

Forest area and forest area change

Background paper to the Kotka V Expert Consultation

1 Introduction

Forest area provides the first indication of the relative importance of forests in a country or region, while estimates of forest area change over time provide an indication of the demand for land for forestry and other land uses, and may also illustrate the impact of significant environmental disasters and disturbances on forest ecosystems. Forest area is relatively easy to measure, and this variable has therefore been selected as one of the 48 indicators for monitoring progress towards the Millennium Development Goals agreed by the United Nations (particularly Goal 7 – Ensuring environmental sustainability).

2 FRA 2005 variables

For FRA 2005, countries were asked to report on the following parameters related to the extent of forest resources:

- Area of “forest”
- Area of “other wooded land”
- Area of “other land with tree cover”

Whereas the first two parameters have traditionally been included in the global forest resources assessments, the third parameter is a new variable aimed at capturing those areas in which forest cover criteria are met, but the predominant land use is agricultural (e.g. orchards and oil-palm plantations) or urban (e.g. urban parks)

2.1 Definitions

Category	Definition
Forest	<p>Land spanning more than 0.5 hectares with trees higher than 5 metres 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.</p> <p>Forest is determined both by the presence of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 metres (m) in situ. Areas under reforestation that have not yet reached but are expected to reach a canopy cover of 10 percent and a tree height of 5 m are included, as are temporarily unstocked areas, resulting from human intervention or natural causes, which are expected to regenerate</p> <p><u>Includes:</u> areas with bamboo and palms provided that height and canopy cover criteria are met; forest roads, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas such as those of specific scientific, historical, cultural or spiritual interest; windbreaks, shelterbelts and corridors of trees with an area of more than 0.5 ha and width of more than 20 m; plantations primarily used for forestry or protective purposes, such as rubber-wood plantations and cork oak stands.</p> <p><u>Excludes:</u> tree stands in agricultural production systems, for example in fruit plantations and agroforestry systems. The term also excludes trees in urban parks and gardens</p>
Other wooded land:	<p>Land not classified as forest, spanning more than 0.5 hectares; with trees higher than 5 m and a canopy cover of 5–10 percent, or trees able to reach these thresholds in situ; or with a combined cover of shrubs, bushes and trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use.</p>

Other land with tree cover:	<p>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 m at maturity.</p> <p><u>Includes:</u> groups of trees and scattered trees in agricultural landscapes, parks, gardens and around buildings, provided that the area, height and canopy cover criteria are met; includes tree plantations established mainly for other purposes than wood, such as fruit orchards.</p>
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2.2 Data availability

Information on the extent of **forests** was provided by 228 of the 229 countries and areas reporting for FRA 2005 – the exception being the Marshall Islands, for which no quantitative information was available. Four countries or areas (Guam, Guyana, Lebanon and the Occupied Palestine Territory) did not provide an estimate of forest area for 1990. All other countries and areas provided estimates for all three reporting years (1990, 2000 and 2005).

Information on the extent of **other wooded land** as of 2005 was available from 180 countries and areas, which together account for 64.9 percent of total forest area. Only 61 countries and areas reported on current extent of **other land with tree cover**.

2.3 Data quality

Easier access to satellite imagery and some recent national inventories has resulted in updated information on forest area in many countries. The area-weighted average year for the latest data on forest area was thus 2000 for FRA 2005, compared with 1990 for FRA 2000.

Nevertheless, many developing countries still lack updated information. Some countries have comprehensive information from only one point in time, while others have estimates that are incompatible, making trend analyses difficult. (Refer also to the section on methodologies for data collection below.)

2.4 Methodologies for data collection

The information on forest area was provided by countries.

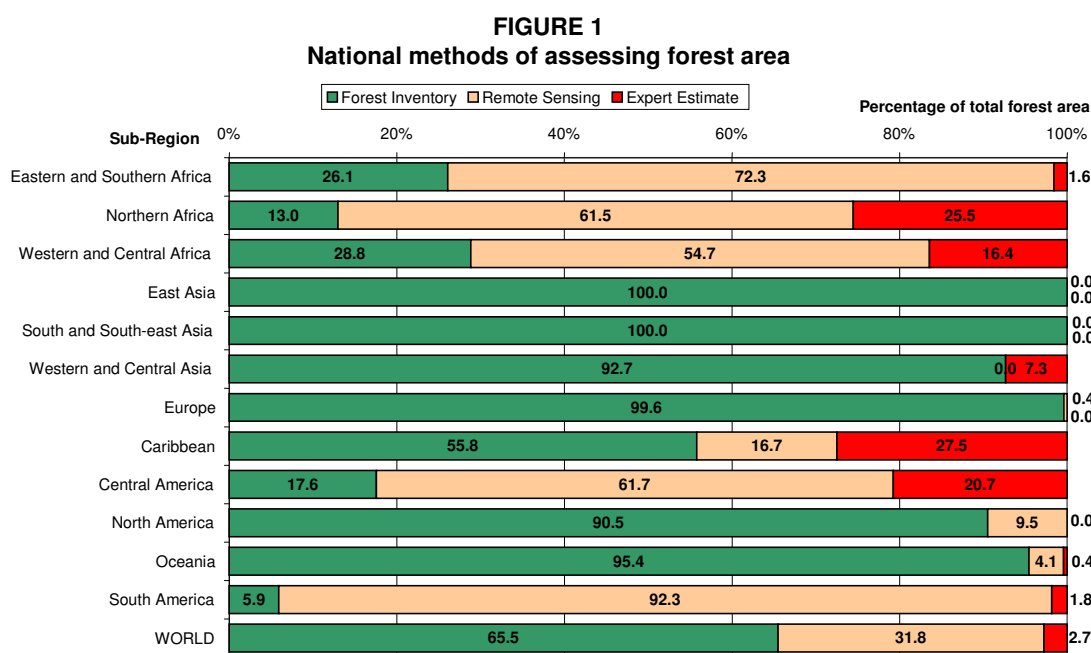


Figure 2 above (based on Table 2 in the FRA 2005 Main Report) illustrates the main methodology used by countries for their latest forest area assessment. While forest inventories (often in combination with remote sensing) are prevalent in most of the industrialised countries and in Asia, remote sensing is most common in Africa and Latin America. Expert estimates are often used for countries with limited forest area.

The low threshold for crown cover and minimum area poses some problems when remote sensing imagery is the main source of the information – as does the land use requirement and temporarily unstocked areas. On the other hand, remote sensing offers a relatively affordable way of updating information on the area and distribution of forests and other wooded land.

2.5 Issues related to the definitions and classification

The definitions used for “forest”, “other wooded land” and “other land” are well established. Some countries have used slightly different thresholds for the minimum area, crown cover or tree height and these have generally been accommodated to ensure compatibility between assessments in a given country and consistency in national reporting. As mentioned above, the low thresholds for crown cover and minimum area pose some problems when remote sensing imagery is the main source of the information – as does the land use requirement.

A number of countries had difficulties estimating the area of other wooded land. Specific problems were reported for those areas where grazing is one of the main uses and it was difficult to ascertain whether such lands were “predominantly under agricultural land use” or not.

“Other land with tree cover” was a new variable in FRA 2005 aimed at capturing those areas in which forest cover criteria are met, but the predominant land use is agricultural (e.g. orchards and oil-palm plantations) or urban (e.g. urban parks).

Issues have also been raised regarding the classification of “temporarily unstocked forests” (also problematic in remote sensing studies) and as to whether forest plantations should be included in the definition of “forest”. In the latter case, the table related to forest characteristics facilitates separate analysis.

Several countries were reluctant to include rubber plantations in the definition of “forest” for FRA 2005.

One country has requested that areas dominated by coconut (planted or natural) used primarily for forestry purposes (coco-lumber) be included in the definition of forests. The current definition makes this possible as long as the minimum thresholds for area, crown cover and height are met, in addition to the land use. (Most coconut groves/plantations would not be considered forests as the main use is agricultural (copra).)

3 Proposals for FRA 2010

The proposals presented below are based on the responses to the FRA 2005 evaluation questionnaire sent to all national correspondents, FAO staff, the FRA Advisory Group and representatives of forest related organisations and reporting processes (Members of the Collaborative Partnership on Forests, criteria and indicator processes and environmental NGOs). Feedback received on the release of the Key Findings of FRA 2005 and the Main

Report has also been included where relevant. These proposals have not been prioritised and are presented for discussion by working group participants.

3.1 Deletions

Given the low response rate, it could be argued that the category “other land with tree cover” should be excluded. However, this class helps narrow the gap between the “forest cover” assessed through remote sensing and the “forest” as defined by countries and in the global forest resources assessments.

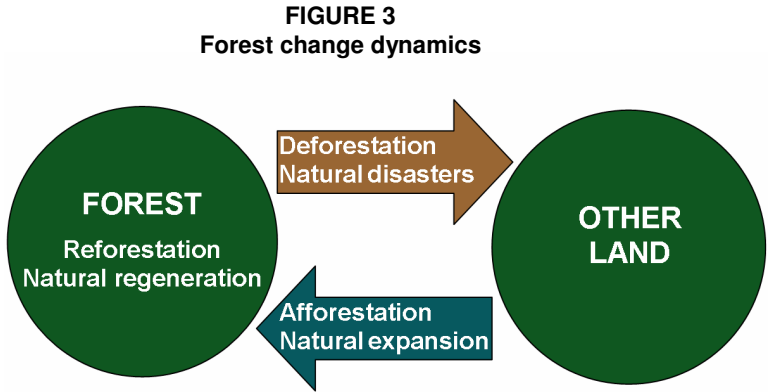
3.2 Additions

Spatial distribution of forests. FRA 2005 did not include a remote sensing study, nor were maps showing the location of forests requested from countries. Several suggestions have been received to show the distribution of forests.

“Trees outside forests” comprise an important resource, both in terms of wood and non-wood forest products and the environmental and social services they provide. Some of these are captured under the category “other land with tree cover”, but roadside plantings and individual trees are e.g. not included. A methodology for assessing “trees outside forests” has yet to be developed, but a thematic study could perhaps be included as part of the next assessment.

Forest change dynamics. In FRA 2005, information on changes to the forest area was limited to the calculation of net area changes per year for each country, based on information provided for 1990, 2000 and 2005. These changes were then aggregated to the subregional, regional and global level. A rough estimate of the global deforestation rate was also provided, but was based on a number of assumptions.

Figure 3 below is a simplified model illustrating forest change dynamics. It has only two classes: forests and all other land. A reduction in forest area can happen through either of two processes. Deforestation, which is by far the most important, implies that forests are cleared by people and the land converted to another use, such as agriculture or infrastructure. Natural disasters may also destroy forests, and when the area is incapable of regenerating naturally and no efforts are made to replant it, it too reverts to other land.



Where part of a forest is cut down but replanted (reforestation), or where the forest grows back on its own within a relatively short period (natural regeneration), there is no change in forest area.

The net change in forest area is thus the sum of all negative changes due to deforestation and natural disasters and all positive changes due to afforestation and natural expansion of forests.

For FRA 2010, it is proposed to include estimates of each of the following elements of forest changes: **deforestation** (due to human intervention and natural disasters), **afforestation** and **natural expansion** of forests. It may not be possible to obtain this information at country level, but regional and global estimates could be obtained through interpretation of remote sensing imagery of selected sample plots from different points in time.

Forest fragmentation. The total area of forest does not indicate the size of the individual blocks of forest, information which is crucial for monitoring the ability to effectively conserve biological diversity and to provide a number of other environmental and socio-economic services. It may not be possible to obtain information on this variable through country reporting, but it could be included in a remote sensing component.

3.3 Other changes proposed

Respondents to the FRA 2005 evaluation questionnaire proposed the following specific changes to the definition of “forest”:

- A change to the explanatory notes to allow the inclusion of areas dominated by **coconut** (planted or natural) which are used primarily for forestry purposes (coco-lumber).
- Exclusion of **rubber plantations** in the definition of “forest”.

3.4 Proposals for how the information could be obtained

The response rate to the table on **forest area** in FRA 2005 was very high indicating that it should be retained as part of the country reports.

The spatial distribution of forests could be displayed on a world map using remote sensing technology, as was done for FRA 2000.

An assessment of “**trees outside forests**” could be undertaken as a thematic study given the lack of accepted methodology.

Guidance is sought from Kotka on how information on rates of **deforestation, afforestation, natural expansion and forest fragmentation** can best be obtained and at which level (national, regional and/or global) this information should be collected. Refer to Annex 1 for an illustration of various potential indices for forest fragmentation and to the background paper on remote sensing.

4 Summary of proposals for FRA 2010

Tables:

Current T1

FRA 2005 Categories	Area (1000 hectares)		
	1990	2000	2005
Forest			
Other wooded land			
Other land			
...of which with tree cover ¹⁾			
Inland water bodies			
TOTAL			

1) Area of “Other land with tree cover” is included in the area reported under “Other land” and should therefore be excluded when calculating the total area for the country.

- Change the reporting years (change 2005 to 2010).
- Exclude “other land with tree cover”?
- Include note to allow coconut groves for forestry purposes in the definition of forests?
- Exclude or include rubber plantations in the definition of forest?

Thematic studies:

Trees outside forests

Any other proposals?

Remote sensing component:







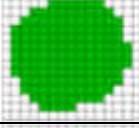
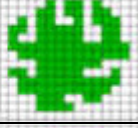




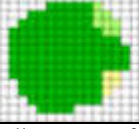
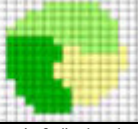
Distribution of forest (forest cover map)

Forest/land use change dynamics (Deforestation/Afforestation/Natural expansion (sampling))

Fragmentation (sampling? forest cover map?)

Annex 1. Forest fragmentation

Spatial indices for different configurations of forested landscapes with low and high values.

Spatial Indices	Low Value	High Value	Description	Units
Area Metrics			Area proportion of one class type in % of a specific landscape	- % per km ² - % to whole area
Patch Density Metrics			Total number of patches or their relative proportions in a given area	- No. per km ² - No. per whole area
Edge Metrics			Amount of edges occurring between patches or classes	- m per km ² - m to whole area
Shape Metrics			Measure for the complexity of forest shapes	High / Low values per: - km ² - Whole area
Core Area Metrics			Measure for inner central parts of patches in relation to the total patches	Percentage of the total core area in relation to: - km ² - Whole area
Nearest Neighbour Metrics			Minimum distance (as edge to edge) from one patch to the nearest neighbouring patch of the same class.	Averages (meters) of all the minimum distances within - km ² - Whole area
Diversity Metrics			Extent to which one or a few class types dominate the landscape index.	High / Low values per: - km ² - Whole area

(Source: Based on information at <http://www.gmes-forest.info/index.htm>)