless of ignition source that burns according to management objectives and requires limited or no suppression action.

9.2.3 Original data

The detection of forest fire is being done by FSI on daily basis since November, 2004 using remote sensing based system developed by the University of Maryland (USA) and NASA viz MODIS Rapid Response System which provides number of forest fires and put on the website by them. On the other hand the area affected due to forest fire is observed during national forest inventory. The ICFRE has also compiled data as reported by the state forest departments on the extent of the area affected by the forest fires.

National Category	Number of Forest Fires		
	2005	2006	2007
No of Fires	20 567	16 789	17 622

National Category	Forest Land/Area Affected by forest fires in million hectares			
	1985	1987	2000	2005
Forest Area Affected	0.986	1.034	0.199	1.6

9.3 Analysis and processing of national data

9.3.1 Calibration

Not required

9.3.2 Estimation and forecasting

The forest area affected by fire for the year 1990 and 2000 compiled by ICFRE has been incomplete. Using the forest area of the non-responding states, the total area affected by the forest fire has been estimated for these two years. The NFI data was used for estimating area affected by forest fire in the year 2005. The estimation of the area affected by the forest fire is generally on the ocular basis. Even FSI does not assess the area affected by forest fire during NFI and the same is observed qualitatively* (heavy, moderate and occasional) during the national forest inventory. Since no estimate for 2000 is available and there has been no abnormal situation in the year 2000, the estimates of 2005 has been used for 2000 also.

9.3.3 Reclassification into FRA 2010 categories

Not required.

9.4 Data for Table T9

Table 9a

FRA 2010 category	Annual average for 5-year period					
	1990		2000		2005	
	1000 hectares	number of fires	1000 hectares	number of fires	1000 hectares	number of fires
Total land area affected by fire	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
... of which on forest	1 034	n.a.	1 605	n.a.	1 605	18 326
... of which on other wooded land	n.a.		n.a.		n.a.	
... of which on other land	n.a.		n.a.		n.a.	

Table 9b

FRA 2010 category	Proportion of forest area affected by fire (%)		
	1990	2000	2005
Wildfire	100	100	100
Planned fire			

9.5 Comments to Table T9

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Area affected by fire	Heavy: more than 50 % area in 2 ha plot is affected by fire while in Moderate between 10-50 % and in Occasional less than 10 %.	
Number of fires	The numbers of the forest fires reported in the original data are based on downloading of the same from the website and all points are not verified in the field.	
Wildfire / planned fire		

10 Table T10 – Other disturbances affecting forest health and vitality

10.1 FRA 2010 Categories and definitions

Term	Definition
Disturbance	Damage caused by any factor (biotic or abiotic) that adversely affects the vigour and productivity of the forest and which is not a direct result of human activities.
Invasive species	Species that are non-native to a particular ecosystem and whose introduction and spread cause, or are likely to cause, socio-cultural, economic or environmental harm or harm to human health.
Category	Definition
Disturbance by insects	Disturbance caused by insect pests.
Disturbance by diseases	Disturbance caused by diseases attributable to pathogens, such as bacteria, fungi, phytoplasma or virus.
Disturbance by other biotic agents	Disturbance caused by biotic agents other than insects or diseases, such as wildlife browsing, grazing, physical damage by animals, etc.
Disturbance caused by abiotic factors	Disturbances caused by abiotic factors, such as air pollution, snow, storm, drought, etc.

10.2 National data

10.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
Forest Research Institute, Dehardun Sh. R.S. Bhandari,	H	Disturbance by insects		
Forest Research Institute, Dehardun Dr.. N.S.K. Harsh	H	Disturbance by pathology		
National Forest Inventory Database of FSI	H	Disturbances by insects and diseases.	2005	

10.2.2 Classification and definitions

There is no definition for area affected by insects or diseases.

10.2.3 Original data

Area Affected by disturbances

The forest Survey of India under its national forest inventory programme collects data on parameters like injuries to crop, biotic factors and abiotic factors which includes Boral attack, leaf defoliator attack, damage by other pest and pathogens, felling lopping, grazing, land

slide, flood, other natural calamities etc. On the basis of these information, the area affected by disturbances has been estimated.

Area affected by insects and disease

The national paper presented on the “Dalbergia Sissoo in India” mentions that Dalbergia sissou is diseased over an area of 8 400 square kilometres of Gangetic plains in north of Bihar (one of the States of India) alone. With a very conservative assumption that at least one percent of this figure spans forest land leads to an estimate of about 8,400 hectares of forest area affected by this disease.

The “Annual Report” of Ministry of Environment and Forests, Government India (GOI, 2001) indicates mortality of millions of trees of Shorea robusta due to a stem borer insect (Hoplocerambyx spinicornis). However, the report does not indicate the area of forest affected by this insect. Therefore, a very conservative assumption has been made that the insect has affected at least 1000 sq.km of forests during the year 2000.

The information on major outbreak of insects and diseases affecting forest health and vitality has been obtained from Forest Research Institute Dehradun.

10.3 Analysis and processing of national data

10.3.1 Calibration

Not required

10.3.2 Estimation and forecasting

The area affected by different category of disturbances has been estimated on the basis of NFI data 2005.

10.4 Data for Table T10

Table 10a – Disturbances

FRA 2010 category	Affected forest area (1000 hectares)		
	1990	2000	2005
Disturbance by insects	n.a.	322	839
Disturbance by diseases	n.a.	122	0
Disturbance by other biotic agents	n.a.	n.a.	25499
Disturbance caused by abiotic factors	n.a.	n.a.	4383
Total area affected by disturbances	n.a.	n.a.	29882

Notes: The figures for the reporting years refer to the averages of annually affected areas for the 5-year periods 1988-1992, 1998-2002 and 2003-2007 respectively.

Table 10b – Major outbreaks of insects and diseases affecting forest health and vitality

Description / name	Tree species or genera affected (scientific name)	Year(s) of latest outbreak	Area affected (1000 hectares)	If cyclic, approx. cycle (years)
Needle spot, <i>Bifussella saccata</i>	<i>Pinus Wallichiana</i>	2003	10.0 approx.	Yes, yearly
Gall rust, <i>Haplophragmium ponderosum</i>	<i>Acacia modesta</i>	2002	5	Yes, yearly
Canker rots, <i>Ganoderma applantum</i> , <i>Phellinus pachypholeus</i> , <i>P. caryophyllii</i>	<i>Cinnamomum camphora</i> , <i>Peltophorum vogelianum</i> , <i>Termenalia myriocarpa</i> , <i>Ficus glaberrima</i> , <i>Mangifera indica</i>	2004	8	Yes, three years
Twig canker, diseases, <i>Fusarium sambucinum</i>	<i>Eucalyptus camaldulensis</i>	2004	2.0	Yes, yearly
Twig canker, <i>Fusarium solani</i>	<i>Terminalia arjuna</i>	2003	5.0	Yes, yearly
Stem canker, <i>Pestalotiopsis</i>	<i>Jatropha curcas</i>			
Dwarf mistletoe <i>Arceuthobium minutissimum</i>	<i>Pinus Wallichiana</i>	2006	25	Yes, yearly
Twig canker, <i>Pestalotiopsis versicolor</i>	<i>Cinnamomum camphora</i>	2006	2.0	Yes, yearly
Root rot, <i>Amyloporus campbelli</i>	<i>Tectona grandia</i>	2000	2.0	No
Rust, <i>Aecidium kamali</i>	<i>Terminalia tomentosa</i>	2001	2.0	Yes, yearly
Mortality, <i>Phytophthora cinnamomi</i>	<i>Cedrus deodara</i>	2000	20	No
Mortality, <i>Rhizoctonia bataticola</i>	<i>Azadirachta indica</i>	2003	5	No
Stem Cankers, <i>Botryodiplodia theobromae</i> and <i>Phoma</i> sp.	Rohida trees	2003	2	No
Mortality, <i>Ganoderma lucidum</i> , <i>Botryodiplodia theobromae</i>	<i>Prosopis cineraria</i>	2005	10	No
Root rot, <i>Ganoderma lucidum</i>	<i>Dalbergia sissoo</i> , <i>Albizia</i> spp., <i>Acacia</i> spp.	2003	10	No
Die back, <i>Phomopsis tectonae</i>	<i>Tectona grandis</i>	2000	10	Yes, yearly
Vascular wilt, <i>Ralstonia solanacearum</i>	<i>Tectona grandis</i>	2001	20	No
Leaf blight, <i>Asperisporium pongamiae</i>	<i>Pongamia pinnata</i>	2000	30	Yes, yearly
Sal heart wood borer <i>hplocerambyx spinicornis</i>	<i>Shorea robusta</i>	2005-2006 (mild)	21	15 years
<i>Ascotis imparata</i>	<i>Shorea robusta</i>	2002 to 2008	4	Yearly outbreaks at different places
<i>Hyblasa purea Eutectona machaeralis</i>	<i>Tectona granids</i>	2004 to 2008	2	Central Tarai Forest Division, Haldwani
Outbreak of sal heartwood borer	<i>Shorea robusta</i>	2007-08	1.1	- Do -
Otbreak of sal defoliator	<i>Shorea robusta</i>	2008-09	1	Umaria Forest Division, Chhattisgarh
Outbreak of teak defoliator & skeletonizer	<i>Tectona grandis</i>	2001-08	3	Sporadic every year in M.P. and Maharashtra
Gypsy moth (<i>Lymantria</i> spp.) Defoliator Cater Pillar	<i>Willow & Poplar</i>	2006-7	9	-

Note: Area affected refers to the total area affected during the outbreak.

Table 10c – Area of forest affected by woody invasive species

Scientific name of woody invasive species	Forest area affected 2005 (1000 hectares)
Total forest area affected by woody invasive species	

Note: The total forest area affected by woody invasive species is not necessary the sum of the values above, as these may be overlapping.

10.5 Comments to Table T10

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Disturbance by insects		Disturbances by insects in 2005 include also disturbances by diseases, since it is not possible to disaggregate figures.
Disturbance by diseases	The area affected by diseases less than 1000 ha has not been reported in the table.	
Disturbance by other biotic agents	Grazing by domestic animals affects the major area of biotic agents category.	
Disturbance caused by abiotic factors		
Major outbreaks		
Invasive species		

11 Table T11 – Wood removals and value of removals

11.1 FRA 2010 Categories and definitions

Category	Definition
Industrial roundwood removals	The wood removed (volume of roundwood over bark) for production of goods and services other than energy production (woodfuel).
Woodfuel removals	The wood removed for energy production purposes, regardless whether for industrial, commercial or domestic use.

11.2 National data

11.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
Forestry Statistics India, 1988-94	M	Industrial round Wood and wood fuel	1990	
Forestry Statistics India, 2003	M	Industrial round Wood and wood fuel	2000	
Timber/bamboo trade bulletin	M	Price of timber and fuel wood	2000 2005	
National Forest Inventory Data base of FSI	H	Growing stock, TOF	2005	
Energy used by Indian household, NSSO Report No.410/2	H	Average households, Consumption per person	1997	
Energy used by Indian household, NSSO Report No.464(55/1.0/6	H	Average households, Consumption per person	2001	
Energy Sources of Indian Household for Cooking and Lighting 2004-06, NSSO Report No.511(61/1.0/4	H	Average households, Consumption per person	2007	
M Neelakhanthan	H	quantity of fuelwood collected by households	1999	Paper on Consumption of Fuel wood & chips as fuel: what do the NSS data reveal?

11.2.2 Classification and definitions

National class	Definition
Industrial round wood removals	The wood removed (volume of roundwood under bark) for production of goods and services other than energy production (woodfuel).
Woodfuel removals	The wood removed for energy production purposes, regardless whether for industrial, commercial or domestic use.

11.2.3 Original data

Category	Industrial roundwood removals		Wood fuel removals	
	1990	2000	1990	2000
Production from forest	4 534	2 953	42 634	49 167

11.3 Analysis and processing of national data

11.3.1 Calibration

Not required

11.3.2 Estimation and forecasting

The estimation of industrial roundwood and wood fuel has been carried out separately. The estimates of industrial round wood have been generated separately for forest and TOF. From forest, the estimate of industrial wood for 1990 and 2000 has been taken from Forestry Statistics India, 1988-94 and 2003 respectively. The ICFRE compiles the estimates of round wood from the state forest departments. The estimates taken from forestry statistics are duly adjusted for non-responding states. The ratio of the round wood to recorded forest area as obtained for 2000 has been applied to recorded forest area of 2005 to get the estimates of industrial round wood for 2005. For TOF, the same has been estimated from NFI data. The NFI data gives species wise growing stock for the entire country. The total growing stock estimates has been grouped into three categories namely fast growing, slow growing and species not having any wood value as industrial or fuel wood. With the help of growing stock data and average rotation period of species under three categories, the production was estimated.

The wood fuel production was estimated using consumption approach. For consumption of wood fuel separate calculation was carried out for four different categories where consumption of fuel wood is substantial. These four categories are fuel wood consumed by household, used for cremation, hotels & restaurant and cottage industries. For estimation of fuel wood consumption in household sector, NSSO quinquennial surveys were used. From NSSO Surveys, information on total estimated households, their size and consumption per person per month were taken. For cremation, the average death rate religion wise has been taken from CSO. For hotel & restaurants, the total number of hotels& restaurants has been taken from National Building Organisation. The consumption estimates under cremation and hotels is taken on the basis of expert judgement. For cottage industries, a study done by Gujarat government was used to derive a ratio and applied the same to total consumption of first three categories. By adding the consumption of four categories, the total consumption of fuel wood was obtained. By consumption approach, the total consumption was taken as total production. Out of the total production, the production from forest was calculated on the basis of study by Dr. Neelkhanthan (1999). Of the total free collection, only 25 % has been assumed to be coming out of forests (about 20 % of India's population are confined to forest areas and on their fringes).

11.3.3 Reclassification into FRA 2010 categories

Not required.

11.4 Data for Table T11

FRA 2010 Category	Industrial roundwood removals			Wood fuel removals		
	1990	2000	2005	1990	2000	2005
Total volume (1000 m ³ o.b.)	35 055	41 173	45 957	213 169	245 837	260 752
... of which from forest	4 534	2 953	2 957	42 634	49 167	52 150
Unit value (local currency / m ³ .b.)	2 780	4 643	6 000	556	929	1200
Total value (1000 local currency)	97453000	191166000	275742000	118522000	228382000	312902000

	1990	2000	2005
Name of local currency	INR	INR	INR

11.5 Comments to Table T11

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Total volume of industrial roundwood removals	The wood removal from forests constitutes only about 6 % of the total and the rest is from TOF where the removal is derived from the growing stock of the TOF estimated by FSI. For the annual removal from TOF, a rotation of 10 years has been assumed for fast growing tree species and 60 years for other tree species with industrial wood value.	More and more wood is coming from TOF.
Total volume of woodfuel removals		
Unit value	For unit value expert judgement has been taken from Timber/bamboo bulletin which provides prices of different spp. of timber in different diameter class.	
Total value		

12 Table T12 – Non-wood forest products removals and value of removals

12.1 FRA 2010 Categories and definitions

Term	Definition
Non-wood forest product (NWFP)	Goods derived from forests that are tangible and physical objects of biological origin other than wood.
Value of NWFP removals	For the purpose of this table, value is defined as the market value at the site of collection or forest border.

NWFP categories

Category
<p><u>Plant products / raw material</u></p> <ol style="list-style-type: none"> 1. Food 2. Fodder 3. Raw material for medicine and aromatic products 4. Raw material for colorants and dyes 5. Raw material for utensils, handicrafts & construction 6. Ornamental plants 7. Exudates 8. Other plant products <p><u>Animal products / raw material</u></p> <ol style="list-style-type: none"> 9. Living animals 10. Hides, skins and trophies 11. Wild honey and bee-wax 12. Wild meat 13. Raw material for medicine 14. Raw material for colorants 15. Other edible animal products 16. Other non-edible animal products

12.2 National data

12.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
Forestry Statistics India, 2003	M	Non-wood forest products	2000, 2001	

12.2.2 Classification and definitions

National class	Definition
Non-wood forest product (NWFP)	Goods derived from forests that are tangible and physical objects of biological origin other than wood.

12.2.3 Original data

Products	Year (MT)	
	2000-01	2001-02
Sal seeds	57 145	58 447
Tendu leaves	369 444	299 654
Gums	483.18	438.29
Resin	36 074	40 203
bamboo	1 371 267	1 209 275
canes/ratton	22 632	12 715
Lac*	54.8	42.4
Fodder*	230 744.9	229 504
Drugs*	1 921.88	7 177.338

*Data pertains to 1988-99 and 1999-00

Products	Value in (000) Rs.
Sal seeds	56.88
Tendu leaves	1 877 950
Gums	1 389 034
Resin	402 927
bamboo	478 418
canes/ratton	1 983
Lac*	712
Fodder*	9 100
Drugs*	86 100

*Data pertains to 1988-99 and 1999-00

12.3 Analysis and processing of national data

12.3.1 Calibration

Not required

12.3.2 Estimation and forecasting

For estimating the removal of NWFP for 2005, the average of removals of 2000-01 and 2001-02 has been used. For estimating the value of 2005, the average value of 2000-01 and 2001-02 has been inflated annually by 5 % (which is equivalent to annual increase of Whole sale Price Index of the country).

12.3.3 Reclassification into FRA 2010 categories

12.4 Data for Table T12

Rank	Name of product	Key species	Unit	NWFP removals 2005		NWFP category
				Quantity	Value (1000 local currency)	
1 st	Tendu leaves	<i>Diospyros melanoxylon</i>	MT	334 549	2 396 793	8
2 nd	Gums	<i>Butea monosperma</i>	MT	461	1 772 798	3
3 rd	Bamboo	<i>Dandrocalamus spp.</i>	MT	1 290 271	610 596	5
4 th	Resin	<i>Pinus roxburghii</i>	MT	38 139	514 248	4
5 th	Fodder	Misc.	MT	230 124	109 888	2
6 th	Drugs	Misc	MT	4 550	11 614	3
7 th	Cane & Rattan	<i>Calamus spp.</i>	MT	17 674	2 531	5
8 th	Lac	<i>Schleichera oleosa</i>	MT	48.6	909	8
9 th	Sal Seeds	<i>Shorea robusta</i>	MT	57 796	73	3
10 th						
All other plant products					434 191	
All other animal products						
TOTAL					5 853 641	

	2005
Name of local currency	INR

12.5 Comments to Table T12

Variable / category	Comments related to data, definitions, etc.
10 most important products	The products like sal seeds, gum, lac, fodder and drugs (medicinal and aromatic plants) are highly under estimated.
Other plant products	
Other animal products	The products of wild animals in India are not traded excepts for honey, wax, lacs etc.
Value by product	
Total value	

13 Table T13 – Employment

13.1 FRA 2010 Categories and definitions

Category	Definition
Full-time equivalents (FTE)	A measurement equal to one person working full-time during a specified reference period.
Employment	Includes all persons in paid employment or self-employment.
Paid employment	Persons who during a specified reference period performed some work for <u>wage or salary</u> in cash or in kind.
Self-employment	Persons who during a specified reference period performed some work for <u>profit or family gain</u> in cash or in kind (e.g. employers, own-account workers, members of producers' cooperatives, contributing family workers).

13.2 National data

13.2.1 Data sources

The employment by production and other activities in forest is not reported at the national level. A study done by World Bank (WB, 2000) to estimate the employment potential in forestry sector in India based on 1993 data has formed the main source of this reporting. The employment generated per unit of activity such as production of timber, plantation, etc of this study has been used to estimate the employment in 2000 and 2005. The updates of production of timber etc. and area under other activities has been derived from relevant Reporting Tables.

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
WB. 2000. India: Alleviating Poverty through Employment. The World Bank. 2000	L	Employment under various forestry activities.	1993	

13.2.2 Classification and definitions

National class	Definition
Principal “Usual Status” or Principal Activity	The activity on which the person spent relatively more time preceding 365 days.
Employed in Principal Activity or Usual Status	A person is “working or employed” if he or she was engaged for a relatively longer time during the past year in one or more work activities (economic activities).
Unemployed in Principal Activity or Usual Status	A person is “seeking or available for work or unemployed” if he or she was not working but was seeking or was available for work for a relatively longer time during the past year.
Out of Labour Force (Primary Activities)	A person is “out of labour force” if he or she was engaged in non-economic activities for a relatively longer time of the reference year.
Principal Status “Worker” or “Employed	A person categorised as “worker” or “employed” on the basis of principal status is as principal status “worker” or “employed”. Explanation: Unpaid helpers, who assist in operation of an economic activity in household farm or non farm activities are also considered as workers. It does not

National class	Definition
	include persons engaged in collection of firewood as a non-economic activity.
Subsidiary Status “Worker” or “Employed”	A person categorised as non worker (unemployed or “out of labour force”) who pursued some economic activity in a subsidiary capacity. Explanation: Unpaid helpers, who assist in operation of an economic activity in household farm or non farm activities are also considered as workers. It does not include persons engaged in collection of firewood as a non-economic activity.
Total Workers	Sum of Principal Status Workers and Subsidiary Status workers under “Usual Status” Classification.
Economic Activity	It includes (a) all market activities performed for pay or profit that result in production of goods and services for exchange, and (b) selected non market activities like agriculture sector activities that result in production (including gathering of uncultivated crops, forestry, collection of firewood, hunting, fishing etc.) of agriculture produce for consumption; activities relating to the production of fixed assets for personal use (including houses, roads, wells, machinery, tools etc. for household enterprise and construction of private or community facilities free of charge)

(Source: Source Census of India, 2001)

13.2.3 Original data

The following table presents the number of principal and subsidiary forest workers in 1993 in the eight forest related categories mentioned in a World Bank Study (WB, 2000).

National Class	Number in 1993 (in millions)
Firewood/fuelwood by exploitation of forest	0.049
Gathering of fodder from forests	0.014
Uncultivated materials in forests	0.300
Hunting, trapping, and game propagation	0.067
Forestry and logging	1.488
Plantations ¹	4.703
Planting, replanting and conservation of forestry	0.532
Forest services	0.344

(Source: WB, 2000.)

Note. 1. The total estimated annual employment provided by plantations, which includes plantations of non forest species also on non-forest land with or without trees, is 9.406 million. It is assumed that only fifty percent is related to forests and Other Wooded lands.

13.3 Analysis and processing of national data

13.3.1 Calibration

The figure on employment in study (WB, 2000) are taken as standard verified figures and therefore do not need for any calibration.

13.3.2 Estimation and forecasting

To calculate the employment in 1990, 2000 and 2005, it has been assumed that the employment in the eight forest related employment groups of the World Bank Study (WB, 2000) will follow the same trend required for FRA. Since the national data is available only for three categories namely wood production, fuel wood and plantation. From which employment per unit of these three categories was generated. These ratios have been applied

on eight employment categories of World Bank. The ratio of logging was applied on forestry & logging, forest services and conservation of forest, the ratio of plantation is applied on plantation and ratio of fuel wood was applied on fire wood, fodder, uncultivated materials and hunting etc. The estimates of self and paid employment have been obtained by expert judgement.

Eight Employment Categories As per the World Bank	Corresponding temporal trend used for Employment per unit	Type of employment
Firewood/fuelwood by exploitation of forest	Production of Fuel wood	Self
Gathering of fodder from forests	Production of Fuel wood	Self
Uncultivated materials in forests	Production of Fuel wood	Self
Hunting, trapping, and game propagation	Production of Fuel wood	Self
Forestry and Logging	Production of Industrial Round Wood	Paid
Plantations	Annual Establishment of Plantations	Paid
Planting, replanting and conservation of forests	Production of Industrial Round Wood	Paid
Forest services	Production of Industrial Round Wood	Paid

(Note 1. Most of the hunting trapping and game propagation is currently prohibited in the country.

13.3.3 Reclassification into FRA 2010 categories

National Classes of Employment	Percentage of a National Class to a FRA Class
	Production of Goods
Firewood/fuelwood by exploitation of forest	100
Gathering of fodder from forests	100
Uncultivated materials in forests	100
Hunting, trapping, and game propagation	100
Logging	100
Plantations	0
Planting, replanting and conservation of forests	0
Forest Admin services	100

13.4 Data for Table T13

FRA 2010 Category	Employment in 1000 (years FTE)		
	1990	2000	2005
Employment in primary production of goods	6 360	6 053	6 188
...of which paid employment	5 948	5 587	5 683
...of which self-employment	412	466	505
Employment in management of protected areas	24.6	24.6	24.6

13.5 Comments to Table T13

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Employment in primary production of goods	The major component of employment is on plantation activities but it is not known whether World Bank surveyed certain areas to estimate the number or it was estimated on the basis of expenditure incurred on forestry plantations.	
Paid employment / self-employment	The data on self employment seems to be underestimated in absence of any supporting documents	
Employment in management of protected areas	More information is awaited from sub-nationals/states which will help in providing better estimates.	

Other general comments to the table

Best effort was made to get any new study data but nothing was available. NSSO do collects data on employment but for the agriculture sector where forestry is also included and it is not possible to segregate for forestry.

14 Table T14 – Policy and legal framework

14.1 FRA 2010 Categories and definitions

Term	Definition
Forest policy	A set of orientations and principles of actions adopted by public authorities in harmony with national socio-economic and environmental policies in a given country to guide future decisions in relation to the management, use and conservation of forest and tree resources for the benefit of society.
Forest policy statement	A document that describes the objectives, priorities and means for implementation of the forest policy.
National forest programme (nfp)	A generic expression that refers to a wide range of approaches towards forest policy formulation, planning and implementation at national and sub-national levels. The national forest programme provides a framework and guidance for country-driven forest sector development with participation of all stakeholders and in consistence with policies of other sectors and international policies.
Law (Act or Code) on forest	A set of rules enacted by the legislative authority of a country regulating the access, management, conservation and use of forest resources.

14.2 Data for Table T14

Indicate the existence of the following (2008)			
Forest policy statement with national scope	<input checked="" type="checkbox"/>	Yes	
	<input type="checkbox"/>	No	
If Yes above, provide:	Year of endorsement	1988	
	Reference to document	National Forest Policy, 1988	
National forest programme (nfp)	<input checked="" type="checkbox"/>	Yes	
	<input type="checkbox"/>	No	
If Yes above, provide:	Name of nfp in country	National Forestry Action Plan	
	Starting year	1999	
	Current status	<input type="checkbox"/>	In formulation
		<input checked="" type="checkbox"/>	In implementation
		<input type="checkbox"/>	Under revision
Reference to document or web site	www.envfor.nic.in		
Law (Act or Code) on forest with national scope	<input checked="" type="checkbox"/>	Yes, specific forest law exists	
	<input checked="" type="checkbox"/>	Yes, but rules on forests are incorporated in other (broader) legislation	
	<input type="checkbox"/>	No, forest issues are not regulated by national legislation	
If Yes above, provide:	Year of enactment	1927, 1972, 1980	
	Year of latest amendment	Time to time	
	Reference to document	Indian Forest Act 1927 Wildlife (Protection) Act, 1972 Forest Conversation Act, 1980	

In case the responsibility for forest policy- and/or forest law-making is decentralized, please indicate the existence of the following and explain in the comments below the table how the responsibility for forest policy- and law-making is organized in your country.	
Sub-national forest policy statements	√ Yes
	No
If Yes above, indicate the number of regions/states/provinces with forest policy statements	8
Sub-national Laws (Acts or Codes) on forest	√ Yes
	No
If Yes above, indicate the number of regions/states/provinces with Laws on forests	35

14.3 Comments to Table T14

Variable / category	Comments related to data, definitions, etc.
Forest policy statement with national scope	
National forest programme (nfp)	Though the national forestry action plan is being implemented but in the absence of adequate fund/budget, implementation is only partial.
Law (Act or Code) on forest with national scope	
Sub-national forest policy statements	
Sub-national Laws (Acts or Codes) on forest	

15 Table T15 – Institutional framework

15.1 FRA 2010 Categories and definitions

Term	Definition
Minister responsible for forest policy-making	Minister holding the main responsibility for forest issues and the formulation of the forest policy.
Head of Forestry	The Head of Forestry is the Government Officer responsible for implementing the mandate of the public administration related to forests.
Level of subordination	Number of administrative levels between the Head of Forestry and the Minister.
University degree	Qualification provided by University after a minimum of 3 years of post secondary education.

15.2 Data for Table T15

Table 15a – Institutions

FRA 2010 Category	2008
Minister responsible for forest policy formulation : please provide full title	Minister for Environment & Forests
Level of subordination of Head of Forestry within the Ministry	1 st level subordination to Minister
	√ 2 nd level subordination to Minister
	3 rd level subordination to Minister
	4 th or lower level subordination to Minister
Other public forest agencies at national level	None
Institution(s) responsible for forest law enforcement	Ministry of Environment & Forests and the Regional offices, State Forest Departments, National Tiger Conservation Authority, Directorate of Wildlife Preservation,

Table 15b – Human resources

FRA 2010 Category	Human resources within public forest institutions					
	2000		2005		2008	
	Number	%Female	Number	%Female	Number	%Female
Total staff	180 596	4.07	179 673	4.07	179 119	4.06
...of which with university degree or equivalent	33 435	7.05	33 264	7.05	33 161	7.05

Notes: The data of the total human resources working under state forest departments is taken firstly from Forestry Statistics, India (ICFRE) 2001 and 2003. In addition many state forest departments and forestry institutions under central governments provided the latest data (2008) on total human resources as well as the percentage of female and the educational qualifications of their staff.

15.3 Comments to Table T15

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Minister responsible for forest policy formulation		
Level of subordination of Head of Forestry within the Ministry		
Other public forest agencies at national level		
Institution(s) responsible for forest law enforcement		
Human resources within public forest institutions		

16 Table T16 – Education and research

16.1 FRA 2010 Categories and definitions

Term	Definition
Forest-related education	Post-secondary education programme with focus on forests and related subjects.
Doctor's degree (PhD)	University (or equivalent) education with a total duration of about 8 years.
Master's degree (MSc) or equivalent	University (or equivalent) education with a total duration of about five years.
Bachelor's degree (BSc) or equivalent	University (or equivalent) education with a duration of about three years.
Technician certificate or diploma	Qualification issued from a technical education institution consisting of 1 to 3 years post secondary education.
Publicly funded forest research centers	Research centers primarily implementing research programmes on forest matters. Funding is mainly public or channelled through public institutions.

16.2 National data

16.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year (s)	Additional comments
Forestry Statistics India, 2001	M	Staff strength	2000	
Forestry Statistics India, 2003	M	Staff strength	2001	
Information received from DDG, Education, ICFRE	H	Students of M.Sc & B.Sc.	2008	
Information received from State forest Departments	H	Total staff, male/female	2008	

16.2.2 Original data

Category	Graduation ¹⁾ of students in forest-related education	
	2008	
	Number	%Female
Master's degree (MSc) or equivalent	615	55
Bachelor's degree (BSc) or equivalent	808	50

16.3 Analysis and processing of national data

16.3.1 Estimation and forecasting

The number of students in MSc and BSc for 2008 along with percentage of female has been compiled from ICFRE. For other years, the same intake has been presumed. For professionals working under publicly funded forest research, persons working in state forest department and central organisation have been combined. The bifurcation of total staff among different categories and percentage of female has been worked out from the information received from state forest departments.

Data for Table T16

FRA 2010 Category	Graduation ¹⁾ of students in forest-related education					
	2000		2005		2008	
	Number	% Female	Number	% Female	Number	% Female
Master's degree (MSc) or equivalent	565	55%	565	55%	565	55%
Bachelor's degree (BSc) or equivalent	808	50%	808	50%	808	50%
Forest technician certificate / diploma	3 000	2%	3 000	2%	3 000	2%
FRA 2010 Category	Professionals working in publicly funded forest research centres ²⁾					
	2000		2005		2008	
	Number	% Female	Number	% Female	Number	% Female
Doctor's degree (PhD)	482	24	425	24	394	24
Master's degree (MSc) or equivalent	1 226	23	1 080	23	1 002	23
Bachelor's degree (BSc) or equivalent	1 572	18	1 389	18	1 289	18

16.4 Comments to Table T16

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Graduation of students in forest-related education	The numbers mentioned are average of at least five years and therefore have been rounded off. The number specially of technician level who are given in service education/training is highly inconsistent.	Numbers are more or less static.
Professionals working in public forest research centres		

17 Table T17 – Public revenue collection and expenditure

17.1 FRA 2010 Categories and definitions

Category	Definition
Forest revenue	All government revenue collected from the domestic production and trade of forest products and services. For this purpose, forest products include: roundwood; sawnwood; wood-based panels; pulp and paper; and non-wood forest products. As far as possible, this should include revenue collected by all levels of government (i.e. central, regional/provincial and municipal level), but it should exclude the income of publicly owned business entities.
Public expenditure	All government expenditure on forest related activities (further defined below).
Operational expenditure (sub-category to Public expenditure)	All government expenditure on public institutions solely engaged in the forest sector. Where the forest administration is part of a larger public agency (e.g. department or ministry), this should only include the forest sector component of the agency's total expenditure. As far as possible, this should also include other institutions (e.g. in research, training and marketing) solely engaged in the forest sector, but it should exclude the expenditure of publicly owned business entities.
Transfer payments (sub-category to Public expenditure)	All government expenditure on direct financial incentives paid to non-government and private-sector institutions, enterprises communities or individuals operating in the forest sector to implement forest related activities.
Domestic funding	Public expenditure funded from domestic public financial resources, including: retained forest revenue; forest-related funds; and allocations from the national budget (i.e. from non-forest sector public revenue sources).
External funding	Public expenditure funded from grants and loans from donors, non-governmental organisations, international lending agencies and international organisations, where such funds are channelled through national public institutions.

17.2 National data

17.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
		Revenue	2000, 2005	

Table 17a - Forest revenues

FRA 2010 Categories	Revenues (1000 Rupees)	
	2000	2005
Forest revenue	15 165 800	15 074 200

Table 17b - Public expenditure in forest sector by funding source

FRA 2010 Categories	Domestic funding (1000 local currency)		External funding (1000 local currency)		Total (1000 local currency)	
	2000	2005	2000	2005	2000	2005
Operational expenditure						
Transfer payments						
Total public expenditure						
If transfer payments are made for forest management and conservation, indicate for what specific objective(s) - Please tick all that apply.	<input type="checkbox"/>	Reforestation				
	<input type="checkbox"/>	Afforestation				
	<input type="checkbox"/>	Forest inventory and/or planning				
	<input type="checkbox"/>	Conservation of forest biodiversity				
	<input type="checkbox"/>	Protection of soil and water				
	<input type="checkbox"/>	Forest stand improvement				
	<input type="checkbox"/>	Establishment or maintenance of protected areas				
	<input type="checkbox"/>	Other, specify below				

Comments to Table T17

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Forest revenue		
Operational expenditure		
Transfer payments		