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COMMITTEE ON FORESTRY

Item 8(b) of the Provisional Agenda

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THE GLOBAL FOREST RESOURCES ASSESSMENT 2000 SUMMARY REPORT

Information Note

ACKNOWLEDGEMENTS

The FRA 2000 represented a major effort of the FAO Forestry Department, member countries, donors, partners and individual experts. Countries provided the basic data for the assessment in the form of technical reports and analyses. Many contributed staff to interpret satellite imagery and conduct technical work to assess forest and ecological conditions. Several countries donated to the assessment, including Austria, Denmark, Finland, France, Italy, Japan, Sweden, Switzerland, and the United Kingdom. Valuable in-kind contributions were provided by Sweden, India and the United States. The United Nations Economic Commission for Europe (UN-ECE) collected the basic information for industrialized countries.

Important partners included the Australian Bureau of Rural Sciences; the Autonomous National University of Mexico; the Bishop Museum (US); the Brazilian Institute of Environment and Natural Resources; the Canadian Forest Service; CIRAD-Forêt (France); the Department of Remote Sensing and Landscape Information Systems, University of Freiburg (Germany); the EROS Data Center (US); the European Forest Institute (Finland); the Faculty of Agricultural and Forest Sciences of Tuscany (Italy); the Federal Agency for Nature Conservation (Germany); the Federal Research Institute for Forestry and Wood Products (Germany); the Forest National Corporation of Sudan; the Forest Survey of India; the Foundation for American Friendship (Argentina); the Institute of Remote Sensing Applications of China; the International Institute for Applied Systems Analysis (Austria); the Italian Overseas Institute; the National Aeronautics and Space Administration (US); the National Board of Forestry (Sweden); the Regional Community Forestry Training Center (Thailand); the State University of New Jersey, Rutgers; the Swedish

University of Agricultural Sciences; the Tropical Agriculture Research and Higher Education Center (Costa Rica); the Tropical Science Center (Costa Rica); the United Nations Environment Programme (UNEP); the United States Department of Agriculture, Forest Service; the University of Maryland (US); the University of Michigan (US); and the UNEP-World Conservation Monitoring Centre (UNEP-WCMC).

FAO is grateful for the support of all countries, organizations and experts inside and outside of the organization that made the assessment possible.

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ABBREVIATIONS

CATIE	Tropical Agriculture Research and Higher Education Center
CIS	Commonwealth of Independent States
COFO	Committee on Forestry
FAO	Food and Agriculture Organization of the United Nations
FRA 2000	Global Forest Resources Assessment 2000
GIS	Geographical Information System
INBAR	International Rattan and Bamboo Network
IPF	Intergovernmental Panel on Forests
IUCN	World Conservation Union
NWFP	Non-wood forest products
SCEES	Service central des enquêtes et études statistiques
SFM	Sustainable Forest Management
UN-ECE	United Nations Economic Commission for Europe
WCMC	World Conservation Monitoring Centre

ABSTRACT

The paper presents an overview of findings from the Global Forest Resources Assessment 2000 (FRA 2000). FRA 2000 was based on an exhaustive survey of inventory reports from around the world dialogues with national forestry experts and application of a core global set of definitions. The assessment concluded that the world's forest cover at the year 2000 was 3.86 billion hectares compared to FAO's previous estimate of 3.45 billion hectares in 1995. However, the two estimates are not directly comparable due to changes in definitions and the information base.

Net annual deforestation at the global level is still high at 9 million hectares, with gross deforestation estimated at 13.5 million hectares per annum. This is a significantly lower net rate compared to FAO's previous report for the period 1990-1995 (11.3 million ha per year), partly due to improved datasets. Key factors contributing to the estimate of lower net forest loss are attributed to natural regeneration of forests in industrialized countries and high rates of plantation establishment in Asia, particularly in China and India. However, the large-scale conversion of forests to other land uses was not significantly lower in the tropics between the 1980s and the 1990s.

FRA 2000 showed that the concept of sustainable forest management (SFM) continues to gain momentum around the world. Most countries are involved in international initiatives related to SFM and areas under forest management plans are increasing. But statistics on key indicators of SFM are still missing from a large number of countries. Forest and forestry information has increased in quantity over the past decade, but studies within the current assessment indicate that primary information and first-hand knowledge may not have improved significantly at the global level.

Comprehensive reports are found at www.fao.org/forestry/fo/fra/index.jsp on the FAO website.

INTRODUCTION

1. The Global Forest Resources Assessment 2000 (FRA 2000) was the most comprehensive in its fifty year history and for the first time one global definition of forest was agreed upon and used throughout the world. The assessment was a joint endeavour carried out by FAO in co-operation with its member countries and a number of partners. The agenda for FRA 2000 was developed by some of the world's leading forest inventory specialists at an expert consultation in Kotka, Finland, in 1996 (Nyyssönen & Ahti 1997). In 1997, the FAO Committee on Forestry (COFO) and the fourth session of the Intergovernmental Panel on Forests (IPF-IV) approved the consultation's findings and recommended that FAO serve as the lead agency for the assessment, working in partnership with other institutions in its execution. An important partner was the United Nations Economic Commission for Europe (UN-ECE), which served as the focal point for the assessment of the industrialized temperate and boreal countries. The synthesis of information from the industrialized and developing countries together constitutes the global assessment.

2. FRA 2000 compiled and analysed all available information about the extent, composition, protection and utilization of forests for each country. Special attention was given to estimating the rate of change of forest cover and to documenting the various factors implicated in this. The assessment was conducted as a transparent and highly participatory process, which will publish all background material and analyses. It is the most comprehensive, reliable and authoritative baseline survey of forest resources to date.

3. In addition to the country-specific survey, FRA 2000 included an independent, objective pan-tropical remote sensing survey of forest cover change, a set of global maps of forest cover and ecological zones, and the development and establishment of a forestry information system. Detailed results are available at www.fao.org/forestry/fo/country/nav_world.jsp and www.fao.org/forestry/fo/fra/index.jsp on the World Wide Web. Printed versions will be available shortly.

MAJOR FINDINGS

FOREST AREA

Country information

4. The 2000 assessment concluded that the world's forest cover at the year 2000 was about 3.86 billion hectares, or about 0.6 ha *per capita*. Net deforestation at the global level was estimated at approximately 9 million hectares per year and gross global deforestation at approximately 13.5 million hectares per year. Net deforestation rates were highest in Africa and South America, whereas afforestation, through forest plantations, significantly offset the loss of forests in Asia. In contrast, the forest cover in industrialized countries remained essentially stable (Table 1, Appendix 2).

5. FRA 2000 was the first global assessment to effectively use a common definition for forests in industrialized and developing countries alike (Appendix 1). The result of the uniform application of the forest definition had a significant impact on the global findings for the year 2000, which, in part, resulted in an estimated forest area which was 400 million ha greater than the global figure reported for 1995 (FAO, 1997). This was particularly evident in Australia and the Russian Federation. FAO's 1995 estimate for forests in Australia was 41 million ha, compared to the 2000 estimate of 158 million ha. The dramatic increase of over 115 million hectares of forest is a consequence of the application of a 10 percent canopy cover threshold for defining forest, as opposed to the 20 percent threshold used for industrialized countries in previous assessments. Accordingly, large expanses of Australia's sparsely-stocked forests were incorporated into the year 2000 estimate. In the Russian Federation, FAO's 1995 estimate was 764 million ha, compared to the year 2000 estimate of 850 million hectares.

Table 1. Regional forest cover and forest cover change

Region	Land area	Total forest 2000		Change 1990-2000		*Forest 1995*[2]	*Change 1990-95*[2]
	Million ha	Million ha	%	Million ha/year	%/year	*Million ha*	*Million ha/year*
Africa	3 008	650	17	-5.3	-0.8	*520*	*-3.7*
Asia	3 167	542	14	-0.4	-0.1	*503*	*-2.9*
Oceania	849	201	5	-0.1	n.s.[1]	*91*	*-0.1*
Europe	2 276	1 040	27	0.9	0.1	*933*	*0.5*
North & Central America	2 099	539	14	-0.6	-0.1	*537*	*-0.3*
South America	1 784	874	23	-3.6	-0.4	*871*	*-4.8*
World Total	**13 183**	**3 856**	**100**	**-9.0**	**-0.2**	***3 454***	***-11.3***

[1] n.s. means not significant. [2] according to FAO (1997), included for comparison with present estimates

6. Another factor contributing to the higher estimate for the year 2000 was the inclusion of results from inventories conducted after 1990, some of which contained improved figures that were higher than those previously reported, for example in Mozambique[1]. In other cases, such as in Kenya, more detailed breakdowns of forest classes in the inventory reports facilitated an improved reclassification of national results into the FRA 2000 global standards, thereby including some areas of forests, previously classified as other wooded lands.

7. The forest vegetation and the terminology used to describe them vary widely between countries, compounding the problem of aggregating national data into a uniform global estimate. More than 650 definitions of forest types were assembled from 132 developing countries (from 110 independent surveys). Re-classifying this information into a small set of global classes was a major challenge. The details on how the national definitions were converted into global classes are maintained in the Forestry Information System and are presented on the World Wide Web.

8. Deforestation is defined as the removal of the forest and its replacement by another land use class, such as shifting or permanent agriculture, ranching, mining or water (usually from impoundments). By definition, logging does not in itself result in deforestation, if the forest is allowed to regenerate. Reforestation refers to the re-establishment of forest formations after a temporary condition with a crown cover density of less than 10 percent. However, in many tropical countries, logging roads opens up new areas to farmers who take advantage of the clearings and begin to cultivate crops. Consequently the area is deforested due to the land use change from forest to agriculture. Net deforestation is the sum of all deforestation less gains due to afforestation (forest plantations and natural regeneration in previously unforested areas) (Appendix 1).

9. While the concept of deforestation has remained essentially consistent for FAO's assessments throughout the last 20 years, its actual implementation in the global survey is difficult due to the reliance on country information which was not developed for this purpose. For example, an increased reliance on remote sensing in national surveys, without adequate field sampling or ground truthing, has made the detection of actual changes in *land use* difficult. Instead, changes of *land cover* are assessed with satellite imagery, which may not necessarily coincide with actual changes in the use of the land.

[1] The upward revision of forest cover for 1990 due to more recent and improved national assessments in developing countries is consistent with findings reported in the interim 1995 assessment presented in the State of the World's Forests 1997.

10. From the aggregation of data supplied by countries to FAO, net annual deforestation rates for the period 1990 – 2000 were estimated at 9.0 million ha globally, as compared to previous estimates of 11.3 million ha (1990 – 1995 (FAO, 1997)) and 13.0 million ha (1980 – 1990 (FAO, 1995a)). While these estimates are not fully comparable due to the different methods employed in the various global assessments, as well as changes and updates in the country information base from which the estimates were derived, net deforestation has likely decreased since the 1980s at the global level.

11. Reductions in net deforestation (or gains in forest area) in both developing and industrialized countries were mainly due to significant increases in forest plantations and the succession of forests on abandoned agricultural lands. The current annual rate of plantation establishment is 4.5 million ha worldwide. For the 1990's as a whole, however, it was estimated that about 30 million ha (i.e. 3 million ha/year) of plantations were successfully established, half of which constitute reforestation of previously forested lands. There were no significant transitions from plantations into natural forests, or conversions into agricultural lands.

12. Natural regrowth of forests is occurring in many industrialized countries in areas where agriculture is no longer an economically viable land use. This is a process that has been occurring for several decades, and is particularly evident in some countries within the Commonwealth of Independent States (CIS), including the Russian Federation. The FRA 2000 pan-tropical remote sensing survey also revealed that about 1 million ha of other lands in the tropics revert to forest each year. Along with the establishment of plantations in Asia, these new forests contribute significantly to a lower net deforestation.

13. The above findings are illustrated in Table 2 that shows the broad fluxes of land use by major domain and in Table 3 where the gross and net changes in forest cover are summarized.

Table 2. Annual transitions between natural forest, plantations and other land 1990-2000 in millions of hectares per year [Mha/year], globally and for tropical / non-tropical countries.

Global		into (2000)		
		Natural forest	Plantations	Other land
from (1990)	Natural forest		1.5	13.5
	Plantations	n.s.		n.s.
	Other land	3	1.5	

Tropical countries		into (2000)		
		Natural forest	Plantations	Other land
from (1990)	Natural forest		1	13.5
	Plantations	n.s.		n.s.
	Other land	1	0.8	

Non-tropical countries		into (2000)		
		Natural forest	Plantations	Other land
from (1990)	Natural forest		0.5	n.s.
	Plantations	n.s		n.s.
	Other land	2	0.7	

Notes: Tropical countries include those covered by the FRA 2000 pan-tropical remote sensing survey. The estimated rate of successful plantations for the 1990's as a whole (3 million ha/year) was used.

Table 3. Gross and net change of total forest cover respective gross and net change of natural forest cover by major domain. Million hectares per year 1990-2000

Domain	Gross change	Net change	Gross change, natural forest	Net change, natural forest
Global	- 13.5	- 9.0	- 15	- 12
Tropical countries	- 13.5	- 11.7	- 14.5	- 13.5
Non-tropical countries	n.s.	+ 2.7	- 0.5	+ 1.5

Notes: Tropical countries include those covered by the FRA 2000 pan-tropical remote sensing survey. The estimated rate of successful plantations for the 1990's as a whole (3 million ha/year) was used.

Pan-tropical remote sensing survey

14. FRA 2000 included a remote sensing survey for tropical forests to assess forest change. The survey was based on sampling techniques and the use of satellite imagery and produces information at pan-tropical and regional levels. Results of the study at the pan-tropical level indicate that the world's tropical forests continue to be lost at about 8.6 million ha annually in the 1990's, compared to a loss of around 9.2 million ha during the previous decade. During the same period, the loss of closed forests dropped from 8.0 million ha in the 1980's to 7.1 million ha in the 1990's. With standard errors on these estimates at 15%, the reduction in deforestation rates between the two decades is not significant. Analysis of these results and those of specific countries is continuing, particularly on how to compare the results to the country-specific findings.

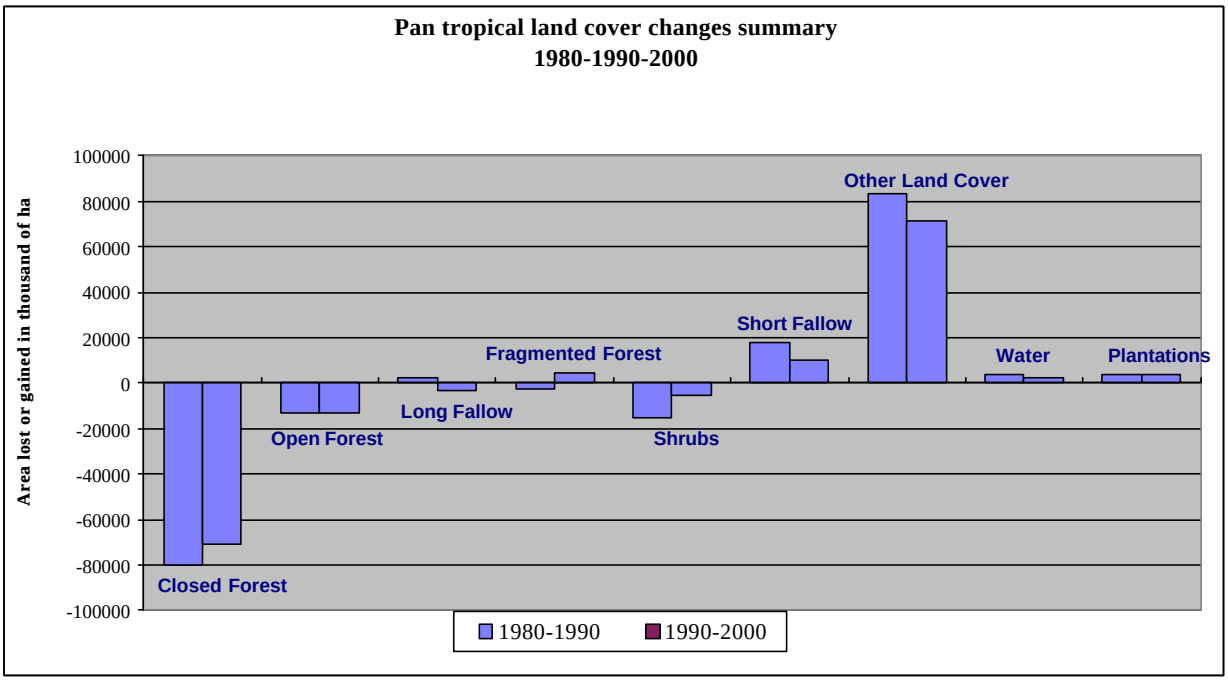
15. Stratified random sampling (10%) of the world's tropical forests was employed through 117 sample units distributed throughout the tropics[2] [3]. For each of the sample units, three Landsat satellite images from different dates provided the raw material for producing statistics on forest and other land-cover changes from the period 1980 to 1990 and from 1990 to 2000. The survey was an update of the study made for FRA 1990 (FAO, 1996), using the same sample, but observing at three (instead of two) points in time over the twenty year period 1980-2000.

16. According to the remote sensing survey, during the last decade, most of the conversion of forests were into agriculture, pastures and shifting agriculture. The rates and causes of deforestation are essentially consistent for natural forests during the two time periods (Figure 1). Important products generated through the survey include change-matrixes for the tropics as a whole and for each region. The matrices show the various forest and land-cover classes and how they change over the last two decades. This study is the first to provide a consistent methodology for assessing forest change between two assessment periods.

[2] The Kotka III meeting advised FAO to consider conducting the remote sensing survey at the global level with about 350 sample units. However, due to financial restrictions, no work was conducted outside the tropics (aside from some pilot activities).

[3] Due to high rates of cloud cover in two sample units in year 2000 imagery, and a missing image for the 1990 sample in another unit, the number of samples used for FRA 2000 was reduced to 113.

Figure 1. *Summary of results from the Remote Sensing Survey. The figure shows the total area change for each land classification as interpreted in the survey, for each of the two ten-year periods studied. Note that although a decrease in the loss of forest can be detected, this is not statistically significant in the study.*



Issues

17. Comparable time series were absent in most countries, including many industrialized ones making precise estimates of forest change difficult at both national and global levels. The lack of fully compatible multi-date information at the national level for most countries continues to be one of the biggest constraints in the global assessments. In fact, the vast majority of national inventories today are still the result of single-shot exercises.

18. Because national forest inventories are long-term endeavours, much of the country information that was used for FAO's periodic assessments was several years old by the time it was incorporated into the assessment. The bulk of the national inventories used for FRA 2000 span a period of more than ten years; the average year for inventories in developing countries and industrialized countries was 1994 and 1996 respectively. The oldest survey used was from 1981. Projecting these figures forward (and backward) to the reference years 1990 and 2000 had major implications for the reliability of the calculation of forest change and deforestation.

19. In addition to the inventory reports from the developing countries and the remote sensing survey, several initiatives were undertaken to review the state-of-the-art knowledge on deforestation including an Expert Consultation on methodologies for forest change estimations (FAO, 2001), a comprehensive review of literature on deforestation and in-depth studies for 12 countries.

20. The Expert Consultation concluded "...the process of deforestation is such a complex process, involving physical, climatic, political, and socio-economic forces which are themselves very complex, that simple generalised models of forest change have so far not been developed. Current models are oversimplified and yield similar predictions of forest cover change rates for countries which are known to be very different (Päivinen and Gillespie, 2000)". Based on these findings, FRA 2000 discontinued using the FRA 1990 model for predicting or extrapolating forest loss based on population dynamics. The correlation between some basic national socio-economic

indicators and the rate of forest cover change is shown in Table 4. The only variable that comes near significance is the proportion of rural population. Still, it only accounts for 14% (r^2) of the variation in forest cover change at national level.

21. The contradiction between the emphasis on deforestation in the global forest agenda and the shortage of reliable information led FRA 2000 to conduct a separate study on the availability of forest change information for the tropics. One study (Rudel *et al.*, 2000) indicated that the number of publications on tropical deforestation has grown at such a rapid rate over the past ten years that it has become difficult to 'keep up' with it. Yet, the uncoordinated ways in which the studies are conducted and the disparate outlets in which they are published, limit the use of the information. In addition, and despite the larger number of publications, the study indicates that first hand (field) knowledge on forest change may have decreased. This represents a challenge for organizations that would like to use such data to monitor tropical forest change or to support policy initiatives.

Table 4. Correlation coefficients (r) between forest cover change rate and selected variables (n=203, data not weighted). All data at national level and from FRA 2000 global tables available at www.fao.org/forestry/fo/fra/index.jsp

	Population density	Population change rate	Population, rural proportion	GNP/capita	Forest change rate
Population density		-0.09	0.00	0.12	-0.04
Population change rate	-0.09		0.31	-0.36	-0.26
Population, rural prop.	0.00	0.31		-0.59	-0.38
GNP/capita	0.12	-0.36	-0.59		0.21
Forest change rate	-0.04	-0.26	-0.38	0.21	

VOLUME AND BIOMASS

22. Total forest volume (over bark) and above ground woody biomass were estimated for 166 countries, representing 99 percent of the world's forest area. The world totals, subject to validation, in process at the time of publication, are 500 billion m^3 of wood equivalent to 350 billion tons of woody biomass. Almost one third is located in South America and 18 percent is in Brazil alone. The world-wide average standing volume is 126 m^3/ha equivalent to 92 tons per ha. South America had the highest average standing volume at 172 m^3/ha, North and Central America 129 m^3/ha, Africa 124 m^3/ha, Europe 112 m^3/ha, Asia 99 m^3/ha and Oceania the lowest with 73 m^3/ha. South America is also the highest in terms of average biomass per ha, at 128 t/ha.

23. Many Central American and Central European countries are among the highest in terms of standing volume by hectare, the former having high-volume tropical rain forests and the latter intensively managed temperate forests.

FOREST PLANTATIONS

24. Overall findings indicated that the world's natural forests were still subject to net decreases due to deforestation, while new forest plantation areas were reported as being established globally at the rate of 4.5 million hectares per year, with Asia and South America accounting for more new plantations than the other regions. For the 1990's as a whole, it was estimated that about 3 million ha per year were successfully established (see also Tables 2 and 3). Of the estimated 187 million ha of plantations worldwide at year 2000, Asia had by far, the largest areas in forest plantation development. In terms of *genera* composition, *Pinus* (20 percent) and *Eucalyptus* (10 percent) remain dominant *genera* worldwide, although overall diversity of species planted was shown to be increasing. Industrial plantations account for

48 percent, non-industrial 26 percent and unspecified 26 percent, of the global forest plantation estate.

25. The results above were the first global estimates with a uniform definition of forest plantations and can therefore not be directly compared to previous estimates. The FRA 2000 country statistics on plantations may also differ from those reported in prior FAO publications (e.g. FAO 1995b), partly due to changes in definitions. For example, rubber tree plantations are now considered as forest plantations, whereas in past assessments they were not. Previous assessments also used general reduction factors to indicate the successful proportion of plantations remaining after establishment. In fact, the 2000 assessment applied reduction factors according to the best available data from each country independently. Another reason for the change in the FAO statistics is the change in the information base from which the estimates were derived. FRA 2000 has the most extensive and up-to-date database on plantations ever compiled. With over 802 references on plantations, the current information base on plantations surpasses all other assessments. These include data from many industrialized countries as well, none of which were included in the prior global assessment reports.

26. At the same time, information about the extent of plantations in many industrialized countries, particularly in Europe, was less clear than the situation in developing countries. Many European countries made no distinction between planted and natural forests in their inventories. Additionally, because trees have been planted over long periods of time in these areas, frequently have long rotation periods (up to 100 years) and commonly use naturally occurring species, the distinction between natural and planted stands is not readily discernible. Nevertheless, FRA 2000 identified the ten countries with the largest reported plantation development programmes (by area) as China with 24 percent of the global area; India with 18 percent; the Russian Federation and the US each with 9 percent; Japan with 6 percent; Indonesia with 5 percent; Brazil and Thailand each with 3 percent; Ukraine with 2 percent and the Islamic Republic of Iran with 1 percent. Together, these account for 80 percent of the global forest plantation area.

27. Within the same ten countries, an estimated 52 percent of forest plantations are grown for industrial purposes to supply raw material for industry; 26 percent for non-industrial uses ; and the purpose was not specified in 22 percent, particularly in the Russian Federation, Japan and the Ukraine. The industrial forest estate ownership, where specified in these ten countries was: 33 percent public; 26 percent private; and 41 percent other or unspecified. For the non-industrial estate, figures were 39 percent public; 39 percent private; and 22 percent other or unspecified. The countries with major industrial plantation areas (expressed as a percentage of national forest plantation area) included the US (100 percent); China (83 percent); and India (37 percent). These three countries account for 73 percent of all industrial forest plantations globally. The countries with major proportions of non-industrial plantation areas included Thailand, 76 percent; India, 63 percent; Indonesia, 42 percent; and China, 17 percent. These four countries accounted for 75 percent of all non-industrial forest plantations globally.

28. Industrial plantations provide the raw material for wood processing for commercial purposes, including timber for construction, panel products and furniture, and pulpwood for paper. In contrast, non-industrial plantations are aimed for example at supplying fuelwood, providing soil and water conservation, wind protection, biological diversity conservation and other non-commercial purposes. In many countries, particularly in the developing world, the end purpose of the plantations is not clearly defined at the onset. In some of these cases, valuable tree resources are established which coincidentally match future needs. However, in others the lack of planning may result in plantations which have little commercial value and a low potential for local use.

TREES OUTSIDE FORESTS

29. Trees outside forests are trees and tree environments on land not defined as forest or other wooded land (Appendix 1). Tree resources outside forests have not been systematically taken into

account in forest resource assessments and are usually overlooked in policy and decision-making processes regarding sustainable natural resources management. However, the role of these resources in providing goods and services in rural and urban environments is important.

30. In countries with little forest cover, trees outside forests constitute the main source of wood and non-wood forest products. For example, in Morocco, where forests are less than 5 percent of the land and other wooded lands only 7 percent, nearly 20 percent of the land may be occupied by trees outside forests, namely as wooded pasture (84 percent of the land occupied by trees outside forests) and fruit tree plantations (12 percent). However, in many areas, the use of trees in conjunction with other land uses is often constrained by insecure access to land and trees, unfavourable and contradictory policies, non-competitive economic return on products and inadequate technology transfer.

31. On agricultural lands in densely populated areas, fruit tree plantations, home gardens and hedgerows may often cover a high proportion of the land. Communities, farmers and herders who do not have access to forests diversify their production and protect their land by maintaining various tree systems on their farms. In Kerala, one of the most densely inhabited States of India, a study in 1998 estimated that about 83 percent of the wood was from homesteads, 10 percent from estates and only about 7 percent from forest areas, when 26.6% of the State area is under forest cover. Trees outside forests met about 90 percent of the fuelwood requirements of the State.

32. Much information on trees outside forests exists, but it is site specific and scattered among different institutions and sectors and was collected to serve a wide range of purposes. The data collection method is rarely reported, complicating the interpretation of the results. Much of the available information does not relate products to resources. Because an important part of trees outside forests belongs to the informal sector, they are frequently not included in forest resource statistics. The economic value of their products is often underestimated and their environmental benefits often completely overlooked. The information related to trees in settlements and cities is almost non-existent.

33. Though statistics on trees outside forests do not exist for most countries, some countries are now addressing the theme in their new surveys. For example, in France, two complementary programmes provide accurate information on the trees outside forests. The National Forest Inventory of 1996 included special inventories for hedgerows, line plantations and isolated trees. Over the last thirty years, the methodologies and scope of inventories aimed at assessing trees outside forests have been refined and are presently part of the National Forest Inventory's mandate. Since 1981, the Teruti survey realized by the "Service central des enquêtes et études statistiques" (SCEES) of the Ministry of Agriculture monitors land use changes and includes trees outside forests. Results from these studies contributed to recognizing the important role of hedgerows in regulating annual run-off and in decreasing peak flow velocity. Today, several national and European Community policies and programmes support the restoration of the landscape with trees outside forests.

34. Many examples exist where the means are being developed to address the assessment of trees outside of forests. For instance, the Tropical Agriculture Research and Higher Education Center (CATIE), Costa Rica, in collaboration with Freiburg University (Germany), is developing a regional methodology for Central America to assess tree resources outside forests. A mix of satellite remote sensing, aerial photos and ground sampling is used to assess and monitor this complex resource at national and regional levels. Parameters monitored include the number of species, their distribution and structure. Increased knowledge and improvements in the tools needed for the assessment of this important emerging issue will allow sustainable use of the resource.

FOREST MANAGEMENT

35. Several developments around the world over the last decade have focused on achieving sustainable forest management (SFM). SFM balances environmental, socio-cultural and economic

objectives of management in accordance with the *Forest Principles* agreed at UNCED in 1992. The SFM concept has stimulated changes in forest policy and legislation in many countries. One indicator of political commitment to the concept of sustainable forest management is the number of countries (149) currently involved in international initiatives to develop and implement criteria and indicators for sustainable forest management. On the ground, changes are occurring in management objectives and practices, and in the involvement of partners in planning and managing forests. FRA 2000 results from industrialized countries (accounting for 45 percent of the total forest area in the world, most of it in the temperate and boreal zone) indicated that 88.7 percent of these forests are being managed according to a formal or informal management plan.

36. National statistics on forest management were not available from a fairly large number of developing countries, including many of the larger countries in Africa and some key countries in Asia. Nevertheless, preliminary results from developing countries show that, out of a total forest area of 2,128 million ha, at least 123 million ha, or about 6%, were covered by a formal, nationally approved forest management plan covering a period of at least 5 years. It must be emphasised that the total area reported to be subject to a formal or informal forest management plan is not necessarily equivalent to the total area of forest under sustainable forest management. Some areas covered by a management plan may not be under sustainable forest management. Conversely, areas may be under sustainable forest management without the existence of a formal management plan.

37. One way of demonstrating that a particular forest is being managed sustainably for wood production purposes is through the act of third party certification. A number of international, regional and national forest certification schemes now exist. Depending on how the term “area certified” is defined, the total global area of certified forests may be estimated to be somewhere between 80 and 110 million hectares. Notably, most certified forests are located in a limited number of temperate countries.

38. A direct comparison with previous estimates of the forest management status in tropical and temperate/boreal regions is not possible due to differences in definitions used. However, in 1980 an estimated 42 million ha of forest in 76 tropical countries were under intensive management for wood production purposes. Looking at the situation in the same 76 countries in 2000, 117 million ha[4] of the forests in these countries are reportedly covered by a formal, nationally approved forest management plan of a duration of more than 5 years - most, but not all, of these for wood production purposes. 2.2 million ha of forests in these countries have been certified by third parties according to standards set by the Forest Stewardship Council.

39. As regards temperate and boreal forests, the situation appears to have remained stable or has improved in the last 20 years. All areas classified as closed forests in the former USSR were reported as covered by management plans in the early 1980s and in 2000 the Russian Federation and most of the CIS states reported that all forests were being managed according to a formal or informal plan. In Europe, 19 countries provided information for forest management assessments in the early 1980s, 1990 and 2000. For these countries the percentage of closed forests "managed according to a forest management plan" in 1980 was 62.5 percent; in 1990, the percentage of forests "under active management" was 72.7 percent; and in 2000, the area reported to be "managed in accordance with a formal or informal management plan" was equivalent to 94.4 percent of the forest area. The percentage of the forest area under management in Canada and the US has increased from 60.0 and 41.4 percent respectively in 1990 to 70.9 and 55.6 percent respectively in 2000.

[4] National data missing from some countries.

FOREST FIRES

40. Severe forest fires around the world gained international attention during the 1990's. Millions of hectares burned in 1997 and 1998 and smoke blanketed large regions of the Amazon Basin, Central America, Mexico and Southeast Asia, disrupting air and sea navigation and causing serious public health problems. Significant losses of forest vegetation and biomass were incurred. Ecosystems generally not subject to fires, such as the Amazon rain forest in Brazil and the cloud forest of Chiapas in Mexico, sustained considerable damage. Although on a smaller scale, the global wildfire situation in 1999-2000 was again serious. Fires were widespread in Indonesia in 1999 and 2000, but not on a scale comparable to 1997-1998. The major fires of 2000 occurred in Ethiopia, the eastern Mediterranean and the western United States.

41. Fires were used commonly to clear areas of forest for agriculture in some countries, some of which contributed to wildfires as they escaped the control of the farmers. Other countries and regions have become more susceptible to larger and more damaging fires as a result of long-term exclusion of fire from forests. Fire exclusion in National Forests in the United States has resulted in unnatural accumulations of fuel loads and thus increases in forest fires since the 1980s. Another important consideration was the large areas of degraded forests and other wooded lands that had been converted to grassland and shrubland through repeated fires, which were much more prone to burn frequently, and therefore prevented a return to tree cover.

42. Comprehensive global statistics on wildland fires required to make a reliable comparison of global fire occurrence in the 1980s and 1990s do not exist[5]. However, some general observations can be made. Both decades experienced high annual variability in regional and national fire occurrence and impacts. *El Niño* episodes, such as in 1982-1983 and 1997-1998, were the most important climatic factors affecting total area burned and fire impacts in both decades. In these years, most of tropical Asia, Africa, the Americas and Oceania experienced extreme wildfire situations. During 1997-1998, the number of land-clearing fires and other fires which escaped control increased in the equatorial forest regions of Southeast Asia and South America. The northern temperate and boreal forest zones also experienced extremely dry years in both decades. Central eastern Asia was affected most severely in 1987, particularly Siberia and northeastern China. The Russian Far East was also severely affected during the 1998 drought.

43. Policy makers are beginning to realize that continued emphasis only on emergency response will not prevent large and damaging fires in the future. Emergency preparedness and response programmes must be coupled with prevention through better land use policies and practices. Actively working toward reduced fire risk with community involvement is an important strategy to better conserve natural resources while reducing the impacts of wildfires. Between 1998 and 2000, several international initiatives related to sustainable development and wildland fire prevention, preparedness, management and response were started or continued. Many countries are now starting to develop policies and practices to improve their institutional capacity to prevent, prepare for, and combat forest fires. At the same time, it should be remembered that fire is one of the natural forces that has influenced plant communities over time and as a natural process it serves an important function in maintaining the health of certain ecosystems. Consequently, the traditional view of fire as a destructive agent requiring immediate suppression has given way to the view that fire can and should be used to meet land management goals under specific ecological conditions.

PROTECTED AREAS

44. Interest in the formal protection of forests, mainly for biological diversity conservation, has increased considerably during the past decade. Many countries have committed themselves to

[5] FRA 2000 compiled country reports on forest fire statistics for countries with national reporting systems, and developed profiles on the ecology and management of forest fires for specific countries.

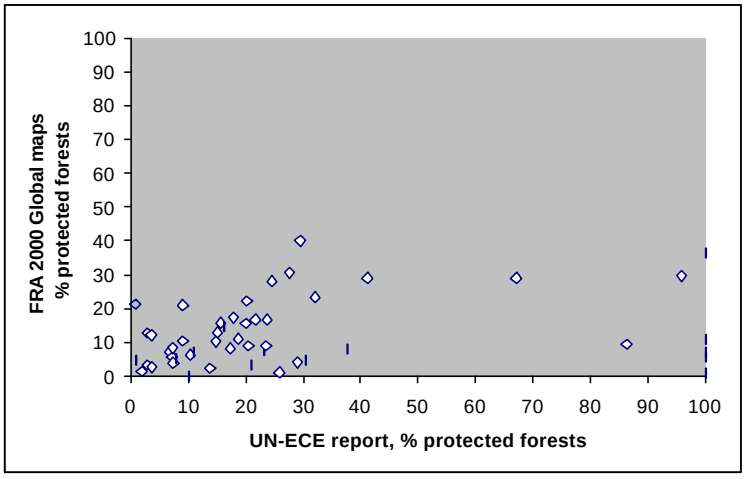
designate considerable portions of their natural forests, with resulting increases in the number and area of national parks and reserves. For FRA 2000, the World Conservation Union (IUCN) classification of protected areas was used (Table 5). The classification scheme has six different classes according to the type of area and the degree of protection afforded. While being the only international standard classification available, the interpretation of the concept of protected areas frequently differs substantially between countries, making the aggregation of statistics unreliable at the global level. As an example, for some countries it is argued that virtually all forests are protected according to IUCN category V as a consequence of general forestry legislation.

45. FRA 2000 relied on two independent sets of statistics, one submitted by countries in response to the FRA 2000 questionnaire and the other from a spatial database developed by the United Nations Environment Programme-World Conservation Monitoring Centre (UNEP-WCMC). The FRA 2000 questionnaire sent to countries was generally directed at forestry agencies, while UNEP-WCMC collected its information from national agencies involved in nature conservation, parks and protected areas. Comparison of these two data sources indicated that much work is still needed to harmonize national and international data, and even data coming from different agencies in the same country (Figure 2).

Table 5. IUCN categories for nature protection

I - Strict nature reserve / wilderness area.
II - National Park.
III - Natural monument.
IV - Habitat/species management area.
V - Protected landscape/ seascape.
VI - Managed resource protection area.

Figure 2. Proportion of protected forests in industrialized countries, country-wise comparison between FRA 2000 global map data and FRA 2000 questionnaire response for industrialized countries (UN-ECE 2000)



46. Consistent global data, broken down by country, could only be established through the UNEP-WCMC spatial database, overlaid on the FRA 2000 global forest cover map. World-wide, about 10 percent of the forests are then found to be protected. Regional results were that North and Central America had 17 percent of their forests under protection; South America, 16 percent;

Africa, 11 percent; Oceania, 10 percent; Asia, 9 percent; and Europe (including the Russian Federation) 5 percent.

47. The increased commitment to expanding the area of forest under protection is a positive development, but it needs to be complemented by efforts to upgrade the effectiveness of protected area management. This issue has received substantial attention in the past few years and its importance is likely to grow as pressures on forests continue to increase.

REMOVALS

48. Whether the goal of SFM is reached in production of forest, depends to a large extent on the implementation of logging practices which ensure that the potential production of goods and services of the forest are sustained over the long term. For FRA 2000, information on harvesting intensities and harvesting plans was studied in 43 tropical countries. One objective with the study was to establish a new system for the collection, analysis and dissemination of information specific to the impact of timber harvesting operations on tropical forests to identify the location and severity of non-sustainable timber harvesting practices.

49. The countries studied represented the forested tropical regions in Africa (19 countries), Asia and Oceania (10 countries) and America (14 countries). The countries surveyed had a forest cover either greater than 5 percent of the total land area, or greater than 1 million hectares. Collectively they accounted for approximately 90 percent of the world's tropical forest resources. Information was gathered through an extensive literature review, and, in some cases, through in-country visits. The literature research focused on data published in government reports and in documentation citing in which the original source of the data could be recorded.

50. Results from the year 2000 show a high variation in harvesting intensity in the countries studied. In Africa, 3.3 million ha were harvested annually, out of the 5.9 million ha under a timber-harvesting scheme. The harvesting intensity was highly variable in the countries and varied from 1 m^3/ha in Zambia to 13m^3/ha in Gabon. In Asia and Oceania, the total forest area under harvesting scheme in the year 2000 was 27.3 million ha, out of which 6.2 million ha were actually harvested each year. The harvesting intensity was much higher compared to Africa and ranged from 5m^3/ha in Myanmar to 23m^3/ha in Vietnam. In tropical America, a total of 16.7 million ha were under a timber harvesting scheme, while 1.9 million ha were harvested annually. The harvesting intensity ranged from 1 m^3/ha in Bolivia to 34m^3/ha in Brazil.

51. Data from industrialized countries supplied by UN ECE to FAO on removals covered 40 countries. However, only total volume extracted per year was reported. For these countries, an estimated 1.2 billion m^3 per year were harvested each year.

NON-WOOD FOREST PRODUCTS

52. For centuries, non-wood forest products (NWFP) have played an important role in the daily life and well being of millions of people worldwide, but the last decade has witnessed a steep increase in interest and activities concerning NWFP. There were numerous projects to promote NWFP use and commercialization as a means to improve the well being of rural populations and at the same time conserve existing forests. Rural and poor people in particular depend on NWFP as sources of food, fodder, medicines, gums, resins, construction material, etc.

53. Although significant advances in research on both the socio-economics and the biology of NWFP have occurred in the last few years, the assessment of NWFP and of the resources providing them is still a difficult task. The multitude and variety of NWFP, the different uses at local, national and international levels, the multiplicity of interests and disciplines involved in NWFP assessment, organizational and financial constraints, the lack of globally, or even nationally, recognized common terminology and units of measurement all contribute to lack and unreliability of information on NWFP.

54. Few NWFP are significant at global level, which is one of the reasons why they are not reported in the global forest products statistics published by FAO. However, when taken at the category level (medicinal plants, fibres, etc) they have global relevance. FRA 2000 data collection activities covered the categories of food; fodder; medicinal plants; perfumes and cosmetics; dying and tanning; utensils, handicrafts, and construction materials; ornamentals; exudates (for plant products); living animals; honey and beeswax; bushmeat; other edible animal products; hides and skins; medicines; colorants; and other non-edible animal products. There is an urgent need to collect statistics on bamboo and rattan as major NWFP. For the industrialized temperate and boreal countries, data on quantities and monetary values are available on Christmas trees, cork, mushrooms, truffles and berries, medicinal plants and decorative foliage, game meat, hides and pelts, honey and nuts were also reported.

55. Traded NWFP contributed to the fulfilment of daily needs and provided employment and income, particularly for rural people and especially women. Internationally traded NWFP, such as bamboo, rattan, cork, gum arabic, aromatic oils and medicinal plants, can achieve high prices in comparison with NWFP traded on national markets and thus contributed to national economic development. However, the majority of NWFP were used for subsistence and in support of small-scale, household-based enterprises. Despite their real and potential importance, no regular monitoring of the resources and evaluation of the socio-economic contribution of NWFP was being carried out by national institutions.

56. Between the multitude of locally traded NWFP (with low extraction volumes, low impact on the resources, and lesser monitoring needs) and the few products which have reached such economic significance to be exploited as commercial crops outside their original natural areas, (rubber and palm oil are two notable examples), are a number of NWFP of commercial significance, the exploitation of which is still largely based on wild sources and forest ecosystems. These forest products and their source species need monitoring and management in the forestry sector to ensure sustainable management and to provide information for policy development.

57. Rattan, for example, is one of the most important commercial non-wood forest products in Asia. Over 700 million people worldwide traded or used rattan for a variety of purposes. Domestic trade and subsistence use of rattan and rattan products were valued at an estimated US$ 3 billion per annum, and another US$4 billion were generated through international trade, according to estimations made by the International Rattan and Bamboo Network (INBAR). In some producer countries, rattan resources are today in short supply. Consequently, rattan processing industries are in decline in these areas with a negative impact on the economy, particularly in rural areas.

58. Data collected for the FRA 2000 NWFP component demonstrated a significant lack of quantitative information at the national level on both the products and the resources. Information was scarce and often mixed with agricultural production statistics. Statistical data, if available at all, was limited to selected internationally traded NWFP and to export quantities. Information on the resource base and on the subsistence use of NWFP is non-existent; this was mainly due to the multitude of products that are used by local people and to the costs of measuring and reporting on subsistence products. For these reasons, data collected were presented as national results in FRA 2000, aggregated to regional and subregional, but not global, levels.

GLOBAL MAPS

59. New global forest and ecological maps provide spatial representation to area statistics of the survey findings from the individual countries and regions, providing a synoptic view of worldwide forest cover. The global ecological zoning map provides an important means of aggregating global information on forests or other natural resources according to their ecological type. The maps can be used in conjunction to show and analyse worldwide forest cover by ecological type or zone (Table 6). The forest cover map was developed using coarse resolution satellite imagery (AVHRR) (Figure 3), while the ecological map was developed from existing

national and regional potential vegetation maps. In previous global assessments, the means and technology did not exist to produce a global map based on satellite imagery.

60. Each map is generated from a corresponding computerised Geographical Information System (GIS) database, which makes it possible to combine them with different spatial and statistical data, permitting new perspectives on the world's forests. Digital versions of the maps that can be used for further analyses are publicly available through the FAO website at www.fao.org/forestry/fo/fra/index.jsp .

Table 6. Total forest area by ecological zone and distribution between regions, according to FRA 2000 global ecological zoning and global forest cover map. Distribution of percentages do not exactly tally with other area statistics due to systematic distortions in the remote sensing classification of forests in the global map.

Ecological Zone	Total forest	Africa	Asia	Oceania	Europe	North & Central America	South America	Total
	million ha	%	%	%	%	%	%	%
Tropical rainforest	1090	24	17			1	58	100
Tropical moist deciduous	410	40	14	6		9	31	100
Tropical dry	180	39	23			6	33	100
Tropical mountain	150	11	29			30	30	100
Subtropical humid forest	170		52	8		34	6	100
Subtropical dry forest	30	16	11	22	30	6	14	100
Subtropical mountain	130	1	47		13	38	1	100
Temperate oceanic forest	30			33	33	9	25	100
Temperate continental forest	270		13		40	46		100
Temperate mountains	130		26	5	40	29		100
Boreal coniferous forest	730		2		74	24		100
Boreal tundra woodland	130				19	81		100
Boreal mountain	410		1		63	36		100
TOTAL	3862	17	14	5	27	14	23	100

Figure 3. FRA 2000 Global Forest map produced during FRA 2000.

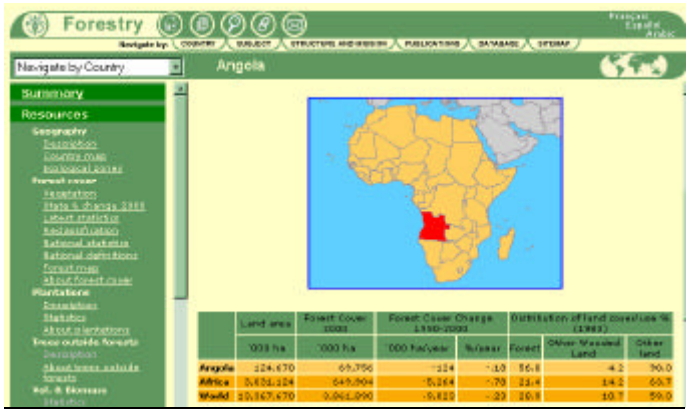
OTHER ASSESSMENT PARAMETERS

61. Special studies on biological diversity and other components were completed in the year 2000 and are undergoing final data analysis and compilation for reporting.

FORESTRY INFORMATION SYSTEM

62. During the course of FRA 2000, the Forest Resources Assessment Programme developed a corporate information system to archive, analyse and disseminate information through the World Wide Web (Figure 4). Using internet technology, an open forum for dialogue with the countries and increased transparency in FAO statistics sources and methods has been achieved. Because of this new way of working, FAO has stimulated country interaction and involvement in the assessment process, as well as public awareness. At the end of the assessment, the information system was incorporated into the FAO Regular Programme.

Figure 4. Dynamically loaded country profiles on forests and forestry constitutes a major output of FRA 2000. The profiles are available to the public through the FAO website at www.fao.org/forestry/fo/country/nav_world.jsp.



CONCLUSION

63. Since 1951, FAO has reported on the world's forest resources in fulfilment of its mandate to collect, analyze and disseminate information on forests and forestry. The Global Forest Resources Assessment 2000 is FAO's latest assessment. It was a joint endeavour, carried out by FAO in co-operation with partners and its member countries. Countries participated actively in the assessment and provided the core information for reporting on forests at the national level.

64. The 2000 assessment concluded that the world's forest cover at the year 2000 was about 3.9 billion hectares. Net deforestation at the global level was estimated at an annual rate of approximately 9 million hectares, with gross global deforestation at 13.5 million hectares. At the same time, the reported annual rate of 4.5 million ha for establishing new plantations was markedly higher than in the past, and the successful planted stands (estimated at 3 million ha/year for the 1990's as a whole) offset some of the losses in natural forests.

65. Fires in forests continued to be a significant problem in the 1990s. Though evidence indicates that the 1980s also sustained large and damaging fires. *El Niño*-related weather conditions along with traditional practices of forest burning in the tropics combined to have devastating effects on the forests of many tropical countries, as well as the livelihoods of their

citizens. Other countries suffered large fires during the 1990s due to high fuel loads accumulations resulting from fire exclusion policies.

66. On the positive side, initiatives relating to sustainable forest management have stimulated many countries to develop management plans for their forests. About 6 percent of tropical forests are now subject to such plans, as are 88 percent of the forests in industrialized countries. Monitoring is still needed to assess implementation of the plans. Additionally, 10 percent of the world's forests are now under some form of formal protection, such as national parks or forest reserves.

67. The availability of reliable and current forest resource and forestry information remains a major issue for global and national assessments. Despite the fact that forestry matters have been high on the agenda in many international fora over the past decades, and some countries have improved their own forest inventories, there was little overall improvement in information quality at the global level during the 1990s. While FRA 2000 collected and analysed more basic technical information than any previous assessment, analysis of the information base show that reliable information on forest area, forest change, volume and biomass was not available for the majority of the world's forests. Further investment is needed in order to develop more comprehensive information for supporting both national and international forestry initiatives.

68. One consequence of the information scarcity is that it is difficult to establish valid time series – at the national as well as global levels. While the previous global assessment (1990) used a similar approach, the results cannot be directly compared to the present study, due to changes in definitions, information quality and methodologies. In the current assessment, a transparent approach was adopted to ensure that all steps in the processing were made publicly available. Besides adding to the credibility of current results, it is expected that dialogue on forest and forestry information will be enriched and that the 2000 assessment can be compared more reliably with future findings.

69. The continued high loss of tropical forest cover and the outbreak of major wildfires, in contrast to the increase in reported plantation establishment, successes in forest management, and protected areas provide a complex picture for the future of the world's forests, and mankind's interaction with them. Future global assessments should strive to improve both the accuracy and depth of the information provided by increasing country capacity, developing worldwide assessment standards and encouraging the development of a global forest survey system. Decision-makers must also be fully involved in defining future information needs that will address their questions and concerns about the state and rate of change of the world's forests.

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CONTRIBUTORS

The Global Forest Resources Assessment 2000 was the product of concerted effort and teamwork on the part of many individuals inside and outside of FAO. Authors of the various sections in this report were Robert Davis (Global Maps); Joachim Lorbach (Removals); Peter Holmgren (Forest Cover, Volume and Biomass, Protected Areas, and Information Systems); Jim Carle (Plantations); Mette Løyche Wilkie (Forest Management); Michelle Gauthier (Trees Outside of Forests); Bob Mutch and Gillian Allard (Fires); Laura Russo (Non-wood Forest Products); and Anne Branthomme and Ingemar Eriksson (Remote Sensing Survey). Jim Ball and Jim Space edited much of the document text. Sören Holm provided invaluable assistance in the statistical analyses of the remote sensing survey data. The entire FRA unit contributed to the development of the various data inputs, along with personnel in the FOR and FOP Divisions.

APPENDIX 1

BASIC DEFINITIONS FOR FRA 2000

The definitions below are taken from FAO (2000) in which the original definition formulations in FAO (1998) are elaborated.

Land use classification

Forest

Forests are lands of more than 0.5 ha, with a tree canopy cover of more than 10 percent, which are not primarily under agricultural or urban land use.

Explanatory note

Forests are 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 meters *in situ.* Areas under reforestation which have yet to reach a crown density of 10 percent or tree height of 5 m are included, as are temporarily unstocked areas, resulting from human intervention or natural causes, that are expected to regenerate. The term specifically includes: forest nurseries and seed orchards that constitute an integral part of the forest; 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 and shelterbelts of trees with an area of more than 0.5 ha and width of more than 20 m; plantations primarily used for forestry purposes, including rubberwood plantations and cork oak stands. The term specifically excludes trees planted primarily for agricultural production, for example in fruit plantations and agroforestry systems

Other wooded land

Other Wooded Land is land with a canopy cover of 5-10 percent of trees able to reach a height of 5 m *in situ*; or a canopy cover of more than 10 percent when smaller trees, shrubs and bushes are included.

Other land

Other land is, for the purpose of forestry, any land not classified as forest or other wooded land as defined above. Includes agricultural land, meadows and pastures, built-on areas, barren land, etc.

Inland water

Area occupied by major rivers, lakes and reservoirs.

Trees outside forests

Trees outside forests are trees and tree environments on land not defined as forest or other wooded land.

Explanatory note

Trees outside forests (ToF) include: (a) groups of trees covering an area of less than 0.5 ha, including lines and shelterbelts along infrastructure features and agricultural fields; (b) scattered trees in agricultural landscapes; (c) tree plantations mainly for other purposes than wood, such as fruit orchards and palm plantations; and (d) trees in parks and gardens and around buildings. ToF are not assigned an area in the overall land use classification, but occurs inside Other land. Although the definition of ToF is based on the trees, the concept includes also the site and other vegetation at the location.

Forest change processes

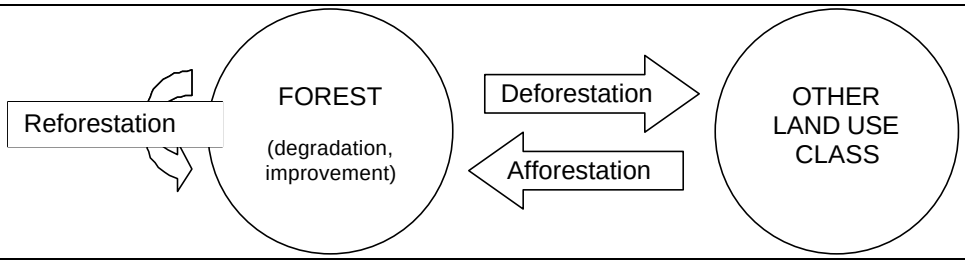
Overview

Forest change processes are central to several national and international forest policy agendas. They are also of high interest to the public in general and are often referred to by media. Many organizations are engaged in forest change issues, and the definitions are therefore important and also politically sensitive. The below summarizes the definitions as used by FAO's Forestry Department. Five terms are defined below. Figure 1 gives an overview of how these relate.

Note that to determine whether the removal of trees from an area is deforestation, it is necessary to predict the future development for the area. If new forest trees are established in the relatively near future, the land is classified as forest throughout the regeneration period (and this regrowth is named "reforestation"). If, on the other hand, a sufficient density of trees is not established in the relatively near future, or if land is converted to other land use, the area should be considered deforested.

Note also that the time frame is central to the forest change definitions and that the length of the threshold period, defaulted to ten years, should be used consistently when applying the terms, to avoid overlaps or gaps in the reporting. Thus "long-term" refers to ten years or more, and "temporary" refers to shorter than ten years. Note that local climatological conditions, land use contexts or the purpose of the analysis may justify that a longer threshold period is used.

Figure 1. Relationships between forest change terms. Forest degradation and Forest improvement occur within forests that continuously stay above the 10% canopy threshold. Reforestation occurs when forests regrowth after temporarily having had below 10% canopy cover, but were considered as forests throughout that time. Deforestation and Afforestation represent the transfers between forest and other land use classes.



Deforestation

Deforestation is the conversion of forest to another land use *or* the long-term reduction of tree canopy cover below the 10% threshold.

Explanatory note

Deforestation implies the long-term or permanent loss of forest cover. Such a loss can only be caused and maintained through a continued man-induced or natural perturbation. Deforestation includes, for example, areas of forest converted to agriculture (including agroforestry), pasture, water reservoirs and urban areas. The term specifically excludes areas where the trees have been removed, due, for example, to harvesting or logging, and where the forest is expected to regenerate naturally or with the aid of silvicultural measures within the long-term. Unless followed by clearing of the remaining logged-over forest for the introduction of alternative land-uses, and the maintenance of the clearings through continued disturbance, forests commonly regenerate, although often to a different, secondary condition. In areas of shifting agriculture, forest, forest fallow and agricultural lands appear in a dynamic pattern where deforestation and the return of forest occur frequently in small patches. To simplify reporting of such areas, the net change over a larger area is typically used. Deforestation also includes areas where overutilization or changing environmental conditions, influence the forest to an extent that it cannot (currently) sustain a tree cover above the 10% threshold, for example burnt-over areas where severe ground conditions or recurring fires for the long-term prevents the return of forest formations, or areas that after clearcutting cannot regenerate because of frost, competing vegetation, or other natural conditions. The concept “long-term” is central in this definition and is defined as ten years. Local climatological conditions, land use contexts or the purpose of the analysis may however justify that a longer time frame is used.

Afforestation

Afforestation is the conversion from other land uses into forest, *or* the increase of the canopy cover to above the 10% threshold.

Explanatory note

Afforestation is the reverse of deforestation and includes areas that are actively converted from other land uses into forest through silvicultural measures. Afforestation also includes natural transitions into forest, for example on abandoned agricultural land or in burnt-over areas that have not been classified as forest during the barren period. As for deforestation, the conversion should be long-term, that is areas where the transition into forest is expected to last less than ten years, for example due to recurring fires, should not be classified as afforestation areas. The concept “long-term” is central in this definition and is defined as ten years. Local climatological conditions, land use contexts or the purpose of the analysis may however justify that a longer time frame is used.

Reforestation

Reforestation is the re-establishment of forest formations after a temporary condition with less than 10% canopy cover due to human-induced or natural perturbations.

Explanatory note

The definition of forest clearly states that forests under regeneration are considered as forests even if the canopy cover is temporarily below 10 per cent. Many forest management regimes include clearcutting followed by regeneration, and several natural processes, notably forest fires and windfalls, may lead to a temporary situation with less than 10 percent canopy cover. In these cases, the area is considered as forest, provided that the re-establishment (i.e. reforestation) to above 10 percent canopy cover takes place within the relatively near future. As for deforestation, the time frame is central. The concept "temporary" is central in this definition and is defined as less than ten years. Local climatological or land use contexts, or the purpose of the analysis, may however justify that a longer time frame is used.

Forest degradation

Forest degradation is a reduction of the canopy cover or stocking within a forest.

Explanatory note

For the purpose of having a harmonized set of forest and forest change definitions, that also is measurable with conventional techniques, forest degradation is assumed to be indicated by the reduction of canopy cover and/or stocking of the forest through logging, fire, windfelling or other events, provided that the canopy cover stays above 10% (cf. definition of forest). In a more general sense, forest degradation is the long-term reduction of the overall potential supply of benefits from the forest, which includes wood, biodiversity and any other product or service.

Forest improvement

Forest improvement is the increase of the canopy cover or stocking within a forest.

Explanatory note

For the purpose of having a harmonized set of forest and forest change definitions, that also is measurable with conventional techniques, forest improvement is assumed to be indicated by the increase of canopy cover and/or stocking of the forest through growth. In a more general sense (cf. forest degradation) forest improvement is the long-term increase of the overall potential supply of benefits from the forest, which includes wood, biodiversity and any other product or service.

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APPENDIX 2

COUNTRY TABLES

General notes

Table updates

The table data represent a summary of FRA 2000 findings as of 1 March 2001. The contents will continue to be updated, including making corrections and adding currently missing data, until the FRA 2000 main report is released. The latest version of the table data is available on the FAO Forestry website (http://www.fao.org/forestry/fo/fra/index.jsp)

Country nomenclature and regional groups used in the tables

The country names and order used in these tables follow standard UN practice regarding nomenclature and alphabetical listing of countries. Data for "China" incorporate values for China (including Hong Kong and Macao) and for "Taiwan Province of China", as consistent with UN practice. The regional groups used in these tables represent FAO's standardized regional breakdown of the world according to geographical (note: not economic or political) criteria.

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Totals

Numbers may not tally because of rounding.

Abbreviations

n.s.	=	not significant, indicating a very small value
-	=	not available (n.a.)
n.ap.	=	not applicable
000	=	thousands
	=	empty data cells indicate a zero value

Table 1. Forest data by country

The land area" figure refers to total area of the country, excluding areas under inland water bodies.

The table shows the forest cover in year 2000 and the estimated change between 1990 and 2000. Adjustments to the standard reference years 1990 and 2000 were made by FAO, based on available national statistics. "Total forest" is the sum of natural forest and plantations. "Forest cover change" is the net change in forests and includes expansion of plantations, and losses and gains in the area of natural forests.

Forest plantations are forest stands of introduced species, or intensively managed stands of indigenous species of even age class and regular spacing. The table shows the total plantation area in year 2000, which is included in the total forest area.

Volume refers to total volume over bark of living trees above 10 cm diameter at breast height. Biomass refers to above ground mass of the woody part (stem, bark, branches, twigs) of trees, alive or dead, shrubs and bushes. Note: For "industrialized" countries (Europe, CIS countries, Japan, Australia, New Zealand, Canada and USA) the stem volume for all living trees has been used for the volume figure. Some variation as to the minimum diameter applied is reported in UN-ECE (2000).

Table 2: Forest management status 2000

The table summarizes membership of eco-regional processes on criteria and indicators, the area under forest management plans, the forest protected area and the area of forests certified by country.

Criteria and Indicators for Sustainable Forest Management

ATO African Timber OrganiZation

DZAf The Dry-Zone Africa Process on Criteria and Indicators for Sustainable Forest Management

DFAs Regional Initiative for the Development and Implementation of National Level Criteria and Indicators for the Sustainable Management of Dry Forests in Asia

EUR The Pan-European Forest Process on Criteria and Indicators for Sustainable Forest Management

ITTO International Tropical Timber Organization

LEP Lepaterique Process of Central America on Criteria and Indicators for Sustainable Forest Management

MON Montreal Process on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests

NE The Near East Process on Criteria and Indicators for Sustainable Forest Management

TARA The Tarapoto Proposal of Criteria and Indicators for Sustainability of the Amazon Forest

Notes:

(a) Bosnia-Herzegovina, Georgia, San Marino and Yugoslavia were invited to join the Pan-European Forest Process as of December 2000 and have been included in the table.

(b) Cuba and Lao People's Democratic Republic have developed national level criteria and indicators for sustainable forest management without being members of any of the above processes.

(c) Some changes to this column have been made on 5 February 2001.

Area under forest management plans

The definition used for the area under forest management plan is *"The area of 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)".* Exceptions: Industrialized countries (Europe, Cyprus, Turkey, Israel, CIS countries, Japan, Australia, New Zealand, Canada and USA) included also areas with a regularly applied informal plan. For these countries, it was also recommended that areas where a decision has been made not to manage them at all be included (UN-ECE 2000).

The areas under forest management plans are taken from national reports. The percentage is calculated as the percentage of the total forest area for year 2000. Exceptions: Where national reports indicated that all forests are under management, the percentage was set to 100% also for year 2000 and the area figure set to equal the total forest area.

Partial data were obtained from a variety of published sources.

Notes:

(a) Georgia: Forests classified as "undisturbed" are not included;

(b) Philippines: The figure represents the aggregated area covered by tenurial agreements for "forest land" and includes areas which are not defined as forests according to the FRA 2000 definition. A forest management plan is required under these agreements, but may not have been formally approved for all areas;

(c) Australia: Only the forests managed for wood supply are included;

(d) Finland: The original figure provided was 18,609,000 ha. However, as of December 2000, a total of 21.9 million ha of forest had been certified and since this implies the existence of a management regime, this latter, more recent figure has been used instead;

(e) Italy: Only forests with specific management plans are included. All other forests in the country are submitted to general silvicultural prescriptions;

(f) Guyana: The figure provided equals the area under concession agreements as all concessionaires must prepare a forest management plan to be approved by the Government;

(g) Numbers with an asterisk (*) represent partial data as national figures were not available.

Forest protected area

Forest protected areas refer to areas within IUCN categories I-VI for nature protection. "Country report" refers to the country submissions to FRA 2000 in which the term "protection" was interpreted broadly, particularly for IUCN categories V-VI and may include areas under general forest management. "Global maps" refers to an overlay of the FRA 2000 global maps of forest cover and the FRA 2000 global mapping (in partnership with UNEP-WCMC) of protected areas with a legal protection status. Percentages refer to total forest area.

Certified forest areas

The cumulative area of forests certified under the following schemes is listed:

ATFP American Tree Farm Program (as of December 2000)

CSA Canada's National Sustainable Forest Management System Standard (as of 21 December 2000)

FSC Forest Stewardship Council-Accredited Certification Bodies (as of 31 December 2000)

GT Green Tag (USA) (as of 31 December 2000)

PEFC Pan-European Forest Certification (National schemes endorsed by the PRFC Council) (as of December 2000)

SFI Sustainable Forest Initiative Program - American Forest and Paper Association (for Canada - as of 21 December 2000, for USA as of October 2000).

Notes:

(a) Although more than 72 million acres of land are enrolled in the SFI program in the US and Canada, only those areas which have been independently certified have been included;

(b) Areas certified under the ISO 14001 Environmental Management System Standard scheme (e.g. 30,980,046 ha in Canada and more than 300,000 ha in New Zealand) have only been included if also certified under specific forest certification schemes;

(c) Ghana, Malaysia and Indonesia, among others, are developing national certification schemes and additional areas may soon be certified under these. A total of 2,325,356 ha of forests in three states of Malaysia (Pahang, Terengganu and Selangor) have, as a first step, been assessed to the requirements of a mutually agreed standard and were awarded "audit statements" by an independent third party assessor (the Keurhout Foundation) under the Malaysia/Netherlands cooperation programme (H. Singh, NTCC pers. comm. (2001)).

Table 1. Forest data by country

Country/Area	Land area	Total forest 2000			Forest cover change 1990-2000		Total plantation area	Volume	Biomass
		Area		Area p.capita	Annual change				
	000 ha	000 ha	%	ha	000 ha	%	000 ha	m^3/ha	t/ha
Algeria	238 174	2 145	0.9	0.1	27	1.3	718	76	75
Angola	124 671	69 756	56.0	5.6	-124	-0.2	141	68	54
Benin	11 222	2 650	23.6	0.5	-70	-2.3	112	317	195
Botswana	58 174	12 427	21.4	7.8	-118	-0.9	1	78	63
Burkina Faso	27 358	7 089	25.9	0.6	-15	-0.2	67	18	16
Burundi	2 783	94	3.4	0	-15	-9.0	73	192	187
Cameroon	47 544	23 858	50.2	1.6	-222	-0.9	80	234	131
Cape Verde	403	85	21.1	0.2	5	9.3	85	144	127
Central African Republic	62 297	22 907	36.8	6.5	-30	-0.1	4	147	113
Chad	128 400	12 692	9.9	1.7	-82	-0.6	14	18	16
Comoros	186	8	4.3	n.s.	0	-4.3	2	105	65
Congo	34 200	22 060	64.5	7.7	-17	-0.1	83	230	213
Côte d'Ivoire	32 246	7 117	22.1	0.5	-265	-3.1	184	232	130
Dem Rep of the Congo	226 705	135 207	59.6	2.7	-532	-0.4	97	231	225
Djibouti	2 319	6	0.3	n.s.	0	0.0	-	36	46
Egypt	100 145	72	0.1	n.s.	2	3.3	72	188	106
Equatorial Guinea	2 805	1 752	62.5	4	-11	-0.6		162	158
Eritrea	11 759	1 585	13.5	0.4	-5	-0.3	22	39	32
Ethiopia	110 430	4 593	4.2	0.1	-40	-0.8	216	98	79
Gabon	26 767	21 826	81.5	18.2	-10	0.0	36	222	137
Gambia	1 130	481	42.6	0.4	4	1.0	2	23	22
Ghana	23 854	6 335	26.6	0.3	-120	-1.7	76	85	88
Guinea	24 586	6 929	28.2	0.9	-35	-0.5	25	203	114
Guinea-Bissau	3 612	2 187	60.5	1.8	-22	-0.9	2	32	20
Kenya	58 038	17 096	29.5	0.6	-93	-0.5	232	60	48
Lesotho	3 035	14	0.5	n.s.	0	0.0	14	60	34
Liberia	11 137	3 481	31.3	1.2	-76	-2.0	119	349	196
Libyan Arab Jamahiriya	175 954	358	0.2	0.1	5	1.4	168	25	20
Madagascar	58 704	11 727	20.0	0.8	-117	-0.9	350	199	194
Malawi	11 628	2 562	22.0	0.2	-71	-2.4	112	180	143
Mali	124 019	13 186	10.6	1.2	-99	-0.7	15	38	31
Mauritania	102 552	317	0.3	0.1	-10	-2.7	25	7	6
Mauritius	203	16	7.9	n.s.	0	-0.6	13	154	95
Morocco	44 655	3 025	6.8	0.1	-1	0.0	534	46	41
Mozambique	78 425	30 601	39.0	1.6	-64	-0.2	50	44	55
Namibia	82 429	8 040	9.8	4.7	-73	-0.9	0	12	12
Niger	126 700	1 328	1.0	0.1	-62	-3.7	73	5	4
Nigeria	91 283	13 517	14.8	0.1	-398	-2.6	693	143	184
Réunion	251	71	28.3	0.1	-1	-0.8	3	200	160
Rwanda	2 633	307	11.7	0	-15	-3.9	261	192	187
Saint Helena	31	2	6.5	0.3	0	0.0	2	-	-
Sao Tome and Principe	95	27	28.3	0.2	0	0.0	-	188	116
Senegal	19 671	6 205	31.5	0.7	-45	-0.7	263	54	30
Seychelles	45	30	66.7	0.4	0	0.0	5	50	49
Sierra Leone	7 174	1 055	14.7	0.2	-36	-2.9	6	248	139
Somalia	63 766	7 515	11.8	0.8	-77	-1.0	3	32	26
South Africa	121 758	8 917	7.3	0.2	-8	-0.1	1 554	63	81
Sudan	250 581	61 627	24.6	2.1	-959	-1.4	641	15	12
Swaziland	1 737	522	30.1	0.5	6	1.2	161	68	115
Togo	5 679	510	9.0	0.1	-21	-3.4	38	160	155
Tunisia	16 362	510	3.1	0.1	1	0.2	202	27	27
Uganda	20 421	4 190	20.5	0.2	-91	-2.0	43	232	163
United Republic of Tanzania	88 166	38 811	44.0	1.2	-91	-0.2	135	75	60
Western Sahara	26 600	152	0.6	0.5	0	0.0	-	67	59
Zambia	74 135	31 246	42.1	3.5	-851	-2.4	75	75	104
Zimbabwe	38 775	19 040	49.1	1.7	-320	-1.5	141	70	56
AFRICA	**3 008 412**	**649 866**	**21.6**	**0.9**	**-5 264**	**-0.8**	**8 036**	**124**	**109**

Table 1. Forest data by country (cont.)

Country/Area	Land area	Total forest 2000			Forest cover change 1990-2000		Total plantation area	Volume	Biomass
		Area		Area p.capita	Annual change				
	000 ha	000 ha	%	ha	000 ha	%	000 ha	m^3/ha	t/ha
Afghanistan	64 958	1 351	2.1	0.1	0	0.0	-	39	27
Armenia	2 852	351	12.3	0.1	4	1.3	13	128	66
Azerbaijan	8 359	1 094	13.1	0.1	13	1.3	20	136	105
Bahrain	69	0	n.s.	0	0	14.9	0	24	14
Bangladesh	14 171	1 334	9.4	n.s.	17	1.3	625	40	39
Bhutan	4 701	3 016	64.2	1.5	0	0.0	21	284	178
Brunei Darussalam	577	442	76.6	1.4	-1	-0.2	3	206	205
Cambodia	17 636	9 335	52.9	0.9	-56	-0.6	90	70	69
China	959 806	163 480	17.0	0.1	1 806	1.2	45 083	90	61
Cyprus	916	117	12.8	0.2	0	0.0	27	43	21
Dem People's Rep Korea	12 054	8 210	68.1	0.4	0	0.0	-	41	25
East Timor	1 479	507	34.3	5.8	-3	-0.6	-	137	136
Gaza Strip	-	-	-	-	-	-	-	-	-
Georgia	6 831	2 988	43.7	0.6	0	0.0	200	145	97
India	328 759	64 113	19.5	0.1	38	0.1	32 578	74	73
Indonesia	190 457	104 986	55.1	0.5	-1 312	-1.2	9 871	137	136
Iran, Islamic Republic of	163 320	7 299	4.5	0.1	0	0.0	2 284	151	149
Iraq	43 832	799	1.8	n.s.	0	0.0	10	50	28
Israel	2 063	132	6.4	n.s.	5	4.9	91	49	-
Japan	36 460	24 081	66.0	0.2	3	0.0	10 682	145	88
Jordan	8 921	86	1.0	n.s.	0	0.0	45	67	37
Kazakhstan	271 731	12 148	4.5	0.8	239	2.2	5	35	18
Kuwait	1 782	5	0.3	n.s.	0	3.5	5	37	21
Kyrgyzstan	19 850	1 003	5.1	0.2	23	2.6	57	32	-
Lao People's Dem. Rep	23 469	12 561	53.5	2.4	-53	-0.4	54	50	31
Lebanon	1 041	36	3.5	n.s.	0	-0.4	2	40	22
Malaysia	32 975	19 292	58.5	0.9	-237	-1.2	1 750	206	205
Maldives	30	1	3.3	0	0	0.0	-	-	-
Mongolia	156 650	10 645	6.8	4.1	-60	-0.5	-	128	80
Myanmar	66 050	34 419	52.1	0.8	-517	-1.4	821	58	57
Nepal	14 718	3 900	26.5	0.2	-78	-1.8	133	175	109
Oman	21 246	1	0.0	0	0	5.3	1	29	17
Pakistan	78 783	2 361	3.0	n.s.	-39	-1.5	980	39	27
Philippines	30 000	5 789	19.3	0.1	-89	-1.4	753	115	114
Qatar	1 100	1	0.1	0	0	9.6	1	22	12
Republic of Korea	9 926	628	6.3	0.1	-5	-0.8	-	58	36
Saudi Arabia	214 969	1 504	0.7	0.1	0	0.0	4	21	12
Singapore	62	2	3.2	n.s.	0	0.0	-	206	205
Sri Lanka	6 561	1 940	29.6	0.1	-35	-1.6	316	59	59
Syrian Arab Republic	18 517	461	2.5	n.s.	0	0.0	229	50	28
Tajikistan	14 270	400	2.8	0.1	2	0.5	10	14	10
Thailand	51 312	14 762	28.8	0.2	-112	-0.7	4 920	30	29
Turkey	76 273	10 225	13.4	0.2	22	0.2	1 854	136	74
Turkmenistan	48 109	3 755	7.8	0.9	0	0.0	12	4	3
United Arab Emirates	8 360	321	3.8	0.1	8	2.8	314	-	-
Uzbekistan	44 740	1 969	4.4	0.1	5	0.2	300	6	-
Viet Nam	33 170	9 819	29.6	0.1	52	0.5	1 711	66	66
West Bank	-	-	-	-	-	-	-	-	-
Yemen	52 797	449	0.9	n.s.	-9	-1.9	-	24	19
ASIA	**3 166 709**	**542 116**	**17.1**	**0.2**	**-371**	**-0.1**	**115 874**	**99**	**83**

Table 1. Forest data by country (cont.)

Country/Area	Land area	Total forest 2000			Forest cover change 1990-2000		Total plantation area	Volume	Biomass
		Area		Area p.capita	Annual change				
	000 ha	000 ha	%	ha	000 ha	%	000 ha	m^3/ha	t/ha
American Samoa	20	12	60.1	0.2	0	0.0	0	-	-
Australia	766 818	158 080	20.6	8.5	0	0.0	1 043	55	57
Cook Islands	23	22	95.7	1.2	0	0.0	1	-	-
Fiji	1 827	815	44.6	1	-2	-0.2	97	-	-
French Polynesia	400	105	26.3	0.5	0	0.0	5	-	-
Guam	55	21	38.2	0.1	0	0.0	0	-	-
Kiribati	73	28	38.4	0.3	0	0.0		-	-
Marshall Islands	18	-	-	-	-	-	-	-	-
Micronesia	69	15	21.7	0.1	-1	-4.5	0	-	-
Nauru	2	-	-	-	-	-	-	-	-
New Caledonia	1 858	372	20.0	1.8	0	0.0	10	-	-
New Zealand	26 542	7 946	29.9	2.1	39	0.5	1 542	322	217
Niue	26	6	-	-	0	0.0	0	-	-
Northern Mariana Islands	46	14	30.4	0.2	0	0.0	-	-	-
Palau	46	35	76.1	1.8	0	0.0	0	-	-
Papua New Guinea	46 284	30 601	66.1	6.5	-113	-0.4	90	102	58
Samoa	283	105	37.1	0.6	-3	-2.1	5	-	-
Solomon Islands	2 890	2 536	87.8	5.9	-4	-0.2	50	-	-
Tonga	76	4	5.3	n.s.	0	0.0	1	-	-
Vanuatu	1 218	447	36.7	2.4	1	0.1	3	-	-
OCEANIA	**848 576**	**201 163**	**23.7**	**6.7**	**-83**	**0.0**	**2 848**	**73**	**64**
Albania	2 760	991	35.9	0.3	-8	-0.8	102	81	58
Andorra	-	-	-	-	-	-	-	0	0
Austria	8 251	3 886	47.1	0.5	8	0.2		286	250
Belarus	20 285	9 402	46.3	0.9	256	3.2	195	153	80
Belgium and Luxembourg	3 287	728	22.1	0.1	-1	-0.2		218	101
Bosnia and Herzegovina	5 066	2 273	44.9	0.6	0	0.0	57	110	-
Bulgaria	10 890	3 690	33.9	0.5	20	0.6	969	130	76
Croatia	5 592	1 783	31.9	0.4	2	0.1	47	201	107
Czech Republic	7 727	2 632	34.1	0.3	1	0.0		260	125
Denmark	4 239	455	10.7	0.1	1	0.2	341	124	58
Estonia	4 175	2 060	49.3	1.5	13	0.6	305	156	85
Finland	30 455	21 935	72.0	4.3	8	0.0		89	50
France	54 379	15 341	28.2	0.3	62	0.4	961	191	92
Germany	34 609	10 740	31.0	0.1	0	0.0		268	134
Greece	13 076	3 599	27.5	0.3	30	0.9	120	45	25
Hungary	9 093	1 840	20.2	0.2	7	0.4	136	174	112
Iceland	9 028	31	0.3	0.1	1	2.2	12	27	17
Ireland	6 889	659	9.6	0.2	17	3.0	590	74	25
Italy	29 407	10 003	34.0	0.2	30	0.3	133	145	74
Latvia	6 222	2 923	47.0	1.2	13	0.4	143	174	93
Liechtenstein	15	7	46.7	0.2	0	1.2		254	119
Lithuania	6 258	1 994	31.9	0.5	5	0.2	284	183	99
Malta	32	0	n.s.	0	0	0.0	0	232	-
Netherlands	3 695	375	10.1	n.s.	1	0.3	100	160	107
Norway	30 636	8 868	28.9	2	31	0.4	300	89	49
Poland	31 464	9 310	29.6	0.2	11	0.1	39	213	94
Portugal	9 099	3 666	40.3	0.4	57	1.7	834	82	33
Republic of Moldova	3 295	325	9.9	0.1	1	0.2	1	128	64
Romania	22 570	6 448	28.6	0.3	15	0.2	91	213	124
Russian Federation	1 707 541	851 392	49.9	5.8	135	0.0	17 340	105	56
San Marino	-	-	-	-	-	-	-	0	0
Slovakia	4 808	2 177	45.3	0.4	18	0.9	15	253	142
Slovenia	2 014	1 107	55.0	0.6	2	0.2	1	283	178
Spain	50 058	14 370	28.7	0.4	86	0.6	1 904	44	24
Sweden	40 642	27 134	66.8	3.1	1	0.0	569	107	63
Switzerland	3 916	1 199	30.6	0.2	4	0.4	4	337	165
The FYR of Macedonia	2 531	906	35.8	0.5	0	0.0	30	70	-

Table 1. Forest data by country (cont.)

Country/Area	Land area	Total forest 2000			Forest cover change 1990-2000		Total plantation area	Volume	Biomass
		Area		Area p.capita	Annual change				
	000 ha	000 ha	%	ha	000 ha	%	000 ha	m^3/ha	t/ha
Ukraine	57 950	9 584	16.5	0.2	31	0.3	4 425	179	-
United Kingdom	24 166	2 794	11.6	n.s.	17	0.6	1 928	128	76
Yugoslavia	10 112	2 887	28.6	0.3	-1	-0.1	39	111	23
EUROPE	**2 276 233**	**1 039 513**	**45.7**	**1.4**	**871**	**0.1**	**32 015**	**112**	**59**
Antigua and Barbuda	44	9	20.5	0.1	0	0.0		202	210
Bahamas	1 388	842	60.7	2.8	0	0.0	-	-	-
Barbados	43	2	4.7	0	0	0.0	0	-	-
Belize	2 296	1 348	58.7	5.7	-36	-2.3	3	352	211
Bermuda	-	-	-	-	-	-	-	-	-
British Virgin Islands	15	3	20.0	0.2	0	0.0	-	-	-
Canada	921 543	244 571	26.5	7.9	0	0.0		120	83
Cayman Islands	-	13	-	0.4	0	0.0	-	-	-
Costa Rica	5 110	1 968	38.5	0.5	-16	-0.8	178	366	220
Cuba	11 086	2 348	21.2	0.2	28	1.3	482	51	30
Dominica	75	46	61.3	0.7	0	-0.7	0	159	166
Dominican Republic	4 873	1 376	28.2	0.2	0	0.0	30	50	53
El Salvador	2 104	121	5.8	n.s.	-7	-4.6	14	-	-
Greenland	-	-	-	-	-	-	-	-	-
Grenada	34	5	14.7	0.1	0	0.9	0	144	150
Guadeloupe	171	82	48.0	0.2	2	2.1	4	-	-
Guatemala	10 889	2 850	26.2	0.3	-54	-1.7	133	618	371
Haiti	2 775	88	3.2	n.s.	-7	-5.7	20	23	14
Honduras	11 209	5 383	48.0	0.9	-59	-1.0	48	101	105
Jamaica	1 097	325	29.6	0.1	-5	-1.5	9	111	116
Martinique	111	47	42.3	0.1	0	0.0	2	5	5
Mexico	195 820	55 205	28.2	0.6	-631	-1.1	267	91	54
Montserrat	11	3	27.3	0.3	0	0.0	-	-	-
Netherlands Antilles	80	3 278	n.s.	n.s.	-117	-3.0	-	-	-
Nicaragua	11 925	1	0.0	0.7	0	0.0	46	269	161
Panama	7 552	2 876	38.1	1	-52	-1.6	40	536	322
Puerto Rico	895	229	25.6	0.1	-1	-0.2	4	-	-
Saint Kitts and Nevis	36	4	11.1	0.1	0	-0.6		-	-
Saint Lucia	62	9	14.5	0.1	-1	-4.9	1	331	198
Saint Pierre and Miquelon	-	-	-	-	-	-	-	-	-
Saint Vincent and Grenadines	39	6	15.4	0.1	0	-1.4	0	289	173
Trinidad and Tobago	513	259	50.5	0.2	-2	-0.8	15	124	129
United States	915 895	225 993	24.7	0.8	388	0.2	16 238	136	108
United States Virgin Islands	34	14	41.2	0.2	0	0.0	-	-	-
NORTH & CENTRAL AMERICA	**2 098 891**	**549 306**	**26.2**	**1.2**	**-570**	**-0.1**	**17 533**	**129**	**94**
Argentina	278 040	34 648	12.5	1	-285	-0.8	926	44	46
Bolivia	109 858	53 068	48.3	6.5	-161	-0.3	46	101	105
Brazil	854 739	532 481	62.3	3.2	-2 226	-0.4	4 982	190	115
Chile	74 437	15 536	20.9	1	-20	-0.1	2 017	125	75
Colombia	113 554	49 601	43.7	1.2	-190	-0.4	141	188	196
Ecuador	28 356	10 557	37.2	0.9	-137	-1.2	167	210	151
Falkland Islands	1	-	-	-	-	-	-	-	-
French Guiana	8 810	7 926	90.0	45.6	0	0.0	1	242	253
Guyana	21 498	16 879	78.5	19.7	-49	-0.3	12	242	253
Paraguay	40 609	23 372	57.6	4.4	-123	-0.5	27	57	59
Peru	128 522	65 215	50.7	2.6	-269	-0.4	640	117	122
Suriname	16 327	14 113	86.4	34	0	0.0	13	242	253
Uruguay	17 741	1 292	7.3	0.4	50	5.0	622	-	-
Venezuela	91 206	49 506	54.3	2.1	-218	-0.4	863	211	233
SOUTH AMERICA	**1 783 696**	**874 194**	**49.0**	**2.6**	**-3 628**	**-0.4**	**10 455**	**172**	**128**
TOTAL-WORLD	**13 182 522**	**3 856 159**	**29.3**	**0.7**	**-9 045**	**-0.2**	**186 760**	**126**	**92**

Table 2. Forest management status 2000

Country/Area	Forest Area 2000	Criteria & Indicators for SFM	Area under forest management plans		Forest protected area			Forest area certified	
					country report		global maps		
	000 ha		000 ha	%	000 ha	%	%	000 ha	scheme
Algeria	2 145	NE	597	27.8	-	-	6	-	-
Angola	69 756	DZAf/ATO	-	-	-	-	3	-	-
Benin	2 650	-	-	-	-	-	32	-	-
Botswana	12 427	DZAf	-	-	-	-	26	-	-
Burkina Faso	7 089	DZAf	694	9.8	-	-	11	-	-
Burundi	94	-	-	-	-	-	29	-	-
Cameroon	23 858	ATO	-	-	-	-	11	-	-
Cape Verde	85	DZAf	-	-	-	-	-	-	-
Central African Republic	22 907	ATO	269*	n.ap.	-	-	15	-	-
Chad	12 692	DZAf	-	-	-	-	27	-	-
Comoros	8	-	-	-	-	-	-	-	-
Congo	22 060	ATO	-	-	-	-	14	-	-
Côte d'Ivoire	7 117	ATO	1 387	19.5	-	-	10	-	-
Dem Rep of the Congo	135 207	ATO	-	-	-	-	9	-	-
Djibouti	6	NE/DZAf	-	-	-	-	0	-	-
Egypt	72	NE	-	-	-	-	0	-	-
Equatorial Guinea	1 752	ATO	-	-	-	-	11	-	-
Eritrea	1 585	DZAf	-	-	-	-	0	-	-
Ethiopia	4 593	DZAf	112	2.4	-	-	15	-	-
Gabon	21 826	ATO	-	-	-	-	16	-	-
Gambia	481	DZAf	-	-	-	-	3	-	-
Ghana	6 335	ATO	-	-	-	-	9	-	-
Guinea	6 929	-	112*	n.ap.	-	-	5	-	-
Guinea-Bissau	2 187	DZAf	-	-	-	-	1	-	-
Kenya	17 096	DZAf	120*	n.ap.	-	-	40	-	-
Lesotho	14	DZAf	n.s.	2.0	-	-	16	-	-
Liberia	3 481	ATO	-	-	-	-	1	-	-
Libyan Arab Jamahiriya	358	NE	-	-	-	-	19	-	-
Madagascar	11 727	-	-	-	-	-	4	-	-
Malawi	2 562	DZAf	-	-	-	-	45	-	-
Mali	13 186	DZAf	-	-	-	-	7	-	-
Mauritania	317	NE/DZAf	-	-	-	-	3	-	-
Mauritius	16	DZAf	-	-	-	-	-	-	-
Morocco	3 025	NE	-	-	-	-	7	-	-
Mozambique	30 601	DZAf	-	-	-	-	7	-	-
Namibia	8 040	DZAf	54*	n.ap.	-	-	5	54	FSC
Niger	1 328	DZAf	-	-	-	-	77	-	-
Nigeria	13 517	ATO	832*	n.ap.	-	-	7	-	-
Réunion	71	-	-	-	-	-	-	-	-
Rwanda	307	-	-	-	-	-	76	-	-
Saint Helena	2	-	-	-	-	-	-	-	-
Sao Tome and Principe	27	ATO	-	-	-	-	-	-	-
Senegal	6 205	DZAf	-	-	-	-	16	-	-
Seychelles	30	DZAf	-	-	-	-	-	-	-
Sierra Leone	1 055	-	-	-	-	-	5	-	-
Somalia	7 515	NE/DZAf	-	-	-	-	3	-	-
South Africa	8 917	DZAf	828*	n.ap.	-	-	7	828	FSC
Sudan	61 627	NE/DZAf	-	-	-	-	10	-	-
Swaziland	522	DZAf	-	-	-	-	4	-	-
Togo	510	ITTO	12	2.4	-	-	14	-	-
Tunisia	510	NE	400	78.4	-	-	4	-	-
Uganda	4 190	DZAf	-	-	-	-	18	-	-
United Republic of Tanzania	38 811	DZAf/ATO	-	-	-	-	14	-	-
Western Sahara	152	-	-	-	-	-	0	-	-
Zambia	31 246	DZAf	-	-	-	-	24	-	-
Zimbabwe	19 040	DZAf	92*	n.ap.	-	-	12	92	FSC
AFRICA	**649 866**		**3 202**	**0.5**				**974**	

Table 2. Forest management status 2000 (cont.)

Country/Area	Forest Area 2000	Criteria & Indicators for SFM	Area under forest management plans		Forest protected area			Forest area certified	
					country report		global maps		
	000 ha		000 ha	%	000 ha	%	%	000 ha	scheme
Afghanistan	1 351	NE	-	-	-	-	0	-	-
Armenia	351	-	351	100.0	107	31	5	-	-
Azerbaijan	1 094	NE	1 094	100.0	1 094	100	7	-	-
Bahrain	0	NE	-	-	-	-	-	-	-
Bangladesh	1 334	DFAs	1 334	100.0	-	-	14	-	-
Bhutan	3 016	DFAs	699	23.2	-	-	25	-	-
Brunei Darussalam	442	-	-	-	-	-	22	-	-
Cambodia	9 335	ITTO	-	-	-	-	24	-	-
China	163 480	MON/DFAs/ITTO	-	-	-	-	3	-	-
Cyprus	117	NE	117	100.0	117	100	37	-	-
Dem People's Rep Korea	8 210	-	-	-	-	-	3	-	-
East Timor	507	-	-	-	-	-	3	-	-
Gaza Strip	-	-	-	-	-	-	-	-	-
Georgia	2 988	EUR	2 438	81.6	111	4	3	-	-
India	64 113	DFAs/ITTO	46 159	72.0	-	-	8	-	-
Indonesia	104 986	ITTO	72*	n.ap.	-	-	16	72	FSC
Iran, Islamic Republic of	7 299	NE	-	-	-	-	12	-	-
Iraq	799	NE	-	-	-	-	0	-	-
Israel	132	-	132	100.0	-	-	63	-	-
Japan	24 081	MON	24 081	100.0	1 758	7	8	3	FSC
Jordan	86	NE	-	-	-	-	0	-	-
Kazakhstan	12 148	-	12 148	100.0	12 148	100	11	-	-
Kuwait	5	NE	-	-	-	-	0	-	-
Kyrgyzstan	1 003	NE	1 003	100.0	866	86	10	-	-
Lao People's Dem. Rep	12 561	-	-	-	-	-	20	-	-
Lebanon	36	NE	-	-	-	-	0	-	-
Malaysia	19 292	ITTO	14 020	72.7	-	-	9	55	FSC
Maldives	1	-	-	-	-	-	-	-	-
Mongolia	10 645	DFAs	-	-	-	-	11	-	-
Myanmar	34 419	DFAs/ITTO	-	-	-	-	5	-	-
Nepal	3 900	DFAs	1 010	25.9	-	-	9	-	-
Oman	1	NE	-	-	-	-	0	-	-
Pakistan	2 361	NE	-	-	-	-	3	-	-
Philippines	5 789	ITTO	6 935	119.8	-	-	7	15	FSC
Qatar	1	NE	-	-	-	-	0	-	-
Republic of Korea	628	MON	4 096	652.2	-	-	4	-	-
Saudi Arabia	1 504	NE	-	-	-	-	9	-	-
Singapore	2	-	2	100.0	-	-	-	-	-
Sri Lanka	1 940	DFAs	1 940	100.0	-	-	18	13	FSC
Syrian Arab Republic	461	NE	-	-	-	-	0	-	-
Tajikistan	400	NE	400	100.0	400	100	1	-	-
Thailand	14 762	DFAs/ITTO	-	-	-	-	23	-	-
Turkey	10 225	NE/EUR	9 954	97.3	194	2	2	-	-
Turkmenistan	3 755	NE	3 755	100.0	113	3	13	-	-
United Arab Emirates	321	NE	-	-	-	-	0	-	-
Uzbekistan	1 969	-	1 969	100.0	1 888	96	30	-	-
Viet Nam	9 819	-	-	-	-	-	6	-	-
West Bank	-	-	-	-	-	-	-	-	-
Yemen	449	NE	-	-	-	-	0	-	-
ASIA	**542 116**		**127 308**	**23.5**				**158**	

Table 2. Forest management status 2000 (cont.)

Country/Area	Forest Area 2000	Criteria & Indicators for SFM	Area under forest management plans		Forest protected area			Forest area certified	
					country report		global maps		
	000 ha		000 ha	%	000 ha	%	%	000 ha	scheme
American Samoa	12	-	-	-	-	-	-	-	-
Australia	158 080	MON	158 080	100.0	23 870	15	13	-	-
Cook Islands	22	-	-	-	-	-	-	-	-
Fiji	815	ITTO	-	-	-	-	0	-	-
French Polynesia	105	-	-	-	-	-	-	-	-
Guam	21	-	-	-	-	-	-	-	-
Kiribati	28	-	-	-	-	-	-	-	-
Marshall Islands	-	-	-	-	-	-	-	-	-
Micronesia	15	-	-	-	-	-	-	-	-
Nauru	-	-	-	-	-	-	-	-	-
New Caledonia	372	-	-	-	-	-	2	-	-
New Zealand	7 946	MON	6 912	87.0	1 661	21	3	363	FSC
Niue	6	-	-	-	-	-	-	-	-
Northern Mariana Islands	14	-	-	-	-	-	-	-	-
Palau	35	-	-	-	-	-	-	-	-
Papua New Guinea	30 601	ITTO	5 341	17.5	-	-	9	4	FSC
Samoa	105	-	-	-	-	-	-	-	-
Solomon Islands	2 536	-	43*	n.ap.	-	-	0	43	FSC
Tonga	4	-	-	-	-	-	-	-	-
Vanuatu	447	ITTO	-	-	-	-	0	-	-
OCEANIA	**201 163**							**410**	
Albania	991	EUR	406	41.0	137	14	2	-	-
Andorra	-	EUR	n.a.	n.a.	-	-	-	-	-
Austria	3 886	EUR	3 886	100.0	785	20	22	550	PEFC
Belarus	9 402	EUR	7 577	80.6	856	9	10	-	-
Belgium and Luxembourg	728	EUR & EUR	656	90.1	179	25	30	4	FSC
Bosnia and Herzegovina	2 273	EUR	2 007	88.3	-	-	1	-	-
Bulgaria	3 690	EUR	3 690	100.0	1 391	38	8	-	-
Croatia	1 783	EUR	1 531	85.9	414	23	8	167	FSC
Czech Republic	2 632	EUR	2 632	100.0	647	25	28	10	FSC
Denmark	455	EUR	455	100.0	93	21	9	n.s.	FSC
Estonia	2 060	EUR	1 125	54.6	187	9	21	-	-
Finland	21 935	EUR	21 900	99.8	2 391	11	7	21 900	PEFC
France	15 341	EUR	15 341	100.0	2 746	18	17	1	FSC
Germany	10 740	EUR	10 740	100.0	7 207	67	29	3 242	PEFC/FSC
Greece	3 599	EUR	2 009	55.8	1 047	29	4	-	-
Hungary	1 840	EUR	1 840	100.0	368	20	16	-	-
Iceland	31	EUR	13	41.9	2	7	7	-	-
Ireland	659	EUR	551	83.6	7	1	5	-	-
Italy	10 003	EUR	1 117	11.2	1 881	19	11	11	FSC
Latvia	2 923	EUR	2 923	100.0	476	16	15	-	-
Liechtenstein	7	EUR	7	100.0	2	22	-	-	-
Lithuania	1 994	EUR	1 938	97.2	297	15	10	-	-
Malta	0	NE	n.s.	100.0	n.s.	10	-	-	-
Netherlands	375	EUR	375	100.0	89	24	9	69	FSC
Norway	8 868	EUR	7 147	80.6	2 297	26	1	5 600	PEFC
Poland	9 310	EUR	9 310	100.0	1 462	16	16	2 743	FSC
Portugal	3 666	EUR	1 201	32.8	634	17	8	-	-
Republic of Moldova	325	EUR	325	100.0	-	-	4	-	-
Romania	6 448	EUR	6 448	100.0	477	7	4	-	-
Russian Federation	851 392	MON/EUR	851 392	100.0	25 542	3	3	33	FSC
San Marino	-	EUR	n.a.	n.a.	-	-	-	-	-
Slovakia	2 177	EUR	1 988	91.3	897	41	29	-	-
Slovenia	1 107	EUR	1 107	100.0	80	7	6	-	-
Spain	14 370	EUR	11 694	81.4	3 420	24	17	-	-
Sweden	27 134	EUR	27 134	100.0	-	-	8	11 167	FSC/PEFC
Switzerland	1 199	EUR	1 153	96.2	43	4	12	49	FSC
The FYR of Macedonia	906	-	906	100.0	-	-	5	-	-

Table 2. Forest management status 2000 (cont.)

Country/Area	Forest Area 2000	Criteria & Indicators for SFM	Area under forest management plans		Forest protected area			Forest area certified	
					country report		global maps		
	000 ha		000 ha	%	000 ha	%	%	000 ha	scheme
Ukraine	9 584	EUR	9 584	100.0	987	10	6	203	FSC
United Kingdom	2 794	EUR	2 319	83.0	897	32	23	958	FSC
Yugoslavia	2 887	EUR	2 723	94.3	2 887	100	6	-	-
EUROPE	**1 039 513**		**1 017 150**	**97.8**				**46 708**	
Antigua and Barbuda	9	-	-	-	-	-	-	-	-
Bahamas	842	-	-	-	-	-	4	-	-
Barbados	2	-	-	-	-	-	-	-	-
Belize	1 348	LEP	1 000	74.2	-	-	37	96	FSC
Bermuda	-	-	-	-	-	-	-	-	-
British Virgin Islands	3	-	-	-	-	-	-	-	-
Canada	244 571	MON	173 400	70.9	19 321	8	5	4 360	FSC/CSA/SFI
Cayman Islands	13	-	-	-	-	-	-	-	-
Costa Rica	1 968	LEP	116*	n.ap.	-	-	36	41	FSC
Cuba	2 348	-	730	31.1	-	-	25	-	-
Dominica	46	-	-	-	-	-	-	-	-
Dominican Republic	1 376	-	152	11.0	-	-	15	-	-
El Salvador	121	LEP	-	-	-	-	1	-	-
Greenland	-	-	-	-	-	-	-	-	-
Grenada	5	-	-	-	-	-	-	-	-
Guadeloupe	82	-	28*	n.ap.	-	-	-	-	-
Guatemala	2 850	LEP	54	1.9	-	-	35	100	FSC
Haiti	88	-	-	-	-	-	1	-	-
Honduras	5 383	LEP	821	15.3	-	-	5	20	FSC
Jamaica	325	-	44	13.5	-	-	11	-	-
Martinique	47	-	10	21.3	-	-	-	-	-
Mexico	55 205	MON	7 100	12.9	-	-	4	169	FSC
Montserrat	3	-	-	-	-	-	-	-	-
Netherlands Antilles	3 278	-	-	-	-	-	-	-	-
Nicaragua	1	LEP	236	23600.0	-	-	23	-	-
Panama	2 876	LEP	20*	n.ap.	-	-	35	1	FSC
Puerto Rico	229	-	57	24.9	-	-	5	-	-
Saint Kitts and Nevis	4	-	-	-	-	-	-	-	-
Saint Lucia	9	-	-	-	-	-	-	-	-
Saint Pierre and Miquelon	-	-	-	-	-	0	-	-	-
Saint Vincent and Grenadines	6	-	-	-	-	-	-	-	-
Trinidad and Tobago	259	ITTO	120	46.3	-	-	-	-	-
United States	225 993	MON	125 707	55.6	66 668	30	40	26 129	FSC/SFI/ATFP/GT
United States Virgin Islands	14	-	-	-	-	-	-	-	-
NORTH & CENTRAL AMERICA	**549 306**		**309 431**	**56.3**				**30 916**	
Argentina	34 648	MON	-	-	-	-	7	-	-
Bolivia	53 068	TARA	6 900	13.0	-	-	31	885	FSC
Brazil	532 481	TARA	4 000	0.8	-	-	17	666	FSC
Chile	15 536	MON	-	-	-	-	14	-	-
Colombia	49 601	TARA	85	0.2	-	-	24	-	-
Ecuador	10 557	TARA	14	0.1	-	-	20	-	-
Falkland Islands	-	-	-	-	-	-	-	-	-
French Guiana	7 926	-	400	5.0	-	-	7	-	-
Guyana	16 879	TARA	4 200	24.9	-	-	1	-	-
Paraguay	23 372	-	3 000	12.8	-	-	5	-	-
Peru	65 215	TARA	1 573	2.4	-	-	10	-	-
Suriname	14 113	TARA	1 568	11.1	-	-	4	-	-
Uruguay	1 292	MON	99	7.7	-	-	5	-	-
Venezuela	49 506	TARA	3 970	8.0	-	-	66	-	-
SOUTH AMERICA	**874 194**		**25 809**	**3.0**				**1 551**	
TOTAL-WORLD	**3 856 159**							**80 717**	