



Forestry Department

Food and Agriculture Organization of the United Nations

FRA 2000

**GUIDELINES FOR ASSESSMENTS IN
TROPICAL AND SUB-TROPICAL
COUNTRIES**

Rome 4 November 1998



The Forest Resources Assessment Programme

Forests are crucial for the well-being of humanity. They provide foundations for life on earth through ecological functions, by regulating the climate and water resources, and by serving as habitats for plants and animals. Forests also furnish a wide range of essential goods such as wood, food, fodder and medicines, in addition to opportunities for recreation, spiritual renewal and other services.

Today, forests are under pressure from expanding human populations, which frequently leads to the conversion or degradation of forests into unsustainable forms of land use. When forests are lost or severely degraded, their capacity to function as regulators of the environment is also lost, increasing flood and erosion hazards, reducing soil fertility, and contributing to the loss of plant and animal life. As a result, the sustainable provision of goods and services from forests is jeopardized.

FAO, at the request of the member nations and the world community, regularly monitors the world's forests through the Forest Resources Assessment Programme. The next report, the Global Forest Resources Assessment 2000 (FRA 2000), will review the forest situation by the end of the millennium. FRA 2000 will include country-level information based on existing forest inventory data, regional investigations of land-cover change processes, and a number of global studies focusing on the interaction between people and forests. The FRA 2000 report will be made public and distributed on the world wide web in the year 2000.

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Document was edited by Henk Simons & Walter Marzoli

Abbreviations

BEF	Biomass Expansion Factor
BV	Biomass of inventoried volume
CATIE	Centro Agronómico Tropical de Investigación y Ensemanza
Cirad	Centre de coopération internationale en recherche agronomique pour le développement
EDC	Eros Data Centre
FAO	Food and Agricultural Organization of the United Nations
FORIS	Forest Resources Information System
FRA	Forest Resources Assessment
GIS	Geographic Information System
SNU	Sub National Unit(s)
UN-ECE	United Nations Economic Commission for Europe
VOB	Volume Over Bark
WD	Wood Density
WCMC	World Conservation Monitoring Centre

1 Introduction

The state of the world's forest is of continuing concern. Previous global assessments have revealed an alarming degree of degradation, fragmentation and depletion of forests. The United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro 1992, highlighted these concerns, which have continued through a number of follow-on conferences.

The Forest Resources Assessment Programme, implemented by FAO, Rome, and UN-ECE Geneva, addresses these concerns by providing periodic assessments of the world's forest resources. The factual information provided by these assessments is used by international organisations, non-governmental organisations, individual countries, and others in debating forest policy and forging solutions to identified problems.

The mission of FAO's forest resources assessment programme, carried out by the Forestry Department, is to *provide the world community reliable information to describe and understand the situation of the world's forests and related resources and how they change over time*. To carry out this mission, FAO's Forest Resources Assessment Programme:

1. Supports capacity building by providing technical assistance to developing countries in the conduct of national forestry assessments;
2. Co-ordinates forest resources assessments for both developing and industrialised countries; and
3. Produces global forest resources assessment data bases and periodic reports.

The Global Forest Resources Assessment 2000 (FRA 2000) is presently the main activity within the Programme and will report on the state of the world's forest by the year 2000 and will include information on forest area (status 2000 and change), ecological aspects of forests and economical potentials of forests. One major part of the FRA 2000 reporting is the assessment and standardization of existing country data on forests.

FRA 2000 is carried out in two parts: assessment of (a) temperate and boreal regions, jointly conducted by UN-ECE and FAO and (b) the tropics and subtropics, carried out by FAO. The assessment work is carried out in close cooperation with the contributing countries.

This document, *Guidelines for Assessment*, is a reference guide to facilitate the compilation and standardized reporting of existing information of forests in tropical and subtropical countries for use in the 2000 assessment. FRA 2000 contains a wide range of information elements, more than any other previous survey. However, the guidelines focus primarily on a set of core parameters, including forest area, forest plantations and forest volume and biomass.

Specifically the guidelines

1. present briefly the information content and assessment procedures of the FRA 2000 for the tropics and subtropics (chapter 2).

2. provide guidance and instructions for data compilation, according to a standard framework of terms and definitions¹FRA 2000 (chapter 3-5).
3. provide basic standard formats for collection of country data on forest resources pertaining to natural forest area, forest plantations, forest volume & biomass (Annex 1).

(FAO's assessments are not intended to reproduce available national statistics or replace them, but to make an objective appraisal of the current state of forest resources and of the rates of change, following a standard methodology and classification system, which allows comparability at global and regional levels.)

¹ *Terms and Definitions for the Global Forest Resources Assessment 2000* (FAO 1998).

2 The Global Forest Resources Assessment 2000

2.1 FRA 2000

2.1.1 Objectives and information content

The immediate objectives for the FRA 2000 are to:

1. Carry out an assessment of forest resources (including information on the products and services provided by forests) on a global basis;
2. Estimate the changes in forests that have taken place since the last assessment in 1990;
3. Compare these changes with the results of all past assessments to establish trends;
4. Provide information that helps understand the reasons for and the effects of change, including the social, economic, and environmental implications;
5. Disseminate results, data bases, and methodologies to interested national and international institutions, world-wide.

The information elements of FRA 2000, defined at the Expert Consultation held in Kotka, Finland in June 1996 (Nyssönen & Athi 1996), are:

Forest and land cover estimates -- status 2000 and change

- forest area by country and at global levels
- land cover change processes and deforestation trends
- forest volume and biomass

Ecological aspects of forests

- status of forests in protected areas
- ecosystem biological diversity (naturalness and fragmentation)
- forest cover change by ecological zones
- biomass change processes
- forest fires (annual area burned and number of fires)

Economic potential of forests

- forests available for wood supply
- fellings and removals
- non-wood forest products and forest services
- forest ownership
- indicators of sustainable forest management

Information system

- electronic information system to disseminate results, conduct dialogues with national correspondents on technical matters and to facilitate information transfer to FAO

Global maps including:

- global land cover map
- ecological zone map
- deforestation risk map

2.1.2 Approaches and methodology

Given the scope and complexity of FRA 2000, various approaches to data capture are needed to cover all aspects of the assessment. Three basic and complementary information generation mechanisms, or modules, available to FRA 2000 are a) the assessment based on existing information and b) assessment based on newly generated information through a global remote sensing survey, and c) special studies.

a) The assessment based on existing information will generate estimates of forest cover, volume and biomass, and other parameters for individual countries. The FAO Forest Resources Information System (FORIS) is based on existing national forest inventory information to derive estimates using international classification standards for a common point in time. With the introduction of new elements of information under the thematic areas (economic potential of forests, forest ownership and forest degradation) this module will now need to rely on a wide variety of information sources and expert opinions, which will require increased contact and dialogue with individual countries. Major activities include:

- dialogue and agreements for information sharing with national organisations of all countries
- collection, archiving and database development of incoming inventory information

- analysis and "adjustment" of the information in co-operation with countries for generating assessments according to common standards for a common reference year
- dialogue and approval process with national organisations concerning results
- technique development for assessment of new forest / environmental parameters.

b) State and change assessments using remote sensing The FORIS information will be complemented by newly generated information on current deforestation rates and, most important, recent trends, based on the results of the remote sensing survey. Survey results will also describe the associated processes and biomass fluxes, and provide information on the underlying cause-effect mechanisms; thematic and consistent information that *only* the remote sensing survey has the capacity to generate. Results will be produced at global, regional and ecological levels since reporting at the country level is not practical with the remote sensing survey. The survey provides as well spatial information necessary for analyses of biological diversity and forest fragmentation.

c) Special studies The information content proposed for FRA 2000 (see 2.1.1) implies a broadening of the assessment into new areas. Much of the information is not available in tropical and subtropical countries in such a way that consistent totals can be produced, nor can it be detected by remote sensing (alone). For a number of parameters, special studies will be carried out, including:

- volume and biomass: state and changes
- status of protected forests
- ecosystem biological diversity
- wood supply / fellings and removals
- non-wood forest products
- forest fires.

Beyond the strict technical needs for information generation for the 2000 assessment, the FRA programme conducts country capacity building activities with participating developing countries. To the extent possible, training and country participation is carried out for all elements of the FRA 2000 assessment through workshops, expert consultations and financial support to national agencies.

2.1.3 Implementation of FRA 2000

FRA 2000 is implemented by FAO and UN-ECE in cooperation with many partners. The FRA programme in Rome is responsible for the overall management and coordination of the assessment. The FRA programme maintains the Forest Resource Information System or *FORIS* database, where basic forestry data from developing countries is archived. Other units within the Forestry Department also contribute to FRA 2000, by carrying out special studies related to non wood forest products, trees outside forests, fellings and removals, plantation

surveys and others. The FAO Regional Offices support data gathering activities in their respective regions.

All UN and FAO member countries have been formally requested to collaborate in the provision of new data for the assessment, as well as in validation exercises and the consolidation of assessment results. Country involvement is of particular importance for estimating the variables of forest area and their changes. Some of the other institutions and organizations which contribute to FRA 2000 include:

<u>Institution</u>	<u>Area of collaboration</u>
CATIE	Data collection for Central America
Cirad	Volume and biomass
EDC	Global forest mapping
WCMC	Protected status of forests, biodiversity

3. Data sources

The collection of existing information is a continuous process. For every new assessment the data sources used in the previous assessments are consulted and new sources identified through contacts in the countries. When new sources are identified, they are compared with the older information to determine which provides the best and most reliable *baseline*². *Comparability*³ between two (or more) information sources is also evaluated, verifying their utility to serve as representative surveys in a continuous time-series.

Information sources for the FAO assessments typically include:

- Tabular data derived from forest inventories and land cover surveys.
- Forest and land cover maps in digital or analogue format.
- Documents (inventory reports, etc.).

Frequently many institutions contribute to providing all the information needed for an assessment, this includes forestry agencies (particularly their inventory, statistics or mensuration units), environmental and natural resources agencies, resource survey units, and mapping and remote sensing institutions. Other organizations, such as regional development agencies may also have relevant information. With this in mind, data compilers need to check with a range of national agencies and organizations to ascertain the existence of new information.

Once the new data sources are transmitted to FAO they will be reviewed and recorded into a bibliographic reference system and archived in the FRA programme's library.

² *Baseline* refers to the inventory or assessment used for estimating forest area according to FAO standard classification and reference year. The single most appropriate assessment is always used as the baseline. Appropriateness is a function of reliability, currency and compatibility with the FAO assessment objectives.

³ *Comparability* between assessments requires that the techniques and protocols employed in the various surveys are sufficient to produce findings which can be compared. Few countries today, even in industrialized regions, are generating comparable multi-date information, as techniques and assessment objectives frequently change from survey to survey.

4. Forest area assessment

For the tropical and subtropical regions a distinction is made in the assessment of *natural forests* and forest plantations. *Natural forest* includes *forest undisturbed by man*, *forest disturbed by man* and *semi-natural forest* (see *Terms and Definitions*, FAO 1998). Input tables and instructions for compiling data on natural forests, and plantations are included in the present document, as are those for volume and biomass (Annex 1).

4.1 Natural forests

The assessment of a country's natural forest area is outlined as follows:

- a) Record the basic features of the forest inventory or land cover survey that provide the input data
- b) Match the country forest/land cover classification with the FRA classification
- c) Assess the reliability of the survey/inventory to serve as a baseline
- d) Compile or disaggregate statistics, as required, for reporting on sub-national areas for the nationally-reported baseline data and FRA standardized country data (adjusted to FAO classification)
- e) Estimate forest cover area for reference years (e.g. 2000 and 1990), by application of adjustment functions (modeling) which relate forest area changes to ecological settings and human population developments.

(Data compilers, in cooperation with the FAO FRA team, are involved in the first four steps, while the FAO FRA team in Rome produces the country estimates for the standard reference years. (Further explanation is given on steps b through e).

4.1.1 Matching the national forest or land cover classification with the FRA classification

Information on forest area must reflect the area actually covered with forests, assessed through field survey or remote sensing. In this context, statistics referring to legally defined forest area (gazetted forests, reserved forests, forest land, etc.) are not categorically considered forest⁴.

Country data sources are commonly heterogeneous, and may include recent and past forest inventories and maps produced using different techniques (aerial photographs, satellite imagery and

⁴ Forest for FRA 2000 is defined as land with tree a crown cover of more than 10 percent, and a tree height of at least five meters. An important distinction is made between closed (>40% crown cover) and open (10 -40 % crown cover) forest.

ground inventories) and classification schemes suited only for national requirements. As a result, the classification system adopted in the existing data may not correspond to the FRA standard classification. For validation purposes, and transparency of the forest estimation procedure, the correspondence between the original country classes and the standard classification must be reported (Annex 1, section 2, table 4). In matching the national classifications with that of FRA 2000, two types of adjustments are usually required; a) the aggregation of original (national) classes into a single FRA 2000 category and b) the disaggregation of original (national) classes into two or more FRA 2000 standard categories.

- a) **Aggregation:** Several different national forest or land-cover classes may need to be aggregated into a single FRA 2000 category, according to the comparability between national and FRA 2000 classes. For example, various detailed forest formations (e.g. evergreen, semi-evergreen, seasonal, montane forests, mangrove), distinguished in a country classification scheme, may all be grouped into the more generalized FRA 2000 category of *closed forest*.
- b) **Disaggregation:** Disaggregation refers to the process of dividing original (national) forest or land-cover classes into two or more FRA 2000 standard categories. Disaggregation is required typically when a single national class contains mosaics of various vegetation types. The mosaics may be composed of vegetation types belonging to different classes found in the standard FRA 2000 classification. An example, typical for Africa, is “mosaic of open forest, shrubs and cultivation”. Matching this class to the FRA 2000 classification might be done as follows:

Table 1. Relationship between a mosaic class and the FRA 2000 classification

National Classification	FRA 2000 Classification	Percentage of original (area)
Mosaic of open forests, shrubs, and cultivation	No direct relationship (disaggregate as below)	n.a
1 st component: open forests	Forest (or Open forest)	40%
2 nd component: shrubs	Other wooded land	40%
3 rd component: cultivation	Non-forest	20%

In such a case the open forest should be termed *forest* (or most likely *open forest*), shrubs belong to *other wooded land* and cultivation to *non forest*. These cases are often difficult to interpret and a combination of indirect methods, local knowledge and sound judgment is needed to perform the matching exercise. The overall detail and quality of the explanatory documentation accompanying the inventory also affects the final quality of the matching. Additionally, the ecological context must be considered while allocating fractions of the mosaic class to the different standard categories. Assumptions used for area calculation must be documented to ensure transparency and repeatability. The area proportions of each of the country classes assigned to standard FRA 2000 classes needs to be recorded. For the example presented in Table 1, the national class “mosaic of open forest, shrubs and cultivation” was split into 40% *open forest*, 40% *shrubs* and 20% *other*

land. By documenting the procedure, it is always possible to revise forest area estimates by allocating different proportions of the mosaics to the standard classes.

4.1.2 Reporting country statistics by sub-national unit

The original country statistics and the derived statistics adjusted to the FRA standard classification should be reported (or disaggregated as needed) into sub-national units (SNU), i.e. by state, province or region. The reasons for compiling and analyzing data at sub-national level can be summarized as follows:

- a) SNU represent smaller geographic units of an entire country. Therefore the ecological conditions and vegetation formations found within them have less variation than the entire set of national conditions.
- b) Population statistics, which comprise an important parameter of the adjustment function for standardizing statistics to a common reference year are commonly collected by SNU. (Using SNU provides a practical means of stratifying observations (i.e. forest area, population density/growth) into strata with lower variance -- an important condition for application of the FRA modeling approach.)
- c) Good collateral information on ecological and socio-economic conditions by SNU is useful for developing perspectives on the reliability of the corresponding forest statistics.
- d) Forest cover statistics at sub-national level can be used to calibrate and improve existing regional/sub-regional forest maps.
- e) Use of SNU is essential for producing statistics on forests by ecological zone.
- f) Use of SNU improves the flexibility of the data collection and time series development. By compiling information for each distinct SNU, a composite of different sources with varying reference years can be used to cover an entire country without causing significant problems in data standardization.

For very small countries no segregation into SNU may be possible or needed since the country as a whole is sufficiently small. However, for most countries a breakdown into primary administrative units (typically provinces, states or regions) is needed. Units should not be too small, as the reliability of the statistics may decrease, due to errors in maps or increases in variance of sample surveys.

For some large countries (e.g. Brazil, India, Indonesia) statistics reported by secondary administrative level is required (for example, districts after states in India, and municipios after

states in Brazil). This is not always possible and a reasonable trade off between size and reliability must be ultimately determined depending on the type and availability of the forest inventory data.

While collecting SNU forest cover data, the existing SNU should be maintained to the extent possible, especially where the size of the units is already sufficient. On the other hand, special efforts should be made in large countries where no SNU breakdown of the forest cover area is presently available (i.e. only a forest area statistics are available for the country as a whole). In such cases, even if no new inventories are available, a significant contribution and improvement in the overall FRA estimate may be achieved by reporting forest statistics by SNU.

If new data at sub-national level are available, existing SNU should be maintained for reporting on FRA 2000. This will facilitate the development of a coherent time series between the two inventories. FAO will provide each country with the SNU currently on file with FRA. Most countries will find that FAO's listing of SNU are identical to their own administrative system.

4.1.3 Assessment of reliability and relevance to FRA 2000

All data sources require an appraisal of their reliability and significance for use in FRA 2000. This appraisal helps to identify information quality, including geographic, methodological and thematic gaps, in addition to tracking the country's progress in advancing the quality of their assessments. Standardized criteria for objective evaluations of information source reliability are not easily developed or carried out. As countries develop inventories and assessments for national purposes and conduct them under conditions unique to their situation, there are inevitable inconsistencies between various national surveys. At the same time, the appropriateness of a national inventory to serve as a reporting element in FRA 2000 can be evaluated in a general way (Table 2).

Table 2. Reliability classes of forest inventories / surveys

Code	Reliability class	Description
1	High reliability	Forest inventories based on high resolution satellite data (LandSat TM, SPOT, IRS, etc.) or aerial photographs, supplemented with extensive field checking or sampling.
2	Medium reliability	Forest inventories based on medium resolution satellite data (typically LandSat MSS) with limited ground truthing or those using high-resolution satellite data or aerial photography with limited or no field checking or sampling
3	Low reliability	Surveys or maps based on heterogeneous material like vegetation maps, land use survey, etc. generally at coarse resolution and often out of date. The reliability class 3 represents the cases with insufficient information and need for a reliable baseline in the future.

Descriptions above are indicative and should be applied along with good professional judgment. In particular, the distinction between reliability classes 1 and 2, is determined by the amount of field work involved and/or the detail of the input data. In absence of extensive field checking or sampling, the reliability class 1 should not be assigned even if high resolution remote sensing data or aerial photographs are used. Data compilers should provide a full explanation behind the assigned reliability codes.

For appraisal of estimates derived from remote sensing data, the suitability of the sensor, spectral and spatial resolution, and scale need to be considered in relation to the vegetation types surveyed. For example, the results derived from NOAA-AVHRR satellite are of limited effectiveness in dry areas, while accuracy is usually better in wet and moist zones.

Compatibility of the country classification system with the FRA 2000 classification also impacts the final accuracy of FRA 2000 reporting (see 4.1.5). Countries are encouraged to develop a matching scheme between the FRA 2000 classifications while developing their new national surveys.

4.1.4 Estimation of forest cover area for reference years

In addition to matching or adjusting national statistics to the FRA 2000 classification scheme, the statistics also require an adjustment to common reference years, namely 1990 and 2000. Standardization to common reference years is conducted with the help of an adjustment function or forest-cover change model, which relates forest cover changes to ancillary variables, i.e. human population change and the ecological zone of the respective forest area (Scotti 1990, FAO 1993).

In using the model, the most recent and reliable forest inventory data (in the form of statistics adjusted to FRA 2000 classes) are used as a baseline for forest cover area. This baseline, along with population density, population growth and ecological zone. All of these variables are usually related to the subnational units of the countries.

In addition to adjusting forest cover area to reference years the model is used to produce estimates on forest cover area change in the absence of reliable time series information from countries (e.g. 1980 - 1990 - 2000). Using historical data on demographic developments, the model can be used to simulate past trends in forest cover changes, useful for global change studies.

4.1.5 Common problems in forest area assessment

Experience from past FAO forest resources assessments has highlighted several common problems that may confront the data compiler.

Differences between national and FRA definitions of forests.

For the purposes of FRA 2000, forest is defined as having a minimum tree crown cover of 10 percent (see *Terms and Definitions*, FAO 1998). However, other national and international classification systems use different criteria and/or crown cover density to define forest. Crown cover thresholds used by different countries and organizations may range from 2% (dry areas) to 70% or even 100%. Therefore, experts with good local knowledge of the vegetation and familiarity with the inventory providing the baseline statistics are needed to make adjustments for classifications.

Accurate adjustments are crucial to the overall accuracy of the assessment, since the forest area will be decreased if the crown cover threshold used by the country is lower than FRA's or increased if the threshold is higher. The amount of forest area to be added or deducted will have to be determined for each specific case and typically requires a re-evaluation of the original inventory report, maps or field surveys. Depending on the complexity and size of the inventory this procedure may be quite time consuming. FAO will assist any developing country that requests help in re-allocating the statistics from national inventories

Shifting cultivation:

Areas under forest fallow due to shifting cultivation systems may present major sources of discrepancies between country-supplied statistics and the final FRA 2000 information. In FRA 2000, Forest fallow system is classified under *other wooded land* and refers to all complexes of woody vegetation derived from the clearing of natural forest for shifting agriculture. Forest fallow system consists of a mosaic of various successional phases of forest regeneration, secondary forest, patches of uncleared forests, and agriculture areas (some containing trees) which cannot be segregated (especially from satellite imagery). Therefore, accurate distinctions between forest and forest fallow system may not always possible in national surveys and some countries classify forest fallow as forest. In such cases, forest cover estimates for FRA 2000 will be lower than the country estimate due to the removal of the fraction of forest fallow system from the area of forest

Distinction between natural forests and plantations:

Natural forest formations should be separated from plantations for FRA 2000 reporting. Significant differences in economic potential and ecology of natural forests compared to plantation forests, as well as the way in which most developing countries compile statistics necessitate the distinction. However, it is often difficult to identify planted forests as a separate entity from natural forests in national surveys. For example in the case of satellite imagery-based forest cover assessments at 1:250,000 scale (often used for national surveys) it may not be possible to distinguish natural forests from plantations, especially if patches of mature plantation are surrounded by natural forests. Additionally, young plantations may not show up on the imagery at all. These factors can lead to either the over or under-estimation of forests or plantations.

4.2 Forest plantations

Forest plantations constitute an increasingly important part of the forest resources for many countries. Area estimates for existing forest plantations are generally derived from the following sources:

- Statistically designed inventories of forest plantations
- Statistics for planted areas reported by planting agencies or appearing in national progress reports
- Estimates derived from nursery production
- Expert local knowledge

A comprehensive review of the official plantation area should be made which includes information on how area statistics have been generated. Ideally, the area of forest plantations should be derived from statistically designed forest inventories/surveys which can provide a reliable estimate of net planted area as well as species composition, volume and age class distribution. Moreover if inventories of forest plantation are carried out on successive occasions they can provide information on growth and yield also. Unfortunately such information is rarely available in developing countries, and in most cases the forest plantation area is based on official statistics, reports and conjecture.

Estimation of gross and net area of forest plantations

Statistics for planted areas reported by planting agencies or appearing in national progress reports are frequently not representative. Examples of such problems include planting agencies reporting inflated area figures, planned plantations reported as if actually planted, replanting of failed plantations added to the total, etc. Another problem involves the conversion of seedling production statistics to estimates of area planted, without validation of actual plantation areas on the ground.

Often more attention has been paid to achieving quantitative targets rather than on plantation quality or suitability for either production or protection purposes. Many plantations have failed

because protection and maintenance have been neglected after planting targets have been met or through lack of resources.

In the absence of national statistics on mortality, survival rates for plantations are made by an expert panel according to country, plantation type (industrial or non-industrial), age, organization responsible for raising plantation, the species planted, and site, etc. Indications for plantation survival rates for tropical countries were obtained in a survey of the plantation resources as part of the FRA 1990. An average survival rate of 70% was found (Pandey, 1995). In absence of reliable information on actual planted areas or good estimators of mortality from experts, the default reduction factor of 0.7 will for used for determining net plantation estimates at the global level.

Stocking levels of plantations should also be reported. Stocking refers to the quantity of standing timber on a site, which can be estimated through various means (stem counts, volume or basal area measurements). For each tree species an optimum stocking level will ideally help to produce an optimum yield for a particular site.

5 Volume and biomass

Information on volume and biomass of forests is important for determining carbon storage, as well as the economic potential of the growing stock of forest available for wood supply.

5.1 Growing stock volume

Reliable quantitative information on the volume of growing stock can be obtained only from statistically-designed forest inventories and field measurements. Information provided by countries should consider the following for FRA 2000 reporting:

- Species composition. The volume measurements must refer to all forest-tree species. If only a portion of the species were measured (e.g. commercial species) the volume estimations are not useful for country and global estimates since it is impossible to derive the total growing stock. However, when only volume estimates are available for commercial species they still should be reported.
- Minimum diameter. The minimum diameter at breast height should be 10 cm. If a different minimum diameter was selected this should be clearly specified. Guidelines for converting volumes with different minimum diameters to 10 cm is discussed later on in this section.
- Volume definition. The definition of growing stock volume (see *Terms and Definitions*, FAO 1998) should refer to free bole (from stump or buttresses to crown point or first main branch), measured over bark (Volume Over Bark or VOB), thus excluding branches, at breast height. If branches are included or if a different definition is used this should be mentioned and accounted for in the calculations

Due to the absence of uniform information on forest volume in developing countries, FAO is implementing a new programme to fill gaps in existing information through modeling. This new programme requires that all existing country-supplied information is geo-referenced. Whenever possible, the geographic coordinates of the inventoried area should be supplied together with the inventory results, as follows:

- Polygon and attribute. To register volume information in a GIS in the form of a polygon with volume as an attribute, a georeferenced map is needed showing the inventoried area(s) along with the attribute information on average volume per hectare, range and standard deviation.
- Point and attribute. To register volume information in GIS in the form of a point with volume as an attribute the latitude and longitude of the inventory area are needed along with the attribute information on volume per hectare, range and standard deviation.

Geo-referenced forest inventory data can be analyzed together with other information layers in order to investigate the relationships between volume and other spatial and statistical variables such as soils, slopes, bio-climatic indices, population density, etc. This approach can be used for filling data gaps for the forest types for which no information is available.

Geo-referenced volume information can also be combined with remote sensing data for estimating volume and biomass state and changes. In view of the general scarcity of field data, all existing information should be used. Geo-referencing does not require extensive work and greatly enhances the possibility of using the information for various analytic tasks.

Growing stock volume conversion

When volume data are reported for only a portion of the forest (usually tree species with a minimum diameter of 25-30 cm) volume estimates must be generated using mathematical conversion algorithms (Brown 1990). To obtain growing stock volumes for all dbh classes down to 10 cm dbh volume, expansion factors should only be applied to inventories where the minimum diameter is in the range of 25 - 30 cm . Expansion factors range from 1.1 to 2.5.

5.2 Woody biomass

Biomass refers to the amount of carbon stored in the forest. Estimates for forest biomass are important for developing perspectives on global carbon cycling, which has implications for climate change studies. Biomass is also a fundamental source of fuel for cooking and heating for a large share of the human population living in rural areas in developing countries.

Biomass estimation

Primary biomass data generated through field measurements are relatively scarce, therefore estimates must be derived from other existing data., i.e. forest volume data. The methodological approaches presented here to determine biomass using existing information are taken from the FAO Forestry Paper 134 *Estimating biomass and biomass change of tropical forests – A primer* based on the work of Sandra Brown (Brown 1997).

Two approaches for biomass estimations are presented in the paper, one for estimating biomass density based on existing volume data and an alternative approach for estimating biomass density based on stand tables. The first approach works best with FRA data and has good application in the tropics. The method, based on existing volume data (expressed as cubic meters per hectare) has application only for closed forests – either secondary or mature (growing in wet to semi-dry climates). The primary data needed to apply the methodology is VOB per hectare (see definition given in the previous section). If the minimum diameter is larger than 10 cm the VOB information can be used with some adjustments as shown below.

Biomass density can be calculated from VOB/ha by first estimating the biomass of the inventoried volume and then expanding this value to take into account the biomass of the other aboveground components as follows

$$\text{Total Forest Biomass (t/ha)} = \text{VOB} * \text{WD} * \text{BEF}$$

where

VOB = Volume over Bark (or Growing Stock) (m^3 / ha)

WD = volume weighted average wood density (t of oven dry biomass per m^3 green volume)

BEF = biomass expansion factor (ratio of aboveground oven-dry biomass of trees to oven-dry biomass of inventoried volume)

Ideally, a weighted average wood density value (based on the dominance of each species as measured by volume) should be used. However, if sufficient wood density data of forest species are not available, a weighted mean wood density based on known species, using an arithmetic mean from the table below for unknown species can be used.

Table 3 The arithmetic mean and most common wood density values (t/m^3) for tropical tree species by region (after Brown 1997)

Tropical region	Mean	Common range
Africa	0.56	0.50-0.79
America	0.60	0.50-0.69
Asia	0.57	0.40-0.69

The biomass expansion factor is defined as the ratio of total aboveground oven-dry biomass density of trees with a minimum dbh of 10 cm or more to the oven-dry biomass density of the inventoried volume. Such ratios have been calculated from inventory sources for many broadleaf forest types (young secondary to mature) growing in moist to seasonally dry climates throughout the tropics. Analysis of these data shows that BEFs are significantly related to the corresponding biomass of the inventoried volume according to the following equations.

$$\text{BEF} = \text{Exp}(3.213 - 0.506 * \text{Ln}(\text{BV}) \text{ for } \text{BV} < 190 \text{ t/ha}$$

$$= 1.74 \text{ for } \text{BV} = 190 \text{ t/ha}$$

(sample size = 56 adjusted $r^2 = 0.76$)

where

BV = biomass of inventoried volume in t/ha, calculated as the product of VOB/ha (m^3/ha) and wood density (t/m^3)

References

- Brown, S., 1990. *Volume expansion factors for tropical forests. Unpublished Paper.* Prepared for the FAO Forest Resources Assessment 1990 Project. (Available from author).
- Brown, S., 1997. *Estimating biomass and biomass changes of tropical forests: A primer.* FAO Forestry Paper 134, Rome, Italy.
- FAO, 1993. *Forest resources assessment 1990: tropical countries.* FAO Forestry Paper 112, Rome, Italy.
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- Pandey, D. 1995. *Forest resources assessment 1990: Tropical forest plantation resources.* FAO Forestry Paper 128. Rome, Italy.
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Appendix 1: Input tables for data compilation

General introduction

Countries participating in the FRA 2000 are requested to complete the following tables using their latest forest resources statistics. The tables are the principle means by which data are being collected for the FRA 2000 for individual countries. FRA country focal points will be requested to follow up on data collection through a validation process.

The input tables with accompanying instructions are divided in five sections:

1. Bibliographic references (Table 1)
2. Natural forests / other wooded land (Table 2 - 5)
3. Volume and biomass (of natural forest) (Table 6)
4. Plantations (Table 7 - 13)
5. Additional information on forest area (Table 14 - 18).

Sections 2 to 4 contain the core information of FRA 2000, reflecting the minimum reporting requirements. Section 5 covers additional information on forest area, i.e. division of forest using various criteria (degree of human modification, availability for wood supply, ownership, type of management). This information is not less important, but is likely less available, which implies that uniform reporting on these parameters at the global level is more difficult to achieve.

Before starting to complete the tables the data compilers are referred to the relevant terms and definitions (FAO 1998) and the chapters in this documents related to sections 1 to 4.

One aspect, pertinent to all tables, is the recording of the reference year. Two types clearly need to be distinguished:

a) year of publication of a reference document (needs no further explanation).

b) reference year of the inventory (data): refers to for instance the average year of satellite images or aerial photographs used for a forest inventory or land cover mapping, year of the field inventory for volume measurements, year that plantation statistics were updated, etc. In all input tables this is specified as "Reference year".

Section 1: Bibliographic references

Table 1 - Bibliographic references

Purpose: to record all bibliographic references, including reports, books, maps, digital data etc. that have been used to compile information on a country's forest resources (and to complete the input tables).

Instructions: along with the basic bibliographic elements (Title, author(s), year of publication, etc.), the information content of the source should be recorded, together with a short review of the source indicating relevance and quality for FRA 2000.

Section 2: Natural forests / other wooded land

The purpose of this section is to analyze the state and change of the country's natural forest area by main forest formation (open/closed), and the area of other wooded land. The sequence of the tables follows the steps described in 4.1 of this document.

Table 2 - Description of forest inventories/surveys

Purpose: to provide information on forest inventories or any other survey that contains information on forest/land cover. Based on this information, the quality and utility for forest area estimates in FRA 2000 will be assessed.

Instructions:

- list information on the type of inventory, methodology used, geographic coverage, reference year, vegetation types included, information content and maps. Reference year in this context refers to actual date of the inventory, for instance the average year of satellite images used for forest/land cover mapping, or to the year that the field inventory was carried out
- assess the reliability of the source (see 4.1.3 in this document for a description of the reliability assessment procedure).

It is very important that data reviewers pay special attention in defining all these parameters above, since this table will be the main source for deciding which source will be taken as baseline for a given country. In addition, special consideration should be given to the inventories for the countries or sub-national units for which multi-date observations are available, since the successive observation must be coherent to derive meaningful time series. In the case of multi-date observation a remark on the compatibility with previous observations should be added.

Table 3 - Area of woody vegetation according to national classification

Purpose: to provide information on the extent of the natural forest types according to the national classification (= classification used in the described inventory), by sub-national unit

Instructions: In table 3 the area (in 000 ha) of each national vegetation type used in the described inventory (table 2) needs to be reported by sub-national unit (province, region). One table should be prepared for each sub-national unit, or, when a breakdown by sub-national unit is not available, one for the whole country. For each inventory described, a set of tables need to be completed.

Table 4 Comparability between national classification and FRA 2000 classification

Purpose: to illustrate the comparability between the national classification and the FRA 2000 classification.

Instructions:

- one table needs to be completed for each inventory/survey
- list in the left column the national forest / vegetation types, grouped by or in correspondence with the main FRA 2000 classes (closed and open forest, shrubs, forest fallow system) (Terms and Definitions, FAO 1998). Section 4.1.1 of this document describes the methodology for matching the national forest/land cover classification with the FRA 2000 classification. Several national types may be grouped into one FRA 2000 class since local classifications are generally more detailed. However, in certain cases one national class may have to be split into several standard classes, typically in the case of mosaics. In such cases the proportion to be assigned to each standard class must be indicated.
- data compilers are encouraged to give a full explanation of the matching in the comments, further explained by the definitions of the national classes (listed or attached).

Table 5 – Area of natural forests and other wooded land (FRA 2000 classification)

Purpose: to present the extent of natural forest and other wooded land according to FRA 2000 classification, by sub-national unit.

Instructions: Table 5 presents derived information. The area of FRA 2000 classes is generated by combining the information of Table 3, i.e. area by local class, with the one of Table 4 giving the correspondence with the FRA 2000 classification scheme. Separate tables need to be prepared for each inventory/survey and the reference date of each must be specified. Several geographic units can be reported in the same table if they belong to the same inventory and have the same reference date.

Section 3: Volume and biomass (of natural forests)

Information on volume and biomass of trees is important to indicate the role of forests in carbon storage. In addition, volume of the growing stock of forest available for wood supply is an important indicator of the forest production potential. Aim of the volume data collection is to generate a geo-referenced database of volumes. The data will also be used for estimation of woody biomass (see Section 5.2 of this document), on which primary data are scarce. If

information on woody biomass, based on field measurements, is available, it should be recorded in the same way as volume

Table 6 - Volume data (of natural forests)

Purpose: to provide information on volume data derived from field inventories.

Instructions: the table is divided in three parts, as follows:

a) forest inventory description: record the various details of the inventory: country, name of the inventory, geographic coverage of the inventory (national / partial), reference year and the total inventoried area. In addition some information on the geographic location needs to be recorded, either in form a sketch map showing the inventoried area in a geographic context like location within the country, or geographic coordinates (latitude/longitude) or some other geographic reference like administrative unit, watershed, or others as available.

b) Inventory methodology: the following details need to be recorded:

- the stratification criteria used
- the type imagery used if any (aerial photographs, satellite images)
- a brief description of the sampling design (in this respect a sketch of the sampling design can be attached, since it is often attached to inventory reports), including the sampling intensity (percentage sampled),
- the species coverage (complete or partial)
- the minimum diameter measured
- the type of volume (including or excluding branches, underbark or overbark, etc.)

c) Inventory results: covering the following details:

- the reporting unit, i.e. the unit for which the results are presented. For example, when results of a national inventory are given by province, the reporting unit will be province. Other reporting units could be a forest reserve, management compartments, blocks or others depending on the inventory design. the reporting units must be big enough to be mapped at a scale of 1:1,000,000.
- Volume data: expressed in average volume (in cum) per hectare
- the sampling error for average volume per hectare (at 95% probability)
- stand and stock tables for the Reporting Units defined above. Average stand and stock tables should be attached when available.

Section 4: Plantations

Purpose of the forest plantation study:

1. to detect trends at regional and global level in forest plantation areas, species, ownership or objectives for planning and policy purposes;
2. to model potential present and future wood and fiber supply from plantations;
3. to estimate carbon sequestration by plantations;
4. to estimate the extent to which plantations may be reducing pressure on natural forest wood supply;
5. to estimate the area of plantations established for the provision of environmental functions and services
6. to estimate the area and species of plantations established for the production of fuelwood.

Scope of the forest plantations statistics.

Data provided in the following tables should include:

- total national forest plantations resources (Table 7);
- forest plantations raised for industrial roundwood (Tables 8 and 9) and inventory results of industrial roundwood plantations (Table 10) or estimated growth rates of industrial roundwood species (Table 11);
- “non-forestry” species such as rubber (Table 12a) or coconut, rubber or oil palm (Table 12b), established for the production of wood or fiber products;
- fuelwood plantations (Table 13);
- forest plantations established for environmental and other purposes (Table 14).

The tables should not include figures for trees planted outside the forest (see definition of forest below) even where they actually or potentially provide wood or fiber. This will be the subject of separate studies:

Reliability of data Table 7 includes provision for “standardization”, that is adjustment of the reported figures to allow for known inaccuracies.

Species. Entries in the database are generally by species. Tables should show the main (say 5 or 6) species per country. Aggregation of species will be necessary for modeling

Proportional estimates It is realized that considerably more information is requested than many countries will have available. For each table a figure is requested for the total (shaded boxes), but if figures are not available for the sub-total, it would still be helpful to give a proportional or % estimate. For example, in Table 7, if the Total area for industrial

roundwood supply is known, but not its distribution between ownership types, it would be helpful for a % estimate of the amount grown by the private sector etc.

Section 5: Additional information on forest area

This section is intended to compile information on other aspects of forest area, in order to know more than just the quantitative figure. The information relates to current status of management, ownership, degree of human modification and wood supply potential of the forests. It is expected that this information will be less complete and less comprehensive. A decision on which parameter to include in the global synthesis will be taken after reviewing the completeness and reliability of the information.

In order to facilitate the data compilation, the available information will be reported at national level, either for the total forest area or if possible by country forest classes. In certain large countries, the data compilers are encouraged to report the information at sub-national level.

It is realized that considerably more information is requested than many countries will have available. If an exact area figure is not available for a certain parameter, it would still be helpful to give a proportional or % estimate.

Additional tables include the following:

Table 15 - Forest area by degree of human modification

Table 16 - Forest area by wood supply potential

Table 17 - Forest land by ownership

Table 18 - Forest area under ma

Note: For table 17 the term forest land is used. This is due to the fact that ownership is likely to be available only for legally defined forest (Reserved forests, Gazetted forests, etc.). It is felt that ownership of actual forests is likely to be impossible to assess in developing countries. This is the only case where forest will be referred to a legal definition and not to actual forest.

Section 1: Table 1 - Bibliographic references

<u>Country</u>	
<u>Title</u>	
<u>Author</u>	
<u>Year</u>	
<u>Source</u>	
<u>Date of consult.</u>	
<u>Location</u> (of publication)	

Description of source
(including type of source, overall quality assessment and utility for FRA 2000)

Information content (check one or more topics as appropriate)

Natural Forest	<input type="checkbox"/>	Protected areas	<input type="checkbox"/>
Plantations	<input type="checkbox"/>	Biodiversity	<input type="checkbox"/>
Other wooded land	<input type="checkbox"/>	Forest ownership	<input type="checkbox"/>
Forest area change	<input type="checkbox"/>	Wood supply potential	<input type="checkbox"/>
Total volume	<input type="checkbox"/>	Non-wood forest products	<input type="checkbox"/>
Total biomass	<input type="checkbox"/>	Trees outside forest	<input type="checkbox"/>
Commercial volume	<input type="checkbox"/>	Forest fires	<input type="checkbox"/>

Name of reviewer:

Section 2: Table 2 - Description of forest inventories/surveys

Country Reference year

Title of inventory

Type of inventory

Field / aerial photos / satellite images / ...

Brief summary of methodologies used

Reporting level

National / sub-national

Country coverage

Complete / partial

Map output

yes / no (also indicate
format: analogue /
digital)

Scale of the map

Vegetation types included yes/no

Natural forests	<input type="checkbox"/>
Plantations	<input type="checkbox"/>
All forests	<input type="checkbox"/>
Other wooded land	<input type="checkbox"/>

Additional information included yes/no

Area by forest formation	<input type="checkbox"/>
Volume	<input type="checkbox"/>
Biomass	<input type="checkbox"/>
Forest naturalness	<input type="checkbox"/>
Forest biodiversity	<input type="checkbox"/>
Forest ownership	<input type="checkbox"/>
Wood supply potential	<input type="checkbox"/>

Remarks

Reliability class

1=high 2=medium 3=low

Section 2: Table 3 - Area of woody vegetation according to national classification

Country :

Reference year:

Geographic Unit:

Forest and other woody vegetation types (country classification)	Area (000 ha)
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
Etc.	
Subtotal of country classes corresponding with FRA 2000 forest and other wooded land	
Subtotal other land	
Total land area	

Comments :

Section 2: Table 4 - Comparability between country classification and FRA 2000 classification

Country:

Reference year:

Geographic Unit:

Title of the inventory/survey:

Forest and other woody vegetation types (country classification)	Corresponding FRA 2000 classes
	Closed Forest
	Open Forest
	Shrub
	Forest fallow system

Note: Open and closed forest make up “natural forest”; shrub and forest fallow make up “other wooded land”

Comments:

Section 2: Table 5 - Area of natural forests and other wooded land according to FRA 2000 classification

Country :

Reference year:

Name of Geographic Unit	Natural forests			Other wooded land (OWL)		
	Closed forests	Open forests	Total Natural forests	Shrubs	Forest fallow system	Total OWL
1.						
2.						
3.						
4.						
5.						
6.						
etc						
Total Country						

area in 000 ha

Section 3: Table 6 - Volume data (of natural forests)

Country :

Reference year:

Part 1 : Forest Inventory Description

Name of the Inventory:

National Forest Inventory (Yes or No):

Geographic location:

Total inventoried area (000 ha):

Sketch map attached (Yes or No):

Part 2: Inventory methodology

Stratification criteria:

Sampling design:

Sampling intensity (%):

Species coverage:

Minimum diameter:

Type of volume measured:
(including or excluding branches, underbark or overbark, etc.)

Part 3: Inventory results (by reporting unit)

Reporting Unit name:
 area (ha):

Average volume per hectare (m³/ha):

Sampling error for average volume per hectare at 95% probability (%):

Stand and stock tables attached (Yes or No):

Comments:

Section 4: Table 7 - Total reported area, all forest plantations.

Country:

Reference year:

Type 1	Ownership 2	Reported Area (000 ha) 3
Industrial roundwood production	Private sector, large scale	
	Private sector, small scale	
	Community	
	Public sector, large scale	
	Public sector, small scale	
Total industrial roundwood		
Rubber	Private sector, large scale	
	Private sector, small scale	
	Community	
	Public sector, large scale	
	Public sector, small scale	
Total “non-forest” species		
Fuelwood and poles	Private sector, large scale	
	Private sector, small scale	
	Community	
	Public sector, large scale	
	Public sector, small scale	
Total fuelwood and poles		
Other purposes	Private sector, large scale	
	Private sector, small scale	
	Community	
	Public sector, large scale	
	Public sector, small scale	
Total Other purposes		
Grand total, all forest plantations		

Source document: [please give the official report, official inventory title etc for the figures. If estimates please state]

Notes to Table 7

Column 1:

Total industrial roundwood production to Table 8

Total, Rubber to Table 12a (note that “non-forest” species are not included in Table 7)

Total, fuelwood and poles to Table 13

Total, other purposes to Table 14

Column 3. Please state reliability of the “reported area” and suggest if a reduction factor should be applied to derive a more realistic estimate.

Small-scale refers to small areas of plantation under one owner of no more than 20 ha. Large scale to holdings of larger than 20 ha.

Section 4: Table 8 - Forest plantations for industrial roundwood production

Country:

Reference year:

Species	Area	Purpose											
		Saw/veneer logs						Pulpwood					
1	2	Rotation 3	6-10 4	11-20 5	21-40 6	>40 7	Total 8	Rotation 9	1-5 10	6-10 11	11-20 12	>20 13	Total 14
etc etc													
Total													

This table refers to forest plantations established for the industrial production of roundwood for saw and veneer logs and for pulpwood.

Col. 1, main species or groups of species

Col. 2, derived from Table 7,

Col. 3 and 9., R = Rotation in years

Cols 4-7 and 10-13, age classes, ultimately to be changed to year planted, depending on when the questionnaire is sent out to e.g.

col. 4 will be 1994-98

Cols. 8 and 14, total for saw and veneer logs and for pulpwood respectively.

Section 4: Table 9- Proposed future industrial roundwood plantation programmes

Country:

Reference year (of prognosis):

Ownership	2001-05		2006-10		2011-2015		2016-2020	
	Saw/veneer	Pulp	Saw/veneer	Pulp	Saw/veneer	Pulp	Saw/veneer	Pulp
Private sector, large scale								
Private sector, small scale								
Community								
Public sector, large scale								
Public sector, small scale								
Total								

Area in 000 ha

The figures requested in this table are the planned future industrial roundwood forest plantation programmes, by 5 year period, to give a more realistic trend than would be derived by extrapolating from the past data trends.

Section 4: Table 10 - Standing volume of industrial roundwood, derived from inventory

Country:

Unit of measurement:

Reference year (of inventory):

Standing volume by product	Species A	Species B	Species C	Other species or groups of species				Total
Sawlog/veneer								
Pulp								
Other								
Total								

Table 10 for use where a country has a current inventory.

Section 4: Table 11 - Estimated mean annual increment (MAI), m³/ha/yr, by main industrial plantation species

Country:

Reference year:

Species	Object	MAI
Species A	Sawlog/veneer	
	Pulp	
Species B		
Species C		
etc		

Table 11 data to provide information on growth to estimate or model standing volume where a country has no current inventory

Section 4: Table 12a and b - Estimated area and production of industrial wood and fiber of “non-forest” species

Country:

Reference year:

“Non-forest” species refer to species such as rubber, coconut and oil palm that have traditionally been established for the provision of a non-wood product but which are now also yielding wood or fiber which is used for industrial purposes, either sawn or in reconstituted form.

Table 12a - Estimated area and production of industrial wood and fiber from rubberwood

Species	Total area	Area currently available for wood or fiber supply (thousand ha)	Estimated current production of wood or fiber (thousand m ³)
Rubber			

Note that the area of rubberwood plantations is included in the definition of “forest” (see Terms and Definitions, FAO 1998) and should thus be included under the total area of forest.

Table 12b - Estimated area and production of industrial wood and fiber from coconut, oil palm and other “non-forest” species

Species	Total area	Area currently available for wood or fiber supply (thousand ha)	Estimated current production of wood or fibre (thousand m ³)
Coconut			
Oil palm			
Other			
Total			

Note that the species shown in Table 12b are **not** included in the definition of “forest” and are thus not included in the total area of forest.

Section 4: Table 13 - Areas of fuelwood and pole plantations

Country:

Reference year

Species	Purpose		Total
	Industrial	Rural/domestic	
Total			

Area in 000 ha

Section 4: Table 14 - Areas of plantations established for environmental and other purposes

Country:

Reference year:

Object	Species	Area
Watershed management	Species A	
	Species B etc	
	Mixtures	
Recreation	Species A	
	Species B etc	
	Mixtures	
etc		
Total		

Plantations established for environmental and other purposes broadly include plantations established primarily for environmental or recreational or other non-productive purposes.

Section 5: Table 15 - Forest area by degree of human modification

Country:

Reference year:

Forest type (local classification)	Undisturbed Natural Forest (000 ha)	Natural Forest disturbed by man (000 ha)	Semi-natural Forest (000 ha)
1.			
2.			
3.			
4.			
5.			
6.			
etc			
All forest types			

References:

Comments:

Section 5: Table 16 - Forest area by wood supply potential

Country :

Reference year:

Natural forest type (country classification)	Forests available for wood supply (000 ha)	Forests not available for wood supply (000 ha)
1.		
2.		
3.		
4.		
5.		
6.		
etc.		
All forest types		

References:

Comments:

Section 5: Table 17 - Forest land ownership

Country :

Reference year:

Forest land in public ownership (000 ha)			Forest land owned by indigenous/tribal peoples (000 ha)	Forest land in private ownership (000 ha)
State	Other ¹	Total		

¹ Other: Forest land belonging to cities, municipalities, villages and communes. Also includes any publicly owned forest and other wooded land not elsewhere specified.

References:

Comments:

Section 5: Table 18 - Area of forest under management

Country:

Reference year:

Forest type (using country classification)	Total area (000 ha)	Area under management ¹ (000 ha)			
		Production	Conservation	Other purpose (pls specify)	Total
1.					
2.					
3.					
4.					
5.					
6.					
etc.					
All forest types (Total Forest)					

¹: area under management is defined here as the forest which is managed for various purposes (conservation, production, other) in accordance with a formal, nationally approved, management plan over a sufficiently long period (five years or more)

References:

Comments: