Forestry Department
Food and Agriculture Organization of the United Nations

GLOBAL FOREST RESOURCES ASSESSMENT

COUNTRY REPORTS

BHUTAN

FRA2005/145
Rome, 2005

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 2005 (FRA 2005), which is the most comprehensive assessment to date. More than 800 people have been involved, including 172 national correspondents and their colleagues, an Advisory Group, international experts, FAO staff, consultants and volunteers. Information has been collated from 229 countries and territories for three points in time: 1990, 2000 and 2005.

The reporting framework for FRA 2005 is based on the thematic elements of sustainable forest management acknowledged in intergovernmental forest-related fora and includes more than 40 variables related to the extent, condition, uses and values of forest resources. More information on the FRA 2005 process and the results - including all the country reports - is available on the FRA 2005 Web site (www.fao.org/forestry/fra2005).

The Global Forest Resources Assessment process is coordinated by the Forestry Department at FAO headquarters in Rome. The contact person for matters related to FRA 2005 is:

Mette Løyche Wilkie
Senior Forestry Officer
FAO Forestry Department
Viale delle Terme di Caracalla
Rome 00100, Italy

E-mail: Mette.LoycheWilkie@fao.org

Readers can also use the following e-mail address: fra@fao.org

Report preparation and contact person

This report has been prepared by:

Name: D.B. Dhital (National Correspondent)
Title: Joint Director
Organization: Forest Resources Development Division
Address: Thimphu, Bhutan
Tel/Fax:
Email: db_dhital@moa.gov.bt

The following professionals staff has also contributed to the development of this report.

- Professional staff of Forest Resources Development Division
- All Divisional Forest Officers
- Officers of the Forestry Development Corporation Limited

Contents

1 Table T1 – Extent of Forest and Other wooded land

The information on the extent of "Forest" and "Other wooded land" is necessary for assessing state and change in the forest resources and also for monitoring trends. It also establishes links between national and global classification systems.

1.1 FRA 2005 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 *in situ*. 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 *in situ*; 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)
RGOB, 1995. Land Cover figures of Bhutan (National figures), Ministry of Agriculture, Royal Government of Bhutan	H	Landuse, Forest types	1989
RGOB.1999. Japan Forest Technical Association and Department of Forestry Services, Ministry of Agriculture, Royal Government of Bhutan	H	Landuse and forest types	1999

1.2.2 Classification and definitions

National class	Definition
Mixed conifer	Single species not exceeding 60% percent of the total
Fir	Fir forests. Fir constituting about 80 % of the total.
Blue pine	Blue pine forests. Blue pine constituting about 80 % of the total.
Chir pine	Chir pine forests. Chir pine constituting about 80 % of the total.
Broadleaved + Conifer	Mixture of broadleaf and conifer species of about 80% of the total
Broadleaved forests	Mixture of broadleaved forests of about 80 % of the total.
Conifer plantation	Plantation created of conifer species for productive and protective reasons.
Broadleaved plantation	Plantation created of broadleaf species for productive and protective reasons.
Shrub/Scrub/Grassland/ Pasture forest areas	Forest areas having canopy density more than 5 but less than 10 percent. Pasture includes areas covered by both natural and improved pastures.
Marshy & water spread	This category includes area covered by rivers, lakes and also marshy areas
Other land	Includes snow/glaciers, Rock outcrops, landslides and erosion areas

1.2.3 Original data

National data for 1989

Landuse category	1989(LUSS) (in 1000 ha.)
Forest	
Fir	345.30
Mixed conifer	486.80
Blue pine	128.60
Chir pine	100.90
Conifer + broadleaf	135.80
Broadleaf	1374.90
Plantation	6.40
Scrub	325.80
Pasture	156.40
Horticulture	5.80
Settlement	3.10
Others	598.50
Agriculture	308.80
Water spreads	30.40
Total	4007.50

National Data for 1999

Landuse category	1999(JAFTA) (in 1000 ha.)
Forest	
Fir	506.970
Mixed conifer	495.998
Blue Pine	136.381
Chir pine	279.173
Broadleaf + conifer	313.566
Broadleaf	950.516
Shrub/Grassland	521.46
Agriculture land	172.92
Settlements	1.98
Snow/Glaciers	268.39
Bare land	353.55
Water spread	26.36
Total	**4027.264**

Above data in brief with Scrub/Shrub/Grassland/Pasture shown separately for reclassification.

Broad National Classes	Area in 1000 ha.	
	1989	1999
Forests[1]	2,578.70	2,682.61
Scrub/Shrub/Grassland/Pasture	482.2	521.46
Agriculture lands[2]	314.6	172.92
Water spreads	30.4	26.36
Others[3]	601.6	623.92
Total	**4,007.50**	**4,027.27**

Note: [1] Includes plantation and excludes scrub, shrub, grassland and pastures,
[2] Includes Horticulture . [3] Others includes Snow/ glaciers; Bare land; and Settlements.

1.3 Analysis and processing of national data

1.3.1 Calibration

The total area of the country, as per Land Cover figures of Bhutan -1995 (National figures) Ministry of Agriculture, Royal Government of Bhutan is 40,075 square kilometers. The country would like to maintain this for reporting. However to satisfy FRA 2005 guidelines, following calibration has been done only for the purposes of FRA 2005. The Scrub/Shrub/Grassland/Pasture has been tabulated separately for ease in reclassification and area of water bodies has been matched with FAOSTAT, which is 0. The country prefers to use proportionate method of calibration over the remainder method. This is mainly because the proportionate method maintains the national statistics on percentage of forest cover but indicates higher area where as the remainder method maintains the national statistics on area of the forest cover but reduces the figure of percentage of forest cover. Further that it is the percentage figure that is more important and used more frequently than the area figure.

A. Calibration Factor

Category	**1989**	**1999**
FAOSTAT Area	4,700.00	4,700.00
Proportionate Calibration Factor	1.17280	1.16704

B. Calibrated data

Broad National Classes	**1989**	**1999**
Forests[1]	3024	3131
Scrub/Shrub/Grassland/Pasture	566	609
Agriculture lands[2]	316	202
Water spreads	0	0
Others[3]	794	758
Total	**4700**	**4700**

Note: [1] Includes plantation and excludes scrub, shrub, grassland and pastures.
[2] Horticulture merged with agriculture for 1989. [3] Others includes Snow/glaciers; Bare land and Settlements.

1.3.2 Estimation and forecasting

Area under various broad national classes after estimation and forecasting using linear interpolation and extrapolation techniques is as under

Broad National Classes	**1990**	**2000**	**2005**
Forests	3035	3141	3195
Scrub/Shrub/Grassland/Pasture	566	609	611
Agriculture lands	318	199	186
Water spreads	0	0	0
Others	781	751	708
Total	**4700.00**	**4700.00**	**4700.00**

1.4 Reclassification into FRA 2005 classes

Reclassification (percentage allocation) according to FRA 2005 classes

Reclassification	**Forest**	**Other wooded land**	**Other land with tree cover**	**Other land**	**Inland water**
Forests	100 %				
Scrub/Shrub/ Grassland & Pasture		100 %			
Agriculture land				100 %	
Water spreads					100 %
Others				100 %	

1.5 Data for National reporting table T1

FRA 2005 Categories	**Area (1000 hectares)**		
	1990	**2000**	**2005**
Forest	3035	3141	3195
Other wooded land	566	609	611
Other land	1099	950	894
Inland water bodies	0	0	0
TOTAL	**4700**	**4700**	**4700**

1.6 Comments to National reporting table T1

(i) The country wishes to maintain its statistics on the total area of the country, as reported in the Land Cover figures of Bhutan -1995 (National figures) Ministry of Agriculture, Royal Government of Bhutan is 40,075 square kilometres. The calibration of national data has been done just to meet FRA 2005 specifications.

(ii) The country prefers to use proportionate method of calibration over the remainder method. This is mainly because the proportionate method maintains the national statistics on percentage of forest cover but indicates higher area where as the remainder method maintains the national statistics on area of the forest cover but reduces the figure of percentage of forest cover. Further that it is the percentage figure that is more important and used more frequently than the area figure.

2 Table T2 – Ownership of Forest and Other wooded land

2.1 FRA 2005 Categories and definitions

Global Classification and definitions (FRA 2005)

Category	Definition
Private ownership	Land owned by individuals, families, private co-operatives, corporations, industries, religious and educational institutions, pension or investment funds, and other private institutions.
Public ownership	Land owned by the State (national, state and regional governments) or government-owned institutions or corporations or other public bodies including cities, municipalities, villages and communes.
Other ownership	Land that is not classified either as "Public ownership" or as "Private ownership".

2.2 National data

2.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)
RGOB.1999 Japan Forest Technical Association and Department of Forestry Services, Ministry of Agriculture, Royal Government of Bhutan	H	Landuse and forest types	1999
RGOB. 1995. Land cover figures of Bhutan , Ministry of Agriculture, Royal Government of Bhutan.	H	Landuse types/forest types	1989
Forest and Nature Conservation Act, 1995	M	Ownership of the forest land	1995
Forest and Nature Conservation Rules, 2003	M	Ownership of the forest land	2003

2.2.2 Classification and definitions

National class	Definition
Reserved Forests	All forests land in the Country is a government reserved forests except the forest areas that are removed from the purview of reserved forest or allotted to a person by the Royal Government. Reserved forestland also includes the (i) community forest and (ii) the Protected Areas. The ownership is with the State.
Private Forests	Any area of private lands that has been registered as private forests pursuant to the rules of Forest and Nature Conservation Rules, 2003 are private forest land. The ownership lies with the private individuals.

2.2.3 Original data

All forests and other wooded land are owned by the Royal government. No information is available on "private forests", if any.

2.3 Analysis and processing of national data

2.3.1 Calibration

This step not needed.

2.3.2 Estimation and forecasting

This step not needed.

2.4 Reclassification into FRA 2005 classes

Reclassification (Percentage allocation) FRA 2005 classes

National Classes of ownership	Public ownership	Private ownership	Other or unspecified ownership
Forest	100 %		
Other wooded land	100 %		

2.5 Data for National reporting table T2

FRA 2005 Categories	Area (1000 hectares)			
	Forest		Other wooded land	
	1990	2000	1990	2000
Private ownership	n.d.a.	n.d.a.	n.d.a.	n.d.a.
Public ownership	3035	3141	566	609
Other ownership	n.d.a.	n.d.a.	n.d.a.	n.d.a.
TOTAL	**3035**	**3141**	**566**	**609**

2.6 Comments to National reporting table T2

3 Table T3 – Designated function of Forest and Other wooded land

The information on the designated functions is essential for efficient planning, design and implementation of forest policy and for assessment of cross-sectoral impacts. The term "designated functions" refers to the functions assigned for the purpose for which that forest is suitable.

3.1 FRA 2005 Categories and definitions

Types of designation

Category	**Definition**
Primary function	A designated function is considered to be primary when it is significantly more important than other functions. This includes areas that are legally or voluntarily set aside for specific purposes.
Total area with function	Total area where a specific function has been designated, regardless whether it is primary or not.

Designation categories

Category / Designated function	**Definition**
Production	Forest / Other wooded land designated for production and extraction of forest goods, including both wood and non-wood forest products.
Protection of soil and water	Forest / Other wooded land designated for protection of soil and water.
Conservation of biodiversity	Forest / Other wooded land designated for conservation of biological diversity.
Social services	Forest / Other wooded land designated for the provision of social services.
Multiple purpose	Forest / Other wooded land designated to any combination of: production of goods, protection of soil and water, conservation of biodiversity and provision of social services and where none of these alone can be considered as being significantly more important than the others.
No or unknown function	Forest / Other wooded land for which a specific function has not been designated or where designated function is unknown.

3.2 National data

The national data are not maintained by designated functions of forests. However, the Department of Forests of Bhutan has classified the 'forest' into following three classes based on broad functions served by the forests, There are also areas where no functions have been assigned at the present moment. The National Forest Policy of 1974, Forest and Nature Conservation Act, 1995, The Forest Management Code of Bhutan and the exercise for Forest Resources Potential Assessment have also classified the forest of the country into the three functional classes but it does not distinguish between "forests" and "Other wooded lands".

(i) Production forest (managed for meeting the requirement of timber and NWFP)

(ii) Protection Forests (managed for protection of soil, water and for biological stability).

(iii) Protected Area Network (Parks and Sanctuaries- for conservation of biological diversity).

3.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)
Forest Resources Potential Assessment (FRPA) for Bhutan, 2004, Department of Forests, Royal Government of Bhutan	H	Production forests, Protection forests, Protected Areas	1989
Land Cover figures of Bhutan-1995 (National Figures), Ministry of Agriculture, Royal Government of Bhutan	H	Area by landuse types	1989
National Forest Policy of Bhutan. 1974. Ministry of Agriculture, Royal Government of Bhutan	H	Policy Statements	1974
Forest and Nature Conservation Act of Bhutan.1995. Ministry of Agriculture, Royal Government of Bhutan	H	Policy Statements	1995

3.2.2 Classification and definitions

National class	Definition
Production forest	Forests that are managed for meeting the timber, fuelwood and NWFP demand in the country.
Protection forests	Forests that are managed for protection of soil, water resources, and for biological stability.
No/unassigned designation	Forests areas that have not been assigned any designated functions. However, these forests could be assigned for meeting the rural subsidised timber need and also for producing saw logs and other industrial timbers. The forest can also be managed for producing NWFP.

3.2.3 Original data

The original data is derived from the Land Cover figures of Bhutan-1995 (National Figures), Ministry of Agriculture, Royal Government of Bhutan. Based on these data set, functional classification was done as part of Forest Resources Potential Assessment of Bhutan by the Forest Resources Development Division of the Department of Forests.

A. Protection Area (1989)

It is the forest area where timber production is restricted . It includes "Protected Area network", area above 4000 meters above mean sea level (245.000 ha.), in-operable areas (845,000 ha) and buffer areas around roads, river and scrubs.

Forest Area restricted for timber production ***(Protection Area)***	**Area in ha.**
Total (A)	**2,078,532.00**

B. Production Area (1989)

It is the f**orest area available for timber production.**

Forest area available for timber production	**Area in ha.**
Total (B) ***(Production Areas)***	**409,564.00**

C. No Functional Designation (1989)

It includes the forest area, which have not been formally allocated or designated with any primary function. However, these forest areas could be brought under timber production.

Forest area that could be brought under timber production ***(Functional designation not assigned)***	**Area in ha.**
(a) Forest around settlements presently having low potential	264,779.00
(b) Degraded forest	32,356.00
(c) Forest areas > 15 KM from road	69,479.00
(d) Small patches of forests <100 ha	59,196.00
(e) Forest areas < 4000 ha and >10 KM from road	70,187.00
(f) Forest areas <1000 ha > 5 KM from road	76,801.00
Total (C)	**572,798.00**

D: Biodiversity Conservation (1993)

The protected areas of Bhutan comprises four national parks, four wildlife sanctuaries and one strict nature reserve. The "PA" network, revised in 1993 to represent Bhutan's complete ecosystems, encompasses about 26.3 percent of the land (1117,170 ha). It is assumed that this entire area is contained in the designated "protection area". In 1999, an additional 9.5 percent of the country was demarcated as biological corridors linking all nine protected areas, and declared a gift to the earth from the Bhutanese people.

Category	**Area in 000 ha**
Forest	701
OWL	196
Other	212
Inland Water bodies	8
Total	**1117**

(Source : GIS database WWF Bhutan)

3.3 Analysis and processing of national data

3.3.1 Calibration

This step is not necessary.

3.3.2 Estimation and forecasting

A. Estimation of Net area under Protection

In 1993, the Forest and OWL cover 701 (000 ha) and 196 (000 ha) respectively within the 1117 (000 ha) of the area under protected area net work (PAs). It is assumed that entire 897 (000 ha) of "Forests" and "Other wooded land" of PAs is contained in the area designated as "protection" area.

Category	Area in 000 ha
Area of Forests and OWL under Protection under "PA"s	897
Remaining Area of Forests under Protection (excluding “PA”s)	1181
Total	2078

B. Distribution of area under different functions

The following table presents distribution of area under functions in 1989. It totals to 3061 (000 ha) of forests and shrub land.

National Functions	Area (Forest and OWL) "000" ha
Production	410
Protection	1181
Protected Area	897
No Designation	573
Total	**3061**

C. **Distribution of designated areas under “forest” and “Other wooded land” in 1989**

The following table presents the percentage distribution of area under forests and other wooded lands in 1989. This table has been developed to provide an objective basis for assuming percentage distribution within and among “Forests” and “OWL” for 1990, 2000 and 2005.

National Functions	Area 1989	Forests		OWL	
	in 000 ha	Area	Percent	Area	Percent
Production	410	410	15.90		
Protection	1181	1181	45.79		
Protected Area	897	701	27.18	196	40.66
No Designation	573	287	11.13	286	59.34
Total	**3061**	**2579**	**100.00**	**482**	**100.00**

E. Total area under different functions

The division of area under different functions in “forests” and “OWL”, has been estimated using above percentage distribution within and among forest and OWL areas.

National Functions	Area in 000 ha					
	1990		2000		2005	
	Forest	OWL	Forest	OWL	Forests	OWL
Production	483		500		508	
Protection	1390		1439		1464	
Protected Area	825	230	854	247	869	248
No Designation	337	336	348	362	354	363
Total	**3035**	**566**	**3141**	**609**	**3195**	**611**

3.4 Reclassification into FRA 2005 classes

The national data are not exactly in the FRA 2005 classes, therefore reclassification was done as required by FRA 2005.

Reclassification to FRA 2005 categories for "Primary function".

National Classes	Production	Protection	Conservation	Social Service	No Designation
Production	100%				
Protection		100%			
Protected Area Network			100%		
No or unknown designation					100%

Reclassification to FRA 2005 categories for "Total Area with function".

National Classes	Production	Protection	Conservation	Social Service	No Designation
Production	100%				
Protection		100%	100%		
Protected Area Network		100%	100%	100%	
No or unknown designation					100%

3.5 Data for National reporting table T3

FRA 2005 Categories / Designated function	Area (1000 hectares)					
	Primary function			Total area with function		
	1990	2000	2005	1990	2000	2005
Forest						
Production	483	500	508	483	500	508
Protection of soil and water	1390	1439	1464	2215	2293	2333
Conservation of biodiversity	825	854	869	2215	2293	2333
Social services				825	854	869
Multiple purpose				not appl.	not appl.	not appl.
No or unknown function	337	348	354	not appl.	not appl.	not appl.
Total – Forest	**3035**	**3141**	**3195**	**not appl.**	**not appl.**	**not appl.**
Other wooded land						
Production						
Protection of soil and water				230	247	248
Conservation of biodiversity	230	247	248	230	247	248
Social services				230	247	248
Multiple purpose				not appl.	not appl.	not appl.
No or unknown function	336	362	363	not appl.	not appl.	not appl.
Total – Other wooded land	**566**	**609**	**611**	**not appl.**	**not appl.**	**not appl.**

3.6 Comments to National reporting table T3

4 Table T4 – Characteristics of Forest and Other wooded land

The information on "characteristics" is essential to understand the development of appropriate and efficient silvicultural and management practices to ensure and promote sustainability of the forest resource. These practices define the future structures and composition of forest resources and their ability to provide goods and services. It also provides information of the degree of human impacts on the forest ecosystems.

4.1 FRA 2005 Categories and definitions

Category	Definition
Primary	Forest / Other wooded land of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed.
Modified natural	Forest / Other wooded land of naturally regenerated native species where there are clearly visible indications of human activities.
Semi-natural	Forest / Other wooded land of native species, established through planting, seeding or assisted natural regeneration.
Productive plantation	Forest / Other wooded land of introduced species, and in some cases native species, established through planting or seeding mainly for production of wood or non wood goods.
Protective plantation	Forest / Other wooded land of native or introduced species, established through planting or seeding mainly for provision of services.

4.2 National data

4.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)
DOF.1999. Records of forest plantations of Bhutan. Department of Forests, Ministry of Agriculture, Royal Government of Bhutan	M	Plantation area	1999
DOF. 2003. Vision strategy for Nature conservation, Department of Forests, Ministry of Agriculture, Royal Government of Bhutan.	H	Area of protected Areas	2003
MOA. 1995. Land Cover figures of Bhutan-1995 (National Figures), Ministry of Agriculture, Royal Government of Bhutan	H	Area by landuses	1989
DOF. 2000. Forestry in Bhutan (Facts and figures)- 2000, Department of Forests publication	M	Area of FMUs	2000
DOF. 2004. Forest Resources Potential Assessment (FRPA) for Bhutan. Department of Forests, Royal Government of Bhutan	M	Areas	1989

4.2.2 Classification and definitions

The information has been derived using the following equivalents in national definitions.

National class	Definition
Protected Areas	A little more than half of the forest area in the Protected Areas have been categorised as **Primary**. In this forest no human interference have taken place. In the other areas some human activities have taken place like collection small timber, firewood and non-wood forest products for *bonafide* consumption by the local people. This area has been categorised as **modified natural** forest.
Forest covered by management plans	This category of forest are those that have approved forest management plans and are under intensive management. The forests are harvested under approved silvicultural system and are put under natural regeneration. However, if the natural regeneration fails even after three years then artificial regeneration are carried out.

National class	Definition (contd.)
Forest areas that are not covered by management plans	The forest areas where there are no approved management plans are put under this category. Removal on the selection system is done for supplying the timber and firewood for the local people for their *bonafide* consumption. The area is generally left for natural regeneration.
Plantation	All plantations created under afforestation and reforestation scheme has been put under this category. The objectives for creating most of these plantations are for producing timber and other non-wood forest products. It is assumed that about 15 percent of the total plantation area have been created for protective objective and the rest with productive objectives.

Primary Forests

Fifty percent of the forests in the Protected Areas are assumed as Primary forests. Since in the Protected Areas like National Parks and Wildlife Sanctuaries there is very little human activities and the ecological processes are not disturbed. The above assumption creates a problem that the figure of area of primary forest increases with increase in area designated as "PA" where as in reality the area of primary forest cannot increase such short durations as 10 or 15 years (1990 to 2000 and 2005). Therefore, the area of forests under "PA" in 1990 has been assumed as area of primary forests in 1990, 2000 and 2005. The forest area under "PA" in 2000 and 2005, which is over and above that in 1990 has been treated as "modified forests".

The OWL areas under "PA" are treated similarly and are considered to be in their "primary" ecological state and are not considered in an anthropogenic degraded state of "forests".

Semi-natural

All forest areas that are covered by some type of approved forest management plan and which are under intensive management have been reported under semi-natural category. These areas are harvested under approved silvicultural system and are expected to regenerate naturally. The artificial or assisted natural regeneration is carried out in cases where the natural regeneration has not succeed in reforestation of the harvested areas.

Plantations

All plantations established either under afforestation and or reforestation schemes are bring considered as plantations under this category. The main objective of most of these plantations is to provide timber and other non-wood forest products, It has is assumed that about 15 percent of the total plantations are for protective purposes and the balance 85 percent are for productive purposes.

Modified Natural

All remaining areas of forest (total forest-plantation-primary forests) are treated as modified forests. It mostly includes areas where there are no approved management plans. The selection system is used to supply timber and firewood to the local people for their *bonafide* consumption. The area is generally left for natural regeneration. It also includes the forest area under "PA" in 2000 and 2005, which over and above the "PA" in 1990.

4.2.3 Original data

	Forest		OWL[1]	
National Categories	**Areas in 000 ha.**		**Areas in ha.**	
	1989	**1999**	**1989**	**1999**
Forest with management plans	35.00	170.00	48.22	78.21
Plantation	0.71	1.55	0	0

Note: [1]There are no exact national data as per the above-mentioned FRA categories. The area figures given above under OWL are based on Expert knowledge.

4.3 Analysis and processing of national data

4.3.1 Calibration

This step is not necessary

4.3.2 Estimation and forecasting

The national figures, after estimation and forecasting, are given in the following table.

Variable	**Forest (000 ha)**			**OWL (000 ha)**		
	1990	**2000**	**2005**	**1990**	**2000**	**2005**
Forest with management plans	49	184	251	51	81	96
Plantation	1	2	2	0.0	0.0	0.0
Protected Area (Table 3)	825	854	869	196	212	213
Protection Area (Table 3)	1390	1439	1464			
Forest without management plan (Rest of the forest area)	770	662	609	319	316	302
Total	**3035**	**3141**	**3195**	**566**	**609**	**611**

Further, as indicated before the primary forest area has been assumed to remain constant since 1990. Any area under "PA" network in 2000 and 2005 that exceeds the figure for 1990 has been transferred to the category of "Modified forests".

4.4 Reclassification into FRA 2005 classes

National Class	**Percentage of a national class into a FRA classes**								
	Pri. For	**Modified For.**	**Semi-Nat. For**	**Product. Pl.**	**Protect Pl.**	**Pri. OWL**	**Mod. OWL**	**Semi OWL**	**Pl OWL**
	%	**%**	**%**	**%**	**%**	**%**	**%**		**%**
Forest with management plans			100%					100%	
Plantation				85%	15%				100%
Protected Area (Table 3)	50%	50%				50%	50%		
Protection Area (Table 3)	100%					100%			
Forest without management plan (Rest area)		100%							

4.5 Data for National reporting table T4

FRA 2005 Categories	Area (1000 hectares)					
	Forest			Other wooded land		
	1990	2000	2005	1990	2000	2005
Primary	413	413	413	98	98	98
Modified natural	2573	2543	2529	417	430	417
Semi-natural	49	184	251	51	81	96
Productive plantation	1	1	2	0	0	0
Protective plantation	0	0	0	0	0	0
TOTAL	**3035**	**3141**	**3195**	**566**	**609**	**611**

4.6 Comments to National reporting table T4

The fifty percent of the total area under “PA” network has been assumed to be the primary forests with the condition that it does not exceed the figure in 1990. Any excess over the 1990 figures has been transferred to the category of “Modified forests”.

5 Table T5 – Growing stock

5.1 FRA 2005 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.
Commercial growing stock	The part of the growing stock of species that are considered as commercial or potentially commercial under current market conditions.

5.2 National data

5.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)
DOF. 1989. Report on Pre-investment Survey of Forest Resources in Southern Bhutan, Department of Forests, Royal Government of Bhutan (Part I)	H	Growing stock per stratum,	1989
DOF. 1989 Report on Pre-investment Survey of Forest Resources in Central and Eastern Bhutan, Department of Forests, Royal Government of Bhutan, Volume I	H	Growing stock per stratum	1989
DOF. 1989. Report on Pre-investment Survey (PIS) of Forest Resources in north-western Bhutan, Department of Forests, Royal Government of Bhutan	H	Growing stock per stratum	1989

5.2.2 Classification and definitions

National class	Definition
Growing Stock	Volume of all trees above 10 cm dbh measured at breast height (i.e. 1.30 meters from ground level).
Commercial Growing Stock	Assumed 40percetn of the total growing stock

5.2.3 Original data

The following data is from various survey reports (DOF, 1989).

Forest Types	Area 000 ha	Volume 000 cubic meter	Volume/ha
Chir pine	101	8466	83.91
Blue pine	129	5607	43.60
Fir & Spruce	345	92635	268.27
Mixed conifers	487	40276	82.74
Conifers mixed with broad leaved	136	71764	528.45
Hard wood	1381	310229	224.59
Total	**2579**	**528978**	205.13

Note : An area of 6.4 (000 ha) has been added to Hardwoods to match the forest area figures in1989 (Table 1)

5.3 Analysis and processing of national data

5.3.1 Calibration

This step is not necessary.

5.3.2 Estimation and forecasting

A. Growing stock in 1999

Applying the per hectare growing stock of by species for 1989 to the area under species (or groups of species) in 1999 (Table 1) leads to the following table.

Forest types	**Area (000 ha)**	**Volume (m^3/ha)**	**Total Volume (000 m^3)**
Chir pine	279.00	83.91	23,410.34
Blue pine	136.00	43.60	5,929.85
Fir & Spruce	506.97	268.27	136,007.29
Mixed Conifer	495.00	82.74	40,954.42
Conifer mixed with broadleaved	313.00	528.45	165,405.98
Upland & lowland hardwoods	952.64	225.64	214,951.38
Total	**2,682.61**		**586,659.27**

(Note.1: An area of 2.64 ("000 ha) has been added to Hardwood to match forest area in 1999 in Table 1)

B. Estimating growing stock for 1990, 2000 and 2005.

Method of linear interpolation and extra-polation has been used to develop the estimates.

Growing Stock	**1990**	**2000**	**2005**
	Volume in million m3		
	535	592	621

The commercial growing stock is being assumed as 40 percent of the total growing stock.

5.4 Reclassification into FRA 2005 classes

Reclassification (percentage allocation) into FRA 2005 classes

5.5 Data for National reporting table T5

FRA 2005 Categories	**Volume (million cubic meters over bark)**					
	Forest			**Other wooded land**		
	1990	**2000**	**2005**	**1990**	**2000**	**2005**
Growing stock	535	592	621	n.a.	n.a.	n.a.
Commercial growing stock	214	237	249	n.a.	n.a.	n.a.

Specification of country threshold values	Unit	Value	Complementary information
1. Minimum diameter at breast height of trees included in Growing stock (X)	cm	5	
2. Minimum diameter at the top end of stem (Y) for calculation of Growing stock	cm	5	
3. Minimum diameter of branches included in Growing stock (W)	cm		
4. Minimum diameter at breast height of trees in Commercial growing stock (Z)	cm		
5. Volume refers to "Above ground" (AG) or "Above stump" (AS)	AG / AS	AG	
6. Have any of the above thresholds (points 1 to 4) changed since 1990	Yes/No	No	
7. If yes, then attach a separate note giving details of the change	Attachment		

5.6 Comments to National reporting table T5

6 Table T6 – Biomass stock

6.1 FRA 2005 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 living 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 biomass	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.

6.2 National data

6.2.1 Data sources

Pre-Investment Survey of Forest Resources (PISFR) is the most important data source for growing stock per hectare and also the total growing stock. The data are valid for 1989. National Forest Inventory has not been carried out after (PISFR) study.

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)
Brown, Sandra. 1997. Estimating Biomass Change in Topical Forests. A Primer. FAO Forestry Paper No. 134	H	Biomass Expansion Factor	All years
Brown, S. L. and P. E. Schroeder. 1999. Spatial Patterns of Aboveground Production and Mortality of Woody Biomass for Eastern U.S. Forests. Ecological Applications, 9(3)1999, Ecological Society of America.	H	Biomass Expansion Factor	All years
GPG, 2003. Good Practise Guidance for Land-use, Land-use Change and Forestry. IPCC.	H	Basic Densities Root: Shoot Ratio Dead to Live Ratio	All

6.2.2 Classification and definitions

National class	Definition
Growing Stock	Volume of all trees above 10 cm dbh measured at breast height (i.e. 1.30 meters from ground level).

6.2.3 Original data

The national data for biomass stock is not available. Therefore the biomass has been estimated based on growing stock data in Table 5 and using following factors, mainly from GPG (2003).

A. Basic Density

Species	Basic density
	tonnes/m^3
Chir pine	0.39
Blue pine	0.30
Fir and Spruce	0.40
Mixed Conifer	0.41
Conifer mixed with broadleaf	0.45
Upland hardwood & Lowland hardwood	0.49

The weighted basic densities have been computed for 1989 and 1999 as 0.459 and 0.446 respectively by using the above densities and the relative species composition in 1989 and 1999.

B. Biomass Expansion Factor

There are no national estimates for Biomass Expansion Factor (BEF). The following table presents estimates of BEF using the formula (BEF = EXP (3.213-0.506*LN(Stem biomass per hectare) for broadleaved species (Sandra Brown, 1997) and using the formula (BEF = exp{1.771 - 0.339* LN (Stem biomass per hectare) for conifers (Brown and Schroeder, 1999). The later formula is for USA but is one of the few formula that are available for conifers that mainly cover pine and spruce species, which are the main constituent of the growing stock in Bhutan.

BEF	1990	2000	2005
Broadleaved Species	2.69	2.64	2.60
Coniferous Species	1.33	1.31	1.29
Weighted BEF	1.87	1.84	1.82

The table also presents the weighted average BEF computed by using the broad proportion (60:40) of the volume of the coniferous and broad leaved species in the growing stock.

C. Root to shoot ratio

Following the broad proportion (60:40) of the volume of the coniferous and broad leaved species in the growing stock in 1989 and 1999, a weighted average (0.372) Root to Shoot ratio has been calculated using the default values for conifers (0.46) and broadleaved (0.24) forests in GPG (2003).

D. Dead to live Ratio

Following the GPG (2003), the default value of 0.11 has been adopted for “Dead to Live” ratio to estimate deadwood biomass.

6.3 Analysis and processing of national data

6.3.1 Calibration

This step is not necessary.

6.3.2 Estimation and forecasting

A. Weighted basic density

It has been assumed that the weighted basic density for 1989 hold good for 1990 and that of 1999 for 2000 and 2005.

B. Above Ground Biomass estimation

Category	**Unit**	**1990**	**2000**	**2005**
Growing stock	million m^3	535	592	621
Basic density	tonnes/ m^3	0.459	0.446	0.446
BEF		1.87	1.84	1.82
Above Ground Biomass	**miillion tonnes**	**459**	**486**	**503**

C. Below Ground Biomass

A weighted root shoot ration of 0.35 have been used.

Category	**Unit**	**1990**	**2000**	**2005**
Above Ground Biomass	Million tonne	459	486	503
Root Shoot Ratio		0.372	0.372	0.372
Below Ground Biomass	million tones	**171**	**181**	**187**

D. Dead Wood Biomass

Category	**Unit**	**1990**	**2000**	**2005**
Total Live biomass	million tonne	630	667	690
Dead to live ratio		0.11	0.11	0.11
Dead Wood Biomass	million tones	**69**	**73**	**76**

6.4 Reclassification into FRA 2005 classes

This step is not necessary.

6.5 Data for National reporting table T6

FRA 2005 Categories	**Biomass (million metric tonnes oven-dry weight)**					
	Forest			**Other wooded land**		
	1990	**2000**	**2005**	**1990**	**2000**	**2005**
Above-ground biomass	459	486	503	n.a.	n.a.	n.a.
Below-ground biomass	171	181	187	n.a.	n.a.	n.a.
Total living biomass	630	667	690	n.a.	n.a.	n.a.
Dead wood biomass	69	73	76	n.a.	n.a.	n.a.
TOTAL	699	740	766	n.a.	n.a.	n.a.

7 Table T7 – Carbon stock

The information on Carbon stock indicates the contribution of "Forest" and "Other wooded land" to the carbon cycle. The information is used by international processes that monitor greenhouse gases and climate change.

7.1 FRA 2005 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 living 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 biomass	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 a minimum diameter chose by the country for lying dead (for example 10 cm), in various states of decomposition above the mineral or organic soil. This includes the litter, fumic, and humic layers.
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.

7.2 National data

7.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)
GPG, 2003. Good Practise Guidance for Land-use, Land-use Change and Forestry. IPCC.	H	Basic Densities, Root: Shoot Ratio, Dead to Live Ratio	All

7.2.2 Classification and definitions

No national definitions on forest carbon stocks.

7.2.3 Original data

A. Conversion factor Biomass to Carbon

The carbon stock, in the forest, has been estimated based on the biomass data from Table T6 and using the default conversion factor (0.5) provided in the Good Practice Guidance (2003) for LULUCF.

B. Carbon in forest litter

The default factor of 22 tonnes C per ha. (GPG, 2003) has been assumed to estimate carbon content of forest litter.

C. Soil Carbon

The forest soil classification has not been done in Bhutan in classes mentioned in GPG (2003). Therefore, based on expert knowledge, it has been assumed that (i) HAC Soils span about 50 % of forest area, LAC Soils 30 % of forest area and sandy soils remaining 20% of the forest area.

Forest	Area (1000 hectares)		
	1990	**2000**	**2005**
HAC Soils	1518	2071	1598
LAC Soils	911	1242	959
Sandy soils	606	828	638
Total	**3035**	**4141**	**3195**

7.3 Analysis and processing of national data

7.3.1 Calibration

The basic data are derived from Table T6, therefore calibration is not considered necessary.

7.3.2 Estimation and forecasting

A. Carbon in Living biomass and Dead wood biomass

FRA 2005 Categories	Carbon (Million metric tonnes)					
	Forest			Other wooded land		
	1990	**2000**	**2005**	**1990**	**2000**	**2005**
Carbon in above-ground biomass	230	243	251	n.a.	n.a.	n.a.
Carbon in below-ground biomass	85	90	94	n.a.	n.a.	n.a.
Sub-total: Carbon in living biomass	**315**	**333**	**345**	n.a.	n.a.	n.a.
Carbon in dead wood	35	37	38	n.a.	n.a.	n.a.

B. **Carbon in Litter**

Category	**1989**	**1999**
Forest Area 000	3035	3141
Default factor 22 tonnes/ha	22	22
Carbon in million tonnes	**67**	**69**

C. Carbon in Forest Soil

Following GPG (2003) it has been assumed that the per hectare carbon content of HAC, LAC and Sandy forest soils is 88, 63 and 34 tonnes.

Forest	Carbon in million tonnes		
	1990	**2000**	**2005**
HAC Soils	134	182	141
LAC Soils	57	78	60
Sandy soils	21	29	22
Total	**212**	**289**	**223**

7.4 Reclassification into FRA 2005 classes

Reclassification is not considered necessary.

7.5 Data for National reporting table T7

FRA 2005 Categories	Carbon (Million metric tonnes)					
	Forest			Other wooded land		
	1990	**2000**	**2005**	**1990**	**2000**	**2005**
Carbon in above-ground biomass	230	243	251	n.a.	n.a.	n.a.
Carbon in below-ground biomass	85	90	94	n.a.	n.a.	n.a.
Sub-total: Carbon in living biomass	**315**	**333**	**345**	n.a.	n.a.	n.a.
Carbon in dead wood	35	37	38	n.a.	n.a.	n.a.
Carbon in litter	67	69	70	n.a.	n.a.	n.a.
Sub-total: Carbon in dead wood and litter	**102**	**106**	**108**	n.a.	n.a.	n.a.
Soil carbon to a depth of 30 cm	**212**	**289**	**223**	n.a.	n.a.	n.a.
TOTAL CARBON	**629**	**728**	**676**	n.a.	n.a.	n.a.

7.6 Comments to National reporting table T7

8 Table T8 – Disturbances affecting health and vitality

A disturbance is defined as an environmental fluctuation and destructive event that disturb forest health, structure, and/or change resources or physical environment at any given spatial or temporal scale. Disturbances that affect health and vitality include biotic agents such as insects and diseases and abiotic agents such as fire, pollution and extreme weather conditions. To manage the impact of these agents it is essential to develop appropriate management regimes and to mitigate their impacts.

8.1 FRA 2005 Categories and definitions

Category	Definition
Disturbance by fire	Disturbance caused by wildfire, independently whether it broke out inside or outside the forest/OWL.
Disturbance by insects	Disturbance caused by insect pests that are detrimental to tree health.
Disturbance by diseases	Disturbance caused by diseases attributable to pathogens, such as a bacteria, fungi, phytoplasma or virus.
Other disturbance	Disturbance caused by other factors than fire, insects or diseases.

8.2 National data

8.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)
Data compiled from territorial Divisional offices	M	Area affected	1992 to 2004

8.2.2 Classification and definitions

National class	Definition
Forest fire	Wild fire that are either unplanned or uncontrolled which burns the forest and destroys the flora and fauna.
Disturbances by insects	Disturbances caused by insects that are detrimental to forest health.
Disturbances by diseases	Disturbances caused by diseases attributable to pathogens, such as bacteria, fungi, phytoplasma or virus.

8.2.3 Original data

A. Forest affected by fire

Year	1992-1993	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000
Area affected (in ha)	29,182.37	2,240.78	19,627.72	10,812.10	9,853.32	6,487.28	13,535.95	13,455.33

2000-2001	2001-2002	2002-2004
9,325.68	5,856.66	1,620.14

B. Forest affected by pests

Years	1992	1993	1994	1995	1996	1997	1998	1999
Area affected (in ha)	0.87	n/a	13.64	4.50	18.54	9.17	10.05	230.14

2000	2001	2002	2003	2004
238.00	39.63	29.70	116.91	13.17

C. Forest areas affected by diseases

Years	1999	2000	2001	2002	2003
Area affected (in ha)	5.00	15.00	205.00	70.23	5.02

8.3 Analysis and processing of national data

8.3.1 Calibration

This step is not considered necessary.

8.3.2 Estimation and forecasting

Estimation and forecasting was not considered necessary.

8.4 Reclassification into FRA 2005 classes

Reclassification of national data on forest fire is not considered necessary. The information is more or less, as per FRA 2005 format. However the data is mainly for forest and it is not available before 1992. The data for 2000 is an average of 1998 – 2002 (six months of 1998 and six months of 2002, which is only four years).

8.5 Data for National reporting table T8

FRA-2005 Categories	Average annual area affected (1000 hectares)			
	Forests		Other wooded land[1]	
	1990	2000	1990	2000
Disturbance by fire	n.a.	8.4	n.a.	n.a.
Disturbance by insects	n.a.	0.11	n.a.	n.a.
Disturbance by diseases	i.d	0.07[1]	n.a.	n.a.
Other disturbance	n.a.	n.a.	n.a.	n.a.

(Note: 1. The figure is an average of four years (1999 – 2002).)

8.6 Comments to National reporting table T8

Data has not been collected separately for ‘forests’ and ‘other wooded land’ and has been assumed to be for forest only.

9 Table T9 – Diversity of tree species

The information on diversity of tree species provides the information on tree species distribution. It will also give information for addressing some and /or many critical issues relating to conservation of biodiversity in the forests. Further the information also helps in meeting the requirement of reporting to the national government as to some international organizations on the biodiversity of the country.

9.1 FRA 2005 Categories and definitions

Category	Definition
Number of native tree species	The total number of native tree species that have been identified within the country.
Number of critically endangered tree species	The number of native tree species that are classified as "Critically endangered" in the IUCN red list.
Number of endangered tree species	The number of native tree species that are classified as "Endangered" in the IUCN red list.
Number of vulnerable tree species	The number of native tree species that are classified as "Vulnerable" in the IUCN red list.

9.2 National data

9.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)
IUCN 2003. 2003 IUCN Red List of threatened species.	H	Threatened,, endangered and vulnerable species	2003

9.2.2 Classification and definitions

There are no standard national definitions or classification.

9.2.3 Original data

As per IUCN Red List of threatened species, 2003, the following species are recorded as (i) critically endangered (ii) endangered (iii) vulnerable.

(a) Critically endangered tree species (1 species) *Bazzania bhutanica*

(b) Endangered tree species (2 species.) *Andrewsianthus ferrugineus*
Schistochila macrodoni

(c) Vulnerable (4 species) *Aglaia perviridis*
Aquilaria malaccepeciosumnsis
Cupressus cashmeriana
caphophyllum speciosum

9.3 Analysis and processing of national data

This step is not necessary

9.4 Reclassification into FRA 2005 classes

This step is not necessary.

9.5 Data for National reporting table T9

FRA 2005 Categories	**Number of species (year 2000)**
Native tree species	105
Critically endangered tree species	1
Endangered tree species	2
Vulnerable tree species	4

9.6 Comments to National reporting table T9

As per IUCN Red List of threatened species, 2003, the following species are recorded as (i) critically endangered (ii) endangered (iii) vulnerable.

(a) Critically endangered tree species (1 species) *Bazzania bhutanica*

(b) Endangered tree species (2 species.) *Andrewsianthus ferrugineus*
Schistochila macrodoni

(c) Vulnerable (4 species) *Aglaia perviridis*
Aquilaria malaccepeciosumnsis
Cupressus cashmeriana
Caphophyllum speciosum

10 Table T10 – Growing stock composition

The information on "Growing stock composition" is important for understanding the dynamics of forests composition and addresses some critical issues relating to conservation of biodiversity. It also helps in developing efficient management plans and to satisfy needs for national and international reporting related to biodiversity.

10.1 FRA 2005 Categories and definitions

List of species names (scientific and common names) of the ten most common species.

10.2 National data

10.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)
DOF. 1989. Report on Pre-investment Survey of Forest Resources in Southern Bhutan, Department of Forests, Royal Government of Bhutan (Part I)	H	Species-wise Growing stock	1989
DOF. 1989 Report on Pre-investment Survey of Forest Resources in Central and Eastern Bhutan, Department of Forests, Royal Government of Bhutan, Volume I	H	Species-wise Growing stock	1989
DOF. 1989. Report on Pre-investment Survey of Forest Resources in north-western Bhutan, Department of Forests, Royal Government of Bhutan	H	Species-wise Growing stock	1989

10.2.2 Original data

Based on the report prepared by Pre-Investment Survey of Forest Resources, on the growing stock for 1989, in term of the contribution of volume is furnished below. The growing stocks indicated are regardless of their commercial importance.

Composition of growing stock vis a vis percentage of each species *(for 1989)*

Species Scientific name	Common name	Growing Stock in Forests (million cubic meters) 1989	Percentage
Abies densa	Fir	108.63	20.5
Quercus spp.	Oak	93.47	17.7
Tsuga brunoniana	Hemlock	31.72	6.0
Rhododendron spp.	Rhododendron	19.84	3.8
Machilus spp.	Kawla	17.27	3.3
Acer spp.	Maple	15.24	2.9
Betula spp.	Birch	14.48	2.7
Picea spinulosa	Spruce	12.68	2.4
Pinus wallichiana	Blue pine	10.76	2.0
Pinus roxburghii	Chir pine	9.47	1.8
Rest of the species		195.42	36.9
TOTAL		**528.98**	**100.0**

Note: [1] The percentage distribution off volume is assumed to be same as was during 1989.

10.3 Analysis and processing of national data

10.3.1 Calibration

Not considered necessary.

10.3.2 Estimation and forecasting

The percentage distribution of species-wise volume of 1989 has been assumed for 1990 and 2000 also as no national level forest inventory has been conducted since 1989. The data for total growing stock for 1990 and 2000 has been taken from Table T5.

10.4 Data for National reporting table T10

FRA 2005 Categories / Species name (Scientific name)	**Common name**	**Growing Stock in Forests (million cubic meters)**	
		1990	**2000**
Abies densa	Fir	110	122
Quercus spp.	Oak	95	105
Tsuga brunoniana	Hemlock	32	36
Rhododendron spp.	Rhododendron	20	23
Machilus spp.	Kawla	18	20
Acer spp.	Maple	16	17
Betula spp.	Birch	14	16
Picea spinulosa	Spruce	13	14
Pinus wallichiana	Blue pine	11	12
Pinus roxburghii	Chir pine	10	11
Rest of the species		196	216
TOTAL		**535**	**592**

10.5 Comments to National reporting table T10

11 Table T11 – Wood removal

The information provided in the under-mentioned tables gives the actual wood removal from the forest. It indicates the economic and social utility of the forest resources in national economy and dependent local communities. This information will also help to monitor sustained use of forest resources by comparing actual removal with sustained potential.

11.1 FRA 2005 Categories and definitions

Category	Definition
Industrial wood removal	The wood removed (volume of roundwood over bark) for production of goods and services other than energy production (woodfuel).
Woodfuel removal	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)
DOF. 1992. Terminal Report for 7th Five year plan, Department of Forest (1987-92).	M	Removal	1987 to 1992
DOF. 2004. Progress Reports obtained from the Divisional Forest Officers, Department of Forests	M	Removal	2004
DOF. 2004. Information obtained from the Forestry Development Corporation, Ltd. Thimphu	M	Removal	2004

11.2.2 Classification and definitions

National class	Definition
Commercial supply	Royalty at market value is applicable for the supplies (e.g. trees, poles/posts and logs) made for commercial uses. The consumers buy the material in open auctions.
Rural supply	Logs, trees, poles/posts when supplied to the rural villagers for their *bonafide* rural consumption, subsidised rate of royalty is charged.
Royalty free supply	No royalty is realised on supplies made on *"royalty free supply"*.

11.2.3 Original data

A. Wood removal

The following quantity of timber supplied in 1990 is average of supplies made during 1987 – 92.

Sl.No.	Particulars	Unit	Supply during 1987-92[2]	Conversion factor[1]	Quantity in Log volume (m3)	Average per year (m3)
1	Trees	Nos	510,519.00	1.300	663,674.70	132,734.94
2	Poles	Nos	472,628.00	0.067	31,666.07	6,333.21
3	Logs	cft.	5,470,732.00	35.310	154,934.35	30,986.87

Total	**850,275.12**	**170,055.02**

Note:
[1] Conversion factor used for converting "number of trees" to m^3 is 1.300. Conversion factor used for converting "number of poles" to m^3 is 0.067. [2] July 1987 to December 1987 = 6 months. January 1998 to December 1991 = 4 years. January 1992 to June 1992 = 6 months)

However, the following data for 2000 the information is not available for all relevant years hence it is simply the actual supply made for the year. This is not average figure.

Sl.No.	Particulars	Unit	Supplied during 2000	Conversion factor	Total vol. supplied during 2000 (m^3)
1	Trees	Nos	85,090.00	1.300	110,617.00
2	Poles/posts	Nos	285,974.50	0.067	19,160.29
3	Logs	cu.m	65,055.99		65,055.99
	Total				**194,833.28**

Note: [1] Conversion factor used for converting "number of trees" to m^3 is 1.300. Conversion factor used for converting "number of poles" to m^3 is 0.067.

B. Wood fuel removal

Similarly, following quantity of wood-fuel removal for 1990 has been calculated by averaging the supplies made during 1987 – 92.

Sl.No.	Particulars	Total fuelwood supply during year19987-92 in m^3	Total supply per year in m^3
Total wood fuel removal		**715,268.00**	**143,053.60**

Note:July 1987 to December 1987 = 6 months. January 1998 to December 1991 = 4 years
January 1992 to June 1992 = 6 months).

However, wood-fuel removed during 2000 is the actual removal made during that year.

Sl No	Wood fuel	Unit	Total supplied during 2000 (m^3)
1	**Wood fuel removal**		**94,611.00**

11.3 Analysis and processing of national data

11.3.1 Estimation and forecasting

The data for wood removal including data for 2005 after forecasting is given below.

A. Wood

National Classes	Volume in m^3		
	1990	**2000**	**2005**
Trees	132,735	110,617	99,558
Poles/posts	6,333	19,160	25,574
Logs	30,987	65,056	82,090
Total	**170,055**	**194,833**	**207,222**

B. Wood fuel

The data for woodfuel removal including data for 2005 after forecasting is given below.

	Volume in m^3		
National Category	**1990**	**2000**	**2005**
Woodfuel	143,053.60	94,611.00	70,389.70

11.4 Reclassification into FRA 2005 classes

National classes of roundwood	**Percentage of a national class belonging to FRA Class**	
	Industrial roundwood	**Wood fuel (Fuelwood)**
Trees	100%	
Poles/posts	100%	
Logs	100%	
Woodfuel		100%

11.5 Data for National reporting table T11

FRA 2005 Categories	**Volume in 1000 cubic meters of roundwood over bark**					
	Forest			**Other wooded land[1]**		
	1990	**2000**	**2005**	**1990**	**2000**	**2005**
Industrial roundwood	170	195	207	n.a.	n.a.	n.a.
Woodfuel	143	95	70	n.a.	n.a.	n.a.
TOTAL for Country	**313**	**290**	**277**	n.a.	n.a.	n.a.

Note:[1]Supply of roundwood and woodfuel (fuelwood) are made from the forest. Small volume may have been supplied, especially to the rural people, from the other wood land but the data are not maintained separately. Therefore it is assumed that the supply are only from the forest.

11.6 Comments to National reporting table T11

(i) Export of timber and firewood, in the primary form is banned since 1999.

(ii) Number of trees supplied for rural use, on subsidised rate of royalty, has gone down after 1999. People have switched over to the alternate construction materials for constructing their rural dwelling houses.

(iii) Firewood supply has also gone down manifold during 2000. It is because people have started switching over to the use of electricity and gas as a source of energy for cooking and space heating.

12 Table T12 – Value of wood removal

The information on the value of the wood removed from the forest indicates the economic contribution from the forests and woodlands. This information would be very important for development and monitoring of national policies and for evaluating the economic sustainability of the forests.

12.1 FRA 2005 Categories and definitions

Category	Definition
Value of industrial wood removal	Value of the wood removed for production of goods and services other than energy production (woodfuel).
Value of woodfuel removal	Value of the wood removed for energy production purposes, regardless whether for industrial, commercial or domestic use.

12.2 National data

The data for 1990 is obtained from the Terminal Progress Report compiled by the Department of Forests for the five-year plan period (i.e. for 1987-19920). The reporting period is from July of preceding year to June of the succeeding year. It covers six months of the first year and another six months of the succeeding year. The figures for 2000 are the actual figures for that particular year.

12.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)
DOF. 1992. Terminal Report for 6th Five year plan, Department of Forest (1987-92).	M	Volume	1987 to 1992
DOF. 2004. Progress Reports obtained from the Divisional Forest Officers, Department of Forests	M	Volume	2004
DOF. 2004. Information obtained from the Forestry Development Corporation, Ltd. Thimphu. Bhutan	M	Volume	2004

12.2.2 Classification and definitions

The Report uses the term "revenue" and not "market value" for the following products supplied by the Forest Department. example:

1. When the trees, poles/posts and logs are supplied to the villagers for their *bonafide* uses or consumption then government charges subsidised rate of royalty (stumpage).
2. When the trees, poles/posts and logs are supplied to the urban dwellers for their uses then government charges full commercial rate of royalty (stumpage).

National class	Definition
Commercial supply	Royalty at market rate is applicable for the supplies (e.g. trees, poles/posts and logs) made for commercial uses. The consumers buy the material in open auctions.
Rural supply	Logs, trees, poles/posts when supplied to the rural villagers for their *bonafide* rural consumption, subsidised rate of royalty is charged.
Royalty free supply	No royalty is realised on supplies made on *"royalty free supply"*.

12.2.3 Original data

National classes	Value in Nu. (1990)
Trees	135,790,000.00
Poles/posts	5,900,000.00
Logs	58,000,000.00
Sub total	**199,690,000.00**
Woodfuel	1,890,000.00
Total	**201,580,000.00**

Note: The value for 1990 is the average value for 5 years i.e. July 1987 to June 1992.

12.3 Analysis and processing of national data

12.3.1 Calibration

This step is not necessary.

12.3.2 Estimation and forecasting

The value of royalty for 2000 is not available. Therefore, it has been assumed that value per m^3 obtained in 1990 also applies for 2000 and 2005.

	For 1990		
Particulars	**Volume in m3**	**Value in Nu.**	**Value/m3 (in Nu)**
Trees	132,734.94	135,790,000.00	1,023.02
Poles/posts	6,333.21	5,900,000.00	931.60
Logs	30,986.87	58,000,000.00	1,871.76
Total	**170,055.02**	199,690,000.00	**1,174.27**
Woodfuel	**143,053.60**	**1,890,000.00**	**13.21**
Grand total	**313,108.62**	**201,580,000.00**	

Based on the above value per m^3 values, the following values for removal of wood and wood fuel have been calculated in national currency.

Particulars	**1990**	**2000**	**2005**
	Value in Nu.		
Trees	135,790,000.00	113,162,988.06	101,849,482.09
Poles/posts	5,900,000.00	17,849,670.39	23,824,505.58
Logs	58,000,000.00	121,769,233.87	153,653,850.81
Sub total	**199,690,000.00**	**252,781,892.32**	**279,327,838.48**
Woodfuel	**1,890,000.00**	**1,249,984.55**	**929,976.83**
Total	**201,580,000.00**	**254,031,876.87**	**280,257,815.31**

Using following exchange rates the values in national currencies have been transformed into units of "000"US dollars.

For 1990 1USD = Ngultrum 18.07
For 2000 1USD = Ngultrum 46.75
For 2005 1USD = Ngultrum 43.76

	1990	2000	2005
	Value in "000'US Dollars[1]		
Trees	7515	2420	2328
Poles/posts	326	382	544
Logs	3210	2605	3511
Sub total	11051	5407	6383
Woodfuel	105	27	21
Total	11156	5434	6404

[1]EXCHANGE RATE

12.4 Reclassification into FRA 2005 classes

National classes of roundwood	Percentage of a national class belonging to FRA Class	
	Induatrial roundwood	Wood fuel (Fuelwood)
Trees	100%	
Poles/posts	100%	
Logs	100%	
Woodfuel		100%

12.5 Data for National reporting table T12

FRA 2005 Categories	Value of roundwood removal (1000 USD)					
	Forest			Other wooded land		
	1990	2000	2005	1990	2000	2005
Industrial roundwood	11051	5407	6383	n.a.	n.a.	n.a.
Woodfuel	105	27	21	n.a.	n.a.	n.a.
TOTAL for Country	11156	5434	6404	n.a.	n.a.	n.a.

12.6 Comments to National reporting table T12

1. Export of timber and firewood, in the primary form, is banned since 1999. This is one of the reasons for fall in value of industrial roundwood. The rate in the local market is relatively low.

2. The number of trees supplied for rural use, on subsidised rate of royalty, has also gone down during 2000. People have switched to the alternate construction materials for constructing their rural dwelling houses.

3. Fuelwood supply has also gone down manifold during 2000, as a result, the value of royalty has decreased, for both industrial roundwood and woodfuel during 2000 and, of course, the forecasted figures for 2005.

13 Table T13 – Non-wood forest product removal

The information on removal of "non wood forest products" (NWFP) from forest and other wooded land demonstrates the potential of forests to provide NWFP, both as important commodities for national and international markets, and for the livelihood of local and indigenous people dependent on them. This information indicates the priority NWFPs deserve in development of national policies and management strategies.

13.1 FRA 2005 Categories and definitions

The following categories of non-wood forest products have been defined:

Category
Plant products / raw material
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
Animal products / raw material
9. Living animals
10. Hides, skins and trophies
11. Wild honey and bee-wax
12. Bush meat
13. Raw material for medicine
14. Raw material for colorants
15. Other edible animal products
16. Other non-edible animal products

13.2 National data

13.2.1 Data sources

References to sources of information	**Quality (H/M/L)**	**Variable(s)**	**Year(s)**
RGOB.2000. Renewable Natural Resources Statistics, 2000, Volume I, Ministry of Agriculture, Royal Government of Bhutan	H	Quantity removed	2000
DOF. 1992. Terminal Report for 6th Five year plan, Department of Forest (1987-92).	M	Quantity removed	1987 to 1992
DOF. 2004. Records from Bhutan Museum of Natural History, Department of Forests, Ministry of Agriculture.	M	Quantity removed	2004

13.2.2 Classification and definitions

National class	**Definition**
NWFP- Plants Products	Currently it includes Mushroom, Cane shoot, Fern tops, Edible oil seeds, Fodder, Medicinal and aromatic plants, Resin and turpentine oil, Colorants and dyes, Raw material for handicraft items, Ornamental plants, Other non wood products.
NWFP- Animal products	Currently it includes skin, hides, antlers, trophy, birds parts, like skin , skin body parts, honey, wax, and edible animal parts etc..

13.2.3 Original data

Removal of the following categories of non wood forest products in Bhutan			
Category **Plant products / raw material** **1. Food**	**Unit**	**Total quantity removed during 1990**	**Total quantity removed during 2000**
Mushroom	Kg	n.a.	955.60
Caneshoots	Kg	n.a.	4,878.00
Fern tops	Kg	n.a.	147,091.00
Edible oilseed	Kg	n.a.	149,630.00
Sub-Total		n.a.	**302,554.60**
2. Fodder			
Fodder	Kg	n.a.	166,360,950.00
Sub-Total	Kg	n.a.	**166,360,950.00**
3. Raw material for medicine and aromatic products			
Terminalia chebula / Terminalia belerica (locally known as Aroo/Baroo)	Kg	n.a.	190.00
Chirata	Kg	n.a.	2,926.60
Litsea	Kg	n.a.	1,996.40
Pipla	Kg	56.60	3,383.00
Lemon Grass Oil	Kg	5,117.84	102,117.00
Sofin oil	Kg	1,998.36	n.a.
Terpentine	Kg	110,376.45	n.a.
Sub-Total	Kg	**117,549.25**	**110,613.00**
4. Raw material for colorants and dyes	Kg	n.a.	19,296.00
Sub-Total	Kg	n.a.	**19,296.00**
5. Raw material for utensils, handicrafts & construction			
Bamboo	Kg	1,451,908.75	3,848,428.43
Cane	Kg	n.a.	3,231,600.00
Sub-Total	Kg	**1,451,908.75**	**7,080,028.43**
6. Ornamental plants		n.a.	
Sub-Total			
7. Exudates			
Resin	Kg	239,811.00	111,611.70
Sub-Total	Kg	**239,811.00**	**111,611.70**
8. Other plant products			
Bettle leaf	Kg	n.a.	207.00
Daphne	Kg	n.a.	1,3157.40
Thatch grass	Kg	n.a.	83,460.00
Broom	Kg	n.a.	1,416.00
Gokul dhup	Kg	n.a.	11.00
Sub-Total		n.a.	**98,251.40**
Grand Total		**1,809,269.00**	**174,083,305.13**

Animal products / raw material	Unit	1990	2000
9. Living animals	No.	n.a.	n.a.
10. Hides, skins and trophies			
Skin	No.	n.a.	203
Trophy	No.	n.a.	196
Skull	No.	n.a.	87
Skeleton + Partial Skeleton	No.	n.a.	182
Total no. of skin, trophy, skull, skeleton + partial skeleton			**668**
Collected birds' parts	Unit		
Skin	No.	n.a.	220
Skeleton	No.	n.a.	80
Trophy	No.	n.a.	97
Total no. of skin, skeleton, trophy (birds)			**397**

13.3 Analysis and processing of national data

13.3.1 Estimation and forecasting

Where the original data for 1990 is missing, there it has been assumed to be same as for 2000 or vice versa. The forecasting for 2005 has been done when the data for both 1990 and 2000 is available, otherwise the available data (1990 or 2000) has been assumed for all the three years (1990, 2000 and 2005).

13.4 Reclassification into FRA 2005 classes

National class	Percentage of national class that falls in FRA class of NWFP								
	1	2	3	4	5	6	7	8	9
Mushroom, Cane shoot, Fern tops, and Edible oil seeds	100								
Fodder		100							
Raw material for medicinal plants			100						
Chirata, Litsea, Pipla, Lemon grass oil, Sofin oil, Turpentine, and Gokul dhup				100					
Colorants & dyes					100				
Bamboo and Canes						100			
Ornamental plants							100		
Resin								100	
Beetle leaf									100
Daphne, Thatch and Broom									100

Note: The number in column represent following NWFP

ID	Name of plant products/raw materials	ID No	Name of Products
1	Food	5	Raw materials for utensils, handicrafts etc.
2	Fodder	6	Ornamental plants
3	Medicinal Plants	7	Exudates
4	Colorants & dyes	8	Others

13.5 Data for National reporting table T13

The national data after forecasting, wherever applicable, are given below:

FRA 2005 Categories	Scale factor	Unit	NWFP removal		
			1990	2000	**2005**
Plant products / raw material					
1. Food		tonnes	303	303	303
2. Fodder		tonnes	166361	166361	166361
3. Raw material for medicine and aromatic products		tonnes	118	111	107
4. Raw material for colorants and dyes		tonnes	19	19	19
5. Raw material for utensils, handicrafts & construction		tonnes	1452	7080	9894
6. Ornamental plants		tonnes	n.a.	n.a.	n.a.
7. Exudates		tonnes	240	112	48
8. Other plant products		tonnes	98	98	98
Animal products / raw material					
9. Living animals			0	0	0
10. Hides, skins and trophies	thousand	Nos	1	1	1
11. Wild honey and bee-wax			n.a.	n.a.	n.a.
12. Bush meat			n.a.	n.a.	n.a.
13. Raw material for medicine			n.a.	n.a.	n.a.
14. Raw material for colorants			n.a.	n.a.	n.a.
15. Other edible animal products			n.a.	n.a.	n.a.
16. Other non-edible animal products			n.a.	n.a.	n.a.

13.6 Comments to National reporting table T13

14 Table T14 – Value of non-wood forest product removal

The value of non-wood forest products (NWFP) is an important component of the economic health of forest resources and support to local communities. The information will also help in allocation of resources and in priority setting at national level planning (social, economic and sectoral).

14.1 FRA 2005 Categories and definitions

The following categories of non-wood forest products have been defined:

Category
Plant products / raw material
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
Animal products / raw material
9. Living animals
10. Hides, skins and trophies
11. Wild honey and bee-wax
12. Bush meat
13. Raw material for medicine
14. Raw material for colorants
15. Other edible animal products
16. Other non-edible animal products

14.2 National data

14.2.1 Data sources

References to sources of information	**Quality (H/M/L)**	**Variable(s)**	**Year(s)**
RGOB.2000. Renewable Natural Resources Statistics, 2000, Volume I, Ministry of Agriculture, Royal Government of Bhutan	H	Value of removal	2000
DOF. 1992. Terminal Report for 6th Five year plan, Department of Forest (1987-92).	M	Value of removal	1987 to 1992
DOF. 2003. Progress Report of the Department of Forests (period 1999 – 2003), Department of Forest.	M	Value of removal	1999 to 2003
DOF. 2004. Records from Bhutan Museum of Natural History, Department of Forests, Ministry of Agriculture.	M	Value of removal	2004

14.2.2 Classification and definitions

National class	**Definition**
NWFP- Plants Products	Currently it includes Mushroom, Cane shoot, Fern tops, Edible oil seeds, Fodder, Medicinal and aromatic plants, Resin and turpentine oil, Colorants and dyes, Raw material for handicraft items, Ornamental plants, Other non wood products.
NWFP- Animal products	Currently it includes skin, hides, antlers, trophy, birds parts, like skin , skin body parts, honey, wax, and edible animal parts etc..

14.2.3 Original data

The national records are not kept in FRA 2005 classes. However , the compiled information is being presented below in FRA 2005 categories.

Value of removal of Non wood forest products in National Currency "Nu"		
Plant products / raw material	1990	2000
1. Food		
Mushroom	n.a.	13,177.72
Cane shoot, Fern tops and Edible Oil Seeds	n.a.	n.a.
Sub-Total		13,177.72
2. Fodder	n.a.	n.a.
3. Raw material for medicine and aromatic products		
Terminalia chebula / Terminalia bellirica (Aroo/Baroo)		114.00
Chirata		1,500.79
Litsea		8,364.92
Pipla	1,132.00	67,660.00
Lemon Grass Oil, Sofin Oil, and Turpentine	n.a.	n.a.
Sub-Total	1,132.00	77,639.71
4. Raw material for colorants and dyes	n.a.	n.a.
5. Raw material for utensils, handicrafts & construction		
Bamboo	232,745.37	622,693.00
Cane	n.a.	2466.79
Sub-Total	232 745.37	625 159.79
6. Ornamental plants	n.a.	n.a.
7. Exudates		
Resin	997 613.76	464,304.67
Sub-Total	997,613.76	464,304.67
8. Other plant products		
Bettle leaf	n.a.	993.60
Daphne	n.a.	8,157.58
Thatch grass	n.a.	862.42
Broom	n.a.	111.86
Gokul dhup	n.a.	12.32
Sub-Total	n.a.	10,137.78
Grand Total	1,231,491.13	1,190,419.67

Animal products / raw material	1990 Value (Nu.)	2000 Value (Nu.)
9. Living animals	0	0
10. Hides, skins and trophies	n.a.	n.a.
11. Wild honey and bee-wax	n.a.	n.a.
12. Bush meat	n.a.	n.a.
13. Raw material for medicine	n.a.	n.a.
14. Raw material for colorants	n.a.	n.a.
15. Other edible animal products	n.a.	n.a.
16. Other non-edible animal products	n.a.	n.a.

14.3 Analysis and processing of national data

14.3.1 Estimation and forecasting

Where the original data for 1990 is missing, there it has been assumed to be same as for 2000. The forecasting for 2005 has been done when the data for both 1990 and 2000 is available, otherwise the available data (1990 or 2000) has been assumed for all the three years.

14.4 Reclassification into FRA 2005 classes

National class	Percentage of national class that falls in FRA class of NWFP								
	1	2	3	4	5	6	7	8	9
Mushroom, Cane Shoot, Fern tops, and Edible Oil Seeds	100								
Fodder		100							
Raw materials for medicinal plants			100						
Chirata. Litsea, Pipla, Lemaon grass oil, Sofin Oil, Turpentine, and Gokul dhup				100					
Colorants & dyes					100				
Bamboo and Canes						100			
Ornamental plants							100		
Resin								100	
Beetle leaf, Daphne, Thatch and Broom									100

Note: The numbers in column heading represent the following

ID No.	Name of Products	ID No	Name of Products
1	Food	5	Raw materials for utensils, handicrafts etc.
2	Fodder	6	Ornamental plants
3	Medicinal Plants	7	Exudates
4	Colorants & dyes	8	Others

14.5 Data for National reporting table T14

FRA 2005 Categories	Value of NWFP removed in (1000 USD)		
	1990[1]	2000[2]	2005
Plant products / raw material			
1. Food	0.28	0.28	0.28
2. Fodder	n.a.	n.a.	n.a.
3. Raw material for medicine and aromatic products	0.06	1.66	2.46
4. Raw material for colorants and dyes	n.a.	n.a.	n.a.
5. Raw material for utensils, handicrafts & construction	12.88	13.37	13.62
6. Ornamental plants	n.a.	n.a.	n.a.
7. Exudates	55.21	9.93	9.93
8. Other plant products	0.22	0.22	0.22
Animal products / raw material			
9. Living animals	n.a.	n.a.	n.a.
10. Hides, skins and trophies	n.a.	n.a.	n.a.
11. Wild honey and bee-wax	n.a.	n.a.	n.a.
12. Bush meat	n.a.	n.a.	n.a.
13. Raw material for medicine	n.a.	n.a.	n.a.
14. Raw material for colorants	n.a.	n.a.	n.a.
15. Other edible animal products	n.a.	n.a.	n.a.
16. Other non-edible animal products	n.a.	n.a.	n.a.
TOTAL	**68.65**	**25.46**	**26.51**

Notes

[1] Exchange rate used for 1990 is 1 USD = 18.07 Ngultrum. (**Source:** Guidelines for Country Reporting to FRA 2005, Working paper 82).
[2]Exchange rate used for 2000 is 1 USD = 46.75 Ngultrum (**Source:** Guidelines for Country Reporting to FRA 2005, Working paper 82).
[3] The revenue from the resin tapping operation has gone down drastically.

14.6 Comments to National reporting table T14

Where the original data for 1990 is missing, there it has been assumed to be same as for 2000. The forecasting for 2005 has been done when the data for both 1990 and 2000 is available, otherwise the available data (1990 or 2000) has been assumed for all the three years.

15 Table T15 – Employment in forestry

The information on employment if forestry is useful in identifying trends, especially in the context of public expectation, policies, industry development and socio-economic dependence.

15.1 FRA 2005 Categories and definitions

Category	Definition
Primary production of goods	Employment in activities related to primary production of goods, like industrial roundwood, woodfuel and non-wood forest products.
Provision of services	Employment in activities directly related to services from forests and woodlands.
Unspecified forestry activities	Employment in unspecified forestry activities.

15.2 National data

15.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)
DOF. 2004. Progress Report of the Department of Forests	M	Information on workers	2000 to 2004
FDC. 2004. Progress Report of the Forestry Development Corporation Limited	M	Information on workers	2000 to 2004
DOF. 2004. Administration and Finance Division, Ministry of Agriculture, Department of Forests	M	Information on personnel	2000 to 2004

15.2.2 Classification and definitions

National class	Definition
People engaged in logging, nursery and plantation activities by the Forest Department and Forestry Development Corporation Limited	Wage employees in the forestry activities like raising of nursery, plantations, silvicultural activities, and logging activity etc. are categorised as wage-workers under "primary activity".
Regular employees of the Forest department and Forestry Development Corporation Limited	All the regular employees of the Department of Forests and Forestry Development Corporation Limited has been categorised as regular employees.
People engaged in non wood forest products collection	People engaged in collection of fodder for animals maintained by the Department are categorised as "unspecified forestry activities".

15.2.3 Original data

The table given below provides information on number of workers under the Department of Forests. The number of regular employees with Department of Forests and Forest Development corporation for the reference year 1990 is not available.

National category of employment	1990	1995	2000	2001	2002	2003	2004
	Number of persons						
Medicinal plants collection	4		6				
Employed in plantation works	231		2,684				20
Employed in nursery			2				
Firewood collection			5		1	2	2
Collection of fodder from forest	11		2				21
Engaged in logging			2				
Forest Services			1085				1185

The table given below provides information on number of workers under the Forestry Development Corporation Limited.

National category of employment	1990	1995	2000	2001	2002	2003	2004
	Number of persons						
Engaged in logging	97		154				168
Firewood collection			39				61
Employed in plantation works	127		70				58
Employed in nursery	3		4				4
Regular employees of Corporation		228	187				184

Employment in activities related to primary production of goods like production of industrial wood and fuelwood and non wood forest products and employment in activities directly related to services from forestry from both the Department of Forests and Forestry Development Corporation Limited added up is given in the following table.

National category of employment	1990	1995	2000	2001	2002	2003	2004
	Number of persons						
Medicinal plants collection	4		6				
Employed in plantation works	358		2,754				78
Employed in nursery	3		6				4
Firewood collection			44		1	2	63
Collection of fodder from forest	11		2				21
Engaged in logging	97		156				168
Forest Services staff[1]	n.a.		1085				1,185
Regular employees of Corporation	n.a.	228	187				184

15.3 Analysis and processing of national data

15.3.1 Estimation and forecasting

All data missing against different categories in 1990 is assumed to be same as in 2000 against respective categories.

National category of employment	Number of persons	
	1990	2000
Medicinal plant collection	4	6
Employed in plantation works	358	2,754
Employed in nursery	5	6
Firewood collection	44	44
Collection of fodder from forest	11	2
Engaged in logging	99	156
Regular Employees of FD	1085	1085
Regular Employees of FDC	187	187
Total	**1793**	**4240**

15.4 Reclassification into FRA 2005 classes

About 46% of the total regular employees with the forest department have been apportioned to the category of "provision of services" based on percentage (46%) of protected areas to total forest area.

National class of employment	Percentage of national class belonging to FRA class		
	Primary production of goods	Provision of services	Unspecified forestry activities
Medicinal plants collection	100%		
Employed in plantation works	100%		
Employed in nursery	100%		
Firewood collection	100%		
Collection of fodder from forest	100%		
Engaged in logging	100%		
Regular employees of FD	54%	46%	
Regular employees of Corporation	100%		

15.5 Data for National reporting table T15

FRA 2005 Categories	Employment (1000 person-years)	
	1990	2000
Primary production of goods	1.359	3.806
Provision of services[1]	0.434	0.434
Unspecified forestry activities	0	0
TOTAL	**1.793**	**4.240**

15.6 Comments to National reporting table T15