-FRA 2015 WORKING PAPER-

Guide for country reporting for FRA 2015

The Forest Resources Assessment Programme

To promote a Global Forest Resources Assessment that meets long-term global needs, COFO in its twentieth session (2010), requested FAO to prepare a long-term strategy for the FRA programme consistent with prospects for sustainable funding. COFO in its twenty-first session (2012) endorsed this strategy and the implementation of FRA 2015 as a first step. This Guide is intended to support data collection and reporting as part of the FRA 2015 process.

Exactly how FRA can contribute to increasing the area and quality of sustainably managed forest has not always been clearly stated, yet it is essential if the assessment is to target those users who contribute meeting the challenges of forest management in the 21st century. FRA can help shape both policy making processes, inform and encourage forest-related investment decisions by a wide range of actors, including governments, private companies, NGOs and donor organizations. FRA must also be able to adapt to meet different needs of the diverse global forest data users: governments, non-governmental organizations, the media, intergovernmental agencies, academia, research institutions and the private sector. Understanding and meeting these diverse client needs is an important on-going challenge and an important element in how FRA 2015 was designed.

The new Forest Resources Information Management System (FRIMS), the Collaborative Forest Resources Questionnaire (CFRQ) and many of the changes in the reporting template for 2015 have been initiated to help achieve the following objectives:

1. Reducing the reporting burden and increasing harmonization of forest definitions
2. Improving data quality
3. Enhancing presentation and communication results

We hope that this Guide and the other supporting documents, meetings and workshops posted at http://www.fao.org/forestry/fra/76871/en/ will help make the reporting process easier and help all of us achieve higher standards of global forest resource assessment.

For any comments or questions please contact:

Kenneth MacDicken
Senior Forestry Officer
FAO Forestry Department
Viale delle Terme di Caracalla
Rome 00153, Italy

E-mail: Kenneth.MacDicken@fao.org or fra@fao.org

More information on the Global Forest Resources Assessment can be found at:
www.fao.org/forestry/fra

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Table of Contents

APPENDICES

1 How to read and use this document

This document contains guidelines on how to prepare country reports for the global Forest Resources Assessment 2015 (FRA 2015). It explains both the general methodology that should be applied and gives specific guidance for each question to be answered in FRA 2015. Together with the Terms & Definitions document, the guidelinesconstitute the main reference documentfor the FRA 2015 country reporting process.

The guidelines is being produced as an online FRA Working Paper, but will be updated periodically based on questions and guidance needed by the National correspondents. Each revision will retain the same Working Paper number, but will include a new Version number. All versions of the Guidelines will be provided primarily through the FRA webpage http://www.fao.org/forestry/fra

The Guidelines are structured as follows:

Chapter 2: Reporting to FRA 2015: Outlines the country reporting process, time schedule and deadlines for submission of the country reports.

Chapter 3: General Guidelines: Provides generic instructions to all questions and guidance on the Forest Resources Information Management System (FRIMS).

Chapter 4: Question specific guidelines: provides specific guidance for all questions and Frequently Asked Questions (FAQs).

The appendices contain reference information and a wide variety of default values, conversion and expansion factors:

Appendix 1 - Example of reporting on question 1
Appendix 2 - List of UN official country areas
Appendix 3 - General weight and volume conversion factors
Appendix 4 - Adjustment of growing stock thresholds
Appendix 5 - Default values and conversion factors for estimating biomass and carbon

2 Country reporting to FRA 2015

The main activities and deadlines for the country reporting process for FRA 2015 are outlined below.

Activity	Tentative date	Comment/output
Global Meeting in Preparation for the Global Forest Resources Assessment 2015 (FRA 2015) and the Collaborative Forest Resources Questionnaire (CFRQ) (Chiang Mai, Thailand)	6-10 May 2013	Training of National Correspondents and work on the FRA 2015 country reports and the CFRQ questionnaires.
Regional, sub-regional and national workshops	March 2013 – November 2013	Country reporting process, technical assistance including regional workshops and review of draft country reports.
Deadline for submission of draft country reports	1st July 2013	Countries are strongly encouraged to submit draft reports well in advance of the deadline.
Deadline for completion of final country reports	1st October 2013	Country reports reviewed and completed.
Confirmation of final country reports	December	Official request for validation of the final country reports will be sent to countries.
Public release of FRA 2015 Key Findings	March 2015	Release of the key findings.
Public release of FRA 2015 report(s), public access to FRIMS and the country reports	September 2015	All country reports are made publicly available on internet.

The preparation of the country report for FRA is an important task. The data provided in the country report will be compiled and published by FAO and will be widely used as a reference information regarding the world's forests.

National Correspondents are requested to submit to FAO the country report written in either English, French or Spanish following a standardized format. There are two options for submitting the reports, either in word format via e-mail or using the new Forest Resources Information Management System (FRIMS), which is an online means of completing the FRA 2015 data entry. National Correspondents are encouraged to use the FRIMS as it provides a number of functionalities that will facilitate and improve the reporting and reduce the amount of time required for reporting and analysis.

The questions included in FRA 2015 may need attention from a multidisciplinary team in order to cover all aspects of the report. It may also take some time to identify and locate national data; it is therefore recommended that National Correspondents carry out the necessary steps for getting started with the process as soon as possible in order to avoide delays in the submission of the country report. The National Correspondents are strongly encouraged to submit their reports well in advance of the deadline. This gives more time for the review and for making adjustments or amendments to the reports when necessary. Please note that countries may submit a partial draft report at an early stage for a first review of the key tables by the team of reviewers. This approach may save time when compiling the report as many questions relate to to other questions.

The submitted country reports will undergo review by a team of reviewers and once the review is completed, countries will be asked to confirm the report before it is published. The finalized country reports will be sent to the Head of Forestry for confirmation. Note that FAO

does not require National Correspondents to obtain official approval before submitting the draft report for review.

Table 1. Overview of the Topics, questions and reference years

TOPIC / Variable	Unit	Reporting year				
		1990	2000	2005	2010	2015
FOREST AREA AND FOREST CHARACTERISTICS						
1.1 Forest area	1000 ha	x	x	x	x	x
1.2 Area of other wooded land	1000 ha	x	x	x	x	x
1.3 Area of other land	1000 ha	x	x	x	x	x
1.3.1 …of which with tree cover	1000 ha	x	x	x	x	x
1.4 Inland water bodies	1000 ha	x	x	x	x	x
1.5 Total country area	1000 ha	x	x	x	x	x
1.6 Forest expansion	1000 ha/yr	x	x	x	x	
1.6.1 ...of which afforestation	1000 ha/yr	x	x	x	x	
1.6.2 ...of which natural expansion of forest	1000 ha/yr	x	x	x	x	
1.7 Deforestation	1000 ha/yr	x	x	x	x	
1.7.1 ...of which human induced	1000 ha/yr	x	x	x	x	
1.8 Reforestation	1000 ha/yr	x	x	x	x	
1.8.1 ...of which artificial	1000 ha/yr	x	x	x	x	
2.1 Primary forest	1000 ha	x	x	x	x	x
2.2. Other naturally regenerated forest	1000 ha	x	x	x	x	x
2.2.1 ...of which introduced species	1000 ha	x	x	x	x	x
2.2.1.1 …of which naturalized		x	x	x	x	x
2.3 Planted forest	1000 ha	x	x	x	x	x
2.3.1...of which introduced species	1000 ha	x	x	x	x	x
2.4 Area of mangrove forest	1000 ha	x	x	x	x	x
2.4.1 ...of which planted	1000 ha	x	x	x	x	x
2.5 Primary forest transition matrix	1000 ha	(1990-2000, 2000-2010, 2010-2015)				
PRODUCTION						
3.1 Total forest growing stock	Million m^3	x	x	x	x	x
3.1.1 ...of which coniferous	Million m^3	x	x	x	x	x
3.1.2 ...of which broadleaved	Million m^3	x	x	x	x	x
3.2 Total other wooded land growing stock	Million m^3	x	x	x	x	x
3.2.1 ...of which coniferous	Million m^3	x	x	x	x	x
3.2.2 ...of which broadleaved	Million m^3	x	x	x	x	x
3.3 Net annual increment	m^3/ha/yr	x	x	x	x	
3.3.1 ...of which coniferous	m^3/ha/yr	x	x	x	x	
3.3.2 ...of which broadleaved	m^3/ha/yr	x	x	x	x	
3.4 Volume of top ten species	Million m^3	x	x	x	x	
3.5 Above-ground biomass	Million tonnes	x	x	x	x	x
3.6 Below-ground biomass	Million tonnes	x	x	x	x	x
3.7 Dead wood	Million tonnes	x	x	x	x	x
3.8 Carbon in above-ground biomass	Million tonnes	x	x	x	x	x
3.9 Carbon in below-ground biomass	Million tonnes	x	x	x	x	x
3.10 Carbon in dead wood	Million tonnes	x	x	x	x	x
3.11 Carbon in litter	Million tonnes	x	x	x	x	x
3.12 Soil carbon	Million tonnes	x	x	x	x	x
4.1 Production forest	1000 ha	x	x	x	x	x
4.2 Multiple use forest	1000 ha	x	x	x	x	x
4.3 Value of most important commercial NWFP	1000 local currency				x	

TOPIC / Variable	Unit	Reporting year				
		1990	2000	2005	2010	2015
4.4 Total wood removals	1000 m3	Annual data 1990-2011				
PROTECTIVE FUNCTIONS ECOSYSTEM SERVICES						
5.1 Protection of soil and water	1000 ha	x	x	x	x	x
5.1.1…of which production of clean water	1000 ha	x	x	x	x	x
5.1.2…of which coastal stabilization	1000 ha	x	x	x	x	x
5.1.3… of which desertification control	1000 ha	x	x	x	x	x
5.1.4… of which avalanche control	1000 ha	x	x	x	x	x
5.1.5…of which erosion, flood protection or reducing flood risk	1000 ha	x	x	x	x	x
5.1.6…of which other	1000 ha	x	x	x	x	x
5.2 Ecosystem services, cultural or spiritual values	1000 ha	x	x	x	x	x
5.2.1… of which public recreation	1000 ha	x	x	x	x	x
5.2.2… of which carbon storage or sequestration	1000 ha	x	x	x	x	x
5.2.3… of which spiritual or cultural services	1000 ha	x	x	x	x	x
5.2.4… of which other	1000 ha	x	x	x	x	x
BIODIVERSITY/ CONSERVATION						
6.1 Conservation of biodiversity	1000 ha	x	x	x	x	x
6.2 Forest area within protected areas	1000 ha	x	x	x	x	x
7.1 List of woody invasive species	1000 ha			x	x	
7.2 Area of forest affected by woody invasive species	1000 ha			x	x	
DISTURBANCE AND FOREST DEGRADATION						
8.1 Total land area burned	1000 ha	Annual data 2003-2012				
8.1.1. ...of which forest area burned	1000 ha	Annual data 2003-2012				
8.2 Number of fires	Number	Annual data 2003-2012				
8.2.1 ...of which forest fires	Number	Annual data 2003-2012				
8.3 Area of forest damaged by outbreak of: insects, diseases and severe weather events	1000 ha	List of year(s) of latest outbreak				
9.1 Area of forest with reduced canopy cover	% canopy cover	2000-2010				
MEASURING PROGRESS TOWARD SFM						
i. National-scale enabling environment for SFM						
10.1 Policies supporting sustainable forest management	Boolean	Latest available year				
10.1.1 ...of which in publicly owned forests	Boolean	Latest available year				
10.1.2 ...of which in privately owned forests	Boolean	Latest available year				
10.2 Legislation and regulations supporting SFM	Boolean	Latest available year				
10.2.1 ...of which in publicly owned forests	Boolean	Latest available year				
10.2.2 ...of which in privately owned forests	Boolean	Latest available year				
11.1 National stakeholder platform	Boolean	Latest available year				
12.1 Forest area intended to be in permanent forest land use	1000 ha				X	
12.1.1 ...of which permanent forest estate	1000 ha				X	
13.1 Forest area monitored under a national forest monitoring framework		Latest available year				
13.2 Types of forest reporting progress used at national scale	%, year, check box	List of year(s)				
13.2.1 Criteria and indicators reporting	Boolean	Latest available year				
13.2.2 Periodic national state of the forest reporting	Boolean	Latest available year				
13.2.3 Other	Boolean	Latest available year				
13.2.4 None	Boolean	Latest available year				

TOPIC / Variable	Unit	Reporting year				
		1990	2000	2005	2010	2015
ii. Operational scale progress toward SFM						
14.1 Forest area with management plan	1000 ha				X	
14.1.1 ...of which for production	1000 ha				X	
14.1.2 ...of which for conservation	1000 ha				X	
14.2 Monitoring of forest management plans		Latest available year				
14.2.1 Soil and water management	Boolean	Latest available year				
14.2.2 High conservation value forest delineation	Boolean	Latest available year				
14.2.3 Social consideration/community involvement	Boolean	Latest available year				
14.3 Percent of area under forest management plan that is monitored annually	%	Latest available year				
15.1 Type of stakeholder inputs		Latest available year				
15.1.1 Planning phase	Boolean	Not applicable				
15.1.2 Operations phase	Boolean	Not applicable				
15.1.3 Review of operations	Boolean	Not applicable				
16.1 Area of forest certified under FSC	1000 ha	Annual data 2000-2012				
16.2 Area of forest certified under PEFC	1000 ha	Annual data 2000				
16.3 Area of forest certified by other international certification	1000 ha	Annual data 2000				
16.2 Domestic forest management certification	1000 ha	Annual data 2000				
ECONOMICS/ LIVELIHOODS						
17.1 Forest revenue	1000 local currency		x	x	x	
17.2 Public expenditures on forests	1000 local currency		x	x	x	
18.1 Public ownership	1000 ha	x	x	x	x	
18.1.1 ...of which owned by the state at national scale	1000 ha	x	x	x	x	
18.1.2 ...of which owned by the state at the sub-national government scale	1000 ha	x	x	x	x	
18.2 Private ownership	1000 ha	x	x	x	x	
18.2.1 ...of which owned by individuals	1000 ha	x	x	x	x	
18.2.2 ...of which owned by private business entities and institutions	1000 ha	x	x	x	x	
18.2.3 ... of which owned by local, tribal and indigenous communities	1000 ha	x	x	x	x	
18.3 Unknown ownership	1000 ha	x	x	x	x	
18.4 Holder of management rights of public forests	1000 ha	x	x	x	x	
18.5 Public administration	1000 ha	x	x	x	x	
18.6 Individuals	1000 ha	x	x	x	x	
18.7 Private companies	1000 ha	x	x	x	x	
18.8 Communities	1000 ha	x	x	x	x	
18.9 Other	1000 ha	x	x	x	x	
19.1 Employment in forestry	1000 FTE	x	x	x	x	
19.1.1 ...of which female	1000 FTE	x	x	x	x	
20.1 Gross value added from forestry	Million local currency	Latest available year				
LOOKING FORWARD						
21.1 Government targets/aspirations for forest area in 2020 and 2030	1000 ha	2020 and 2030				
21.2 Forest area earmarked for conversion	1000 ha	2013				

Note: Shaded cells means that the reported values correspond to an average for a five year period.

3 General guidelines

Introduction

These guidelines have been developed in order to facilitate the preparation of the FRA 2015 country reports. They explain the methodology that should be applied when compiling the country report in order to ensure complete, consistent and transparent reports where all reported figures can be traced back to the original data and data source.

Pre-filled reports

In order to reduce the reporting burden, the FRA secretariat has pre-filled country reports with the information submitted for FRA 2010 as well as data from external[1] data sources. It should be noted that the reports are only partially pre-filled and must therefore be thoroughly revised and amended where necessary. When the pre-filled information in a reporting table corresponds to the most recent and best available data, the table could be completed by just adding entries for the most recent year or making forecasts for the year 2015. Should a country prefer to start from the beginning with their country report without using the pre-filled report provided, an empty country report template can be used.

If new and better data are available, the new data sources must be documented as well as the new data. The entire table must then be revised, as the new data may affect estimated trends. Consequently, previously reported data for FRA 2010 can also be affected. Whenever previously reported (FRA 2010) figures are changed, the reason for the change must be documented in the country report under "Comments".

Please see the Forest Resources Information Management System (FRIMS) website at:

FAO encourages countries to use this sytem – which will contain all of the same data as found in the Word version of the Country Report. If you wish to use the FRIMS for data entry and management, please contact: kenneth.macdicken@fao.org.

[1] a) Forest area certified under the international forest management certification schemes: Forest Stewardship Council (FSC) and the Programme for Endorsement of Forest Certification (PEFC)
b) Forest fire data from remote sensing
c) Reduction in forest canopy data from remote sensing
d) Industiral roundwood and woodfuel removals from FAOSTAT
e) Gross Domestic Product from UNDATA/EUROSTAT
d) Forestry contribution to Gross Domestic Product (GDP)

Filling-in the tables

When filling-in data **no fields must be left blank, unless** an entire data Question or table is not reported upon, then all fields can be left blank. In these cases the reason for not reporting should be noted in the "Comments" field e.g. "No data available for this question/table".

Whenever data are missing or too weak to be used for generating some of the requested information, countries may write "n.a." (not available) in corresponding fields in the data table. Knowing that no national data are available is in itself important information and should be documented in the country report.

Note that some tables may contain categories that are not applicable for all countries (e.g. area of mangroves). In these cases, zero (0) should be used to fill in the table and "Not applicable" added in the comments.

Expert estimates

When documented national data are weak or missing, countries can make expert estimates to fill in the requested information, as long as it is clearly documented in the country report in the respective field under "Comments related to data, definitions, etc" and correctly noted as Tier 1. In particular, when other data are completely lacking, countries are encouraged to make documented expert estimates in the following cases:

- in order to make time series complete
- in order to make categories add up to a total

Five-year averages

For reporting tables 1b and 3c. The reported figures for the reporting years should be based on averages for the five-year periods 1988-1992 for 1990, 1998-2002 for 2000, etc. If data are not available to produce five year average this should be documented along with information on how the value for the reporting year(s) was reached. It could be the actual value for the reference year, if available, but preferably it should be an average value of two or more years. Please note that <u>all</u> original data used for the averages must be properly documented under original data.

Formatting

The structure of the reporting tables should not be altered in any way. **Do not insert any rows or columns or change the order of categories and reporting years.** The specified measurement unit (1000 ha, Million m^3, etc.) <u>must</u> be respected even for very small or very large numbers.

Values may be reported with or without decimals. As a rule of thumb, small values (less than 100) should be reported with decimals so the value has at least three (3) significant digits (e.g. 1.23).

When reporting decimals, the dot (.) should be used as separator. Numbers larger than 1000 may use a blank space to separate the thousands (groups of three digits). No other separators should be used.

The selection in the "Tick boxes" in questions 10.1, 10.2, 13.2, 14.2, 15.1: should be marked with an "x".

Comment fields

The comment fields are very important in understanding reported data and for the further processing and analysis of data. Countries are strongly encouraged to document any relevant comments in appropriate comment field. Countries are encouraged to keep comments short and concise.

1. **Comments related to data, definitions, etc:** Relevant information related to data, definitions, data sources, data quality, etc.
2. **Comments on reported trend:** All comments related to the understanding and correct interpretation of reported trends.
3. **Other general comments to the table/Comments:** Space for documentation of any general information related to the reported figures.

Reporting methodology

The standard methodology to be applied to most of the questions is a process that consists of two main steps as outlined below and further explained in the following sections.

STEP ONE: National data (Documentation of: data sources and original data)

- **Data sources:** Identification, selection and documentation of data sources used.

The documentation of each data source should cover the following:

- ✓ Numbering of references (indicate in the text where reference has been used)
- ✓ Full reference: Author(s), year of publication (if published) and title
- ✓ Variable(s), indicate for which FRA variable where the reference is used
- ✓ Reference year(s) for the data. Note that the reference year is the year that the data refer to, not the year of publication
- ✓ Additional comments, listing of any relevant comments

Example 1. Documentation of data sources

#	References to sources of information	Variable(s)	Year(s)	Additional comments
1	a) Smith, B 1988. *National Pine forest and mangrove inventory*. Hypothetical country	Forest area, Growing stock	1986	National inventory of pine and mangrove forests covering the whole country, using remote sensing.

- **Original data:** Documentation of original data including national classes, definitions, data and year. Note that only the original data used for reporting should be documented. This might be done in one or several tables, depending on the complexity

of the data. There is no predefined format for these tables, as data structures may vary between countries.

STEP TWO: Analysis and processing of national data (The analysis of national data comprises three steps that may or may not be necessary to carry out, depending on the nature of the national data)

1. Adjustment (applicable only to area-related variables in order to make totals correspond to total land area)
2. Estimation and forecasting national data to FRA reporting years
3. Reclassification of national classes to FRA categories

The order in which these steps are carried out may vary depending on the structure of data. Adjustment is usually carried out first on all national datasets, thereby adjusting the national datasets to the official land area.

If the national datasets use the same national classes, it is recommended to then estimate/ forecast and reclassify to FRA classes. This approach ensures that the trends according to the national classes can be properly documented.

Sometimes national datasets use different classes and cannot be directly compared. In these cases it is recommended to first make the reclassification of each data set into the FRA categories and then perform the estimation and forecasting of the FRA categories.

When aggregating (adding) sub-national data with different reference years the different estimates should first be brought to a common reference year before the sub-national figures are added up. If the definitions/classifications differ between different sub-national data sets then a harmonization of national classes or reclassification to the FRA categories is necessary prior to adding the various estimates.

All assessments should be based on the most accurate information available. Where a time series is available, estimates can be calculated by simple interpolation. If time series indicate trends that, according to the professional judgment of the NC and/or other specialists taking part of the FRA reporting process, do not reflect the real situation, this must be documented in the country report. In such cases, countries should make an adjustment of the estimated / forecasted data, and clearly document and justify this in the country report.

As a general rule, the documentation in the country report should follow the order in which the steps were carried out.

Adjustment

Adjustment is carried out in order to ensure that the reported area and area-related quantitative figures are consistent. For question 1, the total land area/country area must match the official UN statistics in FAOSTAT.

For other questions, adjustment may be needed to make total area of forest match the corresponding area figures in question 1. For other tables, adjustment by area may sometimes be needed, particularly in cases when available data are partial.

Example 2. Adjustment

Original data

National category	1 000 ha
Forest	7 000
Bushland	3 000
Agriculture	3 000
Swamp	850
Urban	100
Other	850
Total land area	**14 800**

Calculating the adjustment

Official land area from FAOSTAT	15 000
Adjustment factor (=15 000/14 800)	1.01351

Adjusted national data

National category	1 000 ha
Forest	7 095
Bushland	3 041
Agriculture	3 041
Swamp	861
Urban	101
Other	861
Total land area	**15 000**

How to correct official FAOSTAT figures?

Should the area figures generally accepted by your country be different from those maintained by UN Statistics Division and/or FAOSTAT, the competent authority in your country should make sure that an official request is made to UN Statistics Division (for total country area) and to FAOSTAT (for land area and inland water area) to change the official figures. Once an official request is done, the updated figures may be used even if they are still not reflected in the on-line databases. Please note in the report that a request has been sent to FAOSTAT@fao.org and/or Statistics@un.org in order to change the official figures of country area and/or land area.

Estimation and forecasting

The estimation and forecasting of values is often necessary in order to report national data for the FRA reference years (1990, 2000, 2005, 2010 and 2015). The estimation is the process of interpolation between observations and forecasting is the extrapolation of values to the future.

In order do decide whether estimation and/or forecasting are necessary, the following general principles apply:

- If the country has data sources that provide observed data for the requested reporting years these data can be used directly without any estimation
- If available data sets do not correspond to the requested reporting years, estimation and/or forecasting is required
- Data for 2015 will always be forecasts
- Forecasts may also be necessary for reference years 1990, 2000 and/or 2005 if the latest data set is older than the reference year

Forecasts may be made using regression analysis – which may be particularly helpful when past trends have not been linear. Countries are encouraged to use and document the use of curve fitting approaches for forecasts. In some cases, it may be necessary to use a simple linear forecast which does not produce curve fit statistics, but may be easier to use. The following examples show how estimation and forecasting can be carried out using this simplified method:

Example 3. Estimation and forecasting using linear interpolation

Original data for forest growing stock

National class	**Growing stock (million m^3)**	
	1988	**2001**
Forest	500	420

Step 1 calculate the annual change
Time difference between observations (2001-1988 = 13 years)
Difference between observed values (420-500 = -80 million m^3)
Difference per year of annual change (-80/13 = -6.15 million m^3/year)

Step 2 Estimations and forecasting using linear interpolation and extrapolation to estimate growing stock for 1990 and 2015

2a Linear interpolation for the year 1990
Value for 1988 + (difference in years between 1990 and 1988 * difference per year)
500 + (2*-6.15) = 487.7

2b Linear extrapolation for the year 2015
Value for 2001 + (difference between 2001 and 2015 * difference per year)
420 +(14*-6.15) = 333.9

For EXCEL users, note that EXCEL has a built-in function for estimation and forecasting that can facilitate the calculations. See the EXCEL help on the function FORECAST for further information.

It is important to stress that estimation and forecasting is not only an issue of making mathematical calculations. It is equally or even more important to assess whether the estimated/forecasted figures reflect reality. There may be irregular causes for values to vary year to year. These variations do not necessary imply that there is a trend that can be used for estimation and forecasting.

Reclassification

Reclassification is done in order to make national data correspond to the categories defined for FRA. When national classes are identical to FRA categories reclassification step does not need to be done.

Reclassification is usually carried out using a "reclassification matrix", in which each national class is assigned a percentage that applies to each FRA category (see example 5).

For each question, the National Correspondent must decide whether reclassification is needed and if so, construct a reclassification matrix that helps convert national classes into FRA categories and definitions. This is usually a rather subjective assessment (expert estimate), but if there is information available that supports this reclassification it should be documented. Also, if it is only based on expert estimates, this should be noted in the country report.

Example 4. Reclassification

In the reclassification matrix below for question 1, the national classes and their respective area are listed on the left hand side. On the right hand side the FRA categories are found. For each national class, the percentage that belongs to each FRA category is assessed, making sure that the sum equals 100%. In the particular case of question 1, the category "Other land with tree cover" (OLWTC) is a subcategory of "Other land" and included therein, hence it has been put outside the total, and the percentages in this column refers to the percentage of the area under "Other land".

Reclassification matrix

		FRA Categories				
National classes	**1000 ha**	**Forest**	**OWL[1]**	**Other land**	**Total**	**OLWTC[2]**
Productive forest land	15 000	100%			100%	
Swamp	3 000		30%	70%	100%	
Agriculture land	8 000			100%	100%	5%
National parks	3 500	65%	20%	15%	100%	
Urban land	500			100%	100%	10%
TOTAL	**30 000**	**Not applicable**				

Result of reclassification

		FRA Categories				
National classes	**1000 ha**	**Forest**	**OWL[1]**	**Other land**	**Total**	**OLWTC[2]**
Productive forest land	15 000	15 000			15 000	
Swamp	3 000		900	2 100	3 000	
Agriculture land	8 000			8 000	8 000	400
National parks	3 500	2 275	700	525	3 500	
Urban land	500			500	500	50
TOTAL	**30 000**	**17 275**	**1 600**	**11 125**	**30 000**	**450**

[1] OWL = Other wooded land

[2] OLWTC = Other land with tree cover. This is is a sub-category of Other land, hence the percentage given in this reclassification matrix refers to the percentage of the area of Other land that has tree

Reclassification should be applied for each reporting year. The same reclassification matrix can be used for all reporting years. However, it might be necessary to make separate reclassification matrices for different years as the national data may come from different sources with different categories and definitions.

The output from the reclassification is country data transformed to the FRA categories. If input data correspond to the FRA reporting years, the resulting data can be directly inserted in the relevant section of the country report.

Tiers

To increase the understanding of data quality by clearly identifying data sources and ranking them in reliability classes or Tiers. For most variables countries are asked to assign a Tier class 1, 2 or 3, where Tier 3 indicates the highest level of quality and Tier 1 the lowest.

FREQUENTLY ASKED QUESTIONS: GENERAL REPORTING METHODOLOGY

Q: When it is difficult to reclassify national classes into FRA categories, can I use and report data for the national classes as a proxy for the FRA categories?

A: It is important that the time series reported to FRA are consistent. If the national categories are reasonably close to the FRA categories countries may use these as long as this is clearly documented in the country report. However, if the national categories differ substantially from the FRA categories, countries should try reclassifying the national data to the FRA categories. When in doubt, please contact the FRA secretariat.

Q: How do I report a small value when the unit specified in the reporting table is large? For example, I want to report a growing stock of 25000 m^3 but the unit in the reporting table is million m^3?

A: Always report in the unit specified in the reporting table. Small values (less than 100) should be reported with decimals so the value has at least three significant digits. An example: 25000 m^3 should be reported as 0.0250 million m^3 and 2500 m^3 should be reported as 0.00250 million m^3.

Q: What should I do when the national datasets from different years use different definitions and classifications?

A: In order to build a time series, these datasets must first be brought to a common classification system. Usually the best way is to first reclassify both datasets to FRA classes, before making the estimation and forecasting.

Q: Can I correct or change previously reported figures?

A: If new data have become available since last reporting, you may need to also change the historical figures as the new data most likely will affect the trends. Likewise, if you notice that some errors were made in the estimations for FRA 2010, these should be corrected accordingly. Whenever, previously reported figures are changed, the justification should be clearly documented in the comments to the table.

Q: Can sub-national level information on forest area be used to improve/generate national level estimates?

A: If boundaries of the sub-national units are consistent and definitions compatible, sub-national level information can be aggregated to generate a composite national level estimate through addition of the sub-national figures. Where definitions/classifications differ, harmonization of national classes or reclassification to the FRA categories should be done prior to adding the various estimates.

Q: How does one address the problem of different reference years for sub-national level figures used to generate an aggregated national estimate?

A: First bring the different estimates to a common reference year through inter/extrapolation, then add the sub-national figures.

Q: Several tables ask for 5-year averages, but how do we report when we only have data for less than five years?

A: Calculate an average for the available years.

FREQUENTLY ASKED QUESTIONS: SECTION-SPECIFIC ISSUES

This section contains guidelines on how to handle particular cases related to specific reporting tables and aims at facilitating the reporting and improving the understanding on how to interpret the definitions and categories set out in the document "Terms and Definitions for FRA 2015".

Question 1: What is the area of forest and other wooded land and how has it changed over time?

This question contains some of the core variables for FRA 2015. The area of forest as presented in this table constitutes the basis for reporting in many of the other Questions (Table: 2a, 13a, 14c, 18a and 21a) and derivations of variables: for example, growing stock per hectare. Strong efforts should be made to provide as reliable figures as possible.

This question also constitutes the basis for the estimate of changes in global forest area, which attracts much interest from national stakeholders and a global audience.

Special considerations for reporting for table 1a

The countries must report areas on the four main categories **Forest, Other wooded land, Other land and Inland water**. If there is no information on area of Other land, but good estimates of areas of Forest and Other wooded land, the area of Other land can be estimated by using Total land area and subtracting the area of Forest and Other wooded land.

It is important that all international reporting maintain the same data on area of country/ territory, land area and inland water area. The official area figures according to FAOSTAT can be found in Appendix 2. In the case that area figures do not match, an adjustment should be performed as explained in Chapter 3, How to correct official FAOSTAT figures. When performing the adjustment, it is generally recommended to use total land area as the basis. Area of inland water can then be taken directly from Appendix 2.

The area estimates for all years should be based on the current borders and area of the country/territory as of FAOSTAT 2012. Should borders and country/territory area have changed during the period of reporting or the country/territory did not exist at the time of an earlier reporting year, then reported figures should be calibrated to correspond to actual borders.

FAQ: TABLE 1A

Q: How should areas under multiple land use (agroforestry, forest grazing, etc.) be classified in a consistent way, when no land use is considered significantly more important than the others?

A: Agroforestry systems where crops are grown under tree cover are generally classified as "Other land with tree cover", however some agroforestry systems such as the Taungya system where crops are grown only during the first years of the forest rotation should be classified as "forest". In the case of forest grazing (i.e. grazing on land that fulfil the requirements of canopy cover and tree height), the general rule is to include the forest pastures in the area of Forest, unless the grazing is so intensive that it becomes the predominant land use, in which case the land should be classified as "Other land with tree cover".

Q: Mangroves are found below the tidal level and are not part of the total land area, how should they be accounted for in forest area?

A: Most mangroves are located in the inter-tidal zone i.e. above the daily low tide, but below the high water mark. The land area according to country definitions may or may not include the inter-tidal zone. For, all mangroves which meet the criteria of "forest" or "other wooded land" should be included in the respective category in the forest area, even when they are found in areas not classified by the country as land area. When necessary, the area of "other land" should be adjusted in order to ensure that the total land area matches the official figures as maintained by FAO and the UN Statistics Division and a comment about this adjustment included in the comment field to the table.

Q: What estimate should I use for 1990? Our estimate at the time or an estimate projected back from the latest inventory?

A: The estimate for 1990 should be based on the most accurate information available, not necessarily a repetition of a previous estimate or the result of an inventory/assessment undertaken in or just prior to 1990. Where a time series is available for a time period before 1990, the estimate for 1990 can be calculated by simple interpolation. If the latest inventory is considered more accurate than earlier inventories, then this should be taken into account and an attempt made to project the results back in time.

Q: How should I report forest fallows / abandoned "shifting cultivation"?

A: It depends on how you consider the future land use. Long fallows, in which the woody fallow period is longer than the cropping period and trees reach at least 5 m in heightshould be considered as "forest". Short fallows in the cropping period is greater or equal to the fallow period and/or woody vegetation does not reach 5 m during the fallow period should be classified as "other land" and, when relevant, as "other land with tree cover" since the main land use is agriculture.

Q: How should "young forests" be classified?

A: Young forest should be classified as "forest" if the land use criterion is met and the trees are capable of reaching 5 m in height.

Q: Where should line be drawn between "forest" and agricultural tree crops (fruit plantations, rubber plantations, etc.). For example: How to classify a plantation

of *Pinus pinea* with the main objective of harvesting pine nuts? Is it an agricultural tree crop or is it a forest where NWFP are harvested?

A: Rubber plantations should always be classified as "forest" (see explanatory note 7 under the definition of forest). Fruit tree plantations should be classified as "Other land with tree cover". The general rule is that if the plantation is made up of forest tree species, it should be classified as "forest". The case of the *Pinus pinea* plantation for pine nut production should therefore be classified as "forest" and the harvested pine nuts should be reported as NWFP if they are traded commercially.

Q: How do I report on areas of bush-like formations (e.g. in the Mediterranean countries) with a height of about 5m?

A: If the woody vegetation has more than 10% canopy cover of tree species[2] with a height or expected height of 5 m or more, it should be classified as "forest", otherwise it should be classified as "Other wooded land".

Q: How to report when the national figures of country area and inland water are different from FAOSTAT figures in Appendix 2 in the Guidelines?

A: If in such disagreement, make sure that the competent authority of your country communicates the new and correct figures to the UN Statistics Division and to FAOSTAT. Once an official request is done, the updated figures can be used. Please refer to section Chapter 3, how to correct official FAOSTAT figures.

Q: How to report when national data are using different thresholds than FRA definition of forest?

A: Sometimes national data do not allow making estimates with exactly the thresholds specified in the FRA definition. In such cases countries should report according to national thresholds and clearly document the thresholds used in the comments to the table. The same threshold must be used consistently throughout the time series.

Q: How to classify seed orchards?

A: Seed orchards of forest tree species are considered as forest.

Q: How should we report on palm plantations?

A: According to the FRA definition of "forest", oil palm plantations are specifically excluded. Regarding other palm plantations, it is a land use issue. If managed primarily for agricultural production, food and fodder they should be classified as "other land" and – when applicable – as "other land with tree cover". When managed primarily for production of wood and construction material and/or protection of soil and water they should be classified as either "forest" or "other wooded land" depending on the height of the trees. In the specific case of senile coconut palm plantation, the classification depends on expected future land use. If expected to be replaced with a new coconut palm plantation or other agricultural land use it should be classified as "other land with tree cover". If abandoned and not expected to return to agriculture, it should be classified as "forest".

Q: Should natural stands of coconut palms be included in the forest area?

A: Yes, if it is not managed for agricultural purposes and the minimum area, crown cover and height criteria are met (see the definition of "Forest").

[2] A woody perennial with a single main stem, or in the case of coppice with several stems, having a more or less definite crown.

Q: How does the FRA definition of forest correspond with the definition of forest in other international reporting processes?

A: The definition of forest used for reporting to FRA is generally accepted and used by other reporting processes. However, in the specific case of the UNFCCC, the IPCC guidelines for country reporting on greenhouse gas emissions allow for certain flexibility in the national definition of forest, stating that the country can choose the thresholds of the following parameters, allowed interval within parenthesis:

- minimum area (0.05 – 1.0 hectares)
- tree crown cover (10 – 30 per cent)
- tree height (2 – 5 meters)

The thresholds should be selected by the country at the first national communication and must then be kept the same for subsequent national communications

Q: How should I classify power lines?

A: Power and telephone lines less than 20 m wide and crossing through forest areas should be classified as "forest". In all other cases they should be classified as "other land".

FAQ: TABLE 1B

Q: What is the difference between afforestation and reforestation?

A: Afforestation is the planting/seeding of trees on areas that previously were either other wooded land or other land. Reforestation on the other hand takes place in areas that already are classified as forest and does not imply any change of land use from a non-forest use to forest.

Q: Are the FRA definitions of afforestation and reforestation the same as is used in the IPCC guidelines for greenhouse gas reporting?

A: No, the terminology on afforestation and reforestation is different. In the IPCC guidelines, both afforestation and reforestation imply a land use change and correspond to the FRA term afforestation, while the IPCC term revegetation corresponds approximately to the FRA term reforestation.

Q: How should I report areas where enrichment planting has been carried out?

A: If it is expected that the planted trees will dominate the future stand, then it should be considered as reforestation; if the intensity is so low that the planted or seeded trees will have only a minor share of the future growing stock, it should not be considered as reforestation.

Q: When do I consider that abandoned land has reverted to forest and therefore should be included under "natural expansion of forest"?

A: It should fulfil the following:

- having been abandoned from previous land use for a period of time and be expected to revert to forest. There should not be any indications that it will go back to previous land use. The period of time may be chosen by the country and should be documented in a note in appropriate comment field.

- have regeneration of trees that are expected to comply to the definitions of forest

Question 2: What is the area of natural and planted forest and how has it changed over time?

This question seeks to describe the relative extent of natural and planted forest. The categories represent a continuum from undisturbed primary forests to planted forests with introduced tree species.

Special considerations for reporting

The distinction between Planted forest and Other naturally regenerated forest is based on the regeneration method. If it is known or clearly visible that the forest land was regenerated through planting/seeding then it should be classified as Planted forest. If the forest is established by natural regeneration, or if the regeneration method is unknown, it should be classified as Other naturally regenerating forest.

In the specific case of coppice, the distinction between Planted forest and Other naturally regenerated forest is based on whether the coppice is from trees were originally planted/seeded or established through natural regeneration.

The distinction between Primary and Other naturally regenerated forest is based on the degree of human impact. In order to classify a forest as Primary there should be no clearly visible indications/signs of human activity. This means that primary forests should show natural tree species composition, occurrence of dead wood, natural age structure and natural regeneration processes.

Whenever possible, the Planted forest and Other naturally regenerated forest should be further divided into the sub-category "...of which of introduced species" based on inventory data or expert estimates.

Table 2b is new for FRA 2015. The transition matrix is intended to capture changes in primary forest and what it has been converted to, please note that only net loss in primary forest should be reported on in table 2b.

FAQ : TABLE 2A &2C

Q: How should I interpret "clearly visible indication of human activities" in order to distinguish between "primary forest" and "other naturally regenerated forest"?

A: Almost all forests have been affected one way or another by human activities for commercial or for subsistence purposes by logging and/or collection of non-wood forest products, either recently or in the distant past. The general rule is that if the activities have been of such a low impact that the ecological processes have not been visibly disturbed, the forest should be classified as Primary. This would allow for including activities such as a non-destructive collection of NWFP. Likewise it may include areas where a few trees have been extracted as long as this happened a long time ago. See further the explanatory notes to the definition of Primary forest in the Specifications.

Q: How should I report areas with naturalized species, i.e. species that were introduced a long time ago and which are now naturalized in the forest?

A: Areas with naturalized species that are naturally regenerated should be reported as "other naturally regenerated forest" and also under the subcategory"...of which of introduced species" if they constitute more than 50% of the total growing stock at maturity.

Q: How should I report when it is difficult to distinguish whether a forest is planted or naturally regenerated?

A: If it is not possible to distinguish whether planted or naturally regenerated, and there is no auxiliary information available that indicates that it was planted, it should be reported as "other naturally regenerated forest".

Q: Can I use the area of forest in protected areas as a proxy for reporting on area of primary forest?

A: In some cases, the area of forest in protected areas is the only information available that can be used as a proxy for the area of primary forest. However, this is a very weak proxy subject to major errors which should only be used where there are no better alternatives. Caution should be employed when reporting time series, because establishing new protected areas does not mean that the area of primary forest increases.

Q: How can the ITTO classification of forests be translated to the FRA categories on forest characteristics?

A: ITTO defines primary forest as follows:

Forest which has never been subject to human disturbance, or has been so little affected by hunting and gathering that its natural structure, functions and dynamics have not undergone any unnatural change.

This category can be considered equivalent to the FRA 2015 definition of primary forest.

ITTO defines a degraded primary forest as follows:

primary forest in which the initial cover has been adversely affected by the unsustainable harvesting of wood and/or non-wood forest products so that its structure, processes, functions and dynamics are altered beyond the short-term resilience of the ecosystem; that is, the capacity of the forest to fully recover from exploitation in the near to medium term has been compromised).

This definition falls within the FRA 2015 definition of other naturally regenerated forests.

ITTO defines a managed primary forest as follows:

Forest in which sustainable timber and non-wood harvesting (eg through integrated harvesting and silvicultural treatments), wildlife management and other uses have changed forest structure and species composition from the original primary forest. All major goods and services are maintained.

Also this definition falls within the FRA 2015 definition of other naturally regenerated forests.

Q: Some forests are regularly affected by severe disturbances (such as hurricanes) and will never reach a "stable" climax state, but still there are substantial areas with no visible human impact. Should these be classified as primary forest (despite the visible hurricane impact)?

A: A disturbed forests with no visible human impact and with a species composition and structure that resembles a mature or close-to-mature forest should be classified as "primary", while a severely damaged forest with an age structure and species composition which is significantly different from a mature forest should be classified as a "naturally regenerating forest". See also Explanatory note 1 to the definition of Primary Forest.

Q: What species should be considered as mangroves?

A: FRA uses the definition of mangroves as of Tomlinson's Botany of Mangroves, where the following are listed as "true mangrove species":

Acanthus ebracteatus
Acanthus ilicifolius
Acanthus xiamenensis
Acrostichum aureum
Acrostichum speciosum
Aegialitis annulata
Aegialitis rotundifolia
Aegiceras corniculatum
Aegiceras floridum
Avicennia alba
Avicennia bicolor
Avicennia eucalyptifolia
Avicennia germinans
Avicennia integra
Avicennia lanata
Avicennia marina
Avicennia officinalis
Avicennia rumphiana
Avicennia schaueriana
Bruguiera cylindrica
Bruguiera exaristata
Bruguiera gymnorrhiza
Bruguiera hainesii
Bruguiera parviflora
Bruguiera sexangula
Camptostemon philippinensis
Camptostemon schultzii
Ceriops australis
Ceriops decandra
Ceriops somalensis
Ceriops tagal
Conocarpus erectus
Cynometra iripa
Cynometra ramiflora
Excoecaria agallocha
Excoecaria indica
Heritiera fomes
Heritiera globosa
Heritiera kanikensis
Heritiera littoralis
Kandelia candel
Laguncularia racemosa
Lumnitzera littorea
Lumnitzera racemosa
Lumnitzera x rosea
Nypa fruticans
Osbornia octodonta
Pelliciera rhizophorae
Pemphis acidula
Rhizophora x annamalayana
Rhizophora apiculata
Rhizophora harrisonii
Rhizophora x lamarckii
Rhizophora mangle
Rhizophora mucronata
Rhizophora racemosa
Rhizophora samoensis
Rhizophora x selala
Rhizophora stylosa
Scyphiphora hydrophyllacea
Sonneratia alba
Sonneratia apetala
Sonneratia caseolaris
Sonneratia griffithii
Sonneratia x gulngai
Sonneratia hainanensis
Sonneratia ovata
Sonneratia x urama
Xylocarpus granatum
Xylocarpus mekongensis
Xylocarpus rumphii

Question 3: *What are the stocks and growth rates of the forests and how have they changed?*

Growing stock (Table 3a)

The growing stock of Forest and of Other wooded land forms one of the fundamental tables of the country report. Generally the growing stock figures also constitute the basis for the calculation of Biomass and Carbon stocks. Please note that the definition of growing stock has been modified since the FRA 2010 reporting. The wording of the definition is essentially the same but the threshold values have been specified meaning that growing stock should be reported the specified threshold values of: above ground, 10 centimeter diameter at breast height, up to a top diameter of 0 centimeters. Table 1a has been pre-filled with the reported values in FRA 2010 and countries are asked to when necessary update the pre-filled figures to be in line with the new growing stock thresholds. For this purpose the reported growing stock threshold values as reported in FRA 2010 have also been pre-filled in order to make this work easier. It is up to the national correspondent to decide whether there is need to adjust the figures, as a general rule of thumb slight deviations from the specified threshold values need not to be corrected. For example, if the national data collection includes trees from 8

centimeters in the growing stock data there may not be need to adjust the data but if there are large differences (more than 8 cm from the specified threshold values) these should be corrected. Appendix 4, provides some guidance for how this can be done if available national data is insufficient to perform these adjustments.

Special considerations for reporting on growing stock

If a country has only partial inventories, a decision has to be made on how the inventory data can be "expanded" to a national estimate. One approach is to divide the total area of Forest and Other wooded land into broad classes of "forest types" or into eco-regions, and then use available inventory data to estimate per-hectare figures of growing stock for each of these broad classes. The totals for each class are then calculated (multiplication with respective area) and added together to obtain the requested estimates for Forest and Other wooded land (see example 7).

In some cases, countries may have inventory data that does not directly include tree volume, but rather basal area or number of trees in different diameter classes. In those cases, countries will need to convert basal area or number of trees to volume. This can be done in several ways depending on the inventory data and any available complementary information, but it is difficult to provide any general guidance on how to perform these conversions. National correspondents should provide a description in the country report on how the calculations of growing stock were made and what volume equations or other factors were used.

In some cases biomass data may be available but no growing stock data. In such cases, growing stock may be estimated from biomass, using the default values for biomass expansion factors and wood densities listed in Appendix 5.

Example 7. Growing stock estimates when only partial inventory data are available

The following area estimates are available (1000 hectares)

Total Forest area:	*10 000*
Tropical moist forests:	*8 000*
Pine plantations	*1 500*
Eucalyptus plantations:	*500*
Total Area of OWL	*3 500*

Inventory data give the following estimates:

Tropical moist forests:	*95 m3/ha*
Pine plantations	*130 m3/ha*
Eucalyptus plantations:	*150 m3/ha*

Furthermore, for Other wooded land there is an expert estimate:

Other wooded land	*20 m3/ha*

Total growing stock can then be calculated as follows:

Forest: $((95 \times 8000) + (130 \times 1500) + (150 \times 500)) \times 1000$ = **1 030 million m^3.**
OWL: $(20 \times 3500) \times 1000$ = **70 million m^3**

If it is difficult for a country to provide good estimates for Forest and Other wooded land separately, while there are good figures for these two areas together, a country may report for these as a group, as long as this is clearly documented in the country report under "Comments

related to data, definitions, etc.". However, countries are strongly encouraged to use expert estimates for separating growing stock on Forest and Other wooded land.

Whenever possible, the total growing stock should be further divided into "coniferous" and "broadleaved" species based on inventory data or expert estimates.

Growing stock composition (Table 3b)

In this table, countries are requested to report the Growing stock of the ten most common species plus remaining species. Note that the figures in this table only apply to land classified as Forest.

The reference year for compiling the species list and the order of the species is 2000. The ranking of species is according to volume 2010. **NOTE that there is an error** in the country report template which states that the ranking of species is according to volume for the year 2000. The totals of growing stock for the different reporting years must match corresponding values for forest growing stock in table 3a.

Each species should be identified in the reporting table by both *scientific name* and common name. In special cases countries may report on genera instead of species if their inventory data do not allow the distinction of individual species within certain species groups and clearly document this in the relevant field under "Comments related to data, definitions, etc".

FAQ: TABLE 3A &3B

Q: Is it possible to estimate growing stock from biomass stock using the conversion factors?

A: It is possible, but should be done with much caution; particularly the conversion and expansion factors need a growing stock per hectare as part of the input, so here some assumptions need to be made. Using wood density and biomass expansion factors is more straightforward.

Q: How to report on bamboo?

A: Bamboo should be included in the total growing stock, and also reported under the subcategory "...of which broadleaved" species.

Q: Does Table 3b on growing stock composition refer to natural forests only?

A: No. All the table refer to both natural and planted forests of both native and introduced species.

Q: In table 3b, should the ranking of species be by volume, area or number of trees?

A: By volume (growing stock).

Q: In table 3b, is it possible to provide information by groups of species when the number of species is too large?

A: Yes, if national data do not allow the distinction of individual species within certain species groups, countries may report on genera (or groups) instead of species, and make a note in relevant comment field to the table.

Net annual increment (Table 3c)

Q: How does Net Annual Increment (NAI) differ from Gross Annual Increment (GAI)?
A: The NAI does not include natural losses.

Q: If estimates of removals are not very good or the quantities per forest type are small, can I use Mean Annual Increment MAI instead?
A: Yes, it is possible to use MAI in these circumstances.

Biomass stock (Table 3d)

The information on biomass stock is essential to assess the amount of carbon in the woody vegetation. This information is directly linked to international reporting on greenhouse gases and climate change. The information on biomass stock is also of interest from a wood energy point of view.

For estimations of Biomass and Carbon stocks, the FRA process relies on the methodological framework developed by the IPCC and documented in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4, chapters 2 and 4. This document is available at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.htm. Relevant tables with default values and conversion and expansion factors are presented in Appendix 5.

Special considerations for reporting

General methodological aspects

For any biomass calculation, irrespective of whether for Above-ground biomass, Below-ground biomass or Dead wood, the choice of method is determined by available data and country-specific biomass estimation methods. The following list indicates some choices, starting with the method that provides the most precise estimates.

1. If a country has developed biomass functions for directly estimating biomass from forest inventory data or has established country-specific factors for converting growing stock to biomass, using these should be the first choice.
2. The second choice is to use other biomass functions and/or conversion factors that are considered to give better estimates than the default regional/biome-specific conversion factors published by IPCC (e.g. functions and/or factors from neighbouring countries).
3. The third choice is to use the IPCC default factors and values as presented in Appendix 5. These have been improved since the 2003 Good Practice Guidance and are now available for different geographical regions and ecological zones.

When Biomass is estimated based on Growing stock data, countries should document the methodology and conversion factors used, but the calculations can be simplified by using the estimated growing stock for the reference years from table 3a (and 3b if applicable) as input. Hence, no further calibration or reclassification is necessary.

Estimation of Above-ground and Below-ground biomass

If no specific biomass functions are available, the following general formulas should be used for calculating biomass from growing stock figures:

Box 1. Formula for calculating Above-ground and Below-ground biomass

AGB = GS × BCEF (1a)

or

AGB = GS × WD × BEF (1b)

BGB = AGB × R (2)

Where:

AGB = Above-ground biomass (tonnes)
BGB = Below-ground biomass (tonnes)
GS = Growing stock (Volume, m^3 over bark)
WD = Basic wood density (Dry weight / green volume expressed in tonnes/m^3)
BCEF = Biomass conversion and expansion factor (Above ground biomass / growing stock, (tonnes/m^3))
BEF = Biomass expansion factor (Above ground biomass / stem biomass)
R = Root-shoot ratio (Below-ground biomass / Above-ground biomass)

As seen in the Box above, there are two options to calculate Above-ground biomass, either by directly applying biomass conversion and expansion factors (BCEF) to the Growing stock figures or by using basic Wood Density (WD) to estimate stem biomass and then apply a Biomass Expansion Factor (BEF).

The 2006 IPCC guidelines suggest using the BCEF found in Table Appendix 5, 5.4. However, countries may also choose to use WD (see Appendix 5, table 5.6 and 5.7) and BEF (see Appendix 5, table 5.8). The latter may be particularly useful if the growing stock distribution by species is well known and the basic wood densities of the dominating species are significantly different from the regional average.

Biomass conversion and expansion factors (BCEF) may require some specific explanation. The entry points are climatic zone, forest type and growing stock level in m^3/ha. The growing stock per hectare actually refers to stand/compartment stock level, however for most countries such information is not available. Countries should instead estimate (if possible) the Growing stock and area of each forest type and from this calculate an average growing stock per hectare and subsequently determine the BCEF to apply for each forest type.

The BCEFs (see Appendix 5, table 5.4) are given as an average default value and, within parenthesis, a range. Within this range, lower values apply if growing stock definition includes branches, stem tops and cull trees; upper values apply if branches and tops are not part of Growing stock, minimum top diameters in the definition of growing stock are large, inventories volume falls near the lower category limit or basic wood densities are relatively high.

When it is not possible to determine the growing stock and area by forest type, the National Correspondent has to decide which BCEF to apply or, alternatively, use wood density (WD) and biomass expansion factors (BEF) instead. The decision should take into account a rough expert estimate of distribution by forest types and average growing stock per hectare.

Once the above-ground biomass is estimated, below-ground biomass can be estimated by multiplying the above-ground biomass by the root-shoot ratio (R). In this table, the entry points are ecological zone and above-ground biomass per hectare. Unfortunately, it does not contain the same forest types as the table for BCEF. In the specific case of conifers in tropical and sub-tropical areas, it is recommended to use the entries for conifers in temperate forests.

Example 8. Above-ground and below-ground biomass calculations. The example refers to tropical forests.

Forest area	(1)	3000	(1000 ha)	from T1 (all forests are broadleaved)
Growing stock	(2)	450	(million m^3)	from T6
	(3)	150	(m^3/ha)	(2) / (1) * 1000
BCEF (broadleaved)	(4)	1.3	(tonnes / m^3)	from table 5.4
Root-shoot ratio	(5)	0.24		from table 5.3
Above-ground biomass	(6)	585	(million tonnes)	(2) * (4)
Below-ground biomass	(7)	140	(million tonnes)	(5) * (6)
Dead wood	(8)	n.a.	(million tonnes)	IPCC default value not available
Total		**n.a.**	(million tonnes)	(6)+(7)+(8)

Note: Total is listed as "n.a." as the Dead wood component is unknown.

Calculation of dead wood dry matter

If national estimates based on country-specific data and/or conversion factors are available, these estimates should be reported. **If no national data on dead wood biomass are available, countries should report "n.a."**

Carbon stock (Table 3e)

The information on carbon stock indicates the contribution of forest and other wooded land to the carbon cycle. This information is used by international processes that monitor greenhouse gases and climate change.

For estimations of biomass and carbon stocks, the FRA process relies on the methodological framework developed by the IPCC and documented in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4, chapters 2 and 4. This document is available at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.htm. Relevant tables with default values and conversion and expansion factors are presented in Appendix 5.

Special considerations for reporting

General methodological aspects

In most cases the estimation of the carbon stock of living biomass and dead wood will be based on the biomass data compiled in table 3d. When converting the biomass stock to carbon stock the biomass is multiplied by the carbon fraction. The default global carbon fraction recommended by IPCC is 0.47 (see Appendix 5, table 5.2).

Note, if national estimates of carbon stock are available and these are considered to be more accurate than those obtained by applying the IPCC default carbon fraction to the biomass figures, the national estimates as well as the methods and conversion factors used should be reported.

Carbon in living biomass

If national data on carbon in living biomass are available, these should be used for reporting. If not, the carbon stock in living biomass can be estimated by multiplying the IPCC default carbon fraction (0.47) with the reported values on above-ground and below-ground biomass respectively.

Carbon in dead wood

If national data on carbon in dead wood or dead wood biomass are available, these should be used for reporting. If no national data on carbon in dead wood or dead wood biomass are available, countries should report "n.a.". When converting from dead wood biomass to carbon in dead wood, the default global carbon fraction of 0.47 can be used.

Carbon stock in litter

If national data on carbon in litter are available, these should be used for reporting. If no national or regional data are available, countries may choose to estimate carbon in litter by multiplying the IPCC default value per hectare with total area of forest and other wooded land respectively (see Appendix 5, table 5.9). Please note, however, that the IPCC default values exclude the fine woody debris which by definition forms part of the litter.

Soil carbon

If national data on Soil carbon are available, these should be used for reporting. Note that new in FRA 2015 is that the soil depth that is used for the soil carbon stock estimates has been specified to 30 centimeters (in FRA 2010 it was up to the countries to report to whichever national soil depth used for the soil carbon stock estimates).

If no national or regional data are available, countries may choose to estimate soil carbon by multiplying the IPCC default value per hectare with total area (see Appendix 5, table 5.10). If the IPCC default values are used, a soil depth of 30 cm should be reported.

Example 9. Calculation of carbon stock (the example refers to broadleaved forest in a moist tropical area.)

Forest area	(1)	3000	(1000 ha)	from T1 (all forests are broadleaved)
Above-ground biomass	(2)	585	(million tonnes)	from T7
Below-ground biomass	(3)	140	(million tonnes)	from T7
Carbon fraction	(4)	0.47		from table 5.2
Carbon content in litter	(5)	2.1	(t C ha^{-1})	from table 5.9
Carbon content in soil	(6)	65	(t C ha^{-1})	From table 5.10, assuming LAC soils
Carbon in above-ground biomass	(7)	275	(million tonnes)	(2) * (4)
Carbon in below-ground biomass	(8)	65.8	(million tonnes)	(3) * (4)
Carbon in dead wood	(9)	n.a.	(million tonnes)	IPCC default value not available
Carbon in litter	(10)	6.30	(million tonnes)	(1) * (5) / 1000
Soil carbon	(11)	195	(million tonnes)	(1) * (6) / 1000
Total		**n.a.**	(million tonnes)	(7)+(8)+(9)+(10)+(11)

Note: Total is listed as "n.a." as the Carbon in dead wood component is unknown.

Countries are encouraged to report on litter and soil when ABG and BGB are reported upon.

FAQ: TABLE 3D &3E

Q: What about the biomass/carbon stock of shrubs and bushes? Should they be included or excluded?

A The IPCC guidelines states that when the forest understorey is a relatively small component of the above-ground biomass, it can be excluded provided this is done in a consistent manner throughout the time series. However, in many cases shrubs and bushes are important in terms of biomass and carbon, particularly for areas classified as "other wooded land", and should therefore be included to the extent possible. Please indicate in the relevant comment field how shrubs and bushes have been handled in your biomass estimates.

Q: Should I report the same figures on biomass and carbon stocks to FRA as to UNFCCC?

A: Not necessarily – but ideally the figures reported to UNFCCC should be based on the FRA figures and then adjusted/reclassified, when necessary, to comply with the UNFCCC definitions.

Q: Does "above ground biomass" include forest litter?

A: No, above-ground biomass only includes living biomass.

Q: In our national forest inventory we have biomass estimates where biomass equations have been used. Should I use these or rather use the IPCC default factors in the guidelines

A: Generally, biomass equations are considered to give better estimates than default factors, but if for some reasons you believe that the use of default factors provide a more reliable estimate you may use these factors. In such case please make a comment in the report.

Q: How to report on dead wood dry matter?

A: If no national data on dead wood biomass are available countries should report "n.a." not available.

Q: Can the IPCC default values for litter and soil carbon be applied to Other wooded land?

A: The IPCC default values for litter carbon only apply to mature forests and should not be applied to Other wooded land. The IPCC default values for soil carbon is by climate region and soil type and can be used also for estimating soil carbon on other wooded land.

Question 4: *What is the status of forest production and how has it changed over time?*

FAQ: TABLE 4A

Q: All forests fulfil many different functions (conservation, protection, etc.). Is it therefore correct to report all forest area as "multiple use"?

A: Note that there is a difference between a nature-given function and a designated function. All forests may fulfil one or many nature-given functions but this table aims to capture the designated function, which is an active decision on how the forest should be managed and used. Only when there is an active management decision that a forest should be used for several purposes and that none of these are significantly more important than the other, should the area of this forest be considered as designated for multiple use.

Q: How should I report when the designated function has changed over time? (e.g. areas planted primarily for timber production and later changed to multiple use)

A: The latest available information on designation should be used for this table regardless of whether the forest was previously designated for another purpose. Consequently, a specific area can be reported under one category in 1990 and under another category in 2010.

Q: If the national legislation states that all forests should be managed for production, conservation of biodiversity and protection of soil and water, should I then report all forest area as having "multiple use" as primary designated function?

A: The definition of primary designation function, explanatory note 2, says that "Nation-wide function established in general clauses of national legislation or policies should not be considered as designations". So you must instead look into what functions have been designated at management unit level.

Q: Does the term "designated" imply that the function has to be legally registered?

A: Not necessarily. The definition of "primary designated function" states. "The primary function or management objective assigned to a management unit either by legal prescription, documented decision of the land owner/manager, or evidence provided by documented studies of forest management practices and customary use."

Non-wood forest products (NWFP)

The information on removals and value of non-wood forest products (NWFP) demonstrates the potential of forests to provide NWFP, both as important commodities for national and international markets. This information can be useful to demonstrate where NWFP may deserve a higher priority in the development of national policies and forest management strategies.

Special considerations for reporting

The availability of reliable information on NWFP is low in most countries. The rationale of the table is to capture the ten most important NWFP in terms of commercial value as it is more likely that reliable data is available for these products.

It is recognized that it may be difficult to make a distinction on whether the collected product originates from areas classified as forest. In such cases, countries should, if possible, assess and report the share collected in forest. If countries are unable to derive the share collected in forest countries are encouraged report total quantity and provide a comment in appropriate comment section (e.g "Reported figure refers to forest and other wooded land combined").

Similarly the value of NWFP refers to the market value of the raw material at the site of collection or forest border (e.g. before various stages of processing). However, it is accepted that for many NWFP, this value may be difficult to obtain or derive as only the value of commercialised NWFPs may be available. In these cases, countries are encouraged to estimate the value at the site of collection. If countries are unable to make this estimate they are encouraged to report whatever value is available and provide a comment in appropriate comment section (e.g. the value refers to processed product).

As a general rule of thumb countries are encouraged to report and whenever reported figures deviate from the specification of the table comments should be provided. In the case of expert estimates a comment should be added to appropriate comment field (e.g. reported figure is based on subsistence value and is believed to be an under- or overestimate of the true value but no other reliable estimate exists).

Special cases

In general, all plantations of tree crops managed primarily for NWFPs are excluded with the exception of rubber, bamboo and rattan.

FAQ: TABLE 4B

Q: Can we include services, such as water, ecotourism, recreation, hunting, carbon, etc., in the NWFP table? In other contexts we report on non-wood goods and services where these are included.

A: No, NWFPs are limited to goods only, defined as "tangible and physical objects of biological origin other than wood".

Q: How should we report on production of ornamental plants and crops growing under tree cover?

A: They should be included if collected in the wild. If planted and managed they should not be included as in such case they are not derived from forest but from an agricultural production system.

Q: How to we report on Christmas trees?

A: In FRA Christmas tree plantations are always considered as forests, consequently Christmas trees should be considered as NWFP (ornamental plants).

Q: What about products from multi-purpose trees often growing in agroforestry systems – should they be included as NWFPs?

A: The specifications and the definition of NWFP states that only non-wood products derived from forests should be included. So if the particular agroforestry system is considered to be "forest", the non-wood products derived from multi-purpose trees are NWFPs and should be included in the reporting.

Q: We only have a commercial value of processed products. How should we then report on value?

A: In general, the value should refer to the commercial value of the raw material. However, sometimes raw material value is not available and in such cases you may report on the value of a processed or semi-processed product and clearly note this in the respective comment field.

Q: Are animals which are produced inside the forest considered NWFP?

A: Yes, bushmeat species production should be considered NWFP. Domesticated animals should not be included as NWFP.

Q: If traditional measuring units are used and these are incompatible with units as requested by FRA, what can be done?

A: Use the best conversion factor available to convert the traditional measurement to the one requested in the table, and specify it in the comments section.

Q: Can grazing be considered as fodder and therefore as a NWFP.

A: No, grazing is a service while fodder is a tangible good. So include fodder collected from the forest, but exclude grazing.

Question 5: *How much forest area is managed for protection of soil and water and ecosystem services?*

Reporting tables 5a and 5b are new for FRA 2015. In table 5a protection of soil and water and table 5b ecosystem services, cultural or spiritural values. Note that information is requested for areas with "Total area with designated function" and for "Primary designated function".

Table 5a

Categories	**Designation**
Protection of soil and water	Total area with designated function
…of which production of clean water	Primary designated function
…of which coastal stabilization	Primary designated function
… of which desertification control	Primary designated function
… of which avalanche control	Primary designated function
…of which erosion, flood protection or reducing flood risk	Primary designated function
…of which other (please specify in comments below the table)	Primary designated function

Table 5b

Categories	**Designation**
Ecosystem services, cultural or spiritual values	Total area with designated function
… of which public recreation	Primary designated function
… of which carbon storage or sequestration	Primary designated function
… of which spiritual or cultural services	Primary designated function
… of which other (please specify in comments below the table)	Primary designated function

Total area with designated function

The two main categories of "Total area with designated function" should contain all areas designated for "Protection of soil and water" or "Ecosystem services, cultural or spiritual values", regardless whether they are primarily designated or not. Consequently areas that have more than one function will be counted once for each function they are designated to provide.

Primary designated function

The 10 sub-categories (6+4) of "Primary designated functions" are exclusive and should be counted only once. A primary designated function or management objective is usually assigned to a management unit either by legal prescription, documented decision of the landowner/manager, or by evidence provided by documented studies of forest management practices and customary use. The primary designated function is significantly more important than any other functions.

Question 6: *How much forest area is protected and designated for the conservation of biodiversity and how has it changed over time?*

FAQ: TABLE 6

Q: Can protected areas of IUCN category V and VI be included under "area of forest in protected areas?

A: IUCN category V and VI are explicitly excluded from this category and should not be accounted for when reporting "area of forest in protected areas".

Q: Are all protected areas considered as "conservation of biodiversity"?

A: No, only when conservation of biodiversity is the main reason for protecting the area.

Q: When reporting on area of forest within protected areas, how should we handle cases when we know that illegal logging takes place within the protected areas?

A: In this case, you should report on the area of forest that is legally protected, not whether the protection is enforced or not.

Q: **What is the correlation between the MCPFE protected areas (1.1, 1.2, etc) with the IUCN categories used in FRA 2010?**

A: The MCPFE Assessment Guidelines for Protected and Protective Forest and Other Wooded Land in Europe (2002)[3] explains in detail the MCPFE categories and their relationship to the EEA[4] and IUCN categories. A summary is shown in the figure below

[3] http://www.mcpfe.org/system/files/u1/meetings/02/10elm/Assesment_guidelines_protected.pdf
[4] European Environment Agency

MCPFE CLASSES		EEA*	IUCN**
1: Main Management Objective "Biodiversity"	1.1: "No Active Intervention"	A	I
	1.2: "Minimum Intervention"	A	II
	1.3: "Conservation Through Active Management"	A	IV
2: Main Management Objective "Protection of Landscapes and Specific Natural Elements"		B	III, V, VI
3: Main Management Objective "Protective Functions"		(B)	n.a.

Q: If a forest area has two designated key functions, can we include the area under both categories?

A: No, it can only be included under one category as the table must add up to the total forest area. If one of the functions is more important than the other, report the area under that function – otherwise report under multiple use.

Q: Does the term "designated" imply that the function has to be legally registered?

A: Not necessarily. The definition of "primary designated function" states. "*The primary function or management objective assigned to a management unit either by legal prescription, documented decision of the land owner/manager, or evidence provided by documented studies of forest management practices and customary use.*"

Q: What is the difference between the category "Conservation of biodiversity" and "Forest area within protected areas"?

A: The term "protected area" is generally interpreted to be wider in scope than "conservation of biodiversity" as the protected areas may include areas that are protected for other purposes.

Question 7: *What is the area of forest affected by woody invasive species?*

In this table, countries should list the *scientific name* of the most important woody invasive species that constitute, or are expected to constitute, a problem for forest ecosystem health and vitality.

FAQ: TABLE 7

Q: What do you mean with "woody invasive species"?

A: Woody species are trees and shrubs, and invasive species are defined as "*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*"

Q: What about woody invasive species that threaten environmental aspects (ecosystem stability, etc.) but are of significant socio-economic value. Are they considered invasive?

A: Yes, if they spread and cause environmental harm.

Question 8: **How much forest is damaged each year?**

Table 8a

Fire is a dynamic natural phenomenon with potentially significant impacts on ecosystem resilience, biodiversity and atmospheric carbon flux. Areas affected by fires, or burned areas, have unique characteristics that affect the surface reflectance (e.g. charcoal, removal of vegetation and changes in vegetation structure) and, in this way, can be detected by satellite sensors like MODIS. The MODIS burned area product maps the spatial extent of recent fires on a monthly time-step and is available from year 2000 to current day. There is a time-lag of several months before the product is available for use. The burned area product is created by analysing the time-series of surface reflectance data collected by the MODIS sensor and detecting anomalies in the time-series that signify vegetation surface reflectance changes due to fire. The product has limited utility in dense forest canopy as surface fires that do not affect the forest canopy may go undetected.

Pre-filled values from this analysis are provided in the country reports for review. They can be used (as a Tier 2 analysis) or substituted should nationally available data be more reliable.

Table 8b

In this table countries should list the major outbreaks of insects, diseases and severe weather events that have occurred since 1990. When applicable countries should provide the *scientific name* of the agent (insect or disease), the name of tree species or genera affected, the year (or period of years) of the latest outbreak, the total area affected during the latest outbreak.

Note that forest fires should not be accounted for as a disturbance in this table as it is separately reported on in table 8a, neither should this table include disturbances which are direct results of human activities such as logging damages, over-exploitation, refugee camps, etc.

In some cases, areas have been affected by different disturbances simultaneously, each of which is contributing to reducing the health and vitality of the ecosystem. For example, there are areas affected by storm and then insects, or flooding and then diseases. In such cases the areas should be reported for each relevant disturbance category.

FAQ: TABLE 8

Q: Should the area damaged be the area affected within a given year or the area in which the effects of the disturbance are present/visible?

A: If the damaged area is the result of an outbreak, the total area affected/damaged during the outbreak should be reported.

Q: Should disturbances like "over-exploitation", "selective logging", and "degradation" be included in this table?

A: No, disturbances that are results of human activities should <u>not</u> be included in this reporting table. This table aims to highlight the areas damaged by environmental fluctuation and/or destructive events (insects, diseases, climatic events, etc.), not human-induced disturbances.

Q: Some areas are affected both by insects and diseases. How do we handle this?

A: The categories in this reporting table are not exclusive. Hence, a forest area that has been affected by different disturbances simultaneously, each of which significantly affects the health and vitality of the forest should be counted once for each relevant disturbance category.

Question 9: *What is the forest area with reduced canopy cover?*

Forest degradation is a critical parameter to measure and monitor for its impacts on biodiversity, atmospheric carbon flux and as a pre-cursor to potential deforestation or alteration of forest environmental services such as water cycling and amelioration of land surface temperature. However, forest degradation has many definitions to many different stakeholders and, as such, cannot be used succinctly as a single attribute to measure or monitor. Nevertheless, it is important to provide some kind of information that may assist the effort to characterize forest degradation where it is occurring.

FRA 2015 will include a globally consistent approach and estimate of partial canopy cover reduction from 2000-2010 at the national, climatic domain and global scales. Partial canopy cover reduction that does not meet the definition of deforestation, or nearly complete canopy cover removal, is a potentially valuable proxy variable capable of capturing one of the most notable aspects of forest degradation. Time-series MODIS VCF data with a pixel size of 250 meters will be analyzed for indications of partial canopy removal by calculating the slope of the line formed by the annual percent tree cover estimates and absolute range of percent tree cover measurements over time. Since the pixel size is coarse, only those areas with relatively large amounts of partial canopy cover removal can be detected. The global Intact Forest Landscapes and Global Wetland Map will be used as ancillary datasets to decrease the risk of false detections where forest degradation is unlikely.

Pre-filled values from this analysis are provided to countries for review. They can be used (as a Tier 2 analysis) or substituted should nationally available data be more reliable.

Topic V: Measuring Progress toward SFM

Topic V is new in FRA 2015 and consists of two parts:

i. Questions related to the national-scale enabling environment for sustainable forest management.

ii. Questions related to the operational scale progress towards sustainable forest management.

Part I. National-scale enabling environment for sustainable forest management

Question 10: *What forest policy and regulatory framework exists to support implementation of SFM?*

The legal, policy and institutional framework related to forests help define and facilitate the practice of sustainable forest management. Use the "check boxes" to indicate whether there

are national or sub-national policies and legislations in place that explicitly encourages and guide sustainable forest management.

Q: How do we define SFM for this purpose?
A: Because SFM is a concept that varies widely between countries, we suggest that the policy, legislation or regulations explicity mention SFM as used nationally.

Q: What is included at the sub-national level?
A: Policies and legislation do not always apply to all forest types nor to all legal jurisdictions. The intention is to assess where existing policies, legislation and regulation that support SFM apply, or do not apply, within a country's legal framework. This is particularly important in countries where regulations may for example not apply to privately owned forest land or where forest policy is a sub-national responsibility (e.g. Province, State, District, etc.) and may not exist at the national scale.

3.1 Question 11: Is there a national platform that promotes stakeholder participation in forest policy?

Indicate if there is a national platform or structured means for a broad range of stakeholders where they can provide opinions, suggestions and other input into the development of national forest policy.

Q: What is a national platform?
A: A means that encourages stakeholders to express views on national forest policy – this could include regular meetings with legislators or policy makers, annual forest policy discussions that are open to stakeholders or websites that are constructed to solicit public feedback on national forest policy.

Question 12: **What is the forest area intended to be in permanent forest land use and how has it changed?**

The Permanent Forest Estate (PFE) refers to forest land designated to be retained as forest and which cannot legally be converted to other land uses. Countries vary in the way in which they define the degree of permanence. Some countries may have a PFE designated by the state and accorded a considerable degree of protection under the law. The PFE may contain both forest and non forest areas, note that the reported figures should refer only to the forest area within the PFE.

The concept of state-designated PFEs may not exist in some countries. In such instances, and in other cases where the degree of permanence is unclear, a judgement (expert estimate) has to be made about how much forest can be considered as designated as permanent forest.

Permanent forest land use may differ from PFE – in that private forest lands may not be controlled by government and can be retained or converted based on a private owners interest. FRA 2015 seeks to identify the difference between the PFE and the forest area intended to be in permanent forest land use.

FAQ : TABLE 12

Q: How does forest area intended to be in permanent forest land use differ from the Permanent Forest Estate?

A: Forest area intended to be in permanent forest land use includes private forest lands that are highly likely to remain in forest land use plus public or other forest lands that must remain in forest land use as designated by law. The Permanent Forest Estate (PFE) is only those lands that must legally be retained as permanent forest land.

Q: The concept of Permanent Forest Estate (PFE) does not fit into the national context. How should I report?

A: PFE is the area of forest where a legal decision has been taken that it should remain under forest i.e. where the land use may **not** be changed unless special permission is granted.

Q: If mining operations occurs in an area previously forested and the mining company is obliged to "restore" the forest cover after mining operations are to an end. Could that area still be considered as area under PFE?

A: As long as mining operations are in place, the area is not considered as forest and therefore not included in the PFE.

Question 13: *How does your country measure and report progress toward SFM at the national level?*

An up to date forest monitoring system allows authorities to understand changes to forest extent and quality. It also provides the foundation for making changes in policies, legislation, regulations and practices that can learn from current realities and provide adjustments to better promote/facilitate sustainable forest management.

FAQ: TABLE 13

Q: What is included in the "categories "?

A: The first category is repeated forest inventory – either national or accumulation of sub-national inventories. The second category is other field assessment which may not necessarily provide stocking inventories, but do involve field-based assessment. Updates to other sources seek to add some new information to previous monitoirng work – but at a lower level of intensity. Finally, expert estimate is informed opinion of changes that are not necessarily based on field work or new analysis.

Q: In Table 13b do I need to select only one box?

A: No, you may select all boxes that apply.

Question 14: *What is the area of forest under a forest management plan and how is this monitored?*

Forest management plans, whether for production or conservation, are an important tool in defining management objectives and the practices required to meet those objectives.

FAQ: TABLE 14

Q: Are the production and conservation sub-categories mutually exclusive?
A: Yes, although clearly forests can be managed for both production and conservation, most management plans have a greater emphasis on one or the other. Please choose the sub-category based on which is the pre-dominant purpose.

Q: How is the FRA category "forest area with management plan" related to the MCPFE categories?
A: The FRA category includes both the MCPFE category "forest management plans" and the category "equivalents"

Q: In Table 14c, what is meant by the percent of area monitored annually?
A: This table requests a percent of the total forest area that is under forest management plan (as reported in Table 14a) that is monitored per year on average. If the monitoring system has a fixed area target per year, please report that as a percentage of the Table 14a total.

Question 15: *How are stakeholders involved in the management decision making for publicly owned forests?*

Q: What is meant by significant inputs?
A: Table 15 requests information on whether or not stakeholder inputs are **required** in forest management decisions on public forest land. Examples of significant inputs might be public meetings or hearings that involve forest managers and local residents or well-publicized opportunities for written inputs, etc.

Q: Can more than one type of stakeholder involvement be selected?
A: Yes, please check all boxes that apply.

Question 16: *What is the area of forest under an independently verified forest management certification scheme?*

Measuring the implementation of best practice in forest operations is difficult, but important to the understanding of progress made toward SFM. Forest management certification is the process by which forest management practices are evaluated against a set of standards and requires "independent verification" (generally by a third party) to measure conformity to those standards. It is one means of demonstrating how forest land is being managed in a way that can be tracked over time.

Q: Do the sub-categories of international and domestic forest management certification need to be equal to the total area under forest management certification?
A: No, some forests are certified under both schemes so that adding the two could include some double counting.

Q: What should I do with the pre-filled values provided by FAO?

A: Please review the numbers and if they are correct/reasonable you may leave them as is. If they are incorrect, please substitute the correct values and make a note in the Comments table.

Q: What if the domestic certification scheme is affiliated directly with either FSC or PEFC certifications?

A: Please enter the area only once. The choice of whether to list as international or domestic is up to the Country to define depending on whether the certification is viewed as a domestic or international set of certification and reporting criteria.

Question 17: *How much money do governments collect from and spend on forests?*

Revenue collected from the forest sector is an indication of the contribution of the sector to government finances and, conversely, public sector expenditure on forests is an indication of government support for the forest sector. There is little information available about the financial flows between the forest sector and governments and, in particular, the expenditure of governments in support of sustainable forest management. This table will provide information about the total amount of money collected by governments from the forest sector and total public expenditure on forest activities.

Total government expenditure includes expenditure on forest activities of all relevant institutions (except publicly owned business entities)[5].

Q: Are government revenues from taxation of payments for forest-based climate change mitigation included?

A: Yes, taxes or fees paid to government for forest services, including forest carbon sequestration/storage should be included.

Question 18: *Who owns and manages the forest and how has this changed?*

The allocation of forest ownership and management rights defines who exercises control over which forest resources, for how long, and under what conditions. Thus, the information on this variable is important for policy, institutional and management purposes.

For reporting on this table it should be noted that ownership refers to the forest resource (the trees) and not to the land.

It is important to recall that information on ownership only is requested for land that is classified as Forest. If national data on ownership is not specifically available for the forest area then the ownership categories must be distributed on the forest area as reported in table 1a.

Many countries may have data on public ownership but limited data on private ownership. Notwithstanding, countries are encouraged to provide at least an expert estimate for the main

[5] Where it is impossible or inappropriate to separate the activities of publicly owned business entities from other public sector activities in forest sector, this should be noted and both income and expenditure of the entities should be included in the tables.

category of Private ownership – but if there are no basis for further breaking it down into sub-categories, countries may leave these with "n.a.".

If a country is reporting data under the category Other types of ownership the country should also specify and describe the particular kind of ownership that applies to the area reported under this category.

Regarding management rights of public forests, it may sometimes be difficult to decide whether a specific type of arrangement should be included or not. The key criterion for inclusion is that the arrangement should be "long-term" and also include the responsibility for management of the forest (not only for harvesting). There is no established specific threshold value for "long-term", as this concept may vary between countries.

In some cases, there may also be an overlap between management rights, e.g. a NWFP concession may overlap a timber concession. In such cases, areas should not be double counted.

FAQ ON TABLE 18

Q: How should I report on ownership where indigenous land overlaps protected areas?

A: It is the formal ownership of the forest resources that define how you should report. If the indigenous rights to the forest resources correspond to the definition of ownership, then report as "Local, tribal and indigenous communities". Otherwise, protected areas where indigenous rights are present are likely to be of "public ownership".

Q: My country has a complex land tenure regime that is difficult to fit into the FRA categories. How should I do?

A: Contact the FRA team for advice, describing the particular land/resource tenure regime of your country.

Q: Do the three sub-categories of private ownership add up to total private ownership?

A: Yes.

Q: How to classify ownership of forests planted by private companies on government land?

A: Sometimes, private companies are required to plant trees as part of concession or harvesting agreements. Generally speaking the planted forest is public, unless there are specific legal or contractual clauses giving the private company ownership of the planted trees, in which case they should be classified as private.

Q: How to classify ownership of forests on private land where a permit is needed from the authorities to cut the trees?

A: It depends on the legal status of the ownership of the forest. You may have forests that are legally owned by the private land owner, but the state still can enforce restrictions on harvesting and in this case it is private ownership. You may also have the case where the trees belong to the state even if the land is private. In this case it should be reported as public ownership and a note that the ownership of trees and land are different.

Q: How to report on forest areas with concession rights?

A: Concession rights are not full ownership rights – they usually only refer to the right to harvest and responsibility to manage the forests. Forest concessions are almost always on State land and ownership is therefore "public" and management rights is "private corporations". In the rare case when a private owner gives a concession, it should be reported on under private ownership in table 18a.

Q: How to report on concessions of only commercial species?

A: To be classified as a concession in the table 18b on management rights, the concession should not only give the right to harvest but also the responsibility to manage the forest for long-term benefits. As long at these criteria are fulfilled, it doesn't matter if the harvesting rights only cover a few commercial species, all species or just some NWFPs. If the concession is only a short-term harvesting right, it should be reported under "public administration" in table 18b.

Q: How to report when the ownership status is ambiguous (e.g. communities claiming ownership, disputed ownership, etc.)?

A: The current legal status should be the guiding principle. If legally clear that the land is either public or private it should be reported so, although there may exist claims to the land. Only when it is legally unclear or unknown, it should be reported as "Unknown ownership". Special cases should be documented in detail in appropriate comment field to the table.

Q: Does public lands include leased lands?

A: They should be reported as "public" ownership in table 18a. What category to assign in table 18b depends on the length and other characteristics of the lease.

Q: Should indigenous territories be considered private (indigenous) or public with community user rights?

A: It depends on the national legislation and to what extent it grants legal rights to the indigenous people that correspond to the FRA definition of "ownership", i.e. rights to *"freely and exclusively use, control, transfer, or otherwise benefit from a forest. Ownership can be acquired through transfers such as sales, donations and inheritance."* The country should assess whether this is the case and report accordingly.

Q: How to report public forests that are under co-management agreements (public administration + NGO or Community)?

A: In table 18a, report them as "Public". In 18b, report them under "Other" and explain in "comments to data" how this co-management agreement is set up.

Question 19: *How many people are directly employed in forestry?*

The information on employment in forestry is useful in identifying trends, especially in the context of public expectations, government policies, industry development and the socioeconomic importance of forests.

The unit "Full-time equivalents" (FTE) corresponds to one person working full time. 1000 years FTE corresponds to 1000 persons working full-time during one year, or 2000 persons working half time during one year.

The definition of the category Employment in forestry. This category corresponds to the ISIC/NACE Rev. 4 activity A02 (Forestry and logging). The detailed structure and explanatory notes of activity A02 can be found at: http://unstats.un.org/unsd/cr/registry/isic-4.asp .

FAQ ON TABLE 19

Q: What does the unit FTE stand for?
A: FTE[6] means "Full-time equivalent" and one FTE corresponds to one person working full time during a reference period, in this case the reporting year. Consequently, one person working full time as seasonal employment during 6 months would count as ½ FTE, as would one person working half-time during a whole year.

Q: How to include casual and season labour/employment?
A: Seasonal labour should be recalculated into FTE during the year. Example: If a company employed 10000 people for tree planting during 1 week in 2005, for the whole year 2005 FTE it would be approx.: 10000people / 52 weeks = 192 employees (FTE). It is important that a note on this is made in the appropriate comment field. If official data (in FTE) from the national statistical office are used, these recalculations have already been made.

Q: Should people involved in wood transport be included as employment?
A: You should include people working with wood transport within the forest. Operators of skidders, forwarders and caterpillars transporting logs should therefore be included. Truck drivers should not be included as they generally transport the wood all the way to the industry.

Q: Should we include people working in sawmills in the forest?
A: Generally, people working in sawmill and woodworking industries should not be included. However, small scale work with portable sawmills is a borderline case and countries may decide to include such employment, but if so, a comment should be provided in the report.

[6] The exact definition of full-time equivalent employment is: "...the number of full-time equivalent jobs, defined as total hours worked divided by average annual hours worked in full-time jobs" (http://unstats.un.org/unsd/sna1993/glossform.asp?getitem=202)

Q: There are some cases where sawmills are located inside the forest area, and people may share their time between working in the forest and in the sawmill. How should it be reported?

A: If possible, you should calculate/estimate the time allocated to each activity and report on the part that correspond to the work in the forest. If not possible, please use the total and make a note in the comments field.

Q: Should employment related to "other wooded land" be included?

A: If it is possible to distinguish between employment related to forests and to other wooded land, please provide both figures in the comments section.

Q: Should employment in this table include haulage, processing and other non-forest work?

A: No, only employment directly related to the primary production of goods and to the management of protected areas should be included. For primary production of goods, this includes all the logging activities in the forest, but excludes road transport and further processing.

Q: In my country, the same person works with both production and management of protected areas – how should I report?

A: If possible, his time should be split on the two activities, so that if he/she works 50% with each it should count as 0.5 year FTE for each activity. If not possible to do the split, note the time under the activity on which he/she spends most of the tim

Question 20: *What is the contribution of forestry to Gross Domestic Product (GDP)?*

Q: What should I do if the pre-filled values provided by FAO are not consistent with national statistics?

A: If the values provide in the pre-filled Country Report are incorrect, please substitute the correct values and make a note in the Comments table.

Question 21: *What is forest area likely to be in the future?*

Q: How do we assess what forest area is likely to exist in the future?

A: Table 21a requests an estimated target or hope for forest area in two time periods. We recognize that these are often estimates. A realistic estimate of future forest area can help set expectations of forest area through 2030. Table 21b seeks an estimate of the forest area that is intended for conversion to agriculture or other uses in the future – no time period is specified.

Contact information for technical support

The FRA team of professional staff is available to answer questions and give technical support to countries. Countries are also welcome to take direct contact with the Forestry Officers at the FAO regional and sub-regional offices in matters related to FRA 2015.

General address and contact information for FRA:

Global Forest Resources Assessment 2015
Forestry Department, FAO
00153 Rome, Italy
E-mail: fra@fao.org

Contact persons at the FRA team:

Mr. Kenneth MacDicken (FRA Team Leader)
Senior Forestry Officer
Tel: +3906-5705-2091
Fax: +3906-5705-5137
E-mail: Kenneth.MacDicken@fao.org

Mrs. Emma Foti
Secretary

Tel: +3906-57052839
Fax: +3906-5705-5825
E-mail: Emma.Foti@fao.org

Contact persons at the FAO Regional and sub-regional offices:

Regional Office for Africa (RAF)
Foday Bojang, Senior Forestry Officer
Gamul Abdul Nasser Road
PO Box GP 1628
Accra, Ghana
Tel: +233 (0)21 67-5000
E-mail: Foday.Bojang@fao.org

Sub-Regional Office for West Africa (SFW)
Mr. Fernando Salinas, Senior Forestry Officer
Gamul Abdul Nasser Road
PO Box GP 1628
Accra, Ghana
Tel: +233 (0)21 67-5000
E-mail: Fernando.Salinas@fao.org

Sub-Regional Office for Southern Africa (SFS)
Rene Czudek, Forestry Officer
P.O. Box 3730,
Harare, Zimbabwe

Tel: +263 (0)4 253657
E-mail: Rene.Czudek@fao.org

Sub-Regional Office for Eastern Africa (SFE)
Edward Kilawe, Forestry Officer
Kirkos Sub City, Kebele 01,
House No. 126, Bole Road,
Addis Ababa, Etiopía
Tel: +251 (0)11 5511398
E-mail: Edward.Kilawe@fao.org

Sub-Regional Office for Central Africa (SFC)
Jean Claude Nguinguiri, Forestry Officer
P.O. Box 2643,
Libreville, Gabon
Tel: +241 (0)774783
E-mail: Jeanclaude.Nguinguiri@fao.org

Regional Office for Asia and the Pacific (RAP)
Patrick Durst, Senior Forestry Officer
39 Phra Atit Road
Bangkok 10200, Thailand
Tel: +66 (0)2 697-4000
E-mail: Patric.Durst@fao.org

Sub-Regional Office for Central Asia (SEC)
Ekrem Yazici, Forestry Officer
Ivedik Cad. No. 55,
06170 Ankara, Turkey
Tel: +90 (0)312 3079517
E-mail: Ekrem.Yazici@fao.org

Sub-Regional Office for the Pacific Islands (SAPA)
Mr. Aru Mathias, Forestry Officer
Private Mail Bag
Apia, Samoa
Tel: +685 (0) 22377
E-mail: Aru.Mathias@fao.org

Regional office for Latin America and the Caribbean (RLC)
Ms. Hivy Ortiz Chour, Forestry Officer
Avenida Dag Hammarskjold, 3241, Vitacura
Casilla 10095
Santiago, Chile
Tel: (+56 2) 337-2100
E-mail: Hivy.Ortizchour@fao.org

Subregional Office for Central America (SLM)
Mr. Lars Gunnar Marklund, Senior Forestry Officer
Edificio 238
Apartado 0843-00006 Balboa,
Ancon, Panama 5 Panama

Telephone:+507-3010326
Fax:+507-3010525
E-mail:larsgunnar.marklund@fao.org
Larsgunnar.Marklund@fao.org

Sub-Regional Office for the Caribbean (SLAC)
Mr. Claus Eckelmann, Senior Forestry Officer
PO Box 631-C
Bridgetown, Barbados
Tel: +1 246 426-7110
E-mail Claus.Eckelmann@fao.org

UNECE/FAO Timber Section in Geneva
Mr. Roman Michalak, Forestry Officer
Timber Section
Palais des Nations
CH - 1211 Geneva 10
Tel.: +41-22-917 1286
Fax: +41-22-917 0041
E-mail: Roman.Michalak@unece.org

Regional Office for the Near East (RNE)
Mr. Mohamed Saket, Senior Forestry Officer
P.O. Box 2223
11, El Eslah El Zerai Street Dokki,
Cairo, Egypt
Tel: +20 (0)2 3331-6000
E-mail: Mohamed.Saket@fao.org

Appendix 1 – Example of reporting for question 1a

The following example illustrates country reporting for table 1a, following the structure proposed in for the country reporting. The example shows how the standard methodology can be applied when completing a reporting table. The data in this example are entirely hypothetical and do not correspond to any specific country.

Extent of Forest and Other wooded land

FRA 2015 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 defined 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; 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.

National data

Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
a) Smythe, B 1988. *National Pine forest and mangrove inventory.* Hypothetical country	M[1]	Land use, Forest cover, Growing stock	1986	National inventory of pine and mangrove forests covering the whole country, using remote sensing and field sample plots.
b) Grove 2000, N. *Forestry national report on state of the forest to the year 2000 for* Hypothetical country.	M[1]	Forest cover	1992	Analysis of forest cover based on satellite images.

[1] Assessed as Medium quality "M". The source document provides information based on remote sensing without field sample plots.

Classification and definitions

National class	Definition
Coppice forest	The coppice hardwood forests are native forests of various hardwood species such as buttonwood, mahogany, gum elemi, rat wood, black ebony, braziletto, horseflesh and red cedar.
Pine forest	Pine forests of *Pinus caribaea*.
Wetlands	Land that includes the mangrove forest ecosystems which occurs predominantly on the shores of the country covering the 80 percent of the total wetland. It also includes swamps, and low lands.
Forest land	Includes all land classified as Coppice forest, Pine forest and Wetlands.
Non-forest land	Includes all land not classified as forest land.

Information on threshold values (canopy cover, tree height, etc.) used for defining Forest and Other wooded land in FRA 2015 is not defined in national definitions. For that reason, based on local expert advice, it is assumed that national definitions of "pine forests", "coppice forest" and "mangrove forest" correspond with the FRA 2015 thresholds for classifying them as "Forest".

Original data

National class	1986 1000 ha	1992 1000 ha
Pine forest	200	185
Coppice forest[1]	600	600
Wetland	100	100
Total forest land	**900**	**885**
Non-forest land [2]	100	115
Total land area	**1000**	**1000**

[1)] Estimated from original data as: Total forest land area - area of pine forest – area of wetland
[2)] Estimated from original data as: Total land area – Total forest land area

Note that national data does not provide any assessment of the area of Coppice forest. Additionally, the inventory of the mangrove forests (Smythe, 1988) showed that of the wetlands, 80% of the area was covered by mangrove forests and the remaining 20% were swamps.

Analysis and processing of national data

Adjustment

Source	Total land area (1000 hectares)
National data	1000
FAOSTAT	1007
Calibration factor	1,007

Estimation and forecasting

National classes	Area 1000 hectares						
	1986[2]	1992[2]	1990[3]	2000[3]	2005[3]	2010[3]	2015[3]
Pine forest	201.4	186.3	191.3	166.2	153.6	141.0	130.8
Coppice forest[1]	604.2	604.2	604.2	604.2	604.2	604.2	604.2
Wetlands[1]	100.7	100.7	100.7	100.7	100.7	100.7	100.7
Total forest land area	**906.3**	**891.2**	**896.2**	**871.1**	**858.5**	**845.9**	**835.7**
Non-forest land area	100.7	115.8	110.8	135.9	148.5	161.1	171.3
Total land area	**1007**	**1007**	**1007**	**1007**	**1007**	**1007**	**1007**

[1] There has been no change in the categories of Coppice forest and Wetland forest as these are under protection since the year 1980. (Forestry Department 2008)
[2] Calibrated national data (a calibration factor of 1,007 was used).
[3] Data for the year 1990 was estimated using linear interpolation of the calibrated data from 1986 and 1992. Similarly, data for years 2000, 2005, 2010 and 2015 were forecasted using the same linear trend.

Reclassification into FRA 2015 categories

National classes	Forest	OWL	Other land	Total	OLWTC
Pine forest[1]	100%			100%	n.a.
Coppice forest[1]	100%			100%	n.a.
Wetlands[2]	80%		20%	100%	n.a.
Non-forest land area[1]		20%	80%	100%	n.a.

[1] Assessment based on expert knowledge.
[2] Inventory of mangrove forest (Smythe, 1988).

Data

Table 1a

FRA 2015 categories	Area (000 hectares)				
	1990	2000	2005	2010	2015
Forest	876.1	851.0	838.4	825.8	815.6
Other wooded land	22.1	27.1	29.7	32.2	34.3
Other land	108.8	128.9	138.9	149.0	157,2
...of which with tree cover	n.a.	n.a.	n.a.	n.a.	n.a.
Inland water bodies	5.0	5.0	5.0	5.0	5.0
TOTAL	**1012.0**	**1012.0**	**1012.0**	**1012.0**	**1012.0**

Comments to Table 1a

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Forest		
Other wooded land		
Other land		
Other land with tree cover		
Inland water bodies	Data on area of inland water bodies from FAOSTAT	

Other general comments to the table
The main weakness in the existing national data is the lack of information on the Coppice forest. Another weakness is that there is no national information available on Other land, and particularly the part of Other land that has a tree cover.

Appendix 2 – List of UN official country areas

Country	2009 Official area (1 000 ha)		
	Country area	Land area	Inland water
Afghanistan	65223	65223	0
Albania	2875	2740	135
Algeria	238174	238174	0
American Samoa	20	20	0
Andorra	47	47	0
Angola	124670	124670	0
Anguilla	9	9	0
Antigua and Barbuda	44	44	0
Argentina	278040	273669	4371
Armenia	2974	2848	126
Aruba	18	18	0
Australia	774122	768230	5892
Austria	8387.9	8243.5	144.4
Azerbaijan	8660	8262.2	397.8
Bahamas	1388	1001	387
Bahrain	76	76	0
Bangladesh	14400	13017	1383
Barbados	43	43	0
Belarus	20760	20282	478
Belgium	3053	3028	25
Belize	2297	2281	16
Benin	11262	11062	200
Bermuda	5	5	0
Bhutan	3839.4	3839.4	0
Bolivia (Plurinational State of)	109858	108330	1528
Bosnia and Herzegovina	5121	5100	21
Botswana	58173	56673	1500
Brazil	851488	845942	5546
British Virgin Islands	15	15	0
Brunei Darussalam	577	527	50
Bulgaria	11100	10856	244
Burkina Faso	27422	27360	62
Burundi	2783	2568	215
Cambodia	18104	17652	452
Cameroon	47544	47271	273
Canada	998467	909351	89116
Cape Verde	403	403	0
Cayman Islands	26.4	24	2.4
Central African Republic	62298	62298	0
Chad	128400	125920	2480
Chile	75609.6	74353.2	1256.4

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Country	2009 Official area (1 000 ha)		
	Country area	Land area	Inland water
China	960000.05	932748.95	27251.1
Colombia	114175	110950	3225
Comoros	186.1	186.1	0
Congo	34200	34150	50
Cook Islands	24	24	0
Costa Rica	5110	5106	4
Côte d'Ivoire	32246	31800	446
Croatia	5659	5596	63
Cuba	10989	10644	345
Cyprus	925	924	1
Czech Republic	7887	7725	162
Democratic People's Republic of Korea	12054	12041	13
Democratic Republic of the Congo	234486	226705	7781
Denmark	4309	4243	66
Djibouti	2320	2318	2
Dominica	75	75	0
Dominican Republic	4867	4832	35
Ecuador	25637	24836	801
Egypt	100145	99545	600
El Salvador	2104	2072	32
Equatorial Guinea	2805	2805	0
Eritrea	11760	10100	1660
Estonia	4523	4239	284
Ethiopia	110430	100000	10430
Falkland Islands (Malvinas)	1217	1217	0
Faroe Islands	139.6	139.6	0
Fiji	1827	1827	0
Finland	33842	30390	3452
France	54919	54766	153
French Guiana	8353	8220	133
French Polynesia	400	366	34
Gabon	26767	25767	1000
Gambia	1130	1000	130
Georgia	6970	6949	21
Germany	35712	34861	851
Ghana	23854	22754	1100
Gibraltar	1	1	0
Greece	13196	12890	306
Greenland	41045	41045	0
Grenada	34	34	0
Guadeloupe	170	169	1

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Country	2009 Official area (1 000 ha)		
	Country area	Land area	Inland water
Guam	54	54	0
Guatemala	10889	10716	173
Guernsey*	7.8	7.8	0
Guinea	24586	24572	14
Guinea-Bissau	3613	2812	801
Guyana	21497	19685	1812
Haiti	2775	2756	19
Holy See*	0.044	0.044	0
Honduras	11249	11189	60
Hungary	9303	9053	250
Iceland	10300	10025	275
India	328726	297319	31407
Indonesia	190457	181157	9300
Iran (Islamic Republic of)	174515	162855	11660
Iraq	43524	43432	92
Ireland	7028	6889	139
Isle of Man	57	57	0
Israel	2207	2164	43
Italy	30134	29414	720
Jamaica	1099	1083	16
Japan	37794.7	36450	1344.7
Jersey*	11.6	11.6	0
Jordan	8932	8878	54
Kazakhstan	272490	269970	2520
Kenya	58037	56914	1123
Kiribati	81	81	0
Kuwait	1782	1782	0
Kyrgyzstan	19994.9	19180	814.9
Lao People's Democratic Republic	23680	23080	600
Latvia	6456	6218	238
Lebanon	1045	1023	22
Lesotho	3036	3036	0
Liberia	11137	9632	1505
Libyan Arab Jamahiriya	175954	175954	0
Liechtenstein	16	16	0
Lithuania	6530	6267.5	262.5
Luxembourg	259	259	0
Madagascar	58704	58154	550
Malawi	11848	9428	2420
Malaysia	33080	32855	225
Maldives	30	30	0

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Country	2009 Official area (1 000 ha)		
	Country area	Land area	Inland water
Mali	124019	122019	2000
Malta	32	32	0
Marshall Islands	18	18	0
Martinique	113	106	7
Mauritania	103070	103070	0
Mauritius	204	203	1
Mayotte	37.5	37.5	0
Mexico	196438	194395	2043
Micronesia (Federated States of)	70	70	0
Monaco*	0.2	0.2	0
Mongolia	156412	155356	1056
Montenegro	1381	1345	36
Montserrat	10	10	0
Morocco	44655	44630	25
Mozambique	79938	78638	1300
Myanmar	67659	65352	2307
Namibia	82429	82329	100
Nauru	2	2	0
Nepal	14718	14335	383
Netherlands	4154	3373	781
Netherlands Antilles	80	80	0
New Caledonia	1858	1828	30
New Zealand	26771	26331	440
Nicaragua	13037	12034	1003
Niger	126700	126670	30
Nigeria	92377	91077	1300
Niue	26	26	0
Norfolk Island	4	4	0
Northern Mariana Islands	46	46	0
Norway	32378	30547	1831
Occupied Palestinian Territory	602	602	0
Oman	30950	30950	0
Pakistan	79610	77088	2522
Palau	46	46	0
Panama	7542	7434	108
Papua New Guinea	46284	45286	998
Paraguay	40675	39730	945
Peru	128522	128000	522
Philippines	30000	29817	183
Pitcairn	4.7	4.7	0
Poland	31268	30420	848

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Country	2009 Official area (1 000 ha)		
	Country area	Land area	Inland water
Portugal	9209	9147	62
Puerto Rico	887	887	0
Qatar	1159	1159	0
Republic of Korea	9990	9710	280
Republic of Moldova	3385	3289	96
Réunion	251	250	1
Romania	23839	23006	833
Russian Federation	1709824	1637687	72137
Rwanda	2634	2467	167
Saint Barthélemy*	2.1	2.1	0
Saint Helena	39	39	0
Saint Kitts and Nevis	26	26	0
Saint Lucia	62	61	1
Saint Martin (French part)*	5.44	5.44	0
Saint Pierre and Miquelon	24	23	1
Saint Vincent and the Grenadines	39	39	0
Samoa	284	283	1
San Marino	6	6	0
Sao Tome and Principe	96	96	0
Saudi Arabia	214969	214969	0
Senegal	19672	19253	419
Serbia	8836	8746	90
Seychelles	46	46	0
Sierra Leone	7174	7162	12
Singapore	71	70	1
Slovakia	4904	4809	95
Slovenia	2027	2014	13
Solomon Islands	2890	2799	91
Somalia	63766	62734	1032
South Africa	121909	121447	462
South Sudan*	64432.9	n.a.	n.a.
Spain	50537	49880	657
Sri Lanka	6561	6271	290
Sudan*	186148.4	n.a.	n.a.
Suriname	16382	15600	782
Svalbard and Jan Mayen Islands*	6204	6204	0
Swaziland	1736	1720	16
Sweden	45030	41034	3996
Switzerland	4128	4000	128
Syrian Arab Republic	18518	18363	155
Tajikistan	14255	13996	259

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Country	2009 Official area (1 000 ha)		
	Country area	Land area	Inland water
Thailand	51312	51089	223
The former Yugoslav Republic of Macedonia	2571	2522	49
Timor-Leste	1487	1487	0
Togo	5679	5439	240
Tokelau	1	1	0
Tonga	75	72	3
Trinidad and Tobago	513	513	0
Tunisia	16361	15536	825
Turkey	78356	76963	1393
Turkmenistan	48810	46993	1817
Turks and Caicos Islands	95	95	0
Tuvalu	3	3	0
Uganda	24155	19981	4174
Ukraine	60355	57932	2423
United Arab Emirates	8360	8360	0
United Kingdom	24361	24193	168
United Republic of Tanzania	94730	88580	6150
United States of America	983151	914742	68409
United States Virgin Islands	35	35	0
Uruguay	17622	17502	120
Uzbekistan	44740	42540	2200
Vanuatu	1219	1219	0
Venezuela (Bolivarian Republic of)	91205	88205	3000
Viet Nam	33105.1	31007	2098.1
Wallis and Futuna Islands	14	14	0
Western Sahara	26600	26600	0
Yemen	52797	52797	0
Zambia	75261	74339	922
Zimbabwe	39076	38685	391

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Appendix 3 – General weight and volume conversion factors

Units	Metric Equivalents
1 Inch	= 25.4 millimetres
1 Square foot	= 0.0929 square metre
1 Cubic foot	= 0.02832 square metre
1 Short ton	= 0.9072 metric ton
1 Long ton	= 1.016 metric ton

Table Approximate Equivalents for Forest Measures

Product and Unit	Cubic Meters (u.b.)	Cubic Feet (u.b.)
Sawlogs & veneer logs	*Solid volume without bark*	
1000 board/super feet	4.53	160
Pulpwood round and split		
1 stere	0.72	25.4
1 cord	2.55	90
Woodfuel		
1 stere	0.65	23
1 cord	2.12	74.9
1000 stacked cubic feet	18.41	650

Table Weight and Volume

	Kg/CUM			CUM/MT		
Product	**G**	**C**	**NC**	**G**	**C**	**NC**
Woodfuel, incl. wood for charcoal	725	625	750	1.38	1.60	1.33
Wood charcoal	167					
Sawlogs and Veneer logs						
Tropical			730			1.37
Other		700	800		1.43	1.25
Pulpwood, round and split	675	650	750	1.48	1.54	1.33
Other industrial roundwood	750	700	800	1.33	1.43	1.25
Sawnwood		550	700		1.82	1.43
Veneer sheets	750			1.33		
Plywood	650			1.54		
Particle board	650			1.54		
Hard board	950			1.053		
Medium density fibreboard (MDF)				2		
Insulating board	250			4		

Note: G = General; C = Coniferous; NC = Non-coniferous

Source: FAO forestry statistics Series 171 (pub. 2001).

Appendix 4 – Adjustment of growing stock diameter thresholds.

This Appendix contains some suggestions on ways to adjust some key growing stock variables in the present FRA definition to common thresholds. Achieving harmonised estimates of growing stock can be a quite complicated task. In addition to the different thresholds, countries use different models and techniques based on different geometrical shapes to calculate tree volume. Sampling procedures and intensities differ between countries. Diversity of definitions, plot configurations and estimation methods further complicate harmonised growing stock estimates.

The adjustment methods proposed are deliberately very simple and straightforward. Methods proposed should only be used when alternatives are lacking, i.e. a last resort. National estimates are always preferable to the crude procedures proposed here.

Adjustments to Common Thresholds

Below follows a set of very crude and simple ways to adjust the variables addressed to common thresholds. The recommendations should be seen as a last resort. Use of knowledge of local and/or national conditions will nearly always be preferable to the recommendations below.

Living Trees

If species have been excluded there are two options. The first is an expert estimate, and the second is to accept the estimate as is, providing comment/footnote.

Above Stump to Above Ground

Lacking better alternatives, estimates of growing stock above stump height should be multiplied by 1.01.

Under Bark to Over Bark

Should the issue arise, estimates of growing stock under bark should be multiplied by 1.15. This is not expected to become an issue.

Diameter at Breast Height

If alternatives are lacking, identify a relevant diameter distribution and adjust accordingly. If for example the threshold value available is 40 centimetres, a relevant diameter distribution with data down to at least 10 centimetres should be identified. The percentage of growing stock made up of trees 10 to 39 centimetres at breast height should be determined. Adjust the growing stock estimate accordingly (e.g. should the percentage be 30, then multiply the original estimate by 1.3).

A limited set of diameter distributions for use in the work towards a common threshold value for diameter at breast height are found at the end of this Appendix.

Top Diameter

There is no way to adjust top diameter. Top diameter is an effect of the functions used. Countries will be asked to adjust functions so that the top diameter is set at zero.

Branches and Crown

Should the need arise, the expansion factor of Penman *et al*. (2003) can be used to exclude crowns and branches.

Diameter Distributions

When data have thresholds for diameter at breast height other than that desired and do not permit re-calculation to the value specified, a comparison with a diameter distribution from a similar area may be a last resort.

Growing Stock Data

There are situation where estimates are missing or have arrived at strange results. Relevant existing growing stock data can be of some help. Use of such data can serve as estimates of what a proper estimate might arrive at, it can, of course, never replace a proper estimate done on location.

Typical levels are known for many forest types, and major long term deviations from these is a robust measure of forest degradation, as well as a tool in evaluation of management practices.

What Data are of Use

There is roughly three ways for already existing growing stock data and diameter distribution to be of use for a country reporting to FRA:

- They refer to an internationally defined forest type of relevance
- They refer to national classes of relevance
- They represent a country or area reasonably similar in terms of forest types

General Forest Types and National Classes

General forest types

A large number of forest type schemes and other vegetation classification schemes have been developed over the years (e.g. Schimper F.W.S. 1898, & Holdridge 1979). Most of these are sophisticated tools requiring considerable expertise from the user. They are tools meant for scientific use. What is needed for FRA is a robust set of, not too many, intuitively understandable forest types that need to be relevant in terms of growing stock and nothing else. A simplified version of the ecological zones adopted by FAO has been decided upon. The global ecological zone map (FAO Forestry Paper 169) is based on the Köppen-Trewartha system (Köppen 1931 & Trewartha 1968). The ecological zones are made up of five domains based on temperature: tropical, subtropical, temperate, boreal and polar, with a further division into a second level of 20 global ecological zones.

For the present purpose, the following classification has been made.

- **Tropical/subtropical** (moist deciduous, dry, shrubland, mountain system)
- **Temperate** (oceanic, continental, mountain)
- **Boreal** (coniferous, tundra, mountain)
- **Plantations:**
  Tropical/subtropical (production & other)
  Temperate (production & other)

National Classes

A review of the country reports of FRA 2010 suggests the following classification:

- Dry, open forests (crown closure of less than 40 per cent)
- Dry, closed forest (crown closure of more than 40 per cent)
- Evenaged, often exploited but not under systematic management
- Evenaged, under systematic management
- Unevenaged high forest
- Mangroves
- Montane formations
- Plantations, industrial wood production
- Plantations, other purposes
- No forest
- Unknown

Comments

Ecological zones has the advantage of available and recognised definitions, something only partly available for the latter option which rests on subjective assessments. The latter approach has the advantage of being based on what has actually been reported.

Sources

At present the following sources are those mainly used:

- Regional Reports from FRA 80 (FAO 1981a-d & Lanly 1982). FRA 80 mainly incorporates data from tropical countries. National data are more common than data on national classes.
- Reports from FRA 2000 (FAO 1999a-c), also mainly concerning tropical countries, data on national classes more common, but as a whole not as much data as FRA 80.
- National Forest Monitoring and Assessment (NFMA) data and the FAO-Finnish Programme. Few countries covered, but number is steadily increasing (FAO 2010b).
- Data from accessible national forest inventories
- Country reports in FRA 2005 and 2010, data on national classes available (FAO 2005 & 2010c)
- Scientific publications, difficult to find well referenced data
- Smithsonian Institute, highly detailed data from a few locations, diameter distributions included (Anonymous 2010)

Typical Levels of Growing Stock and Diameter Distributions

Growing stock data have been collected from Dawkins (1959), the regional reports of FRA 80 (FAO 81 a-d), Working Papers in connection to FRA 2000 (FAO 1999 a-c) and the country reports of FRA 2010 (FAO 2010). Diameter distributions have been quoted from Dawkins (1959), the Smithsonian Tropical Research Institute (http://www.ctfs.si.edu/plots/info) and the National Forest Monitoring and Assessment (http://www.fao.org/forestry/nfma/en/).

This is an initial account of growing stock estimates and diameter distributions. Readers are more than welcome to contribute.

What Growing Stock Level to Expect

Ecological Zones

The ecological zones are those used by FRA 2000 (FAO 2000). Estimates are based on the default aboveground biomass in IPCC (2006), see Table 3 for estimates and Table 4 for assumptions.

Figures for natural forest probably originate from, at worst, moderately disturbed forests and/or well managed forests. It must be assumed that plantation figures refer to successful and well managed plantations. On the whole it is the consultant's opinion that figure seem high. National figures are normally lower since they cover a wide spectrum of forest types and degradation.

Table 3. Typical growing stock levels based on aboveground biomass as stated in IPCC (2006)

	Growing stock (m^3/ha), natural forest	Growing stock (m^3/ha), plantations
Tropical rain forest	385 (313-556)	429 (333-500)
Tropical moist deciduous forest	231 (188-333)	343 (267-400)
Tropical dry forest	328 (241-542)	182 (133-300)
Tropical shrubland	177 (130-292)	91 (67-150)
Tropical mountain systems	179 (146-259)	257 (200-300)
Subtropical humid forest	282 (229-407)	400 (311-467)
Subtropical dry forest	328 (241-542)	227 (167-375)
Subtropical steppe	177 (130-292)	114 (83-188)
Subtropical mountain systems	179 (146-259)	321 (250-375)
Temperate oceanic forest	436 (273-818)	533 (333-1000)
Temperate continental forest	291 (182-545)	333 (208-625)
Temperate mountain systems	242 (152-455)	333 (208-625)
Boreal coniferous forest	182 (154-200)	182 (154-200)
Boreal tundra woodland	55 (46-60)	68 (58-75)
Boreal mountain systems	109 (92-120)	136 (115-150)

Table 4. Assumptions made in calculations of typical growing stock levels in Table 3.

	Natural forests			Plantation forests		
Forest type	Aboveground biomass	Wood density	Biomass expansion factor	Aboveground biomass	Wood density	Biomass expansion factor
Tropical rain forest	300	0.6	1,3 (0,90-1,60)	150	0.5	0.7 (0,6-0,9)
Tropical moist deciduous forest	180	0.6	1,3 (1,90-1,60)	120	0.5	0.7 (0,6-0,9)
Tropical dry forest	130	0.6	0,66 (0,40-0,90)	60	0.5	0.66 (0,4-0,9)
Tropical shrubland	70	0.6	0,66 (0,40-0,90)	30	0.5	0.66 (0,4-0,9)
Tropical mountain systems	140	0.6	1,3 (0,90-1,60)	90	0.5	0.7 (0,6-0,9)
Subtropical humid forest	220	0.6	1,3 (0,90-1,60)	140	0.5	0.7 (0,6-0,9)
Subtropical dry forest	130	0.6	0,66 (0,40-0,90)	60	0.4	0.66 (0,4-0,9)
Subtropical steppe	70	0.6	0,66 (0,40-0,90)	30	0.4	0.66 (0,4-0,9)
Subtropical mountain systems	140	0.6	1,3 (0,90-1,60)	90	0.4	0.7 (0,6-0,9)
Temperate oceanic forest	180	0.55	0,75 (0,40-1,20)	160	0.4	0.75 (0,4-1,2)
Temperate continental forest	120	0.55	0,75 (0,40-1,20)	100	0.4	0.75 (0,4-1,2)
Temperate mountain systems	100	0.55	0,75 (0,40-1,20)	100	0.4	0.75 (0,4-1,2)
Boreal coniferous forest	50	0.5	0,55 (0,50-0,65)	40	0.4	0.55 (0,5-0,65)
Boreal tundra woodland	15	0.5	0,55 (0,50-0,65)	15	0.4	0.55 (0,5-0,65)
Boreal mountain systems	30	0.5	0,55 (0,50-0,65)	30	0.4	0.55 (0,5-0,65)

Source: IPCC (2006)

FRA 80

FRA 80 contains very useful country descriptions with local forest types described, often including growing stock estimates. FRA 80 was restricted to tropical countries. Thresholds are not generally available in any detail. Volume is stated over bark and with minimum diameter at breast height of 10 centimetres. When reading documents from FRA 80 caution is needed as adjusted as well as unadjusted growing stock data are presented. Below follows an account of growing stock data. Categories referring to unproductive forest land have been omitted as they are not defined in the documents found on the web.

Tropical Africa

Country	Growing stock (m^3/ha)	Vegetation category
Angola	110	Logged over, broadleaved
Angola	30	Grassland-tree formations
Benin	100-150	Undisturbed, broadleaved
Benin	85-144	Logged over, broadleaved
Benin	20	Grassland-tree formations
Benin	342	Teak plantations
Botswana	20	Grassland-tree formations
Burkina Faso	40	Grassland-tree formations
Burundi	80	Logged over, broadleaved
Cameroon	280	Undisturbed, broadleaved
Cameroon	270	Logged over, broadleaved
Cameroon	30	Grassland-tree formation
DR Congo	250	Undisturbed, broadleaved
DR Congo	220	Logged over, broadleaved
DR Congo	25	Grassland-tree formation
Republic of Congo	250-350	Undisturbed, broadleaved
Republic of Congo	220-335	Logged over, broadleaved

Republic of Congo	140-175	Eucalyptus plantations
Equatorial Guinea	200-220	Undisturbed, broadleaved
Equatorial Guinea	150-170	Logged over, broadleaved
Ethiopia	160	Undisturbed, broadleaved
Ethiopia	100	Logged over, broadleaved
Ethiopia	50	Grassland-tree formation
Ethiopia	200	Coniferous, undisturbed
Ethiopia	70	Coniferous, logged over
Gabon	250	Undisturbed, broadleaved
Gabon	220	Logged over, broadleaved
Gambia	80	Mangrove, undisturbed
Gambia	65	Gallery forest
Ghana	174	Logged over, broadleaved
Ghana	150	Managed, broadleaved
Ghana	30	Grassland-tree formations
Guinea	180	Undisturbed, broadleaved
Guinea	165	Logged over, broadleaved
Guinea	20	Grassland-tree formation
Guinea	180	*Gmelina arborea* plantations
Ivory Coast	270	Undisturbed, broadleaved
Guinea-Bissau	60	Undisturbed, broadleaved
Guinea-Bissau	50	Logged over, broadleaved
Guinea-Bissau	30	Grassland-tree formation
Ivory Coast	230	Logged over, broadleaved
Ivory Coast	230	Managed, broadleaved
Ivory Coast	30	Grassland-tree formation
Ivory Coast	210-245	Plantations, several species
Kenya	180	Undisturbed, broadleaved
Kenya	120	Logged over, broadleaved
Kenya	120	Managed, broadleaved
Kenya	80	Unproductive, broadleaved
Kenya	85	Undisturbed, coniferous
Kenya	40	Logged over, coniferous
Kenya	40	Managed, coniferous
Liberia	170	Undisturbed broadleaved
Liberia	155	Logged over, broadleaved
Liberia	200-250	*Gmelina arborea*, final cut
Liberia	195	*Pinus caribaea*, final cut
Madagascar	70-180	Undisturbed, broadleaved
Madagascar	50-120	Logged over, broadleaved
Madagascar	20	Grassland tree formations
Malawi	120	Logged over, broadleaved, estimate
Malawi	120-130	Plantations, *Pinus patula & eliottii*
Mali	20	Grassland tree formations
Mozambique	70	Undisturbed, broadleaved
Mozambique	50	Logged over, broadleaved
Mozambique	35	Grassland tree formations
Namibia	20	Grassland tree formations
Niger	15	Grassland-tree formations
Nigeria	30	Mangrove
Nigeria	20	Woodlands

Nigeria	15-150	*Azadirachta indica* plantations, final cut
Republic of Central Africa	320	Undisturbed, broadleaved
Republic of Central Africa	290	Logged over, broadleaved
Republic of Central Africa	30	Grassland tree formations
Rwanda	120	Logged over, broadleaved
Rwanda	30	Grassland tree formations
Senegal	120	Undisturbed, broadleaved
Senegal	34	Grassland tree formations
Sierra Leone	160	Logged over, broadleaved
Sierra Leone	30	Grassland tree formations, estimate
Sierra Leone	180	*Terminalia*, spp, final cut
Sierra Leone	70	*Gmelina arborea*, final cut
Somalia	100	Logged over, broadleaved
Somalia	50	Grassland-tree formations
Somalia	50	Degraded montane formations and mangroves
Somalia	75	Logged over juniper forests
Sudan	120	Logged over, broadleaved
Sudan	55	Managed *Acacia nilotica* forests
Tanzania	120	Undisturbed, broadleaved
Tanzania	110	Logged over, broadleaved
Tanzania	20	Grassland-tree formations
Tanzania	500	Plantations, *Cupressus lusitanica*, final cut
Tanzania	500	Plantations, *PInus patula*, final cut
Tchad	120	Logged over, broadleaved
Tchad	30	Grassland-tree formations
Togo	200	Undisturbed, broadleaved
Togo	140	Logged over, broadleaved
Togo	20	Grassland-tree formations
Uganda	180	Undisturbed, broadleaved
Uganda	120	Logged over, broadleaved
Uganda	120	Managed broadleaved
Uganda	20	Grassland-tree formations
Uganda	138-353	Plantations, *Cupressus lusitanica*, final cut
Uganda	88-460	Plantations, *Pinus* spp.
Zambia	120	Undisturbed, broadleaved
Zambia	100	Logged over, broadleaved
Zambia	30	Grassland-tree formations
Zambia	83-121	Plantations, *Eucalyptus grandis*, final cut
Zambia	386-453	Plantations *Pinus* spp.

Tropical America

Country	Growing stock (m^3/ha)	Vegetation category
Belize	60	Logged over, broadleaved
Belize	12	Logged over, coniferous
Bolivia, lowland	140	Undisturbed, broadleaved
Bolivia, lowland	115	Logged over, broadleaved
Bolivia, Chiquitania	60	Undisturbed, broadleaved
Bolivia, Chiquitania	50	Logged over, broadleaved
Bolivia, montane	85	Undisturbed, broadleaved
Bolivia, montane	60	Logged over, broadleaved
Brazil, Amazonia	155	Undisturbed, broadleaved
Brazil, Amazonia	145	Logged over, broadleaved
Brazil, non-Amazonia	195	Undisturbed, broadleaved
Brazil, non-Amazonia	175	Logged over, broadleaved
Brazil, open forest	50	Productive woodlands
Brazil	350	Undisturbed, coniferous
Brazil	100	Logged over, coniferous
Brazil	49-115	Plantations, *Eucalyptus* spp, final cut
Brazil	144-263	Plantations, *Pinus* spp, final cut
Brazil	208	Plantations, *Gmelina arborea* , final cut
Colombia, mixed forest	120-170	Undisturbed, broadleaved
Colombia, mixed forest	60-120	Logged over, broadleaved
Colombia, pure stands	110-250	Undisturbed, broadleaved
Colombia, pure stands	70-90	Logged over, broadleaved
Colombia	318	Plantations, *Tectona grandis*, final cut
Colombia	200	Plantations, *Eucalyptus globulus*, final cut
Colombia	300	Plantations, *Cupressus lusitanica*, final cut
Costa Rica	175	Undisturbed, broadleaved
Costa Rica	125	Logged over, broadleaved
Costa Rica	360	Plantations, *Gmelina arborea*, final cut
Costa Rica	401	Plantations, *Alnus jorillensis*, final cut
Costa Rica	325	Plantations, *Cupressus lusitanica*, final cut
Cuba	75	Plantations, *Pinus* spp
Dominican Republic	60	Undisturbed, broadleaved
Dominican Republic	35	Logged over, broadleaved
Ecuador	100-160	Undisturbed, broadleaved
Ecuador	70-110	Logged over, broadleaved
Ecuador	65	Undisturbed, coniferous
Ecuador	508-620	Plantations, *Cordia alliodora*, final cut
Ecuador	452	Plantations, *Eucalytpus globulus*, final cut
Ecuador	180-240	Plantations, *Pinus radiata*, final cut
El Salvador	50	Logged over, broadleaves
El Salvador	80	Logged over, coniferous
El Salvador	180	Plantations, *Tectona grandis*, final cut
El Salvador	585	Plantations, *Cupressus lusitanica*, final cut
French Guyana	290	Undisturbed, broadleaved
French Guyana	270	Logged over, broadleaved
Guatemala	140	Undisturbed, broadleaved
Guatemala	120	Logged over, broadleaved

Guatemala	40	Logged over, coniferous
Guyana	210	Undisturbed, broadleaved
Guyana	170	Logged over, broadleaved
Haiti	60	Logged over, broadleaved
Haiti	35	Logged over, coniferous
Honduras	140	Undisturbed, broadleaved
Honduras	120	Logged over, broadleaved
Honduras	70	Undisturbed, coniferous
Honduras	30	Logged over, coniferous
Jamaica	126	Undisturbed, broadleaved
Jamaica	60	Logged over, broadleaved
Jamaica	130	Plantations, *Hibiscus elata*
Jamaica	285	Plantations, *Pinus caribaea*
Mexico	85	Undisturbed, broadleaved
Mexico	65	Logged over, broadleaved
Mexico	250	Undisturbed, coniferous
Mexico	75	Logged over, coniferous
Nicaragua	135	Undisturbed, broadleaved
Nicaragua	115	Logged over, broadleaved
Nicaragua	50	Logged over, coniferous
Panama	180	Undisturbed, broadleaved
Panama	130	Logged over, broadleaved
Paraguay	80	Undisturbed, broadleaved
Paraguay	60	Logged over, broadleaved
Paraguay	300	Plantations, *Eucalyptus* spp, final cut
Paraguay	320	Plantations, *Pinus elliottii*, final cut
Paraguay	250	Plantations, *Araucaria angustifolia*, final cut
Peru	140-215	Undisturbed, broadleaved
Peru	130-185	Logged over, broadleaved
Peru	65	Undisturbed, coniferous
Surinam	210	Undisturbed, broadleaved
Surinam	180	Logged over, broadleaved
Trinidad & Tobago	140	Logged over, broadleaved
Venezuela	154	Undisturbed, broadleaved
Venezuela	134	Logged over, broadleaved

Tropical Asia

Country	Growing stock (m^3/ha)	Vegetation category
Bangladesh	120	Undisturbed, broadleaved
Bangladesh	60	Logged over, broadleaved
Bangladesh	100	Managed, broadleaved
Bangladesh	55	Managed, mangrove
Bangladesh	141-265	Plantations, Tectona grandis, total volume after 60 years
Bhutan, broadleaved upland	280	Undisturbed, broadleaved
Bhutan, broadleaved upland	110	Logged over, broadleaved
Bhutan, broadleaved lowland	245	Undisturbed, broadleaved
Bhutan, broadleaved lowland	100	Logged over, broadleaved
Bhutan, coniferous	275	Undisturbed, coniferous
Bhutan, coniferous	110	Logged over, coniferous
Brunei, mixed dipterocarp	310	Undisturbed, broadleaved
Brunei, mixed dipterocarp	155	Logged over, broadleaved
Brunei, peat swamp	250	Undisturbed, broadleaved
Brunei, peat swamp	125	Logged over, broadleaved
Burma, mangrove	40	Undisturbed, mangrove
Burma, mangrove	40	Logged over, mangrove
Burma	180	Undisturbed, broadleaved
Burma	150	Logged over, broadleaved
Burma	155	Undisturbed, coniferous
Burma	100	Logged over, coniferous
Cambodia	230	Undisturbed, broadleaved
Cambodia	200	Logged over, broadleaved
Cambodia	150	Undisturbed, coniferous
Cambodia	180	Logged over, coniferous
Cambodia	60	Grassland-tree formations
India, subtropical/temperate	127	Undisturbed, broadleaved
India, subtropical/temperate	51	Logged over, broadleaved
India, subtropical/temperate	127	Managed, broadleaved
India, deciduous	52	Undisturbed, broadleaved
India, deciduous	21	Logged over, broadleaved
India, deciduous	52	Managed, broadleaved
India, evergreen	206	Undisturbed, broadleaved
India, evergreen	82	Logged over, broadleaved
India, evergreen	206	Managed, broadleaved
India, sal	29	Logged over, broadleaved
India, sal	72	Managed, broadleaved
India, teak	67	Undisturbed, broadleaved
India, teak	27	Logged over, broadleaved
India, teak	67	Managed, broadleaved
India	153	Undisturbed, coniferous
India	61	Logged over, coniferous
India	153	Managed, coniferous
Indonesia, Sumatra	323	Undisturbed, broadleaved

Indonesia, Sumatra	102	Logged over, broadleaved
Indonesia, Kalimantan	323	Undisturbed, broadleaved
Indonesia,Kalimantan	102	Logged over, broadleaved
Indonesia, Java and Bali	92	Logged over, broadleaved
Indonesia, Sulawesi	275	Undisturbed, broadleaved
Indonesia, Sulawesi	92	Logged over, broadleaved
Indonesia, Maluku	275	Undisturbed, broadleaved
Indonesia, Maluku	92	Logged over, broadleaved
Indonesia, Nusa Tenggara	275	Undisturbed, broadleaved
Indonesia, Nusa Tenggara	92	Logged over, broadleaved
Indonesia, Irian Jaya	242	Undisturbed, broadleaved
Indonesia, Irian Jaya	122	Logged over, broadleaved
Laos	220	Undisturbed, broadleaved
Laos	100	Logged over, coniferous
Laos	60	Grassland-tree formations
Peninsular Malaysia	323	Undisturbed, broadleaved
Peninsular Malaysia	204	Logged over, broadleaved
Peninsular Malaysia	260	Managed, broadleaved
Malaysia, Sabah	313	Logged over, broadleaved
Malaysia, Sabah	156	Managed, broadleaved
Malaysia, Sarawak	266	Undisturbed, broadleaved
Malaysia, Sarawak	233	Managed, broadleaved
Nepal, sal	80	Undisturbed, broadleaved
Nepal, sal	40	Logged over, broadleaved
Nepal, terai	60	Undisturbed, broadleaved
Nepal, terai	30	Logged over, broadleaved
Nepal, khair-sissoo	55	Logged over, broadleaved
Nepal	100	Undisturbed, broadleaved
Nepal	50	Logged over, broadleaved
Nepal	120	Undisturbed, coniferous
Nepal	60	Logged over, coniferous
Pakistan	160	Undisturbed, broadleaved
Pakistan	65	Logged over, broadleaved
Pakistan, mangroves	30	Logged over, broadleaved
Pakistan	245	Undisturbed, coniferous
Pakistan	70	Logged over, coniferous
Pakistan	160	Managed, coniferous
Pakistan	35	Grassland-tree formations
The Philippines	305	Undisturbed, broadleaved
The Philippines	165	Logged over, broadleaved
The Philippines	95	Logged over, coniferous
Sri Lanka	200	Undisturbed, broadleaved
Sri Lanka	60	Logged over, broadleaved
Thailand	28	Grassland-tree formations

Growing Stock data from FRA 2000

Presented here is some of the growing stock estimates compiled in connection to work with FRA 2000. Georeferenced growing stock estimates were collected and presented in three working papers concerning Latin America (Working Paper 4), Tropical Asia and Oceania (Working Paper 5) and tropical Africa (Working Paper 9).

Working Paper 4 and 9 are not available in their entirety from the FRA website. Therefore, the only data presented here are from tropical Asia and Oceania.

Country	Location	Source	Year of Inventory	Method	Forest type	Growing Stock	Sampling error	min. DBH
Bangladesh	Chittagong Hills Tract	De Milde R. & Chowdhury J.A., 1985. The Kassalong and Rankhiang reserved forest in the Chittagong hill tracts. FAO/UNDP Project BGD/79/017	1963	na	Tropical moist forest	77.7	na	25
Bangladesh	Chittagong Hills Tract	De Milde R. & Chowdhury J.A., 1985. The Kassalong and Rankhiang reserved forest in the Chittagong hill tracts. FAO/UNDP Project BGD/79/018	1964	na	Tropical moist forest	82	na	25
Bangladesh	Sylhet Forest Division	Drigo R., Shaheduzzaman Md. & Chowdhurry J.A., 1988. Inventory of forest resources of southern Sylhet Division. Assistance to teh forestry section - Phase II FAO/UNDP Project BGD/86/085, Field Document no. 3. FAO, Rome	1987	Cluster sampling, circular plots	Tropical moist forest	75.8	25	30
Bangladesh	Sundarbans	R.G. Ray, 1971. Six forest inventories in the tropics, volume 3 & 4	1959	Random double sampling	Mangroves	53.6	na	12
Bangladesh	Kassalong	R.G. Ray, 1971. Six forest inventories in the tropics, volume 3 & 5	1963	na	Tropical moist forest	77.4	1.7	25
Bangladesh	Rankhiang	R.G. Ray, 1971. Six forest inventories in the tropics, volume 3 & 6	1963	na	Tropical moist forest	75.1	1.7	25
Bangladesh	Cox Bazaar	De Milde R., Shaheduzzaman Md. & Drigo R., 1985. the high forest in the Chittagong District. Assistance to the forestry sector. FAO/UNDP project BGD/79/017, Field Document no. 11, Volume 1.	1985	Stratified, Two stage sampling	Tropical moist forest	78.1	10	12
Bangladesh	Chittagong District	De Milde R., Shaheduzzaman Md. & Drigo R., 1985. the high forest in the Chittagong District. Assistance to the forestry sector. FAO/UNDP project BGD/79/017, Field Document no. 11, Volume 1.	1985	Stratified, Two stage sampling	Tropical moist forest	58.1	11.5	30
Bangladesh	Chittagong Forest Division	De Milde R., Shaheduzzaman Md. & Drigo R., 1985. the high forest in the Chittagong District. Assistance to the forestry sector. FAO/UNDP project BGD/79/017, Field Document no. 11, Volume 1.	1985	Stratified, Two stage sampling	Tropical moist forest	43.2	13.6	30

Bhutan	North Western Bhutan	Gov. India, Ministry of Agriculture and Irrigation. Preinvestment survey of forest resources in northwestern Bhutan. Volume 1 Dehradun	1975	Stratified, systematic sampling blocks	National average	215.9	3.7	5
Bhutan	North Western Bhutan	Gov. India, Ministry of Agriculture and Irrigation. Preinvestment survey of forest resources in northwestern Bhutan. Volume 1 Dehradun	1975	See above	Upland and lowland hardwoods	272.4	4.6	5
Bhutan	North Western Bhutan	Gov. India, Ministry of Agriculture and Irrigation. Preinvestment survey of forest resources in northwestern Bhutan. Volume 1 Dehradun	1975	See above	Conifers/hardwood	241.1	22.2	5
Bhutan	North Western Bhutan	Gov. India, Ministry of Agriculture and Irrigation. Preinvestment survey of forest resources in northwestern Bhutan. Volume 1 Dehradun	1975	See above	Mixed conifers	272.3	11	5
Bhutan	North Western Bhutan	Gov. India, Ministry of Agriculture and Irrigation. Preinvestment survey of forest resources in northwestern Bhutan. Volume 1 Dehradun	1975	See above	Fir and spruce	357.3	5	5
Bhutan	North Western Bhutan	Gov. India, Ministry of Agriculture and Irrigation. Preinvestment survey of forest resources in northwestern Bhutan. Volume 1 Dehradun	1975	See above	Chir	81.8	16.2	5
Bhutan	North Western Bhutan	Gov. India, Ministry of Agriculture and Irrigation. Preinvestment survey of forest resources in northwestern Bhutan. Volume 1 Dehradun	1975	See above	Kail	70.6	19.3	5
Cambodia	Lowlands, west of Cardamomes Mountains	FAO 1971, Forest Survey of the Lowlands West of the Cardamomes Mountains	1967	Systematic sampling (blocks)	Tropical moist forest	52.5	na	10
India	Chitradurcga District	Government of India 1993. The State of Forest Report. Forest Survey of India	1986	na	District data	7.3	na	10
India	Eastern Rajasthan	Government of India 1993. The State of Forest Report. Forest Survey of India	1986	na	District data	10.1	na	10
India	Bankura District	Government of India 1993. The State of Forest Report. Forest Survey of India	1986	na	District data	12.8	na	10
India	Midnapore District	Government of India 1993. The State of Forest Report. Forest Survey of India	1986	na	District data	13.1	na	10
India	Shivalik Region of Hary	Government of India 1993. The State of Forest Report. Forest Survey of India	1985	na	District data	13.9	na	10
India	Southern Region: Ettawah	Government of India 1993. The State of Forest Report. Forest Survey of India	1985	na	District data	14.4	na	10
India	Santhal Pargana & parts	Government of India 1993. The State of Forest Report. Forest Survey of India	1982	na	District data	16.7	na	10
India	Purulia District	Government of India 1993. The State of Forest Report. Forest Survey of India	1982	na	District data	18.5	na	10

India	Mehboobnagar Forest Division	Government of India 1993. The State of Forest Report. Forest Survey of India	1968	na	District data	22.7	na	10
India	Whole of Tripura	Government of India 1993. The State of Forest Report. Forest Survey of India	1975	na	District data	23.1	na	10
India	Lunglei District	Government of India 1993. The State of Forest Report. Forest Survey of India	1989	na	District data	25	na	10
India	Aizwal District	Government of India 1993. The State of Forest Report. Forest Survey of India	1988	na	District data	26	na	10
India	Indore Catchment	Government of India 1993. The State of Forest Report. Forest Survey of India	1982	na	District data	32.4	na	10
India	Southwest Bihar	Government of India 1993. The State of Forest Report. Forest Survey of India	1974	na	District data	35.3	na	10
India	Singbhum District	Government of India 1993. The State of Forest Report. Forest Survey of India	1983	na	District data	39.5	na	10
India	Sandad Catchment	Government of India 1993. The State of Forest Report. Forest Survey of India	1973	na	District data	43.2	na	10
India	Cachar District	Government of India 1993. The State of Forest Report. Forest Survey of India	1983	na	District data	44.6	na	10
India	Kalahandi District	Government of India 1993. The State of Forest Report. Forest Survey of India	1985	na	District data	48.2	na	10
India	Ranchi District	Government of India 1993. The State of Forest Report. Forest Survey of India	1981	na	District data	52.3	na	10
India	Chhimtuipui District	Government of India 1993. The State of Forest Report. Forest Survey of India	1989	na	District data	52.4	na	10
India	Adilabad District	Government of India 1993. The State of Forest Report. Forest Survey of India	1974	na	District data	52.8	na	10
India	Whole Dadra & Nagar Haveli	Government of India 1993. The State of Forest Report. Forest Survey of India	1986	na	District data	53	na	10
India	Nasik, Thane & Raigarth	Government of India 1993. The State of Forest Report. Forest Survey of India	1985	na	District data	53.2	na	10
India	Whole Nagaland	Government of India 1993. The State of Forest Report. Forest Survey of India	1987	na	District data	53.8	na	10
India	Phulbani Catchment & Gajam District	Government of India 1993. The State of Forest Report. Forest Survey of India	1978	na	District data	58	na	10
India	Surat Circle-Dangs, Surat	Government of India 1993. The State of Forest Report. Forest Survey of India	1978	na	District data	59.3	na	10
India	Rajgarh District	Government of India 1993. The State of Forest Report. Forest Survey of India	1985	na	District data	60.1	na	10
India	Koraput District	Government of India 1993. The State of Forest Report. Forest Survey of India	1984	na	District data	61	na	10
India	Whole Manipur	Government of India 1993. The State of Forest Report. Forest Survey of India	1975	na	District data	61.7	na	10

India	Rajnandgaon & Durg District	Government of India 1993. The State of Forest Report. Forest Survey of India	1981	na	District data	65.7	na	10
India	West Champaran District	Government of India 1993. The State of Forest Report. Forest Survey of India	1983	na	District data	67.5	na	10
India	Raipur District	Government of India 1993. The State of Forest Report. Forest Survey of India	1985	na	District data	67.5	na	10
India	Ballarshah Catchment	Government of India 1993. The State of Forest Report. Forest Survey of India	1970	na	District data	67.5	na	10
India	East and South Districts	Government of India 1993. The State of Forest Report. Forest Survey of India	1987	na	District data	74	na	10
India	Naranjpu Catchment Bastar II	Government of India 1993. The State of Forest Report. Forest Survey of India	1974	na	District data	74.2	na	10
India	Shimoga District	Government of India 1993. The State of Forest Report. Forest Survey of India	1984	na	District data	75	na	10
India	Rajgar & Nahan-Simour	Government of India 1993. The State of Forest Report. Forest Survey of India	1976	na	District data	75.9	na	10
India	Chickmagalur & Hassan	Government of India 1993. The State of Forest Report. Forest Survey of India	1985	na	District data	79.4	na	10
India	East Godavari & West God	Government of India 1993. The State of Forest Report. Forest Survey of India	1969	na	District data	80.2	na	10
India	Whole Meghalaya	Government of India 1993. The State of Forest Report. Forest Survey of India	1976	na	District data	80.2	na	10
India	Balaghat & Mandia	Government of India 1993. The State of Forest Report. Forest Survey of India	1980	na	District data	80.5	na	10
India	Wadsa Catchment	Government of India 1993. The State of Forest Report. Forest Survey of India	1970	na	District data	81.3	na	10
India	South and Middle Andaman	Government of India 1993. The State of Forest Report. Forest Survey of India	1981	na	District data	99.4	na	10
India	Hill region Almorah	Government of India 1993. The State of Forest Report. Forest Survey of India	1983	na	District data	106.4	na	10
India	Goa Catchment (except Daman and Diu)	Government of India 1993. The State of Forest Report. Forest Survey of India	1981	na	District data	116.4	na	10
India	Terai Region	Government of India 1993. The State of Forest Report. Forest Survey of India	1983	na	District data	118.4	na	10
India	West and North District	Government of India 1993. The State of Forest Report. Forest Survey of India	1987	na	District data	123.8	na	10
India	Lohit & Tirap Districts	Government of India 1993. The State of Forest Report. Forest Survey of India	1977	na	District data	126.8	na	10
India	East and West Kameng Districts	Government of India 1993. The State of Forest Report. Forest Survey of India	1985	na	District data	134.5	na	10
India	Lower Subansiri	Government of India 1993. The State of Forest Report. Forest Survey of India	1986	na	District data	145.8	na	10
India	Nowgong & Karbi Anglog	Government of India 1993. The State of Forest Report. Forest	1978	na	District data	148.1	na	10

		Survey of India						
India	Bhagirathi & Bhilganga	Government of India 1993. The State of Forest Report. Forest Survey of India	1972	na	District data	183.5	na	10
India	Alkananda Catchment	Government of India 1993. The State of Forest Report. Forest Survey of India	1979	na	District data	185.8	na	10
India	North Andaman	Government of India 1993. The State of Forest Report. Forest Survey of India	1979	na	District data	212.9	na	10
India	Upper Subansiri District	Government of India 1993. The State of Forest Report. Forest Survey of India	1990	na	District data	221	na	10
India	Little Andaman	Government of India 1993. The State of Forest Report. Forest Survey of India	1977	na	District data	268.3	na	10
Malaysia	West Malaysia	FAO, 1973. Fiorestry and Forest Industries Development. A National Forest Inventory of West Malaysia 1970-1972. FO:DP/MAL/2009. Technical Report 5. Rome	1972	Random point in a 5 minute grid	Tropical moist forest	197.2	na	15
Malaysia	West Malaysia	FAO, 1973. Fiorestry and Forest Industries Development. A National Forest Inventory of West Malaysia 1970-1972. FO:DP/MAL/2009. Technical Report 5. Rome	1972	See above	Tropical moist forest	180.2	na	15
Malaysia	West Malaysia	FAO, 1973. Fiorestry and Forest Industries Development. A National Forest Inventory of West Malaysia 1970-1972. FO:DP/MAL/2009. Technical Report 5. Rome	1972	See above	Tropical moist forest	293.9	na	15
Malaysia	West Malaysia	FAO, 1973. Fiorestry and Forest Industries Development. A National Forest Inventory of West Malaysia 1970-1972. FO:DP/MAL/2009. Technical Report 5. Rome	1972	See above	Tropical moist forest	199.9	na	15
Malaysia	Sarawak	FAO 1974. Forestry and Forest Industries Development. The Mixed Dipterocarp Forests of Sarawak and their Potential for Development. Malaysia. FO:DP/MAL/72/009 Technical Report 7	1969	Random one stage design with a nine element point sample cluster	Tropical moist forest	208.3	na	30
Malaysia	Sarawak	FAO 1974. Forestry and Forest Industries Development. The Mixed Dipterocarp Forests of Sarawak and their Potential for Development. Malaysia. FO:DP/MAL/72/009 Technical Report 8	1969	See above	Tropical moist forest	220.2	na	30
Malaysia	Sarawak	FAO 1974. Forestry and Forest Industries Development. The Mixed Dipterocarp Forests of Sarawak and their Potential for Development. Malaysia. FO:DP/MAL/72/009 Technical Report 9	1969	See above	Tropical moist forest	176.9	na	30

Malaysia	Sarawak	FAO 1974. Forestry and Forest Industries Development. The Mixed Dipterocarp Forests of Sarawak and their Potential for Development. Malaysia. FO:DP/MAL/72/009 Technical Report 10	1969	See above	Tropical moist forest	208.9	na	30
Malaysia	Sarawak	FAO 1974. Forestry and Forest Industries Development. The Mixed Dipterocarp Forests of Sarawak and their Potential for Development. Malaysia. FO:DP/MAL/72/009 Technical Report 11	1969	See above	Tropical moist forest	185.2	na	30
Malaysia	Sarawak	FAO 1974. Forestry and Forest Industries Development. The Mixed Dipterocarp Forests of Sarawak and their Potential for Development. Malaysia. FO:DP/MAL/72/009 Technical Report 12	1969	See above	Tropical moist forest	171	na	30
Malaysia	Sarawak	FAO 1974. Forestry and Forest Industries Development. The Mixed Dipterocarp Forests of Sarawak and their Potential for Development. Malaysia. FO:DP/MAL/72/009 Technical Report 13	1969	See above	Tropical moist forest	188.2	na	30
Malaysia	Sarawak	FAO 1974. Forestry and Forest Industries Development. The Mixed Dipterocarp Forests of Sarawak and their Potential for Development. Malaysia. FO:DP/MAL/72/009 Technical Report 14	1969	See above	Tropical moist forest	198.5	na	30
Nepal	Kapilbastu District	Anon 1948 (??). Forest resources of Kapilbastu District. Forest Survey and Statistics Division, Ministry of Forest and Environment. Pulication 54.	1948 (??)	Random sampling	District data	118.1	4.5	12
Nepal	Rautahat District	Soredrager J.K., 1989. Forest Inventory of Rautahat District. Terai Community Forestry Development Project. UTF/NEP038/NEP.	1989	Random stratified Cluster	District data	209	na	12
the Philippines	Region IV	Anon 1988. Natural Forest resources of the Philippines. Philippine-German Forest Resources Inventory Project.	1988	Twostage design. RS for area frame, clusters of angle count samples together with concentri c circles	Tropical moist forest	163.7	na	15
the Philippines	Region XII	Anon 1988. Natural Forest resources of the Philippines. Philippine-German Forest Resources Inventory Project.	1988	See above	Tropical moist forest	200.6	na	15
the Philippines	Region IX	Anon 1988. Natural Forest resources of the Philippines. Philippine-German Forest Resources Inventory Project.	1988	See above	Tropical moist forest	200.1	na	15

the Philippines	Region VIII	Anon 1988. Natural Forest resources of the Philippines. Philippine-German Forest Resources Inventory Project.	1988	See above	Tropical moist forest	159.9	na	15
the Philippines	Region VII	Anon 1988. Natural Forest resources of the Philippines. Philippine-German Forest Resources Inventory Project.	1988	See above	Tropical moist forest	121.5	na	15
the Philippines	Region V	Anon 1988. Natural Forest resources of the Philippines. Philippine-German Forest Resources Inventory Project.	1988	See above	Tropical moist forest	154.5	na	15
the Philippines	Region III	Anon 1988. Natural Forest resources of the Philippines. Philippine-German Forest Resources Inventory Project.	1988	See above	Tropical moist forest	190.7	na	15
the Philippines	Region I	Anon 1988. Natural Forest resources of the Philippines. Philippine-German Forest Resources Inventory Project.	1988	See above	Tropical moist forest	127	na	15
the Philippines	Region VI	Anon 1988. Natural Forest resources of the Philippines. Philippine-German Forest Resources Inventory Project.	1988	See above	Tropical moist forest	128.5	na	15
Sri Lanka	Dry zone	Andrews J.R.T. 1961. Forest Inventory of Ceylon. Prepaed by Hunting Survey Corporation Limited, Toronto, Canada in Cooperation with the Forest Department, Ceylon	1960	na	Tropical dry forest	38.8	na	10
Sri Lanka	Intermediate Zone	Andrews J.R.T. 1961. Forest Inventory of Ceylon. Prepaed by Hunting Survey Corporation Limited, Toronto, Canada in Cooperation with the Forest Department, Ceylon	1960	na	Moist/dry	46.8	na	10
Sri Lanka	Wet Zone	Andrews J.R.T. 1961. Forest Inventory of Ceylon. Prepaed by Hunting Survey Corporation Limited, Toronto, Canada in Cooperation with the Forest Department, Ceylon	1960	na	Tropical moist forest	106.7	na	10
Sri Lanka	Wet Zone, mainly undisturbed forest	Government of Sri Lanka, UNDP & FAO 1985. A National Forest Inventory of Sri Lanka. Forest Inventory for Managementy Planning, Provisional Draft Report. GOSL/UNDP/FAO Project SRL/79/014, Colombo, Sri Lanka.	1982	na	Tropical moist forest	133.3	na	30
Thailand	Surin	FAO, 1963. Forest Invetory of the Northeastern Region. Report to the Government of Thailand No. 1692	1961	Tract Line System	deciduous/ dry	32.9	na	28
Thailand	Nakhophanom	FAO, 1963. Forest Invetory of the Northeastern Region. Report to the Government of Thailand	1961	See above	deciduous/ dry	27.7	na	28
Thailand	Sakonnakhom	FAO, 1963. Forest Invetory of the Northeastern Region. Report to the Government of Thailand	1961	See above	deciduous/ dry	42.8	na	28
Thailand	Loei	FAO, 1963. Forest Invetory of the Northeastern Region. Report to the Government of	1961	See above	deciduous/ dry	33.5	na	28

		Thailand						
Thailand	Udomthani	FAO, 1963. Forest Invetory of the Northeastern Region. Report to the Government of Thailand	1961	See above	deciduous/ dry	86.5	na	28
Thailand	Nongkhai	FAO, 1963. Forest Invetory of the Northeastern Region. Report to the Government of Thailand	1961	See above	deciduous/ dry	59.2	na	28
Thailand	Kalasin	FAO, 1963. Forest Invetory of the Northeastern Region. Report to the Government of Thailand	1961	See above	deciduous/ dry	53.1	na	28
Thailand	Mahasarakham	FAO, 1963. Forest Invetory of the Northeastern Region. Report to the Government of Thailand	1961	See above	deciduous/ dry	12	na	28
Thailand	Roi-et	FAO, 1963. Forest Invetory of the Northeastern Region. Report to the Government of Thailand	1961	See above	deciduous/ dry	47.8	na	28
Thailand	Srisaket	FAO, 1963. Forest Invetory of the Northeastern Region. Report to the Government of Thailand	1961	See above	deciduous/ dry	27.3	na	28
Thailand	Nakhomratchsiom a	FAO, 1963. Forest Invetory of the Northeastern Region. Report to the Government of Thailand	1961	See above	deciduous/ dry	58.9	na	28
Thailand	Chayaphum	FAO, 1963. Forest Invetory of the Northeastern Region. Report to the Government of Thailand	1961	See above	deciduous/ dry	39	na	28
Thailand	Buri-ram	FAO, 1963. Forest Invetory of the Northeastern Region. Report to the Government of Thailand	1961	See above	deciduous/ dry	34.8	na	28
Thailand	Khonkaen	FAO, 1963. Forest Invetory of the Northeastern Region. Report to the Government of Thailand	1961	See above	deciduous/ dry	32.7	na	28
Thailand	Ubonratch-thani	FAO, 1963. Forest Invetory of the Northeastern Region. Report to the Government of Thailand	1961	See above	deciduous/ dry	31.2	na	28
Thailand	Lampang, Chingrai, Prae, Lampoon Chiengmai	Loetsch F., 1958. Forest Inventory of the Northern Teak Bearing Provinces. Report to the Government of Thailand. FAO Report No. 895, Rome.	1957	na	Regional inventory	297.2	na	30

Diameter Distributions

The distributions presented below are meant to be of use in adjusting growing stack estimates to a common threshold in terms of diameter at breast height. A simple method is outlined in the report. Focus has been on collecting distributions from closed tropical forests. The value of diameter distributions in adjusting estimates in open forest needs investigation.

The distributions presented should be used as a last resort. Work to collect diameter distributions has only begun. More distributions will be incorporated into the data bank.

Geographically more specific diameter distributions are provided The Smithsonian Tropical Research Institute. Information is freely available on the web (http://www.ctfs.si.edu/plots/info/). Detailed plot descriptions are provided. Diameter classes are $\geq$ 1, 10, 30 and 60 cm respectively. Information from the following locations are available:

Country	Location	Comments
Ituri	DR. Congo	Slight human impact. Tropical moist forest
Korup	Cameroon	Slight human impact. Tropical moist forest.
Bukit Timah	Singapore	Major human interventions. Tropical moist forest.
Doi Inthanon	Thailand	Lower elevations affected by human activities. Montane forest.
Huai Kha Khaeng	Thailand	Dry evergreen and deciduous forest. Human presence with a long history, no signs of logging in plots.
Lambir	Malaysia, Sarawak	Limited disturbances. Tropical moist forest, includes kerangas forest.
Mudumalai	India	Dry deciduous forest. Long history of a variety of human disturbances including selective logging.
Nanjenshan	Taiwan	Montane mixed temperate and tropical forest. Limited recent disturbances.
Palanan	The Philippines	Tropical moist forest. Some manual illegal logging
Pasoh	Peninsular Malaysia	Tropical moist forest. Limited disturbance.
Sinharaja	Sri Lanka	Tropical moist forest. Lightly logged in early 1970:s
Barro Colorado	Panama	Semi-deciduous moist forest. No logging since 1923.
La Planada	Colombia	Tropical moist mountain forest. Some areas of secondary forest.
Luquillo	Puerto Rico	Tropical moist forest that stretches along a mountain slope. Many forms of human disturbance in the past.

Yasuni	Ecuador	Tropical moist forest. Disturbances in connection to a road and oil exploration.

Appendix 5 – Default values and conversion factors for estimating biomass and carbon.

The tables in this Appendix (except Table 5.8) are extracted from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, chapters 2 and 4. For further details on the tables, see the source document which is available for download at: http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.htm

Table 5.8 is extracted from the IPCC Good Practice Guidance for Land Use, Land Use Change and Forestry, 2003.

This Appendix contains the following tables:

TABLE 5.1 [1]
CLIMATE DOMAINS (FAO, 2001), CLIMATE REGIONS (CHAPTER 3), AND ECOLOGICAL ZONES (FAO, 2001)

Climate domain		Climate region	Ecological zone		
Domain	**Domain criteria**		**Zone**	**Code**	**Zone criteria**
Tropical	all months without frost; in marine areas, temperature >18°C	Tropical wet	Tropical rain forest	TAr	wet: ≤ 3 months dry, during winter
		Tropical moist	Tropical moist deciduous forest	TAwa	mainly wet: 3-5 months dry, during winter
		Tropical dry	Tropical dry forest	TAWb	mainly dry: 5-8 months dry, during winter
			Tropical shrubland	TBSh	semi-arid: evaporation > precipitation
			Tropical desert	TBWh	arid: all months dry
		Tropical montane	Tropical mountain systems	TM	altitudes approximately >1000 m, with local variations
Sub-tropical	≥ 8 months at a temperature >10°C	Warm temperate moist	Subtropical humid forest	SCf	humid: no dry season
		Warm temperate dry	Subtropical dry forest	SCs	seasonally dry: winter rains, dry summer
			Subtropical steppe	SBSh	semi-arid: evaporation >precipitation
			Subtropical desert	SBWh	arid: all months dry
		Warm temperate moist or dry	Subtropical mountain systems	SM	altitudes approximately 800 m-1000 m
Temp-erate	4-8 months at a temperature >10°C	Cool temperate moist	Temperate oceanic forest	TeDo	oceanic climate: coldest month >0°C
			Temperate continental forest	TeDc	continental climate: coldest month <0°C
		Cool temperate dry	Temperate steppe	TeBSk	semi-arid: evaporation > precipitation
			Temperate desert	TeBWk	arid: all months dry
		Cool temperate moist or dry	Temperate mountain systems	TeM	altitudes approximately >800 m
Boreal	≤ 3 months at a temperature >10°C	Boreal moist	Boreal coniferous forest	Ba	coniferous dense forest dominant
		Boreal dry	Boreal tundra woodland	Bb	woodland and sparse forest dominant
		Boreal moist or dry	Boreal mountain systems	BM	altitudes approximately >600 m
Polar	all months <10°C	Polar moist or dry	Polar	P	all months <10°C

Climate domain: Area of relatively homogenous temperature regime, equivalent to the Köppen-Trewartha climate groups (Köppen, 1931).

Climate region: Areas of similar climate defined in Chapter 3 for reporting across different carbon pools.

Ecological zone: Area with broad, yet relatively homogeneous natural vegetation formations that are similar, but not necessarily identical, in physiognomy.

Dry month: A month in which Total Precipitation (mm) ≤ 2 x Mean Temperature (ºC).

FIGURE 5.1 GLOBAL ECOLOGICAL ZONES, BASED ON OBSERVED CLIMATE AND VEGETATION PATTERNS (FAO, 2001).

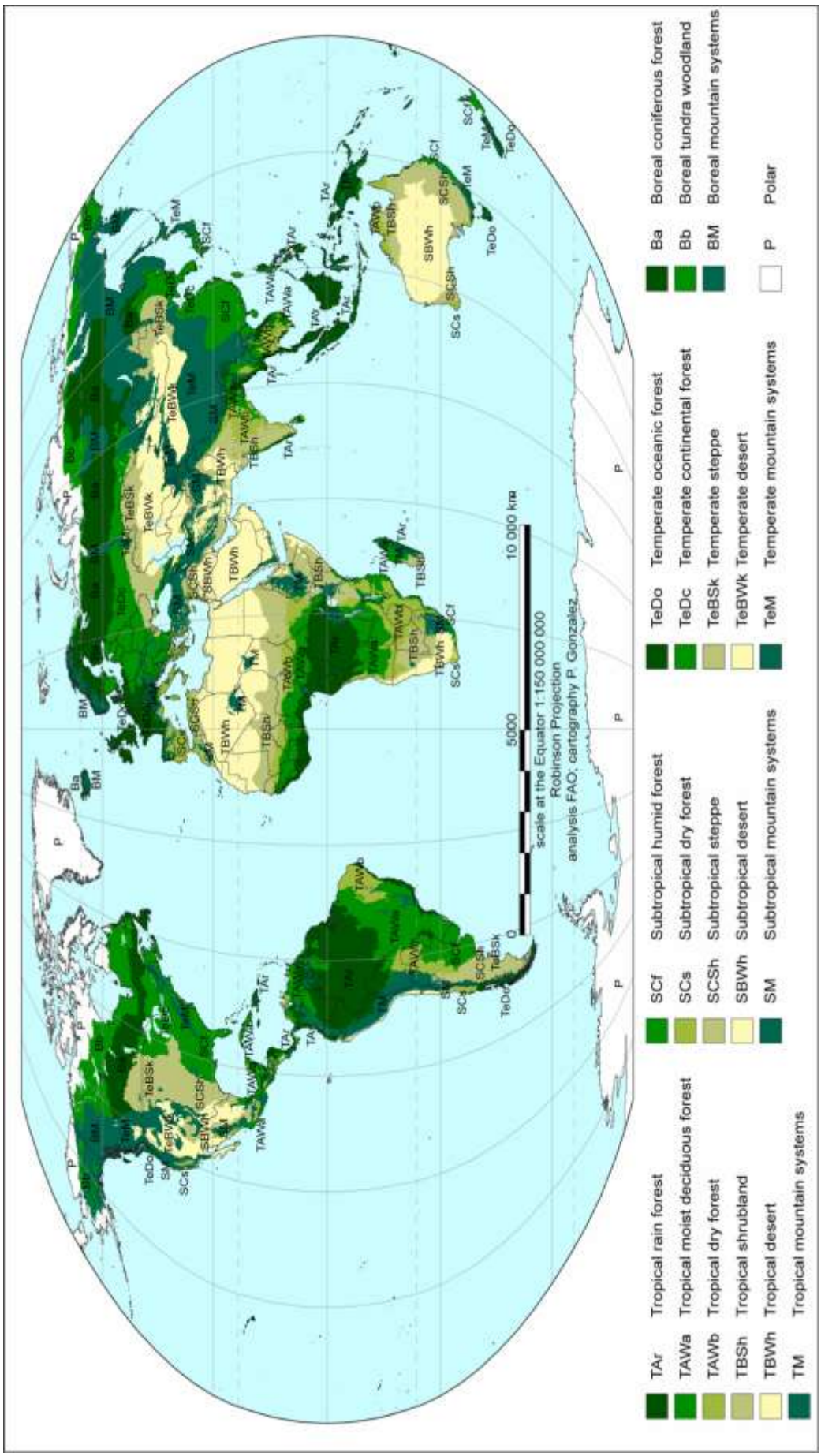

TABLE 5.2 [2] CARBON FRACTION OF ABOVEGROUND FOREST BIOMASS			
Domain	**Part of tree**	**Carbon fraction, (CF) [tonne C (tonne d.m.)$^{-1}$]**	**References**
Default value	All	0.47	McGroddy *et al.*, 2004
Tropical and Subtropical	All	0.47 (0.44 - 0.49)	Andreae and Merlet, 2001; Chambers *et al.*, 2001; McGroddy *et al.*, 2004; Lasco and Pulhin, 2003
	wood	0.49	Feldpausch *et al.*, 2004
	wood, tree d < 10 cm	0.46	Hughes *et al.*, 2000
	wood, tree d ≥ 10 cm	0.49	Hughes *et al.*, 2000
	foliage	0.47	Feldpausch *et al.*, 2004
	foliage, tree d < 10 cm	0.43	Hughes *et al.*, 2000
	foliage, tree d ≥ 10 cm	0.46	Hughes *et al.*, 2000
Temperate and Boreal	All	0.47 (0.47 - 0.49)	Andreae and Merlet, 2001; Gayoso *et al.*, 2002; Matthews, 1993; McGroddy *et al.*, 2004
	broad-leaved	0.48 (0.46 - 0.50)	Lamlom and Savidge, 2003
	conifers	0.51 (0.47 - 0.55)	Lamlom and Savidge, 2003

TABLE 5.3 [3] RATIO OF BELOW-GROUND BIOMASS TO ABOVE-GROUND BIOMASS (R)				
Domain	**Ecological zone**	**Above-ground biomass**	**R [tonne root d.m. (tonne shoot d.m.)$^{-1}$]**	**References**
Tropical	Tropical moist deciduous forest	above-ground biomass <125 tonnes ha^{-1}	0.20 (0.09 - 0.25)	Mokany *et al*., 2006
		above-ground biomass >125 tonnes ha^{-1}	0.24 (0.22 - 0.33)	Mokany *et al*., 2006
	Tropical dry forest	above-ground biomass <20 tonnes ha^{-1}	0.56 (0.28 - 0.68)	Mokany *et al*., 2006
		above-ground biomass >20 tonnes ha^{-1}	0.28 (0.27 - 0.28)	Mokany *et al*., 2006
	Tropical shrubland		0.40	Poupon, 1980
	Tropical mountain systems		0.27 (0.27 - 0.28)	Singh *et al.*, 1994
Subtropical	Subtropical humid forest	above-ground biomass <125 tonnes ha^{-1}	0.20 (0.09 - 0.25)	Mokany *et al*., 2006
		above-ground biomass >125 tonnes ha^{-1}	0.24 (0.22 - 0.33)	Mokany *et al*., 2006
	Subtropical dry forest	above-ground biomass <20 tonnes ha^{-1}	0.56 (0.28 - 0.68)	Mokany *et al*., 2006
		above-ground biomass >20 tonnes ha^{-1}	0.28 (0.27 - 0.28)	Mokany *et al*., 2006
	Subtropical steppe		0.32 (0.26 - 0.71)	Mokany *et al*., 2006
	Subtropical mountain systems		no estimate available	
Temperate	Temperate oceanic forest, Temperate continental forest, Temperate mountain systems	conifers above-ground biomass < 50 tonnes ha^{-1}	0.40 (0.21 - 1.06)	Mokany *et al*., 2006
		conifers above-ground biomass 50-150 tonnes ha^{-1}	0.29 (0.24 - 0.50)	Mokany *et al*., 2006
		conifers above-ground biomass > 150 tonnes ha^{-1}	0.20 (0.12 - 0.49)	Mokany *et al*., 2006
		Quercus spp. above-ground biomass >70 tonnes ha^{-1}	0.30 (0.20 - 1.16)	Mokany *et al*., 2006
		Eucalyptus spp. above-ground biomass < 50 tonnes ha^{-1}	0.44 (0.29 - 0.81)	Mokany *et al*., 2006
		Eucalyptus spp. above-ground biomass 50-150 tonnes ha^{-1}	0.28 (0.15 - 0.81)	Mokany *et al*., 2006
		Eucalyptus spp. above-ground biomass > 150 tonnes ha^{-1}	0.20 (0.10 - 0.33)	Mokany *et al*., 2006
		other broadleaf above-ground biomass < 75 tonnes ha^{-1}	0.46 (0.12 - 0.93)	Mokany *et al*., 2006
		other broadleaf above-ground biomass 75-150 tonnes ha^{-1}	0.23 (0.13 - 0.37)	Mokany *et al*., 2006
		other broadleaf above-ground biomass >150 tonnes ha^{-1}	0.24 (0.17 - 0.44)	Mokany *et al*., 2006
Boreal	Boreal coniferous forest, Boreal tundra woodland, Boreal mountain systems	above-ground biomass <75 tonnes ha^{-1}	0.39 (0.23 - 0.96)	Li *et al*., 2003; Mokany *et al*., 2006
		above-ground biomass >75 tonnes ha^{-1}	0.24 (0.15 - 0.37)	Li *et al*., 2003; Mokany *et al*., 2006

TABLE 5.4 [4]
DEFAULT BIOMASS CONVERSION AND EXPANSION FACTORS (BCEF), TONNES BIOMASS (M^3 OF WOOD VOLUME)$^{-1}$

BCEF for expansion of merchantable growing stock volume to above-ground biomass ($BCEF_S$)

Climatic zone	Forest type	BCEF	Growing stock level (m^3/hectare)							
			<20	**21-50**	**51-100**	**>100**				
Boreal	pines	$BCEF_S$	**1.2** (0.85-1.3)	**0.68** (0.5-0.72)	**0.57** (0.52-0.65)	**0.5** (0.45-0.58)				
	larch	$BCEF_S$	**1.22** (0.9-1.5)	**0.78** (0.7-0.8)	**0.77** (0.7-0.85)	**0.77** (0.7-0.85)				
	firs and spruces	$BCEF_S$	**1.16** (0.8-1.5)	**0.66** (0.55-0.75)	**0.58** (0.5-0.65)	**0.53** (0.45-0.605)				
	hardwoods	$BCEF_S$	**0.9** (0.7-1.2)	**0.7** (0.6-0.75)	**0.62** (0.53-0.7)	**0.55** (0.5-0.65)				
			<20	**21-40**	**41-100**	**100 -200**	**>200**			
Temperate	hardwoods	$BCEF_S$	**3.0** (0.8-4.5)	**1.7** (0.8-2.6)	**1.4** (0.7-1.9)	**1.05** (0.6-1.4)	**0.8** (0.55-1.1)			
	pines	$BCEF_S$	**1.8** (0.6 -2.4)	**1.0** (0.65 -1.5)	**0.75** (0.6-1.0)	**0.7** (0.4-1.0)	**0.7** (0.4-1.0)			
	other conifers	$BCEF_S$	**3.0 (**0.7-4.0)	**1.4** (0.5-2.5)	**1.0** (0.5-1.4)	**0.75** (0.4-1.2)	**0.7** (0.35-0.9)			
			<20	**21-40**	**41-80**	**>80**				
Mediterranean, dry tropical, subtropical	hardwoods	$BCEF_S$	**5.0** (2.0-8.0)	**1.9** (1.0-2.6)	**0.8** (0.6-1.4)	**0.66** (0.4-0.9)				
	conifers	$BCEF_S$	**6.0** (3.0-8.0)	**1.2** (0.5-2.0)	**0.6** (0.4-0.9)	**0.55** (0.4-0.7)				
			<10	**11-20**	**21-40**	**41-60**	**61-80**	**80-120**	**120-200**	**>200**
Humid tropical	conifers	$BCEF_S$	**4.0** (3.0-6.0)	**1.75** (1.4-2.4)	**1.25** (1.0-1.5)	**1.0** (0.8-1.2)	**0.8** (0.7-1.2)	**0.76** (0.6-1.0	**0.7** (0.6-0.9)	**0.7** (0.6-0.9
	natural forests	$BCEF_S$	**9.0** (4.0-12.0)	**4.0** (2.5-4.5)	**2.8** (1.4-3.4)	**2.05** (1.2-2.5)	**1.7** (1.2-2.2)	**1.5** (1.0-1.8)	**1.3**(0.9-1.6)	**0.95** (0.7-1.1)

Note: Lower values of the ranges for $BCEF_S$ apply if growing stock definition includes branches, stem tops and cull trees; upper values apply if branches and tops are not part of growing stock, minimum top diameters in the definition of growing stock are large, inventoried volume falls near the lower category limit or basic wood densities are relatively high. Continuous graphs, functional forms and updates with new studies can be found at the forest- and climate- change website at: http://www.fao.org/forestry/

Average BCEF for inhomogeneous forests should be derived as far as possible as weighted averages. It is good practice to justify the factors chosen.

Sources*:* *Boreal forests*: Alexeyev V.A. and R.A. Birdseye, 1998; Fang J. and Z.M. Wang, 2001; *temperate forests*: Fang J. *et al*., 2001; Fukuda M. *et al*., 2003; Schroeder P. *et al*., 1997; Snowdon P. *et.al*., 2000; Smith J. *et. al*., 2002; Brown S., 1999; Schoene D. and A. Schulte, 1999; Smith J. *et al.*, 2004; *Mediterranean forests*: Vayreda *et al*., 2002; Gracia *et al*., 2002; *tropical forests*: Brown S. *et al*., 1989; Brown S. and A. Lugo, 1992; Brown S., 2002; Fang J.Y., 2001.

TABLE 5.5 [5] ABOVE-GROUND BIOMASS IN FOREST PLANTATIONS				
Domain	**Ecological zone**	**Continent**	**Above-ground biomass (tonnes d.m. ha^{-1})**	**References**
Tropical	Tropical rain forest	Africa broadleaf > 20 y	300	IPCC, 2003
		Africa broadleaf ≤ 20 y	100	IPCC, 2003
		Africa Pinus sp. > 20 y	200	IPCC, 2003
		Africa Pinus sp. ≤ 20 y	60	IPCC, 2003
		Americas Eucalyptus sp.	200	IPCC, 2003
		Americas Pinus sp.	300	IPCC, 2003
		Americas Tectona grandis	240	Kraenzel *et al*., 2003
		Americas other broadleaf	150	IPCC, 2003
		Asia broadleaf	220	IPCC, 2003
		Asia other	130	IPCC, 2003
	Tropical moist deciduous forest	Africa broadleaf > 20 y	150	IPCC, 2003
		Africa broadleaf ≤ 20 y	80	IPCC, 2003
		Africa Pinus sp. > 20 y	120	IPCC, 2003
		Africa Pinus sp. ≤ 20 y	40	IPCC, 2003
		Americas Eucalyptus sp.	90	Stape *et al*., 2004
		Americas Pinus sp.	270	IPCC, 2003
		Americas Tectona grandis	120	IPCC, 2003
		Americas other broadleaf	100	IPCC, 2003
		Asia broadleaf	180	IPCC, 2003
		Asia other	100	IPCC, 2003
	Tropical dry forest	Africa broadleaf > 20 y	70	IPCC, 2003
		Africa broadleaf ≤ 20 y	30	IPCC, 2003
		Africa Pinus sp. > 20 y	60	IPCC, 2003
		Africa Pinus sp. ≤ 20 y	20	IPCC, 2003
		Americas Eucalyptus sp.	90	Stape *et al*., 2004
		Americas Pinus sp.	110	IPCC, 2003
		Americas Tectona grandis	90	IPCC, 2003
		Americas other broadleaf	60	IPCC, 2003
		Asia broadleaf	90	IPCC, 2003
		Asia other	60	IPCC, 2003
	Tropical shrubland	Africa broadleaf	20	IPCC, 2003
		Africa Pinus sp. > 20 y	20	IPCC, 2003
		Africa Pinus sp. ≤ 20 y	15	IPCC, 2003
		Americas Eucalyptus sp.	60	IPCC, 2003
		Americas Pinus sp.	60	IPCC, 2003
		Americas Tectona grandis	50	IPCC, 2003
		Americas other broadleaf	30	IPCC, 2003
		Asia broadleaf	40	IPCC, 2003
		Asia other	30	IPCC, 2003
	Tropical mountain systems	Africa broadleaf > 20 y	60-150	IPCC, 2003
		Africa broadleaf ≤ 20 y	40-100	IPCC, 2003
		Africa Pinus sp. > 20 y	30-100	IPCC, 2003
		Africa Pinus sp. ≤ 20 y	10-40	IPCC, 2003
		Americas Eucalyptus sp.	30-120	IPCC, 2003
		Americas Pinus sp.	60-170	IPCC, 2003
		Americas Tectona grandis	30-130	IPCC, 2003
		Americas other broadleaf	30-80	IPCC, 2003
		Asia broadleaf	40-150	IPCC, 2003
		Asia other	25-80	IPCC, 2003
Subtropical	Subtropical humid forest	Americas Eucalyptus sp.	140	IPCC, 2003
		Americas Pinus sp.	270	IPCC, 2003
		Americas Tectona grandis	120	IPCC, 2003
		Americas other broadleaf	100	IPCC, 2003
		Asia broadleaf	180	IPCC, 2003
		Asia other	100	IPCC, 2003
	Subtropical dry forest	Africa broadleaf > 20 y	70	IPCC, 2003
		Africa broadleaf ≤ 20 y	30	IPCC, 2003
		Africa Pinus sp. > 20 y	60	IPCC, 2003
		Africa Pinus sp. ≤ 20 y	20	IPCC, 2003
		Americas Eucalyptus sp.	110	IPCC, 2003
		Americas Pinus sp.	110	IPCC, 2003
		Americas Tectona grandis	90	IPCC, 2003
		Americas other broadleaf	60	IPCC, 2003
		Asia broadleaf	90	IPCC, 2003
		Asia other	60	IPCC, 2003

TABLE 5.5 (CONTINUED) ABOVE-GROUND BIOMASS IN FOREST PLANTATIONS				
Domain	**Ecological zone**	**Continent**	**Above-ground biomass (tonnes d.m. ha^{-1})**	**References**
	Subtropical steppe	Africa broadleaf	20	IPCC, 2003
		Africa Pinus sp. > 20 y	20	IPCC, 2003
		Africa Pinus sp. ≤ 20 y	15	IPCC, 2003
		Americas Eucalyptus sp.	60	IPCC, 2003
		Americas Pinus sp.	60	IPCC, 2003
		Americas Tectona grandis	50	IPCC, 2003
		Americas other broadleaf	30	IPCC, 2003
		Asia broadleaf > 20 y	80	IPCC, 2003
		Asia broadleaf ≤ 20 y	10	IPCC, 2003
		Asia coniferous > 20 y	20	IPCC, 2003
		Asia coniferous ≤ 20 y	100-120	IPCC, 2003
	Subtropical mountain systems	Africa broadleaf > 20 y	60-150	IPCC, 2003
		Africa broadleaf ≤ 20 y	40-100	IPCC, 2003
		Africa Pinus sp. > 20 y	30-100	IPCC, 2003
		Africa Pinus sp. ≤ 20 y	10-40	IPCC, 2003
		Americas Eucalyptus sp.	30-120	IPCC, 2003
		Americas Pinus sp.	60-170	IPCC, 2003
		Americas Tectona grandis	30-130	IPCC, 2003
		Americas other broadleaf	30-80	IPCC, 2003
		Asia broadleaf	40-150	IPCC, 2003
		Asia other	25-80	IPCC, 2003
Temperate	Temperate oceanic forest	Asia, Europe, broadleaf > 20 y	200	IPCC, 2003
		Asia, Europe, broadleaf ≤ 20 y	30	IPCC, 2003
		Asia, Europe, coniferous > 20 y	150-250	IPCC, 2003
		Asia, Europe, coniferous ≤ 20 y	40	IPCC, 2003
		North America	50-300	IPCC, 2003
		New Zealand	150-350	Hinds and Reid, 1957; Hall and Hollinger, 1997; Hall, 2001
		South America	90-120	IPCC, 2003
	Temperate continental forest and mountain systems	Asia, Europe, broadleaf > 20 y	200	IPCC, 2003
		Asia, Europe, broadleaf ≤ 20 y	15	IPCC, 2003
		Asia, Europe, coniferous > 20 y	150-200	IPCC, 2003
		Asia, Europe, coniferous ≤ 20 y	25-30	IPCC, 2003
		North America	50-300	IPCC, 2003
		South America	90-120	IPCC, 2003
Boreal	Boreal coniferous forest and mountain systems	Asia, Europe > 20 y	40	IPCC, 2003
		Asia, Europe ≤ 20 y	5	IPCC, 2003
		North America	40-50	IPCC, 2003
	Boreal tundra woodland	Asia, Europe > 20 y	25	IPCC, 2003
		Asia, Europe ≤ 20 y	5	IPCC, 2003
		North America	25	IPCC, 2003

TABLE 5.6 [6] BASIC WOOD DENSITY (D) OF TROPICAL TREE SPECIES (OVEN-DRY TONNES (MOIST M^{-3}))

1 = Baker *et al.*, 2004b; 2 = Barbosa and Fearnside, 2004; 3 = CTFT, 1989; 4 = Fearnside, 1997; 5 = Reyes *et al*., 1992

Species	Density	Continent	Reference
Adina cordifolia	0.58-0.59	Asia	5
Aegle marmelo	0.75	Asia	5
Afzelia bipidensis	0.67-0.79	Africa	3
Agathis sp.	0.44	Asia	5
Aglaia llanosiana	0.89	Asia	5
Agonandra brasiliensis	0.74	Americas	4
Aidia ochroleuca	0.78	Africa	5
Alangium longiflorum	0.65	Asia	5
Albizia sp.	0.52	Americas	5
Albizzia amara	0.70	Asia	5
Albizzia falcataria	0.25	Asia	5
Alcornea sp.	0.34	Americas	5
Aldina heterophylla	0.73	Americas	4
Aleurites trisperma	0.43	Asia	5
Alexa grandiflora	0.59	Americas	4
Alexa imperatricis	0.52	Americas	4
Allophyllus africanus	0.45	Africa	5
Alnus ferruginea	0.38	Americas	5
Alnus japonica	0.43	Asia	5
Alphitonia zizyphoides	0.50	Asia	5
Alphonsea arborea	0.69	Asia	5
Alseodaphne longipes	0.49	Asia	5
Alstonia congensis	0.33	Africa	5
Amburana cearensis	0.43	Americas	1
Amoora sp.	0.60	Asia	5
Amphimas pterocarpoides	0.63	Africa	5
Anacardium excelsum	0.41	Americas	4
Anacardium giganteum	0.44	Americas	4
Anadenanthera macrocarpa	0.86	Americas	4
Andira inermis	0.64	Americas	4
Andira parviflora	0.69	Americas	4
Andira retusa	0.67	Americas	5
Aniba amazonica	0.52-0.56	Americas	1
Aniba canelilla	0.92	Americas	4
Aningeria robusta	0.44-0.53	Africa	3
Anisophyllea obtusifolia	0.63	Africa	5
Anisophyllea zeylanica	0.46	Asia	5
Anisoptera sp.	0.54	Asia	5
Annonidium mannii	0.29	Africa	5
Anogeissus latifolia	0.78-0.79	Asia	5
Anopyxis klaineana	0.74	Africa	5
Anthocephalus chinensis	0.33-0.36	Asia	5
Anthocleista keniensis	0.50	Africa	5
Anthonotha macrophylla	0.78	Africa	5
Anthostemma aubryanum	0.32	Africa	5
Antiaris africana	0.38	Americas	5
Antiaris sp.	0.38	Africa	5
Antidesma pleuricum	0.59	Asia	5
Antrocaryon klaineanum	0.50	Africa	5
Apeiba aspera	0.28	Americas	1
Apeiba echinata	0.36	Americas	5
Apeiba peiouma	0.20	Americas	4
Aphanamiris perrottetiana	0.52	Asia	5
Apuleia leiocarpa	0.70	Americas	1
Apuleia molaris	0.76	Americas	4
Araucaria bidwillii	0.43	Asia	5
Ardisia cubana	0.62	Americas	1
Artocarpus comunis	0.70	Americas	5
Artocarpus sp.	0.58	Asia	5
Aspidosperma album	0.76	Americas	4

TABLE 5.6 [6] BASIC WOOD DENSITY (D) OF TROPICAL TREE SPECIES (OVEN-DRY TONNES (MOIST M^{-3}))

1 = Baker *et al.*, 2004b; 2 = Barbosa and Fearnside, 2004; 3 = CTFT, 1989; 4 = Fearnside, 1997; 5 = Reyes *et al*., 1992

Species	Density	Continent	Reference
Aspidosperma macrocarpon	0.67	Americas	1
Aspidosperma obscurinervium	0.86	Americas	4
Astronium gracile	0.73	Americas	4
Astronium graveolens	0.75	Americas	4
Astronium lecointei	0.73	Americas	5
Astronium ulei	0.71	Americas	4
Astronium urundeuva	1.21	Americas	4
Aucoumea klaineana	0.31-0.48	Africa	3
Autranella congolensis	0.78	Africa	5
Azadirachta sp.	0.52	Asia	5
Bagassa guianensis	0.69	Americas	4
Baillonella toxisperma	0.70	Africa	3
Balanites aegyptiaca	0.63	Africa	5
Balanocarpus sp.	0.76	Asia	5
Banara guianensis	0.61	Americas	5
Baphia kirkii	0.93	Africa	5
Barringtonia edulis	0.48	Asia	5
Basiloxylon exelsum	0.58	Americas	5
Bauhinia sp.	0.67	Asia	5
Beilschmiedia louisii	0.70	Africa	5
Beilschmiedia nitida	0.50	Africa	5
Beilschmiedia sp.	0.61	Americas	5
Beilschmiedia tawa	0.58	Asia	5
Berlinia sp.	0.58	Africa	5
Berrya cordifolia	0.78	Asia	5
Bertholletia excelsa	0.62	Americas	4
Bischofia javanica	0.54-0.62	Asia	5
Bixa arborea	0.32	Americas	4
Bleasdalea vitiensis	0.43	Asia	5
Blighia welwitschii	0.74	Africa	5
Bocoa sp.	0.42	Americas	1
Bombacopsis quinata	0.39	Americas	1
Bombacopsis sepium	0.39	Americas	5
Bombax costatum	0.35	Africa	3
Bombax paraense	0.39	Americas	1
Borojoa patinoi	0.52	Americas	5
Boswellia serrata	0.50	Asia	5
Bowdichia coccolobifolia	0.39	Americas	2
Bowdichia crassifolia	0.39	Americas	2
Bowdichia nitida	0.79	Americas	4
Bowdichia virgilioides	0.52	Americas	2
Brachystegia sp.	0.52	Africa	5
Bridelia micrantha	0.47	Africa	5
Bridelia squamosa	0.50	Asia	5
Brosimum acutifolium	0.55	Americas	4
Brosimum alicastrum	0.69	Americas	4
Brosimum guianense	0.96	Americas	4
Brosimum lactescens	0.70	Americas	1
Brosimum parinarioides	0.58	Americas	4
Brosimum potabile	0.53	Americas	4
Brosimum rubescens	0.87	Americas	4
Brosimum utile	0.40-0.49	Americas	1
Brysenia adenophylla	0.54	Americas	5
Buchenavia capitata	0.63	Americas	4
Buchenavia huberi	0.79	Americas	4
Buchenavia latifolia	0.45	Asia	5
Buchenavia oxycarpa	0.72	Americas	4
Buchenavia viridiflora	0.88	Americas	1
Bucida buceras	0.93	Americas	5
Bursera serrata	0.59	Asia	5
Bursera simaruba	0.29-0.34	Americas	5
Butea monosperma	0.48	Asia	5
Byrsonima coriacea	0.64	Americas	5
Byrsonima spicata	0.61	Americas	4

TABLE 5.6 [6] BASIC WOOD DENSITY (D) OF TROPICAL TREE SPECIES (OVEN-DRY TONNES (MOIST M^{-3}))

1 = Baker *et al.*, 2004b; 2 = Barbosa and Fearnside, 2004; 3 = CTFT, 1989; 4 = Fearnside, 1997; 5 = Reyes *et al*., 1992

Species	Density	Continent	Reference
Byrsonima verbascifolia	0.33	Americas	2
Cabralea canjerana	0.55	Americas	4
Caesalpinia sp.	1.05	Americas	5
Calophyllum brasiliense	0.53	Americas	4
Calophyllum sp.	0.46	Americas	1
Calophyllum sp.	0.53	Asia	5
Calpocalyx klainei	0.63	Africa	5
Calycarpa arborea	0.53	Asia	5
Calycophyllum spruceanum	0.74	Americas	1
Campnosperma panamensis	0.37	Americas	1
Cananga odorata	0.29	Asia	5
Canarium sp.	0.44	Asia	5
Canthium monstrosum	0.42	Asia	5
Canthium rubrocostratum	0.63	Africa	5
Carallia calycina	0.66	Asia	5
Carapa guianensis	0.55	Americas	4
Carapa procera	0.59	Africa	5
Cariniana integrifolia	0.49	Americas	4
Cariniana micrantha	0.64	Americas	4
Caryocar glabrum	0.65	Americas	1
Caryocar villosum	0.72	Americas	4
Casearia battiscombei	0.50	Africa	5
Casearia sp.	0.62	Americas	5
Cassia javanica	0.69	Asia	5
Cassia moschata	0.71	Americas	5
Cassia scleroxylon	1.01	Americas	4
Cassipourea euryoides	0.70	Africa	5
Cassipourea malosana	0.59	Africa	5
Castanopsis philippensis	0.51	Asia	5
Casuarina equisetifolia	0.81	Americas	5
Casuarina equisetifolia	0.83	Asia	5
Casuarina nodiflora	0.85	Asia	5
Catostemma commune	0.50	Americas	1
Cecropia sp.	0.36	Americas	5
Cedrela odorata	0.42	Americas	1
Cedrela odorata	0.38	Asia	5
Cedrela sp.	0.40-0.46	Americas	5
Cedrela toona	0.43	Asia	5
Cedrelinga catenaeformis	0.45	Americas	1
Ceiba pentandra	0.18-0.39	Africa	3
Ceiba pentandra	0.28	Americas	4
Ceiba pentandra	0.23	Asia	5
Ceiba samauma	0.57	Americas	1
Celtis luzonica	0.49	Asia	5
Celtis schippii	0.59	Americas	1
Celtis sp.	0.59	Africa	5
Centrolobium sp.	0.65	Americas	5
Cespedesia macrophylla	0.63	Americas	5
Cespedesia spathulata	0.54	Americas	1
Chaetocarpus schomburgkianus	0.80	Americas	5
Chisocheton pentandrus	0.52	Asia	5
Chlorophora excelsa	0.48-0.66	Africa	3
Chlorophora tinctoria	0.73	Americas	4
Chloroxylon swietenia	0.76-0.80	Asia	5
Chorisia integrifolia	0.28	Americas	1
Chrysophyllum albidum	0.56	Africa	5
Chukrassia tabularis	0.57	Asia	5
Citrus grandis	0.59	Asia	5
Clarisia racemosa	0.59	Americas	4

TABLE 5.6 [6] BASIC WOOD DENSITY (D) OF TROPICAL TREE SPECIES (OVEN-DRY TONNES (MOIST M^{-3}))

1 = Baker *et al.*, 2004b; 2 = Barbosa and Fearnside, 2004; 3 = CTFT, 1989; 4 = Fearnside, 1997; 5 = Reyes *et al*., 1992

Species	Density	Continent	Reference
Cleidion speciflorum	0.50	Asia	5
Cleistanthus eollinus	0.88	Asia	5
Cleistanthus mildbraedii	0.87	Africa	5
Cleistocalyx sp.	0.76	Asia	5
Cleistopholis patens	0.36	Africa	5
Clusia rosea	0.67	Americas	5
Cochlospermum gossypium	0.27	Asia	5
Cochlospermum orinocensis	0.26	Americas	5
Cocos nucifera	0.50	Asia	5
Coda edulis	0.78	Africa	5
Coelocaryon preussii	0.56	Africa	5
Cola sp.	0.70	Africa	5
Colona serratifolia	0.33	Asia	5
Combretodendron quadrialatum	0.57	Asia	5
Conopharyngia holstii	0.50	Africa	5
Copaifera officinalis	0.61	Americas	1
Copaifera pubifora	0.56	Americas	1
Copaifera religiosa	0.50	Africa	5
Copaifera reticulata	0.63	Americas	4
Cordia alliodora	0.48	Americas	5
Cordia bicolor	0.49	Americas	4
Cordia gerascanthus	0.74	Americas	5
Cordia goeldiana	0.48	Americas	4
Cordia millenii	0.34	Africa	5
Cordia platythyrsa	0.36	Africa	5
Cordia sagotii	0.50	Americas	4
Cordia sp.	0.53	Asia	5
Corynanthe pachyceras	0.63	Africa	5
Corythophora rimosa	0.84	Americas	4
Cotylelobium sp.	0.69	Asia	5
Couepia sp.	0.70	Americas	5
Couma macrocarpa	0.50	Americas	4
Couratari guianensis	0.54	Americas	4
Couratari multiflora	0.47	Americas	4
Couratari oblongifolia	0.49	Americas	4
Couratari stellata	0.63	Americas	4
Crataeva religiosa	0.53	Asia	5
Cratoxylon arborescens	0.40	Asia	5
Croton megalocarpus	0.57	Africa	5
Croton xanthochloros	0.48	Americas	5
Cryptocarya sp.	0.59	Asia	5
Cryptosepalum staudtii	0.70	Africa	5
Ctenolophon englerianus	0.78	Africa	5
Cubilia cubili	0.49	Asia	5
Cullenia excelsa	0.53	Asia	5
Cupressus lusitanica	0.43-0.44	Americas	5
Curatella americana	0.41	Americas	2
Cylicodiscus gabonensis	0.80	Africa	5
Cynometra alexandri	0.74	Africa	5
Cynometra sp.	0.80	Asia	5
Cyrilla racemiflora	0.53	Americas	5
Dacrycarpus imbricatus	0.45-0.47	Asia	5
Dacrydium sp.	0.46	Asia	5
Dacryodes buttneri	0.44-0.57	Africa	3
Dacryodes excelsa	0.52-0.53	Americas	5
Dacryodes sp.	0.61	Asia	5
Dactyodes colombiana	0.51	Americas	5
Dalbergia paniculata	0.64	Asia	5
Dalbergia retusa.	0.89	Americas	5
Dalbergia stevensonii	0.82	Americas	5
Daniellia oliveri	0.53	Africa	3
Declinanona calycina	0.47	Americas	5
Decussocarpus vitiensis	0.37	Asia	5

TABLE 5.6 [6] BASIC WOOD DENSITY (D) OF TROPICAL TREE SPECIES (OVEN-DRY TONNES (MOIST M^{-3}))

1 = Baker *et al.*, 2004b; 2 = Barbosa and Fearnside, 2004; 3 = CTFT, 1989; 4 = Fearnside, 1997; 5 = Reyes *et al*., 1992

Species	Density	Continent	Reference
Degeneria vitiensis	0.35	Asia	5
Dehaasia triandra	0.64	Asia	5
Dendropanax arboreum	0.40	Americas	4
Desbordesia pierreana	0.87	Africa	5
Detarium senegalensis	0.63	Africa	5
Dialium excelsum	0.78	Africa	5
Dialium guianense	0.88	Americas	4
Dialium sp.	0.80	Asia	5
Dialyanthera sp.	0.36-0.48	Americas	5
Diclinanona calycina	0.47	Americas	4
Dicorynia ghuianensis	0.65	Americas	4
Dicorynia paraensis	0.60	Americas	5
Didelotia africana	0.78	Africa	5
Didelotia letouzeyi	0.50	Africa	5
Didymopanax sp.	0.74	Americas	5
Dillenia sp.	0.59	Asia	5
Dimorphandra mora	0.99	Americas	5
Dinizia excelsa	0.86	Americas	4
Diospyros sp.	0.82	Africa	5
Diospyros sp.	0.47	Americas	1
Diospyros sp.	0.70	Asia	5
Diplodiscus paniculatus	0.63	Asia	5
Diploon cuspidatum	0.85	Americas	4
Diplotropis martiusii	0.74	Americas	1
Diplotropis purpurea	0.78	Americas	4
Dipterocarpus caudatus	0.61	Asia	5
Dipterocarpus eurynchus	0.56	Asia	5
Dipterocarpus gracilis	0.61	Asia	5
Dipterocarpus grandiflorus	0.62	Asia	5
Dipterocarpus kerrii	0.56	Asia	5
Dipterocarpus kunstlerii	0.57	Asia	5
Dipterocarpus sp.	0.61	Asia	5
Dipterocarpus warburgii	0.52	Asia	5
Dipteryx odorata	0.93	Americas	4
Dipteryx polyphylla	0.87	Americas	4
Discoglypremna caloneura	0.32	Africa	5
Distemonanthus benthamianus	0.58	Africa	5
Dracontomelon sp.	0.50	Asia	5
Dryobalanops sp.	0.61	Asia	5
Drypetes sp.	0.63	Africa	5
Drypetes variabilis	0.71	Americas	4
Dtypetes bordenii	0.75	Asia	5
Durio sp.	0.53	Asia	5
Dussia lehmannii	0.59	Americas	5
Dyera costulata	0.36	Asia	5
Dysoxylum quercifolium	0.49	Asia	5
Ecclinusa bacuri	0.59	Americas	4
Ecclinusa guianensis	0.63	Americas	5
Ehretia acuminata	0.51	Africa	5
Elaeocarpus serratus	0.40	Asia	5
Emblica officinalis	0.80	Asia	5
Enantia chlorantha	0.42	Africa	5
Endiandra laxiflora	0.54	Asia	5
Endlicheria sp.	0.50	Americas	1
Endodesmia calophylloides	0.66	Africa	5
Endopleura uchi	0.78	Americas	4
Endospermum sp.	0.38	Asia	5
Entandrophragma utile	0.53-0.62	Africa	3
Enterolobium cyclocarpum	0.34	Americas	4

TABLE 5.6 [6] BASIC WOOD DENSITY (D) OF TROPICAL TREE SPECIES (OVEN-DRY TONNES (MOIST M^{-3}))

1 = Baker *et al.*, 2004b; 2 = Barbosa and Fearnside, 2004; 3 = CTFT, 1989; 4 = Fearnside, 1997; 5 = Reyes *et al*., 1992

Species	Density	Continent	Reference
Enterolobium cyclocarpum	0.35	Asia	5
Enterolobium maximum	0.40	Americas	4
Enterolobium schomburgkii	0.78	Americas	4
Eperua falcata	0.78	Americas	4
Epicharis cumingiana	0.73	Asia	5
Eribroma oblongum	0.60	Africa	5
Eriocoelum microspermum	0.50	Africa	5
Eriotheca longipedicellata	0.45	Americas	4
Erisma uncinatum	0.47	Americas	1
Erismadelphus ensul	0.56	Africa	5
Erythrina sp.	0.23	Americas	5
Erythrina subumbrans	0.24	Asia	5
Erythrina vogelii	0.25	Africa	5
Erythrophleum ivorense	0.70-0.88	Africa	3
Erythrophloeum densiflorum	0.65	Asia	5
Eschweilera amazonica	0.90	Americas	4
Eschweilera coriacea	0.78	Americas	4
Eschweilera ovata	0.81	Americas	4
Eschweilera sagotiana	0.79	Americas	4
Eucalyptus citriodora	0.64	Asia	5
Eucalyptus deglupta	0.34	Asia	5
Eucalyptus robusta	0.51	Americas	5
Eugenia sp.	0.65	Asia	5
Eugenia stahlii	0.73	Americas	5
Euxylophora paraensis	0.70	Americas	4
Fagara macrophylla	0.69	Africa	5
Fagara sp.	0.69	Americas	5
Fagraea sp.	0.73	Asia	5
Ficus benjamina	0.65	Asia	5
Ficus insipida	0.50	Americas	1
Ficus iteophylla	0.40	Africa	5
Fumtumia latifolia	0.45	Africa	5
Gallesia integrifolia	0.51	Americas	1
Gambeya sp.	0.56	Africa	5
Ganua obovatifolia	0.59	Asia	5
Garcinia myrtifolia	0.65	Asia	5
Garcinia punctata	0.78	Africa	5
Garcinia sp.	0.75	Asia	5
Gardenia turgida	0.64	Asia	5
Garuga pinnata	0.51	Asia	5
Genipa americana	0.51	Americas	4
Gilletiodendron mildbraedii	0.87	Africa	5
Gluta sp.	0.63	Asia	5
Glycydendron amazonicum	0.66	Americas	4
Gmelina arborea	0.41-0.45	Asia	5
Gmelina vitiensis	0.54	Asia	5
Gonocaryum calleryanum	0.64	Asia	5
Gonystylus punctatus	0.57	Asia	5
Gossweilerodendron balsamiferum	0.40	Africa	5
Goupia glabra	0.68	Americas	1
Grewia tiliaefolia	0.68	Asia	5
Guarea cedrata	0.48-0.57	Africa	3
Guarea chalde	0.52	Americas	5
Guarea guidonia	0.68	Americas	4
Guarea kunthiana	0.60	Americas	1
Guatteria decurrens	0.52	Americas	1
Guatteria olivacea	0.51	Americas	4
Guatteria procera	0.65	Americas	4

TABLE 5.6 [6] BASIC WOOD DENSITY (D) OF TROPICAL TREE SPECIES (OVEN-DRY TONNES (MOIST M^{-3}))

1 = Baker *et al.*, 2004b; 2 = Barbosa and Fearnside, 2004; 3 = CTFT, 1989; 4 = Fearnside, 1997; 5 = Reyes *et al*., 1992

Species	Density	Continent	Reference
Guazuma ulmifolia	0.50-0.52	Americas	5
Guibourtia demeusii	0.70-0.84	Africa	3
Guillielma gasipae	0.95-1.25	Americas	5
Gustavia speciosa	0.34	Americas	1
Hannoa klaineana	0.28	Africa	5
Hardwickia binata	0.73	Asia	5
Harpullia arborea	0.62	Asia	5
Harungana madagascariensis	0.45	Africa	5
Helicostylis tomentosa	0.72	Americas	4
Heritiera sp.	0.56	Asia	5
Hernandia Sonora	0.29	Americas	5
Hevea brasiliensis	0.49	Americas	4
Hevea brasiliensis	0.53	Asia	5
Hexalobus crispiflorus	0.48	Africa	5
Hibiscus tiliaceus	0.57	Asia	5
Hieronyma chocoensis	0.59-0.62	Americas	1
Hieronyma laxiflora	0.55	Americas	1
Himatanthus articulatus	0.38	Americas	2
Hirtella davisii	0.74	Americas	5
Holoptelea grandis	0.59	Africa	5
Homalanthus populneus	0.38	Asia	5
Homalium sp.	0.70	Africa	5
Homalium sp.	0.76	Asia	5
Hopea acuminata	0.62	Asia	5
Hopea sp.	0.64	Asia	5
Huberodendron patinoi	0.50	Americas	1
Humiria balsamifera	0.66	Americas	4
Humiriastrum excelsum	0.75	Americas	4
Humiriastrum procera	0.70	Americas	5
Hura crepitans	0.36	Americas	4
Hyeronima alchorneoides	0.64	Americas	4
Hyeronima laxiflora	0.59	Americas	5
Hylodendron gabonense	0.78	Africa	5
Hymenaea courbaril	0.77	Americas	1
Hymenaea davisii	0.67	Americas	5
Hymenaea oblongifolia	0.62	Americas	1
Hymenaea parvifolia	0.95	Americas	4
Hymenolobium excelsum	0.64	Americas	4
Hymenolobium modestum	0.65	Americas	4
Hymenolobium pulcherrimum	0.67	Americas	4
Hymenostegia pellegrini	0.78	Africa	5
Inga alba	0.62	Americas	4
Inga edulis	0.51	Americas	1
Inga paraensis	0.82	Americas	4
Intsia palembanica	0.68	Asia	5
Irvingia grandifolia	0.78	Africa	5
Iryanthera grandis	0.55	Americas	4
Iryanthera sagotiana	0.57	Americas	4
Iryanthera trocornis	0.72	Americas	4
Jacaranda copaia	0.33	Americas	4
Joannesia heveoides	0.39	Americas	4
Julbernardia globiflora	0.78	Africa	5
Kayea garciae	0.53	Asia	5
Khaya ivorensis	0.40-0.48	Africa	3
Kingiodendron alternifolium	0.48	Asia	5
Klainedoxa gabonensis	0.87	Africa	5
Kleinhovia hospita	0.36	Asia	5
Knema sp.	0.53	Asia	5
Koompassia excelsa	0.63	Asia	5

TABLE 5.6 [6] BASIC WOOD DENSITY (D) OF TROPICAL TREE SPECIES (OVEN-DRY TONNES (MOIST M^{-3}))

1 = Baker *et al.*, 2004b; 2 = Barbosa and Fearnside, 2004; 3 = CTFT, 1989; 4 = Fearnside, 1997; 5 = Reyes *et al*., 1992

Species	Density	Continent	Reference
Koordersiodendron pinnatum	0.65-0.69	Asia	5
Kydia calycina	0.72	Asia	5
Lachmellea speciosa	0.73	Americas	5
Laetia procera	0.63	Americas	1
Lagerstroemia sp.	0.55	Asia	5
Lannea grandis	0.50	Asia	5
Lecomtedoxa klainenna	0.78	Africa	5
Lecythis idatimon	0.77	Americas	4
Lecythis lurida	0.83	Americas	4
Lecythis pisonis	0.84	Americas	4
Lecythis poltequi	0.81	Americas	4
Lecythis zabucaja	0.86	Americas	4
Letestua durissima	0.87	Africa	5
Leucaena leucocephala	0.64	Asia	5
Licania macrophylla	0.76	Americas	4
Licania oblongifolia	0.88	Americas	4
Licania octandra	0.77	Americas	4
Licania unguiculata	0.88	Americas	1
Licaria aritu	0.80	Americas	4
Licaria cannella	1.04	Americas	4
Licaria rigida	0.73	Americas	4
Lindackeria sp.	0.41	Americas	5
Linociera domingensis	0.81	Americas	5
Lithocarpus soleriana	0.63	Asia	5
Litsea sp.	0.40	Asia	5
Lonchocarpus sp.	0.69	Americas	5
Lophira alata	0.84-0.97	Africa	3
Lophopetalum sp.	0.46	Asia	5
Lovoa trichilioides	0.45	Africa	5
Loxopterygium sagotii	0.56	Americas	5
Lucuma sp.	0.79	Americas	5
Luehea sp.	0.50	Americas	5
Lueheopsis duckeana	0.62	Americas	4
Mabea piriri	0.59	Americas	5
Macaranga denticulata	0.53	Asia	5
Machaerium sp.	0.70	Americas	5
Maclura tinctoria	0.71	Americas	1
Macoubea guianensis	0.40	Americas	5
Madhuca oblongifolia	0.53	Asia	5
Maesopsis eminii	0.41	Africa	5
Magnolia sp.	0.52	Americas	5
Maguira sclerophylla	0.57	Americas	5
Malacantha sp.	0.45	Africa	5
Mallotus philippinensis	0.64	Asia	5
Malouetia duckei	0.57	Americas	4
Mammea africana	0.62	Africa	5
Mammea americana	0.62	Americas	5
Mangifera indica	0.55	Americas	5
Mangifera sp.	0.52	Asia	5
Manilkara amazonica	0.85	Americas	4
Manilkara bidentata	0.87	Americas	1
Manilkara huberi	0.93	Americas	4
Manilkara lacera	0.78	Africa	5
Maniltoa minor	0.76	Asia	5
Maquira sclerophylla	0.57	Americas	4
Marila sp.	0.63	Americas	5
Markhamia platycalyx	0.45	Africa	5
Marmaroxylon racemosum	0.81	Americas	4
Mastixia philippinensis	0.47	Asia	5
Matayba domingensis	0.70	Americas	5
Matisia hirta	0.61	Americas	5
Mauria sp.	0.31	Americas	1
Maytenus sp.	0.71	Americas	5
Melanorrhea sp.	0.63	Asia	5
Melia dubia	0.40	Asia	5
Melicope triphylla	0.37	Asia	5
Meliosma macrophylla	0.27	Asia	5

TABLE 5.6 [6] BASIC WOOD DENSITY (D) OF TROPICAL TREE SPECIES (OVEN-DRY TONNES (MOIST M^{-3}))

1 = Baker *et al.*, 2004b; 2 = Barbosa and Fearnside, 2004; 3 = CTFT, 1989; 4 = Fearnside, 1997; 5 = Reyes *et al*., 1992

Species	Density	Continent	Reference
Melochia umbellata	0.25	Asia	5
Memecylon capitellatum	0.77	Africa	5
Metrosideros collina	0.70-0.76	Asia	5
Mezilaurus itauba	0.70	Americas	4
Mezilaurus lindaviana	0.68	Americas	4
Michelia sp.	0.43	Asia	5
Michropholis sp.	0.61	Americas	5
Microberlinia brazzavillensis	0.70	Africa	5
Microcos coriaceus	0.42	Africa	5
Microcos stylocarpa	0.40	Asia	5
Micromelum compressum	0.64	Asia	5
Micropholi guyanensis	0.65	Americas	4
Micropholi venulosa	0.67	Americas	4
Milletia sp.	0.72	Africa	5
Milliusa velutina	0.63	Asia	5
Mimusops elengi	0.72	Asia	5
Minquartia guianensis	0.76	Americas	1
Mitragyna parviflora	0.56	Asia	5
Mitragyna stipulosa	0.47	Africa	5
Monopetalanthus heitzii	0.44-0.53	Africa	3
Mora excelsa	0.80	Americas	4
Mora gonggrijpii	0.78	Americas	1
Mora megistosperma	0.63	Americas	1
Mouriri barinensis	0.78	Americas	1
Mouriria sideroxylon	0.88	Americas	5
Musanga cecropioides	0.23	Africa	5
Myrciaria floribunda	0.73	Americas	5
Myristica platysperma	0.55	Americas	4
Myristica sp.	0.53	Asia	5
Myroxylon balsamum	0.78	Americas	1
Myroxylon peruiferum	0.78	Americas	1
Nauclea diderrichii	0.63	Africa	5
Nealchornea yapurensis	0.61	Americas	1
Nectandra rubra	0.57	Americas	5
Neesia sp.	0.53	Asia	5
Neonauclea bernardoi	0.62	Asia	5
Neopoutonia macrocalyx	0.32	Africa	5
Neotrewia cumingii	0.55	Asia	5
Nesogordonia papaverifera	0.65	Africa	5
Ochna foxworthyi	0.86	Asia	5
Ochroma pyramidale	0.30	Asia	5
Ochtocosmus africanus	0.78	Africa	5
Ocotea guianensis	0.63	Americas	4
Ocotea neesiana	0.63	Americas	4
Octomeles sumatrana	0.27-0.32	Asia	5
Odyendea sp.	0.32	Africa	5
Oldfieldia africana	0.78	Africa	5
Ongokea gore	0.72	Africa	5
Onychopetalum amazonicum	0.61	Americas	4
Ormosia coccinea	0.61	Americas	1
Ormosia paraensis	0.67	Americas	4
Ormosia schunkei	0.57	Americas	1
Oroxylon indicum	0.32	Asia	5
Otoba gracilipes	0.32	Americas	1
Ougenia dalbergiodes	0.70	Asia	5
Ouratea sp.	0.66	Americas	5
Oxystigma oxyphyllum	0.53	Africa	5
Pachira acuatica	0.43	Americas	5
Pachyelasma tessmannii	0.70	Africa	5
Pachypodanthium staudtii	0.58	Africa	5

TABLE 5.6 [6] BASIC WOOD DENSITY (D) OF TROPICAL TREE SPECIES (OVEN-DRY TONNES (MOIST M^{-3}))

1 = Baker *et al.*, 2004b; 2 = Barbosa and Fearnside, 2004; 3 = CTFT, 1989; 4 = Fearnside, 1997; 5 = Reyes *et al*., 1992

Species	Density	Continent	Reference
Palaquium sp.	0.55	Asia	5
Pangium edule	0.50	Asia	5
Paraberlinia bifoliolata	0.56	Africa	5
Parashorea stellata	0.59	Asia	5
Paratecoma peroba	0.60	Americas	5
Paratrophis glabra	0.77	Asia	5
Parinari excelsa	0.68	Americas	4
Parinari glabra	0.87	Africa	5
Parinari montana	0.71	Americas	4
Parinari rodolphii	0.71	Americas	4
Parinari sp.	0.68	Asia	5
Parkia multijuga	0.38	Americas	4
Parkia nitada	0.40	Americas	4
Parkia paraensis	0.44	Americas	4
Parkia pendula	0.55	Americas	4
Parkia roxburghii	0.34	Asia	5
Parkia ulei	0.40	Americas	4
Pausandra trianae	0.59	Americas	1
Pausinystalia brachythyrsa	0.56	Africa	5
Pausinystalia sp.	0.56	Africa	5
Payena sp.	0.55	Asia	5
Peltogyne paniculata	0.89	Americas	4
Peltogyne paradoxa	0.91	Americas	4
Peltogyne porphyrocardia	0.89	Americas	1
Peltophorum pterocarpum	0.62	Asia	5
Pentace sp.	0.56	Asia	5
Pentaclethra macroloba	0.43	Americas	1
Pentaclethra macrophylla	0.78	Africa	5
Pentadesma butyracea	0.78	Africa	5
Persea sp.	0.40-0.52	Americas	5
Peru glabrata	0.65	Americas	5
Peru schomburgkiana	0.59	Americas	5
Petitia domingensis	0.66	Americas	5
Phaeanthus ebracteolatus	0.56	Asia	5
Phyllanthus discoideus	0.76	Africa	5
Phyllocladus hypophyllus	0.53	Asia	5
Phyllostylon brasiliensis	0.77	Americas	4
Pierreodendron africanum	0.70	Africa	5
Pinus caribaea	0.51	Americas	5
Pinus caribaea	0.48	Asia	5
Pinus insularis	0.47-0.48	Asia	5
Pinus merkusii	0.54	Asia	5
Pinus oocarpa	0.55	Americas	5
Pinus patula	0.45	Americas	5
Piptadenia communis	0.68	Americas	4
Piptadenia grata	0.86	Americas	1
Piptadenia suaveolens	0.75	Americas	4
Piptadeniastrum africanum	0.56	Africa	5
Piratinera guianensis	0.96	Americas	5
Pisonia umbellifera	0.21	Asia	5
Pithecellobium guachapele	0.56	Americas	5
Pithecellobium latifolium	0.36	Americas	1
Pithecellobium saman	0.49	Americas	1
Pittosporum pentandrum	0.51	Asia	5
Plagiostyles africana	0.70	Africa	5
Planchonia sp.	0.59	Asia	5
Platonia insignis	0.70	Americas	5

TABLE 5.6 [6] BASIC WOOD DENSITY (D) OF TROPICAL TREE SPECIES (OVEN-DRY TONNES (MOIST M^{-3}))

1 = Baker *et al.*, 2004b; 2 = Barbosa and Fearnside, 2004; 3 = CTFT, 1989; 4 = Fearnside, 1997; 5 = Reyes *et al*., 1992

Species	Density	Continent	Reference
Platymiscium sp.	0.71-0.84	Americas	5
Podocarpus oleifolius	0.44	Americas	1
Podocarpus rospigliosii	0.57	Americas	1
Podocarpus sp.	0.43	Asia	5
Poga oleosa	0.36	Africa	5
Polyalthia flava	0.51	Asia	5
Polyalthia suaveolens	0.66	Africa	5
Polyscias nodosa	0.38	Asia	5
Pometia sp.	0.54	Asia	5
Poulsenia armata	0.37-0.44	Americas	1
Pourouma sp.	0.32	Americas	5
Pouteria anibifolia	0.66	Americas	1
Pouteria anomala	0.81	Americas	4
Pouteria caimito	0.87	Americas	4
Pouteria guianensis	0.90	Americas	4
Pouteria manaosensis	0.64	Americas	4
Pouteria oppositifolia	0.65	Americas	4
Pouteria villamilii	0.47	Asia	5
Premna angolensis	0.63	Africa	5
Premna tomentosa	0.96	Asia	5
Prioria copaifera	0.40-0.41	Americas	5
Protium heptaphyllum	0.54	Americas	4
Protium tenuifolium	0.65	Americas	4
Pseudolmedia laevigata	0.62-0.63	Americas	1
Pseudolmedia laevis	0.71	Americas	1
Pteleopsis hylodendron	0.63	Africa	5
Pterocarpus marsupium	0.67	Asia	5
Pterocarpus soyauxii	0.62-0.79	Africa	3
Pterocarpus vernalis	0.57	Americas	1
Pterogyne nitens	0.66	Americas	4
Pterygota sp.	0.52	Africa	5
Pterygota sp.	0.62	Americas	1
Pycnanthus angolensis	0.40-0.53	Africa	3
Qualea albiflora	0.50	Americas	5
Qualea brevipedicellata	0.69	Americas	4
Qualea dinizii	0.58	Americas	5
Qualea lancifolia	0.58	Americas	4
Qualea paraensis	0.67	Americas	4
Quararibea asterolepis	0.45	Americas	1
Quararibea bicolor	0.52-0.53	Americas	1
Quararibea cordata	0.43	Americas	1
Quassia simarouba	0.37	Americas	4
Quercus alata	0.71	Americas	5
Quercus costaricensis	0.61	Americas	5
Quercus eugeniaefolia	0.67	Americas	5
Quercus sp.	0.70	Asia	5
Radermachera pinnata	0.51	Asia	5
Randia cladantha	0.78	Africa	5
Raputia sp.	0.55	Americas	5
Rauwolfia macrophylla	0.47	Africa	5
Rheedia sp.	0.60	Americas	1
Rhizophora mangle	0.89	Americas	4
Ricinodendron heudelotii	0.20	Africa	5
Rollinia exsucca	0.52	Americas	4
Roupala moniana	0.77	Americas	4
Ruizierania albiflora	0.57	Americas	4
Saccoglottis gabonensis	0.74	Africa	5
Saccoglottis guianensis	0.77	Americas	4
Salmalia malabarica	0.32-0.33	Asia	5
Samanea saman	0.45-0.46	Asia	5
Sandoricum vidalii	0.43	Asia	5
Santiria trimera	0.53	Africa	5
Sapindus saponaria	0.58	Asia	5
Sapium ellipticum	0.50	Africa	5
Sapium luzontcum	0.40	Asia	5
Sapium marmieri	0.40	Americas	1
Schefflera morototoni	0.36	Americas	1
Schizolobium parahyba	0.40	Americas	1

TABLE 5.6 [6] BASIC WOOD DENSITY (D) OF TROPICAL TREE SPECIES (OVEN-DRY TONNES (MOIST M^{-3}))

1 = Baker *et al.*, 2004b; 2 = Barbosa and Fearnside, 2004; 3 = CTFT, 1989; 4 = Fearnside, 1997; 5 = Reyes *et al*., 1992

Species	Density	Continent	Reference
Schleichera oleosa	0.96	Asia	5
Schrebera arborea	0.63	Africa	5
Schrebera swietenoides	0.82	Asia	5
Sclerolobium chrysopyllum	0.62	Americas	4
Sclerolobium paraense	0.64	Americas	4
Sclerolobium peoppigianum	0.65	Americas	4
Scleronema micranthum	0.61	Americas	4
Sclorodophloeus zenkeri	0.68	Africa	5
Scottellia coriacea	0.56	Africa	5
Scyphocephalium ochocoa	0.48	Africa	5
Scytopetalum tieghemii	0.56	Africa	5
Semicarpus anacardium	0.64	Asia	5
Serialbizia acle	0.57	Asia	5
Serianthes melanesica	0.48	Asia	5
Sesbania grandiflora	0.40	Asia	5
Shorea assamica forma philippinensis	0.41	Asia	5
Shorea astylosa	0.73	Asia	5
Shorea ciliata	0.75	Asia	5
Shorea contorta	0.44	Asia	5
Shorea palosapis	0.39	Asia	5
Shorea plagata	0.70	Asia	5
Shorea polita	0.47	Asia	5
Shorea robusta	0.72	Asia	5
Shorea sp. (balau)	0.70	Asia	5
Shorea sp. (dark red meranti)	0.55	Asia	5
Shorea sp. (light red meranti)	0.40	Asia	5
Sickingia sp.	0.52	Americas	5
Simaba multiflora	0.51	Americas	5
Simarouba amara	0.36	Americas	1
Simira sp.	0.65	Americas	1
Sindoropsis letestui	0.56	Africa	5
Sloanea guianensis	0.79	Americas	5
Sloanea javanica	0.53	Asia	5
Sloanea nitida	1.01	Americas	4
Soymida febrifuga	0.97	Asia	5
Spathodea campanulata	0.25	Asia	5
Spondias lutea	0.38	Americas	4
Spondias mombin	0.31-0.35	Americas	1
Spondias purpurea	0.40	Americas	4
Staudtia stipitata	0.75	Africa	5
Stemonurus luzoniensis	0.37	Asia	5
Sterculia apetala	0.33	Americas	4
Sterculia pruriens	0.46	Americas	4
Sterculia rhinopetala	0.64	Africa	5
Sterculia speciosa	0.51	Americas	4
Sterculia vitiensis	0.31	Asia	5
Stereospermum suaveolens	0.62	Asia	5
Strephonema pseudocola	0.56	Africa	5
Strombosia philippinensis	0.71	Asia	5
Strombosiopsis tetrandra	0.63	Africa	5
Strychnos potatorum	0.88	Asia	5
Stylogyne sp.	0.69	Americas	5
Swartzia fistuloides	0.82	Africa	5
Swartzia laevicarpa	0.61	Americas	1
Swartzia panacoco	0.97	Americas	4
Swietenia macrophylla	0.43	Americas	1
Swietenia macrophylla	0.49-0.53	Asia	5

TABLE 5.6 [6] BASIC WOOD DENSITY (D) OF TROPICAL TREE SPECIES (OVEN-DRY TONNES (MOIST M^{-3}))

1 = Baker *et al.*, 2004b; 2 = Barbosa and Fearnside, 2004; 3 = CTFT, 1989; 4 = Fearnside, 1997; 5 = Reyes *et al*., 1992

Species	Density	Continent	Reference
Swintonia foxworthyi	0.62	Asia	5
Swintonia sp.	0.61	Asia	5
Sycopsis dunni	0.63	Asia	5
Symphonia globulifera	0.58	Africa	5
Symphonia globulifera	0.58	Americas	1
Syzygium cordatum	0.59	Africa	5
Syzygium sp.	0.69-0.76	Asia	5
Tabebuia rosea	0.54	Americas	1
Tabebuia serratifolia	0.92	Americas	1
Tabebuia stenocalyx	0.55-0.57	Americas	5
Tachigalia myrmecophylla	0.53	Americas	4
Talisia sp.	0.84	Americas	5
Tamarindus indica	0.75	Asia	5
Tapirira guianensis	0.50	Americas	4
Taralea oppositifolia	0.80	Americas	1
Tectona grandis	0.50-0.55	Asia	5
Terminalia amazonica	0.65	Americas	1
Terminalia citrina	0.71	Asia	5
Terminalia copelandii	0.46	Asia	5
Terminalia ivorensis	0.40-0.59	Africa	3
Terminalia microcarpa	0.53	Asia	5
Terminalia nitens	0.58	Asia	5
Terminalia oblonga	0.73	Americas	1
Terminalia pterocarpa	0.48	Asia	5
Terminalia superba	0.40-0.66	Africa	3
Terminalia tomentosa	0.73-0.77	Asia	5
Ternstroemia megacarpa	0.53	Asia	5
Tessmania africana	0.85	Africa	5
Testulea gabonensis	0.60	Africa	5
Tetragastris altissima	0.74	Americas	4
Tetragastris panamensis	0.76	Americas	4
Tetrameles nudiflora	0.30	Asia	5
Tetramerista glabra	0.61	Asia	5
Tetrapleura tetraptera	0.50	Africa	5
Thespesia populnea	0.52	Asia	5
Thyrsodium guianensis	0.63	Americas	4
Tieghemella africana	0.53-0.66	Africa	3
Toluifera balsamum	0.74	Americas	5
Torrubia sp.	0.52	Americas	5
Toulicia pulvinata	0.63	Americas	5
Tovomita guianensis	0.60	Americas	5
Trattinickia sp.	0.38	Americas	5
Trema orientalis	0.31	Asia	5
Trema sp.	0.40	Africa	5
Trichilia lecointei	0.90	Americas	4
Trichilia prieureana	0.63	Africa	5
Trichilia propingua	0.58	Americas	5
Trichoscypha arborea	0.59	Africa	5
Trichosperma mexicanum	0.41	Americas	5
Trichospermum richii	0.32	Asia	5
Triplaris cumingiana	0.53	Americas	5
Triplochiton scleroxylon.	0.28-0.44	Africa	3
Tristania sp.	0.80	Asia	5
Trophis sp.	0.44	Americas	1
Turpinia ovalifolia	0.36	Asia	5
Vantanea parviflora	0.86	Americas	4
Vatairea guianensis	0.70	Americas	4
Vatairea paraensis	0.78	Americas	4
Vatairea sericea	0.64	Americas	4
Vateria indica	0.47	Asia	5
Vatica sp.	0.69	Asia	5
Vepris undulata	0.70	Africa	5
Virola michelii	0.50	Americas	4
Virola reidii	0.35	Americas	1
Virola sebifera	0.37	Americas	1

TABLE 5.6 [6] BASIC WOOD DENSITY (D) OF TROPICAL TREE SPECIES (OVEN-DRY TONNES (MOIST M^{-3}))

1 = Baker *et al.*, 2004b; 2 = Barbosa and Fearnside, 2004; 3 = CTFT, 1989; 4 = Fearnside, 1997; 5 = Reyes *et al*., 1992

Species	Density	Continent	Reference
Vismia sp.	0.41	Americas	5
Vitex doniana	0.40	Africa	5
Vitex sp.	0.52-0.57	Americas	5
Vitex sp.	0.65	Asia	5
Vitex stahelii	0.60	Americas	5
Vochysia densiflora	0.29	Americas	1
Vochysia ferruginea	0.37	Americas	1
Vochysia guianensis	0.53	Americas	4
Vochysia lanceolata	0.49	Americas	1
Vochysia macrophylla	0.36	Americas	1
Vochysia maxima	0.47	Americas	4
Vochysia melinonii	0.51	Americas	4
Vochysia obidensis	0.50	Americas	4
Vochysia surinamensis	0.66	Americas	4
Vouacapoua americana	0.79	Americas	4
Warszewicsia coccinea	0.56	Americas	5
Wrightia tinctorea	0.75	Asia	5
Xanthophyllum excelsum	0.63	Asia	5
Xanthoxylum martinicensis	0.46	Americas	5
Xanthoxylum sp.	0.44	Americas	5
Xylia xylocarpa	0.73-0.81	Asia	5
Xylopia frutescens	0.64	Americas	5
Xylopia nitida	0.57	Americas	4
Xylopia staudtii	0.36	Africa	5
Zanthoxylum rhetsa	0.33	Asia	5
Zizyphus sp.	0.76	Asia	5

TABLE 5.7 [vii] BASIC WOOD DENSITY (D) OF SELECTED TEMPERATE AND BOREAL TREE TAXA		
Taxon	**D [oven-dry tonnes (moist m^{-3})]**	**Source**
Abies spp.	0.40	2
Acer spp.	0.52	2
Alnus spp.	0.45	2
Betula spp.	0.51	2
Fagus sylvatica	0.58	2
Fraxinus spp.	0.57	2
Larix decidua	0.46	2
Picea abies	0.40	2
Picea sitchensis	0.40	3
Pinus pinaster	0.44	4
Pinus radiata	0.38 (0.33 - 0.45)	1
Pinus strobus	0.32	2
Pinus sylvestris	0.42	2
Populus spp.	0.35	2
Prunus spp.	0.49	2
Pseudotsuga menziesii	0.45	2
Quercus spp.	0.58	2
Salix spp.	0.45	2
Tilia spp.	0.43	2

1 = Beets et al., 2001
2 = Dietz, 1975
3 = Knigge and Shulz, 1966
4 = Rijsdijk and Laming, 1994

TABLE 5.8 [viii] DEFAULT VALUES OF BIOMASS EXPANSION FACTORS (BEFS)			
Climatic zone	**Forest type**	**Minimum dbh (cm)**	**BEF (overbark)**
Boreal	Conifers	0-8.0	1.35 (1.15-3.8)
	Broadleaf	0-8.0	1.3 (1.15-4.2)
Temperate	Conifers: Spruce-fir	0-12.5	1.3 (1.15-4.2)
	Pines	0-12.5	1.3 (1.15-3.4)
	Broadleaf	0-12.5	1.4 (1.15-3.2)
Tropical	Pines	10.0	1.3 (1.2-4.0)
	Broadleaf	10.0	3.4 (2.0-9.0)

Note: BEFs given here represent averages for average growing stock or age, the upper limit of the range represents young forests or forests with low growing stock; lower limits of the range approximate mature forests or those with high growing stock. The values apply to growing stock biomass (dry weight) including bark and for given minimum diameter at breast height; Minimum top diameters and treatment of branches is unspecified. Result is above-ground tree biomass.

Sources: Isaev *et al*., 1993; Brown, 1997; Brown and Schroeder, 1999; Schoene, 1999; ECE/FAO TBFRA, 2000; Lowe *et al*., 2000; please also refer to FRA Working Paper 68 and 69 for average values for developing countries (http://www.fao.org/forestry/index.jsp)

TABLE 5.9 [ix] DEFAULT VALUES FOR LITTER AND DEAD WOOD CARBON STOCKS				
Climate	**Forest type**			
	Broadleaf deciduous	**Needleleaf evergreen**	**Broadleaf deciduous**	**Needleleaf evergreen**
	Litter carbon stocks of mature forests		**Dead wood carbon stocks of mature forests**	
	(tonnes C ha^{-1})		**(tonnes C ha^{-1})**	
Boreal, dry	25 (10 - 58)	31 (6 - 86)	n.a.[b]	n.a
Boreal, moist	39 (11 - 117)	55 (7 - 123)	n.a	n.a
Cold Temperate, dry	28 (23 - 33)[a]	27 (17 - 42) [a]	n.a	n.a
Cold temperate, moist	16 (5 - 31) [a]	26 (10 - 48) [a]	n.a	n.a
Warm Temperate, dry	28.2 (23.4 - 33.0)[a]	20.3 (17.3 - 21.1)[a]	n.a	n.a
Warm temperate, moist	13 (2 - 31) [a]	22 (6 - 42)[a]	n.a	n.a
Subtropical	2.8 (2 - 3)	4.1	n.a	n.a
Tropical	2.1 (1 - 3)	5.2	n.a	n.a

Source:

Litter: Note that these values do not include fine woody debris. Siltanen *et al.*, 1997; and Smith and Heath, 2001; Tremblay *et al.*, 2002; and Vogt *et al.*,1996, converted from mass to carbon by multiplying by conversion factor of 0.37 (Smith and Heath, 2001).

Dead Wood: No regional estimates of dead wood pools are currently available – see text for further comments

[a] Values in parentheses marked by superscript "a" are the 5th and 95th percentiles from simulations of inventory plots, while those without superscript "a" indicate the entire range.

[b] n.a. denotes 'not available'

Notes (extracted from the 2006 IPCC Guidelines):

Countries can apply the default carbon stock estimates for litter, and if available dead wood pools, provided in Table 5.9, but should recognize that these are broad-scale estimates with considerable uncertainty when applied at the country level. Table 5.9 is incomplete because of the paucity of published data. A review of the literature has identified several problems. The IPCC definitions of dead organic matter carbon stocks include litter and dead wood. The litter pool contains all litter plus fine woody debris up to a diameter limit of 10 cm (see Chapter 1, Table 1.1). Published litter data generally do not include the fine woody debris component, so the litter values in Table 5.9 are incomplete.

While it is the intent of the IPCC Guidelines to provide default values for all variables, it is currently not feasible to provide estimates of regional defaults values for litter (including fine woody debris < 10 cm diameter) and dead wood (> 10 cm diameter) carbon stocks. Litter pool estimates (excluding fine woody debris) are provided in Table 5.9.

TABLE 5.10 [x]
DEFAULT REFERENCE (UNDER NATIVE VEGETATION) SOIL ORGANIC C STOCKS (SOC_{REF}) FOR MINERAL SOILS (TONNES C HA^{-1} IN 0-30 CM DEPTH)

Climate region	HAC soils[1]	LAC soils[2]	Sandy soils[3]	Spodic soils[4]	Volcanic soils[5]	Wetland soils[6]
Boreal	68	NA	10[#]	117	20[#]	146
Cold temperate, dry	50	33	34	NA	20[#]	87
Cold temperate, moist	95	85	71	115	130	
Warm temperate, dry	38	24	19	NA	70[#]	88
Warm temperate, moist	88	63	34	NA	80	
Tropical, dry	38	35	31	NA	50[#]	86
Tropical, moist	65	47	39	NA	70[#]	
Tropical, wet	44	60	66	NA	130[#]	
Tropical montane	88*	63*	34*	NA	80*	

Note: Data are derived from soil databases described by Jobbagy and Jackson (2000) and Bernoux *et al.* (2002). Mean stocks are shown. A nominal error estimate of ±90% (expressed as 2x standard deviations as percent of the mean) are assumed for soil-climate types. NA denotes 'not applicable' because these soils do not normally occur in some climate zones.

[#] Indicates where no data were available and default values from *1996 IPCC Guidelines* were retained.

* Data were not available to directly estimate reference C stocks for these soil types in the tropical montane climate so the stocks were based on estimates derived for the warm temperate, moist region, which has similar mean annual temperatures and precipitation.

[1] Soils with high activity clay (HAC) minerals are lightly to moderately weathered soils, which are dominated by 2:1 silicate clay minerals (in the World Reference Base for Soil Resources (WRB) classification these include Leptosols, Vertisols, Kastanozems, Chernozems, Phaeozems, Luvisols, Alisols, Albeluvisols, Solonetz, Calcisols, Gypsisols, Umbrisols, Cambisols, Regosols; in USDA classification includes Mollisols, Vertisols, high-base status Alfisols, Aridisols, Inceptisols).

[2] Soils with low activity clay (LAC) minerals are highly weathered soils, dominated by 1:1 clay minerals and amorphous iron and aluminium oxides (in WRB classification includes Acrisols, Lixisols, Nitisols, Ferralsols, Durisols; in USDA classification includes Ultisols, Oxisols, acidic Alfisols).

[3] Includes all soils (regardless of taxonomic classification) having > 70% sand and < 8% clay, based on standard textural analyses (in WRB classification includes Arenosols; in USDA classification includes Psamments).

[4] Soils exhibiting strong podzolization (in WRB classification includes Podzols; in USDA classification Spodosols)

[5] Soils derived from volcanic ash with allophanic mineralogy (in WRB classification Andosols; in USDA classification Andisols)

[6] Soils with restricted drainage leading to periodic flooding and anaerobic conditions (in WRB classification Gleysols; in USDA classification Aquic suborders).

[1] Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Table 4.1

[2] Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Table 4.3

[3] Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Table 4.4

[4] Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Table 4.5

[5] Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Table 4.8

[6] Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Table 4.13

[vii] Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Table 4.14

[viii] Source: IPCC Good Practice Guidance for LULUCF – Table 3A.1.10

[ix] Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Table 2.2

[x] Source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Table 2.3