Chapter 5

Productive functions of forest resources

OVERVIEW

Forests and trees outside forests provide a wide range of wood and non-wood forest products. The productive function of forest resources is a common thematic element of all the ecoregional criteria and indicator processes. This reflects an ambition to maintain an ample, valuable supply of primary forest products, while at the same time ensuring that production and harvesting are sustainable and do not compromise the management options of future generations.

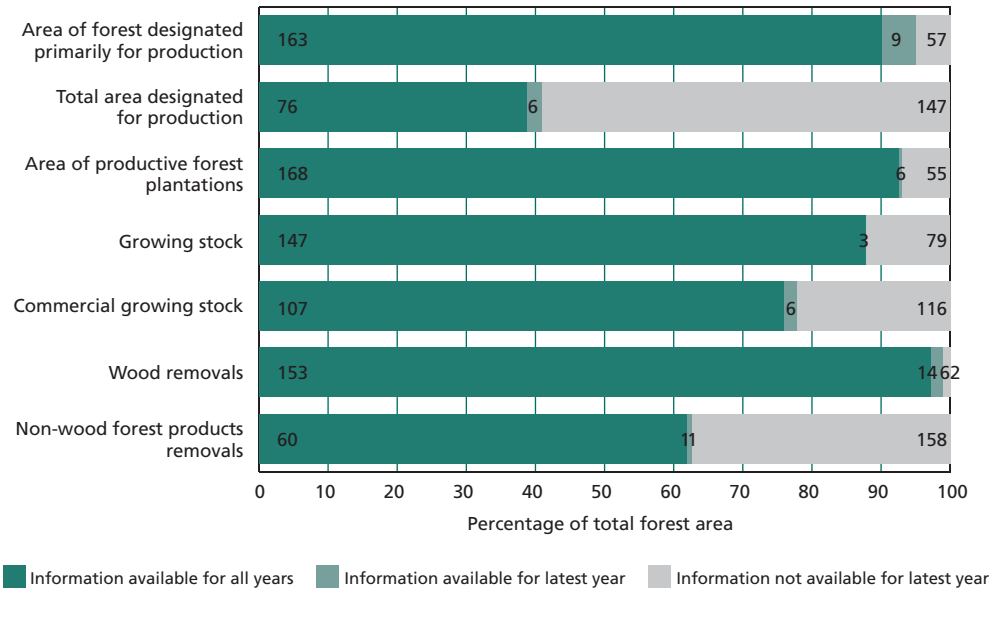
Describing the forest resource as a provider of goods has traditionally been one of the main objectives of global forest resources assessments. Earlier assessments focused on timber supply, but the concept of forest production has since widened to encompass all types of wood and non-wood forest products.

As part of the FRA 2005 reporting process, information was collected on the following variables related to the productive function of forest resources:

- area of forest designated for production;
- area of productive forest plantations;
- growing stock and commercial growing stock;
- removals of wood products;
- removals of non-wood forest products (NWFPs).

Data availability and reliability are problems with some of these variables, for example removals of non-wood forest products, as can be seen in Figure 5.1.

FIGURE 5.1
Information availability – productive functions of forest resources



Note: Figures present number of countries in each category.

KEY FINDINGS

Many products are extracted from forests, ranging from wood for timber and fuelwood to food (berries, mushrooms, edible plants, bushmeat), fodder and other NWFPs. By quantity, wood destined for industrial use is the most important product; among NWFPs, food and fodder are the most significant.

About half the world's forests are designated for production (as either primary or secondary function) and thus are available to supply wood and non-wood forest products. The total area of forest designated for production does not show any significant trend for the period 1990–2005.

Productive forest plantations represented 1.9 percent of global forest area in 1990, 2.4 percent in 2000 and 2.8 percent in 2005. Currently, there are about 109 million hectares of productive forest plantations in the world. The Asia region accounts for 41 percent; Europe 20 ; North and Central America 16; South America and Africa 10 percent each and Oceania 3 percent. The top ten countries account for 73 percent of the total area, with China, the Russian Federation and the United States together accounting for more than half the total area of productive forest plantations.

The area of productive forest plantations increased by 2.0 million hectares per year during 1990–2000 and by 2.5 million hectares per year during 2000–2005. All regions show an increase in plantation area, and the highest plantation rates are found in Asia, particularly in China.

It should be noted that these figures refer only to productive forest plantations[1] and do not include the planted component of semi-natural forests designated for productive purposes. Nor do they include plantations established for the protection of soil and water or other environmental purposes.

In 2005 the total global growing stock of forests is estimated at 434 billion m^3, which corresponds to an average of 110 m^3 per hectare. The countries with the most growing stock per hectare are found in central Europe and some tropical areas.

Total growing stock shows a slight downward tendency – mainly owing to the decrease in forest area. However, some regions also show significant trends in growing stock per hectare, for example Europe shows an increase and Southeast Asia a decrease.

About 202 billion m^3 or 47 percent of the total growing stock is considered commercial. Higher percentages in relation to total volume are found in countries with temperate forests and lower ones in those with tropical forests.

Global wood removals in 2005 amount to 2.8 billion m^3. About 40 percent is fuelwood (1.2 billion m^3), but the proportions vary among regions, with Africa reporting 88 percent of removals as fuelwood, while North and Central America reported only 13 percent.

There are no significant global trends in wood removal. Africa reported increased removals while Asia showed a significant decrease. Europe, North and Central America and South America reported only a slight decrease.

Countries usually do not report illegal removals and informal fuelwood gathering, so figures for removals might be much higher. The reported figures on fuelwood removals are particularly weak, as a large part of fuelwood gathering is informal.

Annual wood removals account for about 0.7 percent of total global growing stock and 1.5 percent of commercial growing stock. These figures are indicative, and the figures on removals should not be directly compared with figures on growing stock, particularly at the country level. Removals take place partially outside forests, e.g. in

[1] In FRA 2005, 'productive forest plantation' is defined as a "forest of introduced species and in some cases native species, established through planting or seeding mainly for production of wood or non-wood goods". Man-made forests of native species are classified as plantations when they are characterized by few species, straight tree lines and even-aged stands, otherwise they are classified as semi-natural forests.

other wooded land and from trees outside forests – particularly fuelwood removals in developing countries – while growing stock estimates refer only to forest area.

There is insufficient information available on NWFPs in most countries, both developing and developed, and they are usually not included in national accounts and trade statistics. Consequently, the figures reported to FRA 2005 are in many cases incomplete, resulting in underestimates of NWFP removals, making it difficult to draw any far-reaching conclusions. However, the figures reported for the period 1990–2005 show a generally increasing trend.

In conclusion, the productive functions of forest resources are of great importance and have not undergone drastic changes during the 15-year period covered by FRA 2005, with the exception of the area of productive plantation forests, which shows a steady increase in all regions and a particularly rapid increase in Asia. Of the remaining variables, some show increasing and others decreasing trends. There are regional variations, but in most cases no clear regional patterns. A few notable regional trends can be seen, however, such as the increase of growing stock per hectare in Europe and its decrease in Southeast Asia. Further, taking under-reporting into account, it can be concluded that substantial amounts of NWFPs are removed annually and that these products play an important role at both local and national levels.

FOREST AREA DESIGNATED FOR PRODUCTIVE PURPOSES

This indicates to what extent forest areas have been set aside for production, either by legal prescription or by decision of the landowner or manager.

Forest designation is reported in two ways: 'primary function' and 'total area with function'. Forest areas with a specific, designated function considered to be significantly more important than other functions are reported as 'primary function'. All areas with a designated function (not necesssarily primary) are reported as 'total area with function'.

Information availability

Of the 229 countries and areas covered by FRA 2005, 172 provided information on forests designated primarily for productive purposes. For 2005, 141 of these reported having areas where production is designated as the primary function, and only 82 countries reported on total area with function. The countries reporting data on areas designated primarily for production account for 94 percent of the global forest area. In a few subregions, however, reporting countries account for a lower proportion of total forest area, i.e. the Caribbean, Central America and Western and Central Africa (Figure 5.2).

The countries that reported data on total area with function account for only 41 percent of the global forest area (Figure 5.3). Asia, North America and South America show higher then average reporting coverage, while Africa, the Caribbean, Europe (due to the absence of reporting by the Russian Federation) and Oceania show coverage below 15 percent.

The remaining countries/areas either did not report or reported that no information was available. These countries may still have areas designated for production, but they are either included in other categories, such as 'multiple use', or cannot be quantified.

Status

Table 5.1 shows a summary by region/subregion of the 2005 status of areas designated primarily for productive purposes.

At the global level, 34 percent of total forest area has production designated as its main purpose. In Europe, some 73 percent of forest area has production as the primary function, while North America reported only 6 percent designated for production – instead reporting most of its forests as designated for multiple use. This indicates a clear regional difference in the perception of forest designation.

FIGURE 5.2
Information availability – area of forest designated primarily for production

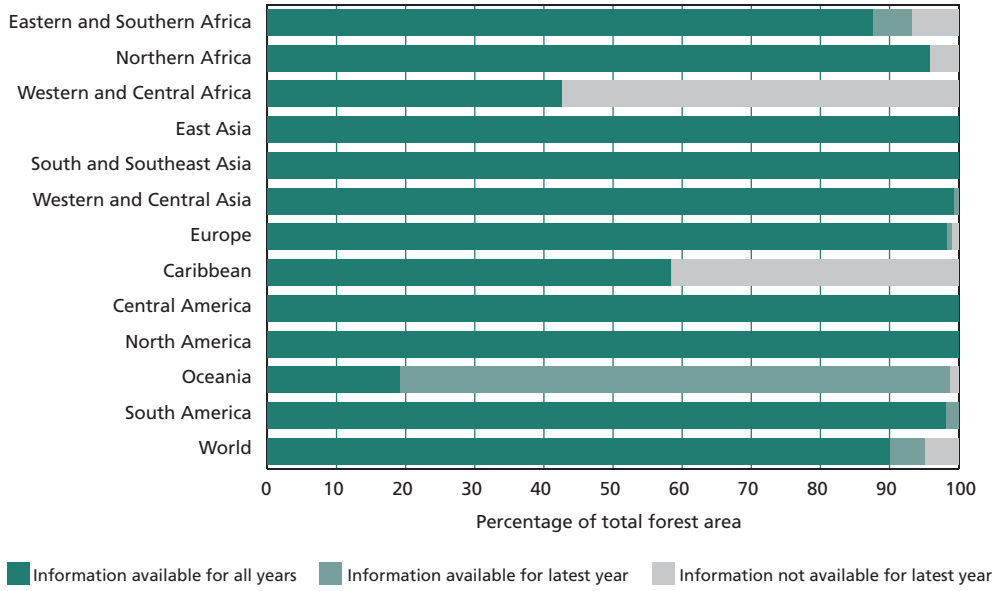
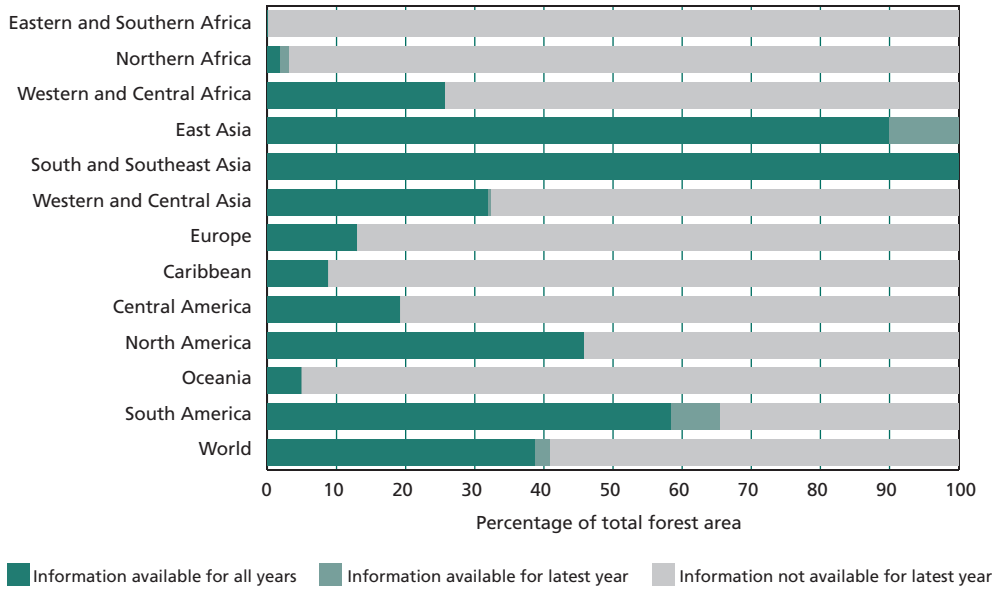


FIGURE 5.3
Information availability – total area of forest designated for production



Data on total area with function are too weak to allow a breakdown by region and subregion. Globally, 54 percent of forest area was reported as designated for productive purposes, whether as the primary or secondary function. This figure can be seen as a global estimate of the area of forest available for the supply of wood and non-wood forest products.

TABLE 5.1
Area of forest designated primarily for production 2005

Region/subregion	Information availability			Area of forest designated primarily for production	
	Countries reporting	Forest area *(1 000 ha)*	% of total forest area	1 000 ha	% of forest area
Eastern and Southern Africa	16	211 181	93.2	41 051	19
Northern Africa	13	125 667	95.9	44 185	35
Western and Central Africa	15	118 280	42.6	52 796	45
Total Africa	**44**	**455 129**	**71.6**	**138 032**	**30**
East Asia	5	244 862	100.0	125 488	51
South and Southeast Asia	17	283 126	100.0	120 098	42
Western and Central Asia	23	43 579	100.0	9 674	22
Total Asia	**45**	**571 567**	**100.0**	**255 260**	**45**
Total Europe	**36**	**991 192**	**99.0**	**724 308**	**73**
Caribbean	9	3 489	58.4	980	28
Central America	7	22 411	100.0	3 312	15
North America	4	677 464	100.0	40 499	6
Total North and Central America	**20**	**703 364**	**99.6**	**44 790**	**6**
Total Oceania	**14**	**203 467**	**98.6**	**22 449**	**11**
Total South America	**13**	**831 540**	**100.0**	**96 346**	**12**
World	**172**	**3 756 260**	**95.0**	**1 281 185**	**34**

TABLE 5.2
Trends in area of forest designated primarily for production 1990–2005

Region/subregion	Information availability (all 3 years)			Area of forest designated primarily for production *(1 000 ha)*			Annual change rate *(%)*	
	Countries reporting	Forest area *(1 000 ha)*	% of total forest area	1990	2000	2005	1990–2000	2000–2005
Eastern and Southern Africa	15	198 343	87.6	39 712	38 156	37 677	-0.40	-0.25
Northern Africa	13	125 667	95.9	48 670	46 016	44 185	-0.56	-0.81
Western and Central Africa	15	118 280	42.6	59 947	55 741	52 796	-0.72	-1.08
Total Africa	**43**	**442 291**	**69.6**	**148 329**	**139 913**	**134 658**	**-0.58**	**-0.76**
East Asia	5	244 862	100.0	126 821	119 688	125 488	-0.58	0.95
South and Southeast Asia	17	283 126	100.0	130 350	132 285	120 098	0.15	-1.91
Western and Central Asia	21	43 272	99.3	9 566	9 591	9 541	0.03	-0.10
Total Asia	**43**	**571 259**	**99.9**	**266 737**	**261 564**	**255 127**	**-0.20**	**-0.50**
Total Europe	**34**	**984 468**	**98.3**	**770 508**	**722 051**	**721 355**	**-0.65**	**0.02**
Caribbean	9	3 489	58.4	849	828	980	-0.25	3.41
Central America	7	22 411	100.0	6 325	4 202	3 312	-4.01	-4.65
North America	4	677 464	100.0	37 934	40 458	40 499	0.65	0.02
Total North and Central America	**20**	**703 364**	**99.6**	**45 108**	**45 488**	**44 790**	**0.08**	**-0.31**
Total Oceania	**11**	**39 593**	**19.2**	**5 651**	**9 371**	**9 261**	**5.19**	**-0.24**
Total South America	**12**	**816 436**	**98.2**	**88 216**	**103 224**	**91 073**	**1.58**	**-2.47**
World	**163**	**3 557 412**	**90.0**	**1 324 549**	**1 281 612**	**1 256 266**	**-0.33**	**-0.40**

Note: As some countries did not report a complete series, figures for 2005 are slightly different from those presented in the preceding table.

Trends

The analysis of trends in area of forest designated primarily for production is based on the countries that reported a complete time series (163 countries representing 90 percent of the global forest area). The results are shown in Table 5.2.

Globally, there is a slight decreasing tendency for area of forest with production as the primary function. Many regions/subregions follow the global trend, while others (e.g. Asia and South America) show an irregular pattern. In the case of Asia, Myanmar adopted a new classification in 2000, adding some 20 million hectares as primarily designated for

production. For South America, most countries are either stable or reporting a steady increase. Peru, however, reported a decrease of about 15 million hectares since 2000.

PRODUCTIVE FOREST PLANTATIONS

Forest plantations – a subset of all planted forests – are defined as forests of introduced species and in some cases native species, established through planting or seeding, with few species, even spacing and/or even-aged stands. Productive forest plantations are defined as forest plantations predominantly intended for the provision of wood, fibre and non-wood forest products.

Productive plantations can also provide protective, recreational, amenity and other functions, which are not precluded by the harvesting of products.

Some forests classified as semi-natural include planted trees of native species, most of which are used for productive purposes. As these forests do not fall under the forest plantation definition, they are not included in this analysis. The FRA 2005 thematic study on planted forests provides a more detailed analysis of both forest plantations and the planted forest component of semi-natural forests (see Chapter 2, Box 2.1).

Information availability

Information on the area of productive forest plantations forms part of country reporting on forest characteristics. Out of 229 countries, 174 provided information for 2005 and 168 information for all three reporting years: 1990, 2000 and 2005. The countries providing information account for 93 percent of the global forest area (Figure 5.4). Unfortunately, information is missing from many of the smaller islands and areas and from many of the countries in the Congo Basin.

Some countries experienced difficulty in differentiating between predominantly productive or protective functions, because their forest plantations are managed for multiple purposes.

Status

The total area of productive forest plantations reported in 2005 was about 109 million hectares, which corresponds to 2.8 percent of the global forest area. The area by region and subregion is presented in Table 5.3.

FIGURE 5.4
Information availability – area of productive forest plantations

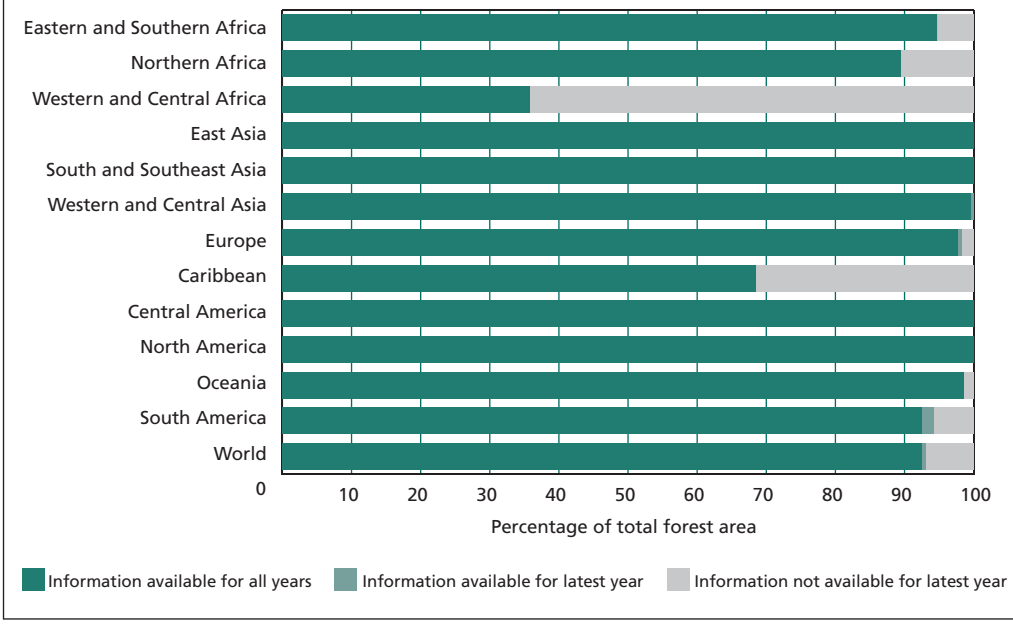


TABLE 5.3
Area of productive forest plantations 2005

Region/subregion	Information availability			Area of productive forest plantations	
	Countries reporting	Forest area *(1 000 ha)*	% of total forest area	1 000 ha	% of forest area
Eastern and Southern Africa	18	214 589	94.7	2 792	1.3
Northern Africa	12	117 193	89.4	6 033	5.1
Western and Central Africa	17	99 566	35.8	1 939	1.9
Total Africa	**47**	**431 347**	**67.9**	**10 764**	**2.5**
East Asia	5	244 862	100.0	30 006	12.3
South and Southeast Asia	17	283 126	100.0	11 825	4.2
Western and Central Asia	23	43 579	100.0	2 591	5.9
Total Asia	**45**	**571 567**	**100.0**	**44 422**	**7.8**
Total Europe	**36**	**983 907**	**98.3**	**21 469**	**2.2**
Caribbean	12	4 090	68.5	280	6.9
Central America	7	22 411	100.0	240	1.1
North America	4	677 464	100.0	17 133	2.5
Total North and Central America	**23**	**703 965**	**99.7**	**17 653**	**2.5**
Total Oceania	**11**	**203 455**	**98.6**	**3 833**	**1.9**
Total South America	**12**	**783 827**	**94.3**	**11 326**	**1.4**
World	**174**	**3 678 069**	**93.1**	**109 469**	**3.0**

Subregions reporting the greatest area of productive forest plantations are East Asia, Europe and North America, together accounting for about 63 percent of global productive forest plantations. In East Asia most of the plantations are found in China, and in North America in the United States.

Subregions reporting the least area of productive forest plantations are the African subregions, the Caribbean, Central America and Western and Central Asia.

In many subregions, the majority of the productive forest plantations are found in just a few countries. In the East Asia subregion, 95 percent of the productive forest plantations are found in China. In South and Southeast Asia, 68 percent are in India, Indonesia, Malaysia and Thailand. In Western and Central Asia, 98 percent are found in the Islamic Republic of Iran and in Turkey. Canada, which acknowledges that it has forest plantations, had insufficient data for area reporting. Thus in North America, 99.6 percent of the reported forest plantations are in the United States. In Eastern and Southern Africa, 51 percent are in South Africa; in Western and Central Africa, 71 percent are in Côte d'Ivoire, Nigeria, Rwanda and Senegal; and in Northern Africa, 96 percent are in Ethiopia, Morocco and the Sudan. The Russian Federation has 55 percent of the productive forest plantations in Europe; Australia and New Zealand 93 percent of those in Oceania; and Argentina, Brazil and Chile 82 percent of those in South America.

The ten countries with the greatest area of productive forest plantations account for 79.5 million hectares or 73 percent of the total global area of productive forest plantations (Figure 5.5). China, the United States and the Russian Federation together account for more than half the world's productive plantations.

Trends

Trends were reported for the 168 countries providing information for all three reporting years. The main results of this analysis are presented in Table 5.4.

At the global level, the area of productive forest plantations increased by 2.0 million hectares per year during 1990–2000, and by 2.5 million hectares per year during 2000–2005, an increase of 23 percent compared with the 1990–2000 period. In relative terms, productive forest plantations accounted for 1.9 percent of total global forest area in 1990, 2.4 percent in 2000 and 2.8 percent in 2005.

FIGURE 5.5
Ten countries with largest area of productive forest plantations 2005
(%)

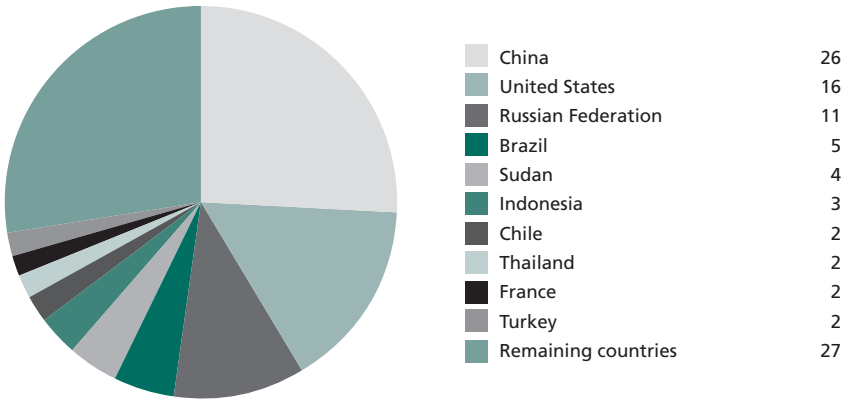


TABLE 5.4
Trends in area of productive forest plantations 1990–2005

Region/subregion	Information availability (all 3 years)			Area of productive forest plantations *(1 000 ha)*			Annual change *(1 000 ha)*	
	Countries reporting	Forest area *(1 000 ha)*	% of total forest area	1990	2000	2005	1990–2000	2000–2005
Eastern and Southern Africa	18	214 589	94.7	2 544	2 712	2 792	17	16
Northern Africa	12	117 193	89.4	6 404	6 158	6 033	-25	-25
Western and Central Africa	16	99 414	35.8	1 099	1 453	1 853	35	80
Total Africa	**46**	**431 195**	**67.9**	**10 046**	**10 323**	**10 679**	**28**	**71**
East Asia	5	244 862	100.0	17 909	23 028	30 006	512	1 396
South and Southeast Asia	17	283 126	100.0	8 896	10 750	11 825	185	215
Western and Central Asia	22	43 443	99.7	2 120	2 428	2 583	31	31
Total Asia	**44**	**571 430**	**100.0**	**28 925**	**36 206**	**44 414**	**728**	**1 642**
Total Europe	**34**	**978 682**	**97.7**	**16 643**	**19 818**	**21 467**	**318**	**330**
Caribbean	12	4 090	68.5	239	243	280	0	7
Central America	7	22 411	100.0	51	183	240	13	12
North America	4	677 464	100.0	10 305	16 285	17 133	598	170
Total North and Central America	**23**	**703 965**	**99.7**	**10 595**	**16 711**	**17 653**	**612**	**189**
Total Oceania	**10**	**203 284**	**98.6**	**2 447**	**3 456**	**3 812**	**101**	**71**
Total South America	**11**	**768 723**	**92.4**	**8 221**	**10 547**	**11 326**	**233**	**156**
World	**168**	**3 657 281**	**92.5**	**76 826**	**97 061**	**109 352**	**2 018**	**2 458**

Note: As some countries did not report a complete series, figures for 2005 are slightly different from those presented in the preceding table.

All subregions except Northern Africa show an increase in productive forest plantations. However, the annual change varies considerably among subregions. The greatest increase by far is in East Asia, mainly due to the reported large-scale establishment of forest plantations in China.

Table 5.5 presents trends for the ten countries with the largest area of productive forest plantations. Table 5.6 shows trends for the ten countries with the greatest annual increase in productive plantations.

China reported the greatest annual increase for the last five-year period, followed by the Russian Federation and the United States. These three countries together account for 71 percent of the global annual increase in productive forest plantations.

TABLE 5.5
Ten countries with largest area of productive forest plantations 1990–2005

Country/area	Area of productive forest plantations *(1 000 ha)*			Annual change *(1 000 ha)*	Annual change rate *(%)*
	1990	2000	2005	2000–2005	2000–2005
China	17 131	21 765	28 530	1 353	5.6
United States	10 305	16 274	17 061	157	0.9
Russian Federation	9 244	10 712	11 888	235	2.1
Brazil	5 070	5 279	5 384	21	0.4
Sudan	5 347	4 934	4 728	-41	-0.8
Indonesia	2 209	3 002	3 399	79	2.5
Chile	1 741	2 354	2 661	61	2.5
Thailand	1 979	1 996	1 997	n.s.	n.s.
France	1 842	1 936	1 968	6	0.3
Turkey	1 459	1 763	1 916	31	1.7

TABLE 5.6
Ten countries with greatest annual increase in productive forest plantation area 1990–2005

Country/area	Area of productive forest plantations *(1 000 ha)*			Annual change *(1 000 ha)*	Annual change rate *(%)*
	1990	2000	2005	2000–2005	2000–2005
China	17 131	21 765	28 530	1 353	5.6
Russian Federation	9 244	10 712	11 888	235	2.1
United States	10 305	16 274	17 061	157	0.9
Viet Nam	664	1 384	1 792	82	5.3
Indonesia	2 209	3 002	3 399	79	2.5
Chile	1 741	2 354	2 661	61	2.5
Australia	1 023	1 485	1 766	56	3.5
Portugal	383	867	1 067	40	4.2
Republic of Korea	748	1 188	1 364	35	2.8
Turkey	1 459	1 763	1 916	31	1.7

GROWING STOCK AND COMMERCIAL GROWING STOCK

Forest growing stock has traditionally been a key indicator of forest capacity for wood production and has formed part of global forest resources assessments since the very beginning. Although FRA 2005 broadened its scope to cover a range of forest benefits, growing stock was still a fundamental piece of information in this assessment, as well as being the basis for estimating biomass and carbon stocks for most countries.

Information from each country on total growing stock and forest area was used to estimate the growing stock per hectare. This is a good indicator of how well-stocked forests are, and the trends in this parameter indicate whether forests are becoming less or better stocked.

FRA 2005 also collected country information on commercial growing stock, i.e. the amount of wood that is considered commercial or potentially commercial. Usually, the commercial growing stock of a country refers to the volume of commercial trees growing in forests where the harvesting of wood is permitted.

Information availability

Of the 229 countries and areas covered by FRA 2005, 147 countries reported on growing stock for all three years, constituting 88 percent of global forest area (Figure 5.6). In most regions, countries have reported well. Only one region – Oceania – shows low reporting on growing stock (15 percent), because Australia did not provide information

on this indicator. With a few exceptions, reporting countries furnished information for all three reporting years. As regards commercial growing stock, 107 countries provided information for all three years (Figure 5.7).

Although many countries provide information on growing stock, the quality of the information is variable. A few countries with repeated national forest assessments have very reliable information, but many countries do not have good inventory data to support growing stock estimates and changes in growing stock over time. In many cases,

FIGURE 5.6
Information availability – growing stock

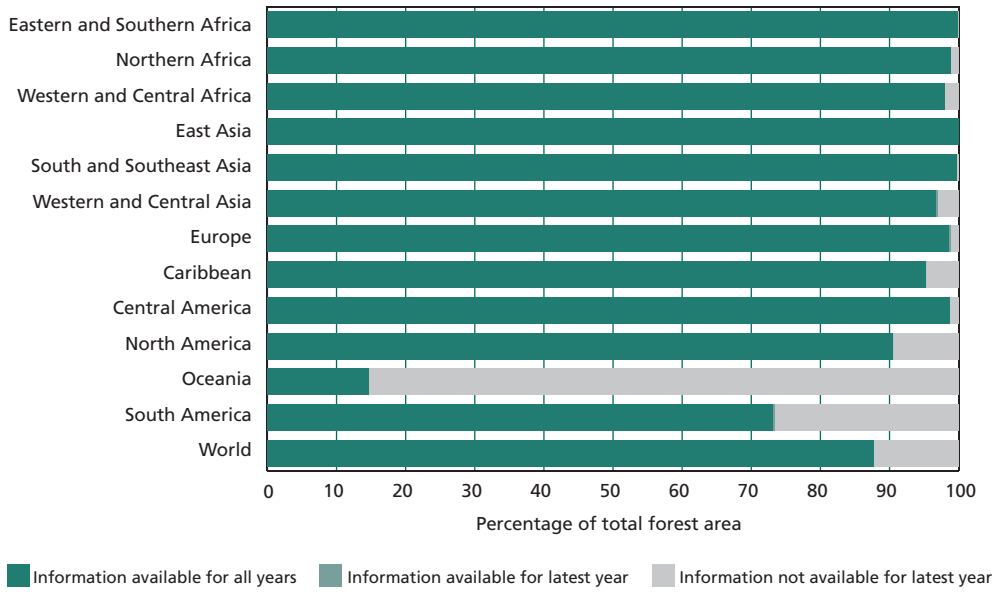
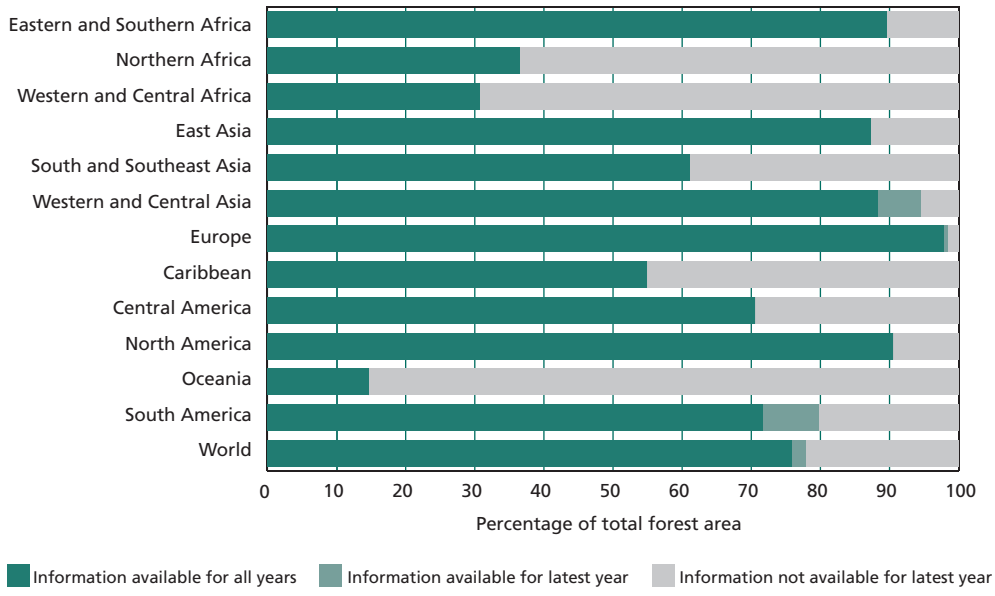


FIGURE 5.7
Information availability – commercial growing stock



a single estimate of growing stock per hectare has been used for all reporting years. Furthermore, the original data on which the estimates are based are often old and not representative of all forests in the country.

FRA 2005 defines growing stock as the standing volume of trees with a diameter at breast height (DBH) of at least 10 cm. However, countries may use national diameter thresholds if the limits are thoroughly documented. This helps countries report data consistently over time and allows for better trend estimates. The trade-off is that comparisons between individual countries become more difficult and that large, forest-rich countries with non-standard diameter thresholds may affect regional and subregional averages.

The analysis of growing stock as presented in Table 5.7 is based directly on the data provided in country reports. No further calculations were done to harmonize the figures to a common diameter threshold.

Status

In order to obtain global, regional and subregional estimates of total growing stock, the stock per hectare was estimated for each subregion for those countries providing information. These estimates were then applied to the total forest area of the subregion. Regional and global estimates were obtained by combining the subregional estimates.

Table 5.7 shows growing stock and growing stock per hectare for 2005. Total global growing stock is estimated at 434 billion m^3, of which about 30 percent is found in South America.

The global average for growing stock per hectare is 110 m^3 per hectare. South America, with 155 m^3 per hectare, and Western and Central Africa, with 189 m^3 per hectare, are significantly higher than average owing to some forest-rich countries reporting high volume (Brazil and the Democratic Republic of the Congo). Oceania, with 36 m^3 per hectare, is significantly lower than average, but few countries are reporting in this region and its estimates are heavily influenced by Papua New Guinea. This country reported low volume per hectare because it only included trees with a DBH above 50 cm in its growing stock estimates. Most countries with well-stocked forests are found in Europe. Of the 11 countries reporting an average growing stock of more than 250 m^3 per hectare, eight are in central Europe.

TABLE 5.7
Forest area and growing stock 2005

Region/subregion	Forest area *(1 000 ha)*	Growing stock	
		million m^3	m^3/ha
Eastern and Southern Africa	226 534	10 015	44
Northern Africa	131 048	2 523	19
Western and Central Africa	277 829	52 420	189
Total Africa	**635 412**	**64 957**	**102**
East Asia	244 862	19 743	81
South and Southeast Asia	283 127	24 202	85
Western and Central Asia	43 588	3 166	73
Total Asia	**571 577**	**47 111**	**82**
Total Europe	**1 001 394**	**107 264**	**107**
Caribbean	5 974	441	74
Central America	22 411	2 906	130
North America	677 464	75 235	111
Total North and Central America	**705 849**	**78 582**	**111**
Total Oceania	**206 254**	**7 361**	**36**
Total South America	**831 540**	**128 944**	**155**
World	**3 952 025**	**434 219**	**110**

The five countries with the greatest total growing stock (Figure 5.8) account for almost 261 billion m^3, which corresponds to 60 percent of the global total. Of these, Brazil has the largest growing stock, with 81 billion m^3 or 19 percent of the total.

Information on commercial growing stock was provided by 113 countries. For each subregion, commercial growing stock was estimated as a percentage of the total growing stock of reporting countries, and these percentages were applied to the total growing stock estimates for each subregion. The results are presented in Table 5.8.

Global commercial growing stock amounts to some 202 billion m^3, which represents about 47 percent of total growing stock. In absolute terms, Europe and North and Central America account for about 130 billion m^3 or 64 percent of global commercial growing stock. In relative terms, there are some important regional differences. Commercial growing stock constitutes a lower percentage of total growing stock in tropical regions (e.g. Africa, Central America and South America) than in temperate regions (East Asia, Europe and North America). This is mainly because of differences in the characteristics of the forests in terms of species diversity and different harvesting regimes. Tropical forests are very rich in species of which only a few are considered

FIGURE 5.8
Five countries with greatest total growing stock 2005
(%)

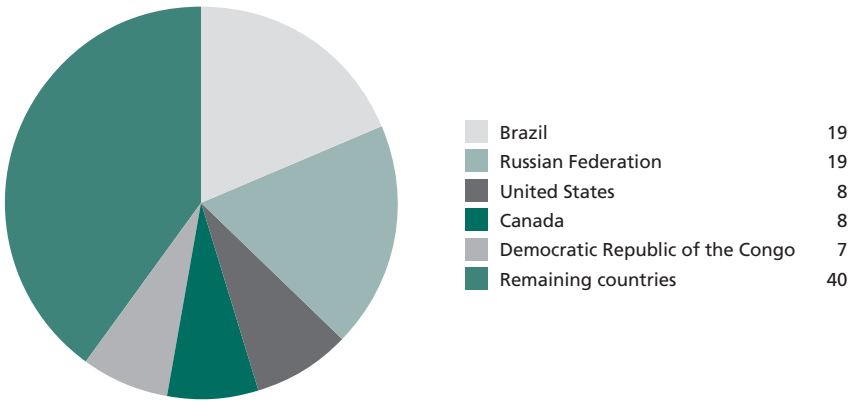


TABLE 5.8
Commercial growing stock 2005

Region/subregion	% of total growing stock	million m^3
Eastern and Southern Africa	22	2 234
Northern Africa	30	767
Western and Central Africa	26	13 407
Total Africa	**25**	**16 408**
East Asia	86	17 065
South and Southeast Asia	34	8 160
Western and Central Asia	60	1 890
Total Asia	**58**	**27 115**
Total Europe	**57**	**61 245**
Caribbean	64	283
Central America	19	563
North America	89	66 968
Total North and Central America	**86**	**67 815**
Total Oceania	**51**	**3 751**
Total South America	**20**	**25 992**
World	**47**	**202 325**

commercial, and harvesting is usually carried out through selective logging in which only trees above a certain minimum diameter are cut. Temperate forests are dominated by a smaller number of species of which many are commercial. Moreover, the harvesting regime in temperate forests is generally not based on minimum diameters, which means that most of the growing stock in areas available for wood supply can be considered commercial.

Trends

Tables 5.9 and 5.10 show trends by region and subregion for growing stock per hectare, total growing stock and commercial growing stock. At the global level, there is a slight decrease in total growing stock for the reporting period. There are some regional tendencies: Africa, Asia, Oceania and South America show a slight decrease, while Europe and North and Central America show a slight increase.

As regards growing stock per hectare, changes at the global level are not significant. At regional and subregional levels, however, there are more significant changes. For example, Europe, excluding the Russian Federation, shows a net increase of 1.2 m^3 per hectare annually for the last 15-year period, while South and Southeast Asia show a net decrease of 1.0 m^3 per hectare annually, mainly due to a decrease in growing stock per hectare in Indonesia.

Changes in total growing stock reflect the combined effects of changes in forest area and in growing stock per hectare. However, for many countries, changes in growing stock only reflect the changes in forest area, because their estimates of growing stock are based on a single figure per hectare determined at one point in time. Thus the actual trends may be more pronounced than what is seen in this analysis.

The trends for commercial growing stock are shown in Table 5.10. At the global level, there is a small decrease in commercial growing stock, mainly due to the decrease in Europe during 1990–2000. The other regions show only small changes. When commercial growing stock is expressed as a percentage of total growing stock, the global pattern is the same, although some subregions (e.g. the Caribbean and South and Southeast Asia) show more pronounced trends.

TABLE 5.9
Trends in growing stock and growing stock per hectare 1990–2005

Region/subregion	Growing stock						Annual change rate *(m^3/ha)*
	million m^3			m^3/ha			
	1990	2000	2005	1990	2000	2005	1990–2005
Eastern and Southern Africa	11 035	10 346	10 015	44	44	44	n.s.
Northern Africa	2 771	2 607	2 523	19	19	19	n.s.
Western and Central Africa	55 566	53 218	52 420	185	187	189	0.3
Total Africa	**69 373**	**66 171**	**64 957**	**99**	**101**	**102**	**0.2**
East Asia	15 850	18 433	19 743	76	82	81	0.3
South and Southeast Asia	32 615	27 296	24 202	101	92	85	-1.0
Western and Central Asia	2 959	3 105	3 166	69	71	73	0.3
Total Asia	**51 423**	**48 834**	**47 111**	**90**	**86**	**82**	**-0.5**
Total Europe (incl. Russian Federation)	**102 063**	**105 374**	**107 264**	**103**	**106**	**107**	**0.3**
Total Europe (excl. Russian Federation)	**22 024**	**25 103**	**26 785**	**124**	**135**	**141**	**1.2**
Caribbean	328	403	441	61	71	74	0.8
Central America	3 585	3 097	2 906	130	130	130	n.s.
North America	72 542	74 227	75 235	107	109	111	0.3
Total North and Central America	**76 455**	**77 727**	**78 582**	**108**	**110**	**111**	**0.3**
Total Oceania	**7 593**	**7 428**	**7 361**	**36**	**36**	**36**	**n.s.**
Total South America	**138 344**	**133 467**	**128 944**	**155**	**157**	**155**	**n.s.**
World	**445 252**	**439 000**	**434 219**	**109**	**110**	**110**	**n.s.**

TABLE 5.10
Trends in commercial growing stock 1990–2005

Region/subregion	Commercial growing stock					
	million m³			% of total growing stock		
	1990	2000	2005	1990	2000	2005
Eastern and Southern Africa	2 519	2 321	2 234	23	22	22
Northern Africa	754	762	767	27	29	30
Western and Central Africa	13 336	13 162	13 407	24	25	26
Total Africa	**16 609**	**16 245**	**16 408**	**24**	**25**	**25**
East Asia	14 013	15 976	17 065	88	87	86
South and Southeast Asia	12 705	9 717	8 160	39	36	34
Western and Central Asia	1 813	1 867	1 890	61	60	60
Total Asia	**28 531**	**27 561**	**27 115**	**55**	**56**	**58**
Total Europe	**66 063**	**60 648**	**61 245**	**65**	**58**	**57**
Caribbean	175	245	283	53	61	64
Central America	717	599	563	20	19	19
North America	64 816	66 376	66 968	89	89	89
Total North and Central America	**65 709**	**67 220**	**67 815**	**86**	**86**	**86**
Total Oceania	**3 849**	**3 777**	**3 751**	**51**	**51**	**51**
Total South America	**28 059**	**26 666**	**25 992**	**20**	**20**	**20**
World	**208 820**	**202 116**	**202 325**	**47**	**46**	**47**

REMOVALS OF WOOD PRODUCTS

Wood products removed from forests and other wooded land constitute an important component of the productive function. The volume of wood removed indicates the economic and social utility of forest resources to national economies and local communities. This information contributes to monitoring the use of forest resources by comparing actual removal with the sustainable potential.

Wood removals are influenced by a number of factors. The following ones should be considered in order to better understand the removal figures from various countries:

- organizational issues, such as legal forms of harvesting, ownership of forest land and logging companies, and availability of forest management plans;
- harvesting systems (clear-cut, polycyclic, diameter limit and species grouping), practices and intensity; illegal logging; and the environmental impact of harvesting;
- institutional framework conditions, which may differ among countries in terms of timber extraction fees, forest law compliance, subsidies and incentives for forest management or non-transparent concession agreements;
- governance issues and the ability to detect and prevent illegal logging.

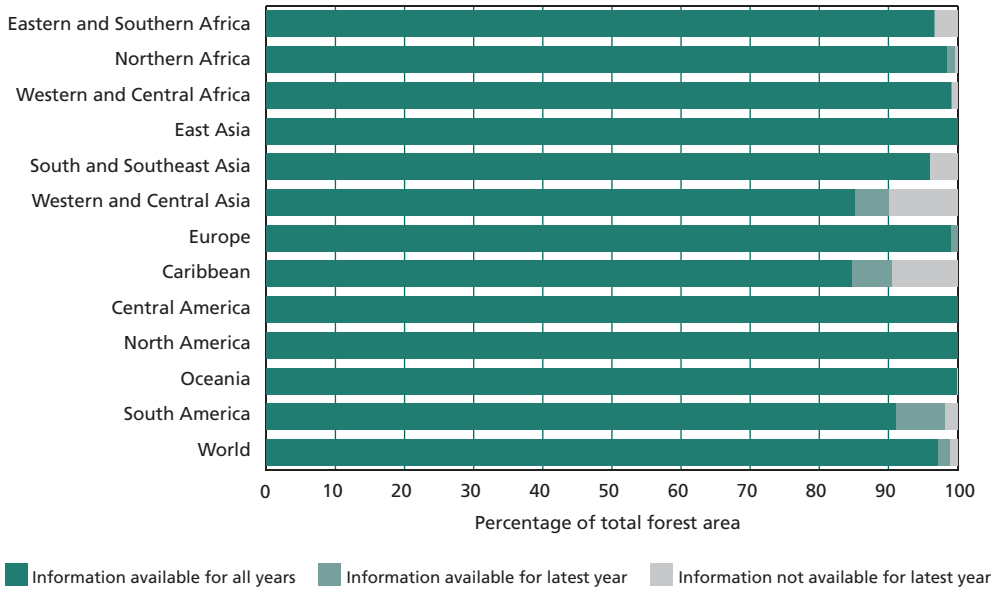
In FRA 2005, reported wood removals from forests and other wooded land cover both industrial roundwood and fuelwood. The data on fuelwood are included because wood is the main source of fuel for cooking and heating in many parts of the world.

For 1990 and 2000, the data reported are five-year averages for 1988–1992 and 1998–2002 respectively. The data for 2005 are forecasts, taking into account the most recent country information available.

Information availability

A total of 167 countries reported on wood removals (Figure 5.9). In terms of forest area, they account for about 99 percent at the global level; non-reporting countries are mostly those with little or no forest area. One reason for the high reporting rate may be that available FAOSTAT data on wood removals were provided to countries for use if no new and better data were available.

FIGURE 5.9
Information availability – wood removals



Globally, quantitative data on wood removals are often based on population figures and consumption estimates, and are weak for this reason. In particular, reported fuelwood removals from several tropical forest countries with significant forest cover and large populations show remarkable deviations from the figures reported by other sources, e.g. FAOSTAT. Such deviations between sources indicate that there are uncertainties that should be considered in using these figures.

Countries usually do not report illegal removals and informal fuelwood gathering, and thus the figures for removals might be much higher than those reported.

Status

Wood removals for 2005 by region and subregion are presented in Table 5.11. Global wood removals in 2005 amount to just over 3 billion m^3, of which about 60 percent is industrial roundwood and 40 percent fuelwood. These figures refer to forest only. An additional 7 million m^3 of fuelwood globally was reported from other wooded land. However, the data behind this figure come from a small number of countries and thus do not allow for a breakdown by region and subregion.

In Africa, the Caribbean, Central America and South and Southeast Asia, removals are mainly fuelwood, while in Central and North America, East Asia, Europe and Oceania, removals are mainly industrial roundwood.

Some 40 countries account for up to 90 percent of the removals in tropical forests.

The five countries reporting the highest figures on wood removals account for 45 percent of total global removals (Figure 5.10).

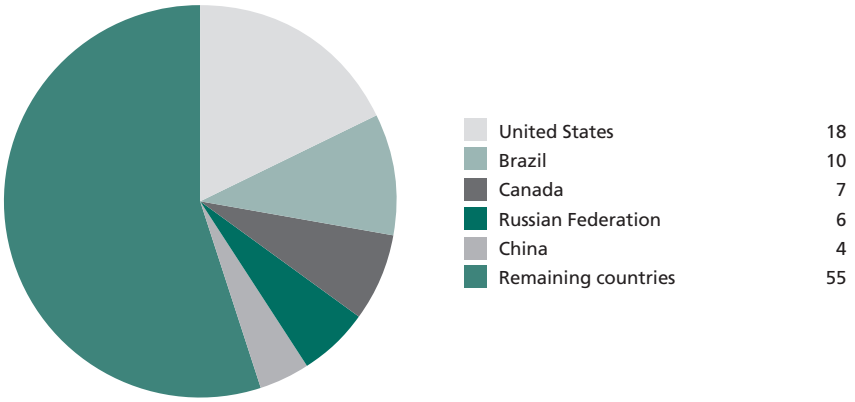
Trends

The trend figures in Table 5.12 are based on those countries that reported a complete time series on wood removals. Global removals show a relatively stable development, without significant changes over the last 15 years. Nor did the proportion between industrial roundwood and fuelwood (60 to 40 percent) change significantly between reporting periods.

TABLE 5.11
Wood removals 2005

Region/subregion	Industrial roundwood	Fuelwood		Total removals
	million m³	million m³	% of total	million m³
Eastern and Southern Africa	34	151	82	185
Northern Africa	8	173	96	181
Western and Central Africa	36	267	88	303
Total Africa	**79**	**591**	**88**	**670**
East Asia	115	56	33	171
South and Southeast Asia	44	113	72	157
Western and Central Asia	15	20	57	34
Total Asia	**174**	**189**	**52**	**362**
Total Europe	**543**	**139**	**20**	**681**
Caribbean	4	16	82	19
Central America	4	40	90	45
North America	717	56	7	773
Total North and Central America	**725**	**112**	**13**	**837**
Total Oceania	**54**	**10**	**15**	**64**
Total South America	**225**	**173**	**44**	**398**
World	**1 799**	**1 214**	**40**	**3 013**

FIGURE 5.10
Five countries with largest volume of wood removals 2005
(%)



Eastern and Southern African countries reported steadily increasing wood removals: from 153 million m³ in 1990 to 185 million m³ in 2005. Only Madagascar reported a decrease, owing to a reduction in removals of fuelwood. Northern, Western and Central Africa also show a steady increase in removals, with the African continent as a whole reporting an escalation from 499 million m³ (1990) to 661 million m³ (2005).

East Asia reported a decline in removals, caused primarily by a significant decrease in China as the result of a logging ban. Decreases were also reported in India, Indonesia and Malaysia in the South and Southeast Asia region. For Asia as a whole, the reduction in removals was significant, from 454 million m³ in 1990 down to 362 million m³ in 2005.

Some European countries show a slight decrease, mainly due to reduced removals of fuelwood in certain countries. However, after a decrease in the 2000 reporting period, the figures are again moving towards the level of 1990.

North and Central America show a very stable development over the last 15 years: Removals decreased slightly from 855 million m³ in 1990 to 837 million m³ in 2005.

TABLE 5.12
Trends in wood removals 1990–2005

Region/subregion	Wood removals *(million m³)*								
	Industrial roundwood			Fuelwood			Total		
	1990	2000	2005	1990	2000	2005	1990	2000	2005
Eastern and Southern Africa	29	32	34	125	146	151	153	177	185
Northern Africa	6	7	8	134	159	170	140	166	178
Western and Central Africa	19	29	33	187	242	264	206	272	297
Total Africa	**54**	**69**	**75**	**445**	**547**	**585**	**499**	**616**	**661**
East Asia	131	116	115	70	60	56	201	176	171
South and Southeast Asia	94	62	44	118	113	113	212	175	157
Western and Central Asia	14	14	15	27	22	19	41	36	34
Total Asia	**239**	**192**	**174**	**215**	**195**	**189**	**454**	**387**	**362**
Total Europe	**606**	**488**	**535**	**138**	**126**	**136**	**743**	**614**	**672**
Caribbean	4	3	4	17	16	16	20	20	19
Central America	3	4	4	30	37	40	32	42	45
North America	697	716	717	105	56	56	802	772	773
Total North and Central America	**703**	**724**	**725**	**151**	**109**	**112**	**855**	**833**	**837**
Total Oceania	**34**	**47**	**54**	**10**	**12**	**10**	**44**	**59**	**64**
Total South America	**144**	**207**	**224**	**302**	**183**	**173**	**446**	**390**	**398**
World	**1 780**	**1 726**	**1 787**	**1 261**	**1 173**	**1 206**	**3 041**	**2 899**	**2 993**

Note: As some countries did not report a complete series, figures for 2005 are slightly different from those presented in the preceding table.

A steady increase was reported for Oceania. Australia, New Zealand and Papua New Guinea account for most wood removals, which have gone from 44 million m³ in 1990 to 64 million m³ in 2005, owing to an increase in industrial roundwood. South America reported a significant reduction, from 446 million m³ in 1990 to 398 million m³ in 2005.

REMOVALS OF NON-WOOD FOREST PRODUCTS

There has been growing recognition of – and expectations for – the role of NWFPs as an integral part of sustainable forest management in developed and developing countries. FAO has defined NWFPs as follows: "Non-wood forest products consist of goods of biological origin other than wood, derived from forests, other wooded land and trees outside forests." They perform a crucial role in meeting the subsistence needs of a large part of the world's population living in or near forests and in providing them with supplementary income-generating opportunities.

A wide variety of products are collected from forests, woodlands and trees outside forests – a major portion of which are consumed by households or sold locally, while some find export markets. Various products have been domesticated and are being cultivated; in fact, the border between NWFPs and agricultural crops is becoming increasingly blurred. The absence of a uniform classification system and limited human/financial resources in the national institutions dealing with NWFPs make the gathering and reporting of data a challenge.

Understanding the potential contribution of NWFPs to sustainable rural development, especially in poverty alleviation and food security, requires good statistical data, which in most cases are gathered sporadically and are often unreliable. However, FAO recognizes the importance of NWFPs to social, economic and environmental contexts and is attempting to draw a global picture based on the best available information. For this reason, FRA 2000, for the first time, included a section on the status of NWFPs, and FRA 2005 seeks to provide additional quantitative information on the amount and value of NWFP removals.

Information availability

Systematic data collection on NWFPs at the national level is rare, although their significant contribution to local livelihoods is well understood empirically. For FRA 2005, countries were asked to report on removals of 16 categories of NWFPs.

In total, 71 countries reported data on removals of at least one NWFP category, and many of these reported for one reporting year only. Many countries did not report any data or only for one or a few categories. Even where national statistics exist, all removals are not always recorded, so the figures reported are in many cases considered underestimates.

Figure 5.11 shows the availability of information in terms of the forest area that NWFP reporting countries represent. At the global level, they encompass 63 percent of total forest area. East Asia and Europe have better availability, and the reporting countries in these subregions cover more than 90 percent of the forest area.

Figure 5.12 shows the availability of information for each specific category of NWFP. Four categories show significantly higher information availability than the others: food, raw materials for medicine and aromatic products, exudates and other plant products. Still, the countries reporting on these four categories only represent 45–55 percent of the global forest area. For the remaining categories, the availability of information is weak, at least at the global level.

Most of the removal data provided are based mainly on commercial figures, but many NWFPs are used and consumed non-commercially. Thus it is assumed that the real removal figures are considerably higher than those provided for FRA 2005.

Regarding the quality of the information, it is important to bear in mind that the figures given in the country reports (even though reported using the same template) may reflect differences in the way data were collected. Asia and Europe show the greatest availability of information. In fact, Asia has traditionally used NWFPs and often includes them in official national accounts and international trade statistics. This is not generally the case in other regions. Thus aggregation of the reported figures and the drawing of any far-reaching conclusions should be avoided or done with extreme care.

FIGURE 5.11
Information availability – NWFP removals

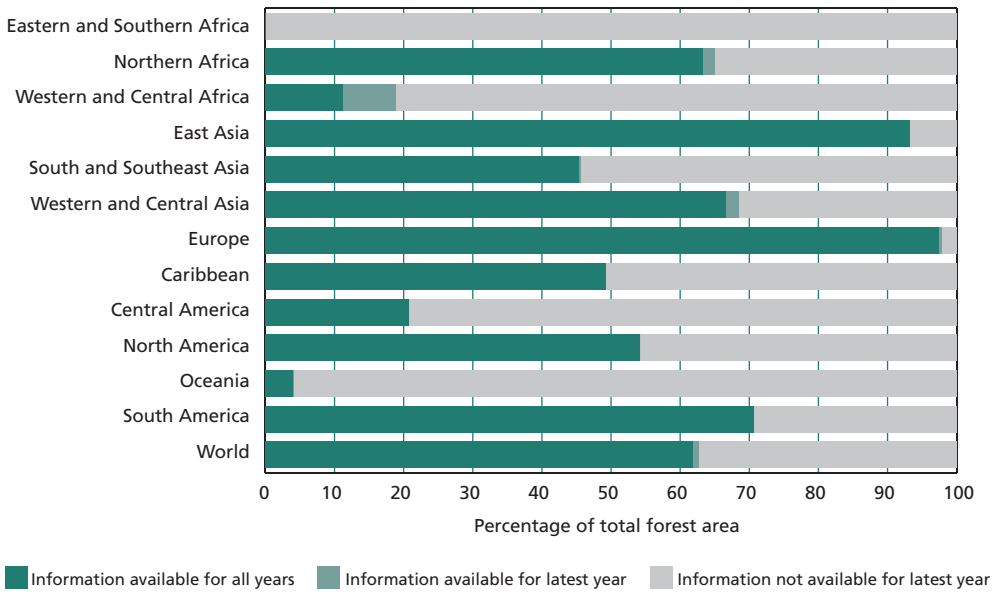


FIGURE 5.12
Information availability – NWFP removals by product category

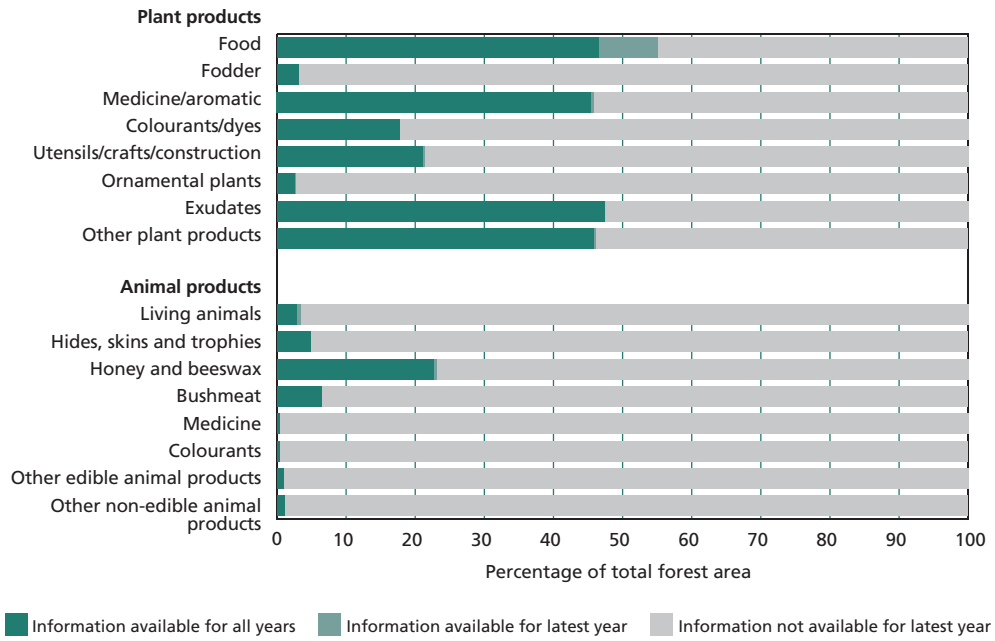


TABLE 5.13
Removals of four categories of NWFPs (plant products) 2005 ***(tonnes)***

Region	Food	Raw material for medicine and aromatic products	Exudates	Other plant products
Africa	88 823	20 400	12 757	11 175
Asia	3 562 991	90 181	1 495 663	606 782
Europe	272 418	6 530	2 216	231 765
North and Central America	6 443	2 867	38 733	149 231
Oceania	-	38	0	5 900
South America	348 259	1 490	17 315	291 966
World	**4 278 935**	**121 505**	**1 566 684**	**1 296 819**

Status

Table 5.13 indicates the four categories of NWFP removals for which the most information is available. As quantities have been calculated for reporting countries only, the regional and world totals are underestimates.

According to the figures reported to FRA 2005, among these four best-covered categories, Asia accounts for the largest removals. With a share of 74 percent, China has by far the world's largest removals of forest plant products for food, consisting mainly of oil seeds, nuts and bamboo shoots. Other countries with significant removal volumes for food are India, the Republic of Korea and Pakistan in Asia; the Czech Republic, Finland, Italy and Sweden in Europe; and Brazil in South America.

China also accounts for 72 percent of removals in the category of exudates, such as tannin extract and raw lacquer, followed by Viet Nam. In the category of plant raw materials for medicinal and aromatic uses, India accounts for half of reported global removals, mainly consisting of medicinal plants and spices. India also has a 42 percent share of total removals in the category of other plant products, such as tendu leaves and lac, followed by Brazil and Mexico.

TABLE 5.14
Annual changes for four categories of NWFPs (plant products) per region 1990–2005 *(%)*

Region	Food		Medicine/aromatics		Exudates		Other plant products	
	1990–2000	2000–2005	1990–2000	2000–2005	1990–2000	2000–2005	1990–2000	2000–2005
Africa	-0.2	0.9	-2.4	-4.2	11.0	9.9	4.0	-3.5
Asia	6.0	4.8	7.2	0.4	2.6	1.0	0.7	-1.5
Europe	-0.6	-0.1	-6.9	5.3	-7.4	-13.6	0.4	-0.3
North and Central America	-	-	-0.1	0.9	0.3	0.5	0.8	0.7
Oceania	-	-	-	-	-	-	1.6	0.3
South America	-2.7	-1.9	-1.5	-3.1	-6.5	-3.2	1.6	-7.5
World	**3.9**	**3.8**	**3.0**	**-0.3**	**2.3**	**1.0**	**1.0**	**-2.9**

For the remaining categories of NWFPs, information was provided by a limited number of countries, so calculation of regional totals is not meaningful. However, some particular aspects may be highlighted.

Fodder removals were reported by only 16 countries. Nevertheless, those countries reported very large quantities, particularly in Asia, indicating that this is a very important product category, however severely under-reported. Raw materials for utensils, crafts and construction, such as bamboo and rattan, were reported in large quantities from countries such as India and Myanmar. Ornamental plants – Christmas trees among them – were reported in large quantities from a number of European countries.

Among animal products, a few African and European countries reported large quantities of live animals, hides, skins and trophies, as well as wild honey and beeswax. The reported figures for edible animals (game and bushmeat) are concentrated in Europe, with 98 percent of the global total. It is well known, however, that bushmeat is an important source of food in many African countries, but these reported very few figures.

Trends

Table 5.14 shows the changes in removals for the four best-covered categories between 1990 and 2000 and between 2000 and 2005. The table is based exclusively on data from countries providing values for all three reporting years. Increasing trends are seen for food and exudates, while both increases and decreases are seen for raw materials of medicines and aromatics and for other plant products. The increase seen between 1990 and 2000 appears to have slowed in recent years, although this may be due to the limited data available and the use by some countries of figures for 2000 as estimates for 2005.