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MAIN REPORT

Forest Resources

of Europe, CIS, North America, Australia, Japan and New Zealand

(industrialized temperate/boreal countries)

UN-ECE/FAO Contribution to the Global Forest Resources Assessment 2000

UNITED NATIONS
New York and Geneva, 2000

NOTE

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Any data provided under the heading "Yugoslavia" relate to the Federal Republic of Yugoslavia which, in accordance with General Assembly resolutions 47/1 and 47/229, cannot continue automatically the membership of the former Socialist Federal Republic of Yugoslavia.

ABSTRACT

The Report Forest Resources of Europe, CIS, North America, Australia, Japan and New Zealand (TBFRA-2000) presents the most recent and the best possible information on the forest resources of the fifty-five industralized temperate/boreal countries, covering practically all aspects and functions of the forest. It presents validated national statistical data, adjusted to the TBFRA standards, graphs, tabular and textual information and analysis in the following specific thematic areas: areas of forest and other wooded land, ownership and management status, wood supply and carbon sequestration, biological diversity and environmental protection, forest condition and damage, and protective and socio-economic functions.

It also includes a section with an analysis of the reliability and comparability of the TBFRA data, an Executive Summary, as well as the methodological components of the study, including the enquiry, and terms and definitions.

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PREFACE

The report "Forest Resources of Europe, CIS, North America, Australia, Japan and New Zealand *(industrialized temperate/boreal countries)*", which is abbreviated hereafter as the "TBFRA-2000", is the UN-ECE/FAO contribution to the FAO Global Forest Resources Assessment 2000. TBFRA-2000 has been carried out under the auspices of the Joint FAO/ECE Working Party on Forest Economics and Statistics, a subsidiary body of the FAO European Forestry Commission and the UN/ECE Timber Committee. As a part of the Global Forest Resources Assessment 2000, it is based on the Global FRA-2000 platform (the Global Framework) which was proposed by the "Kotka-III" expert consultation (June 1996, Kotka, Finland).

This volume, which contains the main TBFRA-2000 results, will be accompanied by a number of thematic papers. The assessment as a whole, and this Main TBFRA-2000 Report, are based on the national replies to a detailed enquiry from the TBFRA correspondents of 55 temperate/boreal industrialized countries. In accordance with the Working Party's programme of work, a team of specialists has guided the preparation of the enquiry and the implementation of the project.

The Main Report includes statistical and descriptive information together with analyses undertaken by high level experts in the following specific thematic areas: Area of Forest and Other Wooded Land (OWL), Ownership and Management Status, Wood Supply and Carbon Sequestration; Biological Diversity and Environmental Protection; Forest Condition and Damage; and Protective and Socio-Economic Functions. These topics constitute the Chapters of the report. The report also includes the Introduction and Executive Summary, as well as a section with an analysis of the reliability and comparability of the data. More than 80 main tables with the validated national statistics on the different parameters of forest resources are included in the publication. In many cases where official TBFRA data were not available, estimates were made by the correspondents in cooperation with the secretariat.

All aspects of the invaluable and interesting information provided by countries could not be covered in this Main Report. The remaining national data will be analysed and published in accompanying discussion papers. The following topics might be the subjects of the accompanying papers: biodiversity, carbon sequestration and balance, protected areas, forest condition and damage to forest, etc.

The country files, which will include tables of essential TBFRA-2000 data for each participating country, will also be published as a satellite paper, and the country information from the TBFRA-2000 database will be supplied and inserted into the Global Forest Resources Assessment 2000. The electronic TBFRA-2000 database will be made available on the Internet (UN/ECE Timber Committee home page).

The TBFRA-2000 publication is issued on the sole responsibility of the secretariat of the UN/ECE Timber Committee and the FAO European Forestry Commission. Every effort has been made to check the accuracy and consistency of the information presented in the report, but because of the enormous mass of data involved, some errors or inconsistencies may have been overlooked and have slipped into the publication. The secretariat would welcome feedback from the readers and users of the publication, as well as comments which would help to improve the quality of future work on the international forest resources assessments.

ACRONYMS, SYMBOLS AND OTHER ABBREVIATIONS

1. Acronyms

AAC	-	Annual allowable cut
CIS	-	Commonwealth of Independent States
CBD	-	Convention on Biological Diversity
d.b.h.	-	Diameter at breast height
EC	-	European Commission
ECE (UN/ECE)	-	United Nations Economic Commission for Europe
EEA	-	European Environment Agency
EFI	-	European Forest Institute
EFICS	-	European Forest Information and Communication System
EFTA	-	European Free Trade Association
ETTS	-	European Timber Trends and Prospects Study(ies)
EU	-	European Union
EU- DGVI	-	Directorate General VI of the European Commission
GAI	-	Gross annual increment
FAO	-	Food and Agriculture Organization of the United Nations
FAWS	-	Forest available for wood supply
FNAWS	-	Forest not available for wood supply
FOWL	-	Forest and other wooded land
FRA	-	Forest Resources Assessment(s)
ICP-Forest	-	International Co-operative Programme on the Assessment and Monitoring of Air Pollution Effects on Forests
IUCN	-	International Union for the Conservation of Nature and Natural Resources
IUFRO	-	International Union of Forest Research Organizations
JRC	-	Joint Research Centre of the European Commission
MSE	-	Mean square error
NAI	-	Net annual increment
NFI	-	National Forest Inventory
NGOs	-	Non-governmental Organizations
NWGS	-	Non-wood goods and services
OWL	-	Other wooded land
SAI/JRC	-	Space Application Institute of the Joint Research Centre
SOFO	-	FAO State of the World's Forests (1997 and 1999)
TBFRA	-	Temperate and boreal forest resources assessment(s)
TZ	-	Temperate zones
UNCED	-	United Nations Conference on Environment and Development
UK	-	United Kingdom of Great Britain and Northern Ireland
USA	-	United States of America
WCPA	-	World Commission on Protected Areas
WRI	-	World Resources Institute
WWF	-	World Wide Fund for Nature
WCMC	-	World Conservation Monitoring Centre

2. Symbols and other abbreviations

0	-	nil or less than half a unit
*	-	estimates (or comments) by National Correspondent or by the secretariat
©	-	mark/reference in Main Tables to notes and comments
①	-	indication in the Main Tables that national data have been adjusted to correspond with the TBFRA definitions
billion	-	thousand million
c	-	conversion factor
cm	-	centimetre
CO_2	-	carbon dioxide
m	-	metre
m^3	-	cubic metre, solid volume
m^3 o.b.	-	cubic metre, overbark
m^3 u.b.	-	cubic metre, underbark
ha	-	hectare
ha/caput	-	hectares per inhabitant
kg	-	kilogram
km^2	-	square kilometer
m.t.	-	metric ton
Pg	-	petagram (Pg = 10^{15} g)
ppm	-	parts per million
Tg	-	teragram (Tg = 10^{12} g)
US$	-	United States dollar

3. References to Diagrams/Figures/Maps/Tables

Diagrams: For example, for Chapter II, Diagrams 2.1, 2.22, 2.3, etc.

Figures in the text of Chapters/Sections: For example, for Chapter II: Figures 2.1, 2.2, 2.3, etc. (Figures S.1, S.2, S.3 etc. for "Executive Summary" and Figures R.1, R.2, R.3, etc. for the Chapter on "Reliability").

Maps in the publication: Maps M.1, M.2, M.3, etc.

Enquiry Tables: Tables of the TBFRA-2000 enquiry (see Appendix II), *Enquiry Table 1, 2, 3*, etc.

Main Tables: Statistical tables of the publication, created from the national data fed into the TBFRA-2000 database, e.g. Main Tables 1, 2, 3, etc.

Tables in the text of Chapters/Sections: For example, for Chapter II: Tables 2.1, 2.2, 2.3, etc. (Table S.1. for "Executive Summary", and Tables R.1, R.2, R.3 etc. for the Chapter on "Reliability").

COUNTRIES AND COUNTRY GROUPINGS

Fifty-five countries are covered by the TBFRA-2000, a considerable increase on the number in previous assessments. This was mainly due to the break-up of the former USSR, former Yugoslavia and former Czechoslovakia into several entities. In order to simplify analysis and presentation of data, the countries have been grouped in this report. Four main groups are distinguished in the main tables: Europe; Commonwealth of Independent States (CIS); North America; and "Other TBFRA". Data on the fifteen countries of the European Union (EU) are shown in the main tables as a sub-set of Europe; the countries concerned are marked with an asterisk below. In some of the chapters, further sub-divisions have been made, as follows:

EUROPE

- **Nordic and Baltic countries**
  - Nordic: Finland*, Iceland, Norway, Sweden*
  - Baltic: Estonia, Latvia, Lithuania
- **Central Europe**
  - Central-Eastern: Austria*, Czech Republic, Hungary, Liechtenstein, Poland, Slovakia
  - Central-Western: France*, Germany*, Luxembourg*, Switzerland
  - North-Western: Belgium*, Denmark*, Ireland*, the Netherlands*, United Kingdom*
- **Southern Europe**
  - Iberian peninsula: Portugal*, Spain*
  - South and South-Eastern: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Greece*, Israel, Italy*, Malta, Romania, Slovenia, The former Yugoslav Republic of Macedonia, Turkey, Yugoslavia

* Member countries of the European Union (EU-15)

COMMONWEALTH OF INDEPENDENT STATES (CIS)

- **Russian Federation**
- **Other CIS:**
  - Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Republic of Moldova, Tajikistan, Turkmenistan, Ukraine, Uzbekistan

NORTH AMERICA

- **Canada**
- **United States of America (USA)**

OTHER TBFRA

- **Australia**
- **Japan**
- **New Zealand.**

There is no ideal way of grouping countries; it depends on the purpose for which they are being grouped. In the present case, they have been grouped mainly on the basis of geographical location, which to some extent reflects their forest characteristics. This is the reason why, for example, one of the Nordic countries, Denmark, has for this report been included in the group of North-Western European countries. The country groupings are shown in the Figures M.1 and M.2. The spatial tree cover distribution is illustrated in the Figures M.3, M.4 and M.5 based on Defries et al. 1999.[1]

[1] R. S. Defries, M. C. Hansen, J. R. G. Townshend, A. C. Janetos and T. R. Loveland, 1999, "A new global 1-km dataset of percentage tree cover derived from remote sensing", Global Change Biology (1999) 5: pp. 1-8.

CROSS-REFERENCE BETWEEN ENQUIRY TABLES AND MAIN TABLES

The TBFRA-2000 Enquiry (reproduced in Appendix II) contains 25 tables. Data supplied in response to these 25 tables have been presented in 81 Main Tables. This page provides a cross reference between the *Enquiry Tables* and the Main Tables.

Enquiry Table No.	*Enquiry Table title*	*Main Table No*
Section I – General Forest Resource Information		
1.	Total area by main classes	1,2
2.	Forest & other wooded land according to "naturalness"	53,54
3.	Forest & other wooded land according to availability for wood supply	3-6
4.	High forest and coppice	5,6
5.	Ownership and management of forest	9-17
6.	Number and size of holdings of forest & other wooded land	18-24
7.	Changes in area of forest & other wooded land over time by main categories	7,8
Section II – Biological Diversity and Protection Status		
8.	Protection status	55
9.	Tree species occurring on forest & other wooded land	
10.	Forest-occurring species at risk or endangered	56-64
11.	Regeneration and extension of forest	65-68
12.	Species diversity and origin of planting material	69
Section III – Wood Supply and Carbon Sequestration Functions		
13.	Age-class distribution of high forest available for wood supply	25-32
14.	Total woody biomass and the volume of growing stock	33-36; 39-41
15.	Increment	42-46
16.	Fellings and removals	47-52
17.	Change in growing stock on forest available for wood supply	37, 38
Section IV – Forest Condition		
18.	Damage to forest & other wooded land	70,71
19.	Forest fire	72-75
20.	Forest condition	76-78
21.	Protection	79-80
Section V – Protective and Socio-economic Functions		
22.	Indigenous and tribal people	Chapter VI
23.	Access to, and use of, forest & other wooded land by public	81
24.	Goods (wood and non-wood) and selected services provided by forest and other wooded land	Chapter VI
25.	Quantity and value of goods (wood and non-wood products) collected and harvested from forest & other wooded land	Chapter VI

LIST OF MAIN TBFRA-2000 TABLES

CHAPTER VI: Protective and Socio-economic Functions

TBFRA AREAS AND TREE COVER MAPS

Figure M.1 TBFRA main groups

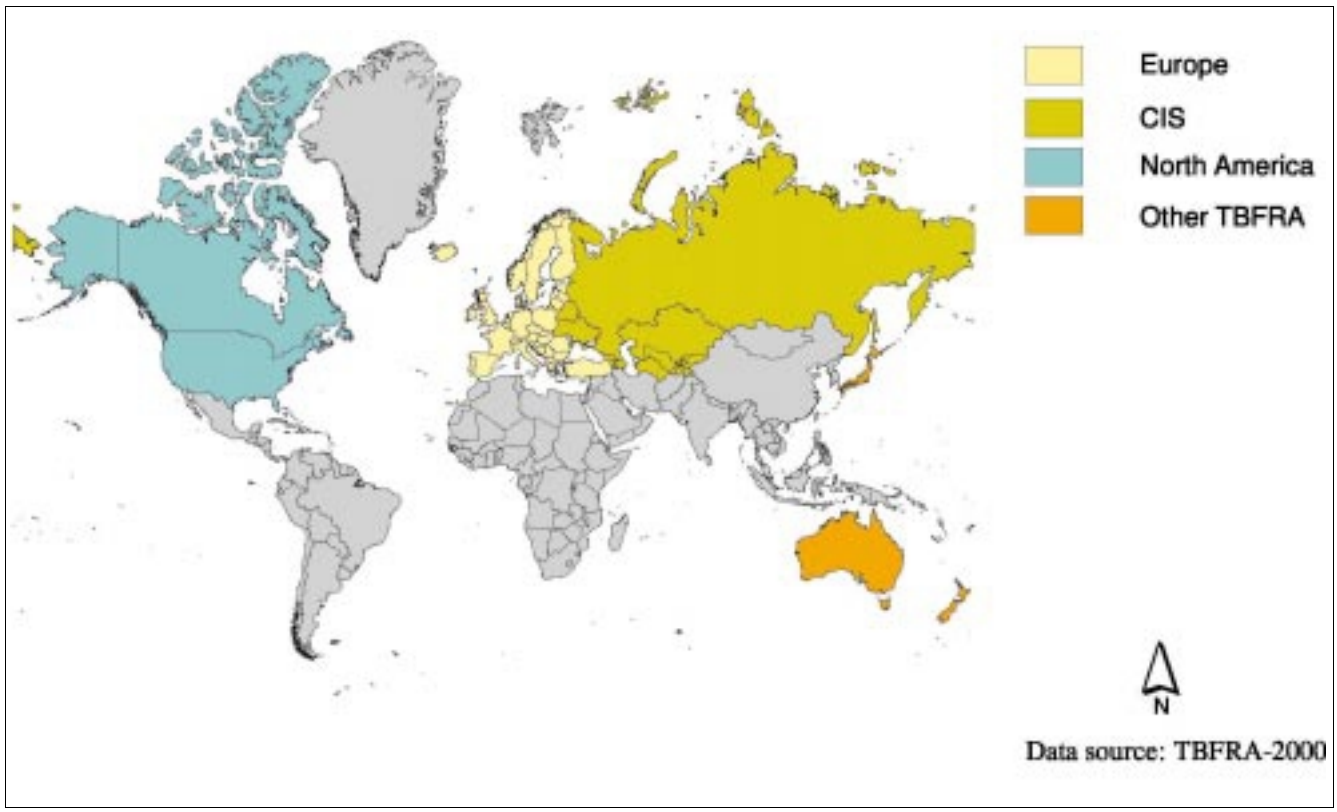


Figure M.2 Europe: TBFRA country groupings

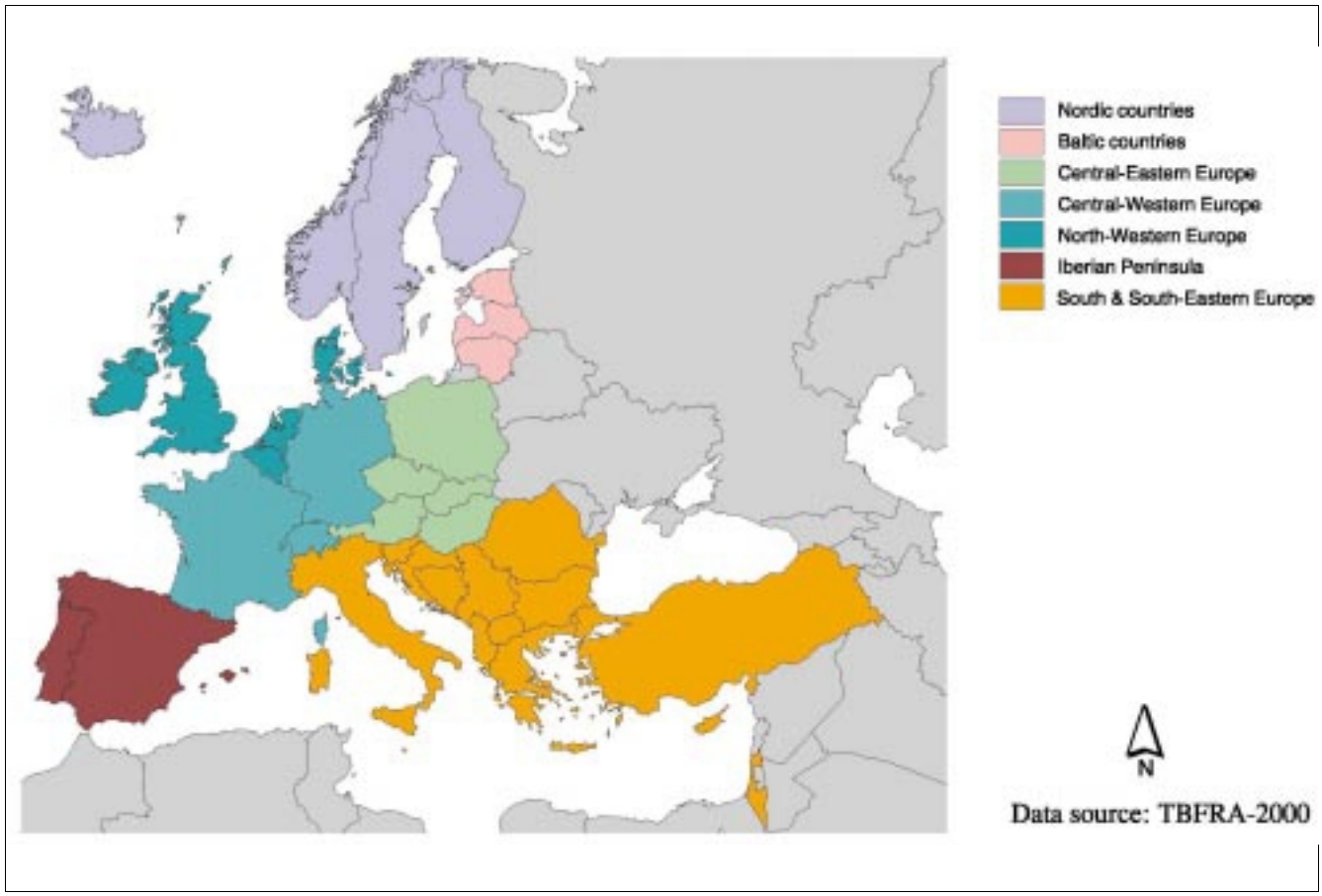
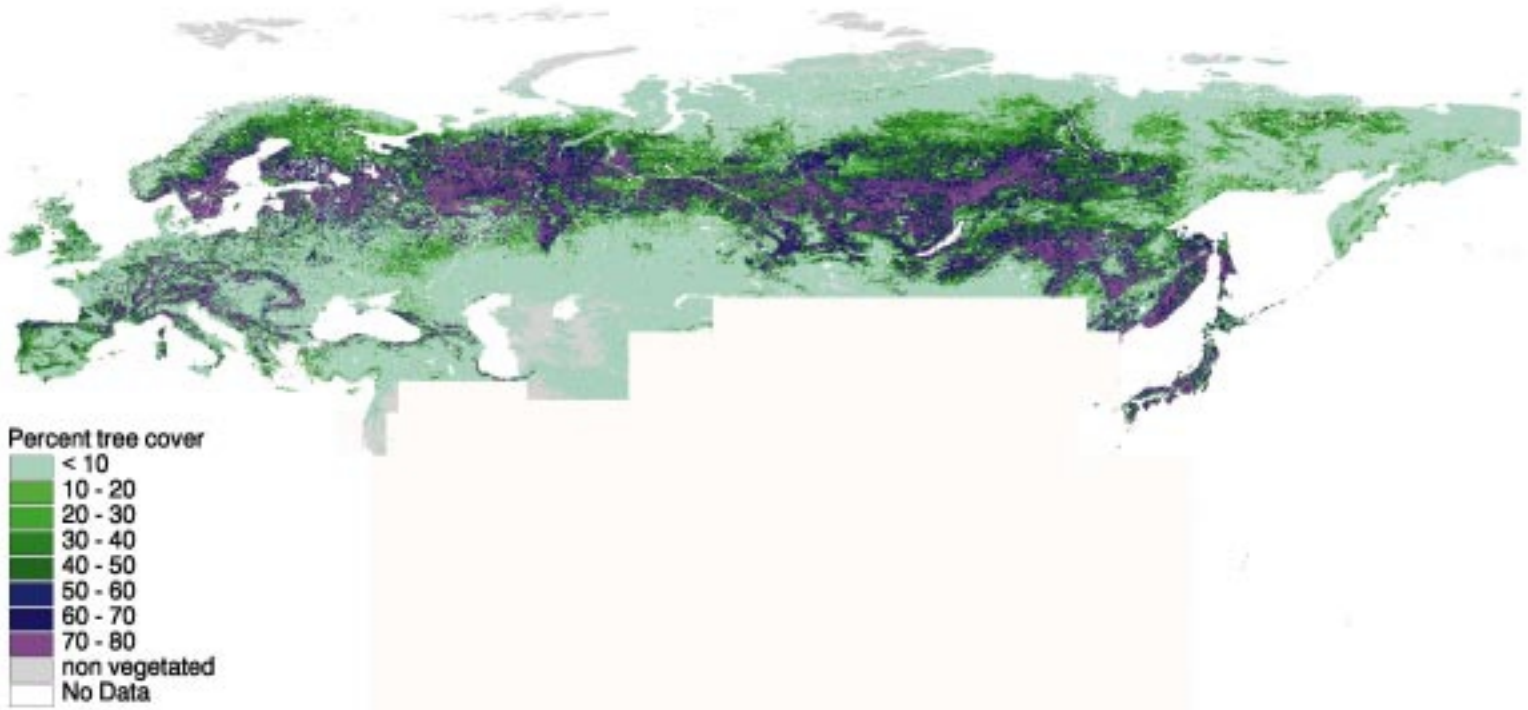


Figure M.3 Tree cover in Europe, CIS and Japan[1]



[1] R.S. De Fries, M.C. Hansen, J.R.G. Townshend, A.C. Janetos and R.T. Loveland, 1999. A new global 1-km dataset of percentage tree cover derived from remote sensing. Global Change Biology (1999)5:1-8.

Figure M.4 Tree cover in North America[2]

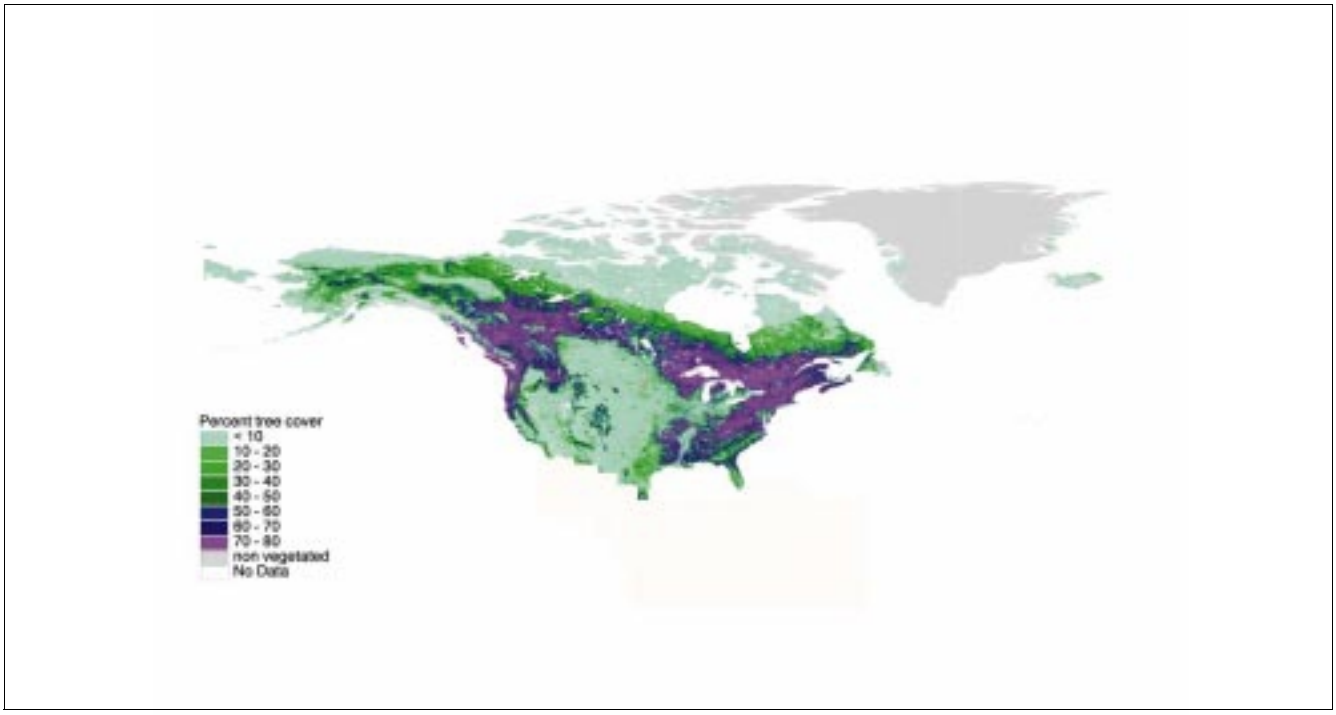
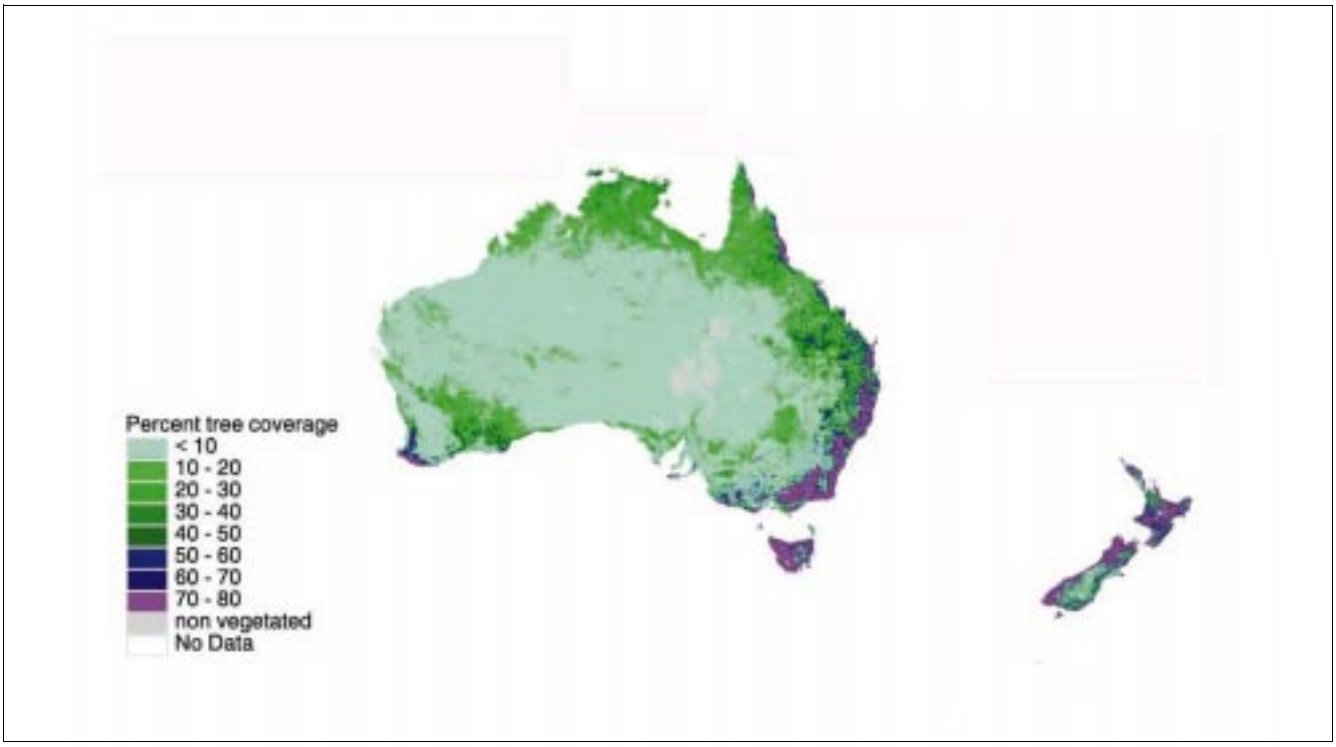


Figure M.5 Tree cover in Australia and New Zealand[2]



[2] R.S. De Fries, M.C. Hansen, J.R.G. Townshend, A.C. Janetos and R.T. Loveland, 1999. A new global 1-km dataset of percentage tree cover derived from remote sensing. Global Change Biology (1999)5:1-8.

EXECUTIVE SUMMARY

INTRODUCTION

There is a strong need for a set of recent, reliable and internationally comparable data on the extent, location, nature, condition and productivity of, and changes to, the forest resource, at the global and regional level, as a vital input to any serious discussion of policy and decision-making relating to wood supply, industry location, protection of biodiversity, climate change, and a whole host of topics linked in one way or another to the forest resource. Since UNCED in 1992 and the second pan-European Ministerial Conference on the Protection of Forests in Europe (Helsinki, 1993), the international forest policy community has repeatedly stressed the need for more and better information on the forest resources of all parts of the world.

The global Forest Resources Assessment (FRA) is the response to those needs; and the publication *Forest Resources of Europe, CIS, North America, Australia, Japan and New Zealand* is a contribution to this global effort. This work has been carried out under the title of the Temperate and Boreal Forest Resources Assessment 2000 and is abbreviated throughout this publication as TBFRA-2000. FAO is responsible for leading this work at the global level, with the coverage of temperate and boreal forests in the UN/ECE region and some other industrialized countries entrusted to a team in Geneva formed by UN/ECE and FAO. TBFRA-2000 is the latest in a series of surveys of the temperate and boreal industrialized countries carried out from Geneva.

The main objective of TBFRA-2000 is to collect and make available the best possible information on the forest resources of the fifty-five countries it covers. It is intended to be useful, not only to governments and the international forest policy community, but also to a wide range of other groups, including the scientific community, forest industries, NGOs, the conventions on biodiversity and climate change, forestry teachers and students, and the general public.

The first step in the preparation of FAO's global Forest Resources Assessment (FRA) process, including TBFRA-2000, was an Expert Consultation on Global Forest Resources Assessment 2000 in Kotka, Finland in 1996 ("Kotka III"), which agreed on the terms and definitions to be applied in all parts of the global FRA. For the TBFRA-2000, data were collected from officially designated national correspondents by means of a questionnaire. The original country data, collected on the basis of national definitions and measuring and sampling techniques, have in many instances had to be adjusted to fit the international definitions for the sake of comparability. The country notes, including explanations of the adjustment process, are intended to provide transparency and to improve the credibility of the data set as a whole. There are quite large differences in data quality between different parts of TBFRA-2000. In general, quality is highest in the "traditional" areas, such as forest area, growing stock and increment, and lower in the "newer" parts, such as biodiversity, forest condition, etc. This is to be expected when the scope is widened to include areas not covered beforehand. The latter types of information are highly relevant to the policy debate and are considered to be good enough for publication (with explanations of their weak points).

Changes over time in the forest resource are at the heart of many of the recent forest policy debates. However, monitoring poses severe methodological problems, for instance separating changes due to changes in methods or in definitions from those arising from real changes in the parameter measured. For TBFRA-2000, national correspondents were asked to estimate change for only a very small number of key parameters.

The preparation of TBFRA-2000 has been an immense team effort involving the co-operation of hundreds of people, whose contributions are warmly acknowledged by the UN-ECE/FAO secretariat in Geneva.

REGIONAL AND TBFRA-2000 TOTALS

All the information which countries were able to provide in response to *Enquiry Tables 1 to 25* of the TBFRA-2000 is contained in the Main Tables 1 to 81 in the body of the report (with the exception of a few parameters, notably the detailed lists of tree species, which will be published in satellite documentation). It is a rather remarkable achievement that all countries provided data on quite a number of the key parameters, such as the area of forest and

TABLE S.1

Regional and TBFRA-2000 totals of selected parameters

Parameter	Million units	Europe	CIS	North America	Other TBFRA	Grand Total
Forest and other wooded land (FOWL)	ha	**215**	**934**	**716**	**613**	**2478**
of which: Forest	ha	**176**	**856**	**462**	**189**	**1682**
of which:	ha					
Predominantly coniferous	ha	91	426	252	16	785
Predominantly broadleaved	ha	57	82	133	168	440
Mixed	ha	25	345	78	5	452
Forest available for wood supply (FAWS)	ha	**149**	**547**	**324**	**42**	**1061**
Forest not available for wood supply (FNAWS)	ha	**27**	**309**	**138**	**147**	**621**
Undisturbed by man	ha	7	**751**	**143**	**24**	925
Semi-natural	ha	157	**82**	**305**	**152**	696
Plantations	ha	12	**23**	**14**	**13**	62
FOWL in public ownership	ha	101	**934**	**516**	**426**	**1977**
FOWL owned by indigenous peoples	ha	**0**	**0**	**8**	**54**	**62**
FOWL in private ownership	ha	**115**	**0**	**191**	**132**	**437**
Average annual change in FOWL	ha	+0.29	+1.18	**+0.43**	+0.05	+1.95
of which: In forest	ha	**+0.50**	**-0.52**	**+0.59**	+0.04	+0.61
of which:	ha					
In FAWS	ha	**+0.11**	**-9.37**	**+0.51**	+0.04	-8.72
In FNAWS	ha	**+0.38**	**+8.86**	**+0.08**	0	+9.33
Total woody biomass	m.t.(o-d)	16296	80754	**61036**	**15497**	173583
of which: Above stump biomass	m.t.(o-d)	13891	62036	**53288**	**12843**	142053
Total growing stock (GS)	m^3 (o.b.)	25854	90997	**70046**	**14697**	201594
of which: GS on FAWS	m^3 (o.b.)	21371	63528	**44390**	**4382**	133671
of which: Coniferous	m^3 (o.b.)	13570	45580	**27647**	493	87290
Average annual change in GS on forest	m^3 (o.b.)	+327	-23	**+257**	+81	+642
of which: On FAWS	m^3 (o.b.)	+252	-106	**+207**	+81	+435
Total net annual increment (NAI)	m^3 (o.b.)	772	1354	**1486**	**192**	3804
of which: NAI on FAWS	m^3 (o.b.)	662	793	**921**	**138**	2514
of which: Coniferous	m^3 (o.b.)	434	483	**544**	101	1562
Total annual fellings	m^3 (o.b.)	465	174	922	71	1633
of which: Annual fellings on FAWS	m^3 (o.b.)	431	146	737	71	1386
of which: Coniferous	m^3 (o.b.)	296	96	533	**54**	979
Total annual removals	m^3 u.b.	355	106	**695**	57	1213

N.B. Figures in **bold** are those where all countries have provided data. The others are *incomplete* regional or grand totals where some country data are missing or partly missing. Detail may not, for this reason or because of rounding, add to totals. For the totals on *areas*, missing data are negligible, in no case exceeding 2 per cent. For those on *volumes*, a few of the amounts not included in the totals are appreciable, for example for coniferous growing stock in "Other TBFRA", for fellings in North America, and for removals in the CIS and "Other TBFRA". None of the figures in plain type in the 'Grand total' column are likely to understate the true totals by more than 4 per cent.

other wooded land, of forest available and not available for wood supply, and of the pattern of ownership; and that a large majority of them could do so for a wider range of parameters. The result is that a rather comprehensive picture emerges of the forest resource situation in the 1990s in the TBFRA area and its component regions: Europe, the CIS countries, North America and the "Other TBFRA" countries, Australia, Japan and New Zealand.

This is summarized in Table S.1. The figures shown in bold type are those where all countries in the regions concerned were able to provide data. These totals are shown in the Main Tables. Thus, the area of 2,478 million hectares of forest and other wooded land includes data from all countries in the TBFRA area. On the other hand, figures that are in plain type indicate that data are missing from one or more countries. These incomplete totals are not shown in the Main Tables. The extent to which they fall short of the absolute totals may be gauged by comparing the sum of them, for example, the three categories of 'naturalness' of forest (925 + 696 + 62 = 1,683 million ha) with the full total for forest (1,682 million ha). This example shows, ignoring the slight discrepancy due to rounding of the figures to the nearest million, that the missing data are insignificant. Indeed, in most cases where the totals are incomplete, the discrepancy between them and what is probably the full total is small, usually a matter of a percent or two, and consequently they can be taken as providing reasonably accurate indications of the regional or grand totals.

In order not to overburden Table S.1 with figures, some important parameters are not shown, but in cases where the figures are in bold type they may be obtained by deduction. For example, the area of other wooded land (OWL) may be calculated by deducting forest (1,682 million ha for the total TBFRA area) from forest and other wooded land (2,478 million), resulting in an area of OWL of 796 million ha.

In several places in the full report there are discussions about the quality, reliability and comparability of the data. Suffice it to say here that particularly for the "traditional" types of information, such as that on area, growing stock, increment and fellings, the quality has been assessed as generally satisfactory. On the other hand, for some of the more recently introduced parameters, for example those concerned with forest condition, protection status, the provision of non-wood goods and services, and so on, some countries could not provide information from official sources and were thus obliged to make estimates or felt unable to provide any figures at all. A further difficulty for countries sometimes arose in interpreting and applying in their responses the definitions used in the TBFRA. This could affect not only the comparability between countries' data, but also the actual statistics. Two cases, amongst others, where caution is merited in using the information are the 'naturalness' of forest and the average annual changes over a period of time in area and growing stock. In the latter case, the large changes shown for the CIS countries, largely accounted for by the Russian Federation, compared with most other countries in the TBFRA area, may be due to the way in which forest available for and not available for wood supply has been understood.

The main findings of TBFRA-2000 are summarized below under the six headings which correspond with the chapters.

AREA OF FOREST AND OTHER WOODED LAND

Information on the area of forest and other wooded land, species distribution, availability and non-availability of forest for wood supply and on silvicultural systems is relevant to all other parts of TBFRA-2000, including the assessment of the resource's biological diversity, its ability to supply wood and to sequestrate carbon, its vulnerability to certain forms of damage and its ability to perform certain social, protection and other environmental functions. These questions are treated in greater depth in subsequent chapters.

General. The total area of forest and other wooded land (FOWL) in the 55 TBFRA-2000 countries in the late 1990s was nearly 2.5 billion ha or somewhat less than half the total land area. Nearly half of the forest was classified as predominantly coniferous, the remainder being predominantly broadleaved or mixed coniferous and broadleaved. Nearly two thirds of it was available for wood supply. With the main exception of the Russian Federation, net changes in the area of FOWL have not been very large. More specifically:

Area of forest and other wooded land. Of the 2,478 million hectares of forest and other wooded land (FOWL), 1,682 million (68 per cent) were classified as forest and 795 million (32 per cent) as other wooded land. (Figure S.1). Thirty-eight percent of the total area of FOWL was located in the CIS countries, 29 per cent in North America, 25 per cent in "Other TBFRA" countries (Australia, Japan, New Zealand) and 9 per cent in Europe.

There was on average about 1.9 ha of FOWL per capita, of which 1.3 ha/cap of forest, the latter being about double the global average. At the country level, the range in forest area per head is very wide, from 31 ha of FOWL per capita in Australia and 14 ha/cap in Canada to virtually nil in Malta. On average in the TBFRA area FOWL covered 46 per cent of the total land area, ranging from 76 per cent in Australia, 75 per cent in Finland and 74 per cent in Sweden to little more than 1 per cent in Iceland and Malta. Australia's area of other wooded land is remarkable in

FIGURE S.1

Area of forest and other wooded land in the TBFRA area

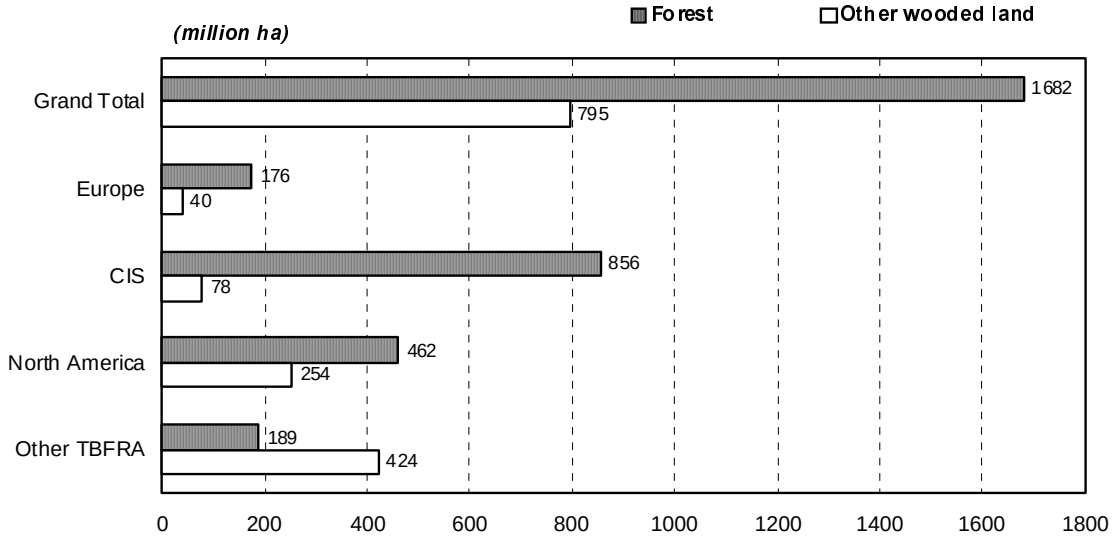


FIGURE S.2

Forest in the TBFRA area by species groups

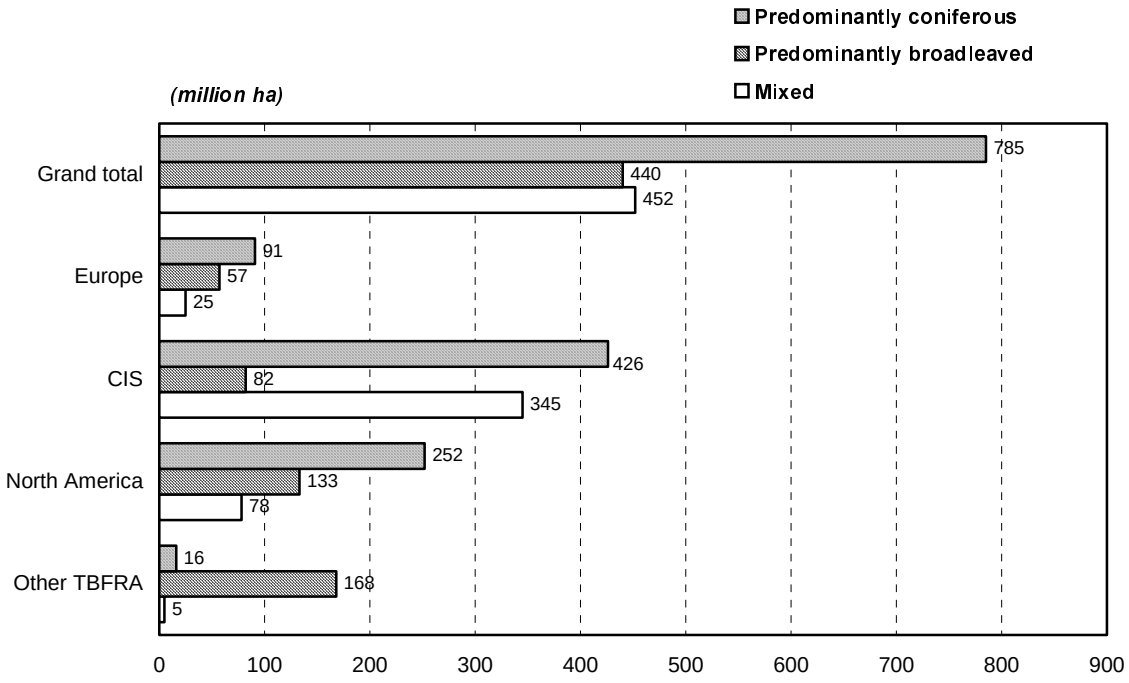


FIGURE S.3

Availability of forest for wood supply in the TBFRA area

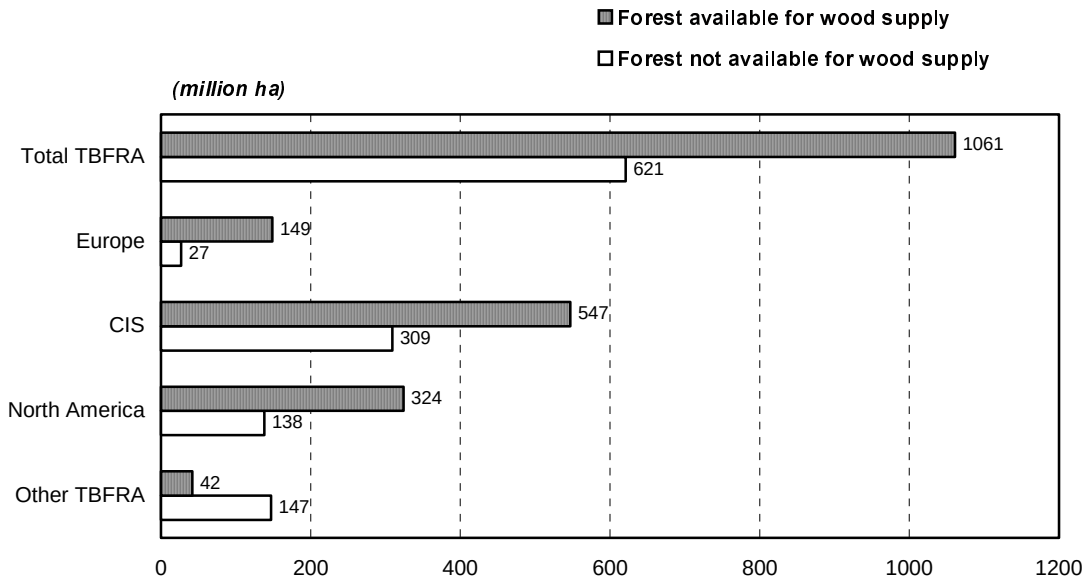
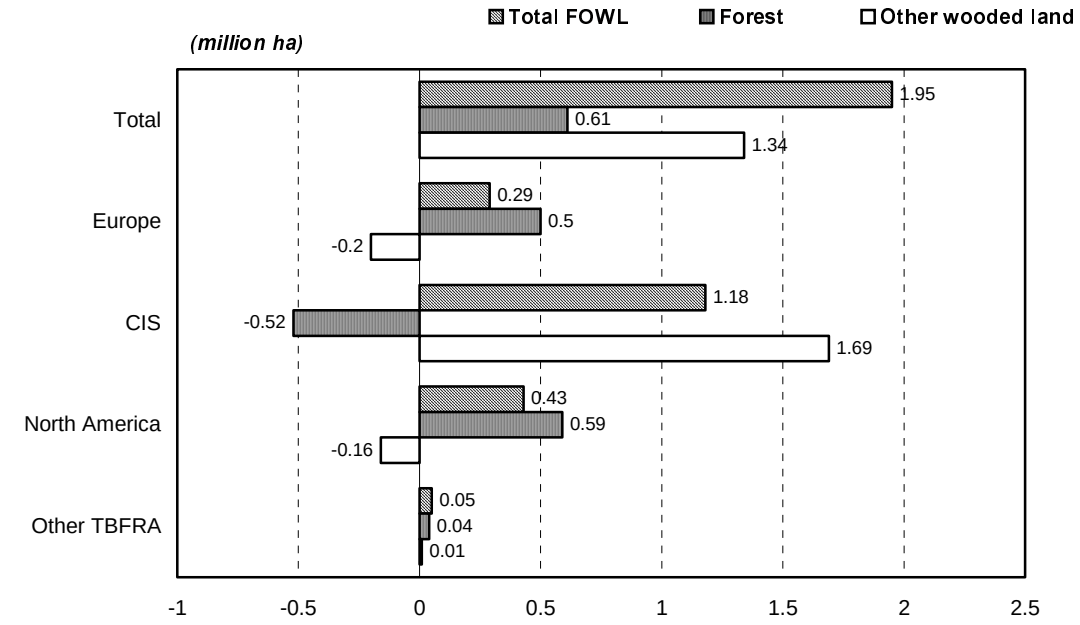


FIGURE S.4

Estimated average annual changes in area of forest and other wooded land (FOWL) in TBFRA area



absolute terms (422 million ha), and for its share of Australia's total land area (55 per cent). It accounts for more than half the total of other wooded land in the TBFRA area.

Species composition and distribution. For the TBFRA countries in aggregate the species distribution in forest on an area basis was as follows: predominantly coniferous 47 per cent, predominantly broadleaved 26 per cent, mixed coniferous and broadleaved 27 per cent; with a small area (in Japan) of predominantly bamboos, palms, etc.

(Figure S.2). About three quarters of the coniferous area lies in the northern boreal belt, while broadleaved or mixed forests predominate in the temperate areas of the northern and southern hemispheres.

Forest available and not available for wood supply. About 63 per cent of the total area of forest in the TBFRA countries is classified as available for wood supply (FAWS) (Figure S.3). The proportion is high in Europe (85 per cent) and low in "Other TBFRA" (22 per cent). About 97 per cent of all FAWS is categorized as high forest; coppice and coppice with standards is of importance in a few countries, mainly in southern Europe. Approximately 80 per cent of the total area of forest not available for wood supply (FNAWS) is considered to fall into this category for economic reasons and 20 per cent for conservation/protection reasons. The importance of the "economic reasons" category is largely due to the figures for the Russian Federation and Canada with their vast areas of remote forest. For Europe nearly two-thirds of FNAWS come under 'conservation/protection reasons' and the USA and Japan put all their FNAWS into this category.

Changes in area over time. Not all countries could provide data on changes and there are doubts about the consistency of data between countries. Data from reporting countries show an average increase in area of about 1.95 million ha per year, of which over 600,000 ha of forest and over 1.3 million ha of OWL (Figure S.4). The largest reported changes were in the Russian Federation with an average annual decline in the area of forest of 1.1 million ha and a rise in that of other wooded land of 1.6 million.

For European countries in total the average annual increase in the area of forest is estimated at nearly 500,000 ha and a decrease in that of other wooded land of about 200,000, mainly due to conversion to forest. There were substantial increases in forest area in the USA and New Zealand; in Canada the area was assumed to remain more or less unchanged. From the available data, it is estimated that the average annual increase in the area of FNAWS in Europe was more than three times that of FAWS. Even though individual countries' trends were different, it appears that in many there was a transfer of areas of FAWS to FNAWS reflecting shifting policies in favour of non-wood goods and services, which was partly offset by afforestation and conversion of other wooded land to establish FAWS.

OWNERSHIP AND MANAGEMENT OF FOREST AND OTHER WOODED LAND

Information on the ownership and management status of forest and other wooded land is important as an indicator of the authority determining the uses to which the land may be put and the intensity of management and use. Designation of land ownership is dependent on a cadastral or legal system which clearly demarcates territory. Such a system exists in most of the countries of the boreal and temperate regions, although in some of them uncertainties about legal ownership still persist. For the purpose of the TBFRA–2000 enquiry ownership is divided into three broad categories: public ownership; private ownership; and owned by indigenous or tribal peoples. The ownership and management status of forest available for wood supply (FAWS) is further sub-divided: for public ownership into State ownership and ownership by other public institutions; and for private ownership into ownership by individuals, by forest industries and by other private institutions.

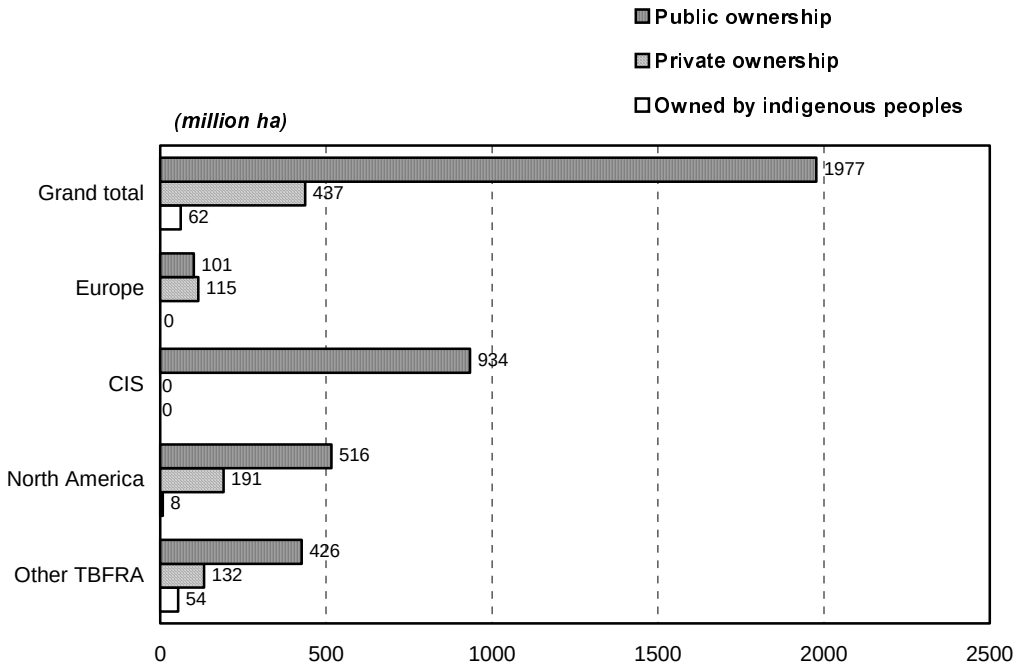
General. Public ownership accounted for nearly 80 per cent of the total area of forest and other wooded land in the TBFRA-2000 countries in aggregate: 100 per cent in the CIS countries and 68 per cent in the others. For forest available for wood supply in countries other than the CIS, State ownership and ownership by individuals each accounted for two fifths of the total and ownership by forest industries for nearly one tenth. Between 80 and 90 per cent of the area of forest and other wooded land in the TBFRA-2000 countries in aggregate is under management. More specifically:

Ownership status. Information about the ownership status of forest and other wooded land was available from virtually all TBFRA-2000 countries, apart from some missing data on ownership by indigenous or tribal peoples in a few countries, where claims are in process. The ownership pattern is changing in many of the countries of Europe and the Commonwealth of Independent States (CIS) whose economies are in transition to forms of market economy, where the process of privatization or restitution is continuing and where therefore the information provided may be partly out of date or may be expected to change significantly over the next decade. For the 55 TBFRA countries in aggregate, approximately 1.97 billion ha or 80 per cent of the area of FOWL was in public ownership, 437 million ha or 18 per cent in private ownership and approximately 62 million ha (between 2 and 3 per cent) owned by indigenous or tribal peoples (Figure S.5). In western Europe, i.e. excluding countries with economies in transition, the proportion in private ownership is 66 per cent and this part of Europe, together with the USA and Japan, differ from the other countries in the TBFRA area where public ownership predominates. Canada, USA, Australia and New Zealand have FOWL owned by indigenous or tribal peoples.

Ownership of forest available for wood supply. For the TBFRA countries in aggregate it is estimated that State ownership and ownership by individuals each account for two fifths of the total and ownership by forest industries for not quite one tenth. 96 per cent of FAWS in public ownership is owned by the State. In several European countries

FIGURE S.5

Forest and other wooded land in the TBFRA area by ownership categories



ownership by other public bodies, such as municipalities and communes, accounted for more than half the publicly owned area; this was the case in France, Italy, Spain and Sweden amongst the larger forest countries. Under private ownership, it is estimated that about 77 per cent of FAWS is owned by individuals, 17 per cent by forest industries and 6 per cent by other private institutions. Ownership by forest industries occurs mainly in North America, the Nordic countries, Portugal, Japan and New Zealand. Ownership by other private institutions is important in terms of area in the USA, Japan, France, Finland and New Zealand.

Management status. It is estimated that about 86 per cent of FOWL in the TBFRA countries in aggregate is managed; the proportion is higher for FOWL in public ownership (89 per cent) than in private (49 per cent). The CIS and "Other TBFRA" countries report that virtually all of their FOWL is being managed. In Canada 52 per cent of FOWL is managed. On average in the TBFRA countries the proportion of FAWS in public ownership that is managed is considerably higher (96 per cent) than that in private ownership (62 per cent). This is a result of, on the one hand, the almost 100 per cent management of public FAWS in the CIS countries and, on the other hand, the relatively low proportion of privately owned FAWS under management in the USA (40 per cent), which is the country with by far the largest area in this category. It would seem that the proportion of FNAWS that countries consider to be under management is about as high as that of FAWS.

Holdings of forest and other wooded land. In Europe, it is estimated that there are about 77,000 holdings in public ownership and 10.7 million in private ownership.The average size of public holdings is 1,200 ha and that of private holdings 10.6 ha. In the USA the number of public holdings is 64, according to the definition of public holdings used there, giving an average size of 1.99 million ha; the number of private holdings is 9.94 million with an average size of 17.2 ha. In most countries the size class distribution of private holdings results in a high proportion of owners owning a small proportion of the total area. There are several million private owners in Europe with holdings of less than 3 ha.

WOOD SUPPLY AND CARBON SEQUESTRATION

A. Growing stock, growth, drain and balance

Information on the volumes of growing stock, annual increment, annual fellings, removals and natural losses, as well as their changes over time, is important for the analysis of the utilization and wood production potential of forest and other wooded land, and the possibilities for maintaining the biodiversity of forests within given wood production scenarios.

Growing stock. The volume of growing stock in the TBFRA region is just over 200 billion m^3 overbark (o.b.)–152 m^3 for each inhabitant. Nearly 80 per cent of that volume is in three countries: the Russian Federation, the USA and Canada. Over 90 per cent of it is on land classified as forest and two thirds–134 billion m^3 o.b.–on forest available for wood supply (FAWS) (Figure S.6). On average in the TBFRA region, two thirds of the growing stock is coniferous, but in the CIS the proportion is nearly 80 per cent while in the "Other TBFRA" group of countries it is just over 20 per cent.

On average, on FAWS the growing stock is between 105 and 145 m^3 o.b./ ha, but the variation between countries is very wide, from less than 50 m^3/ha in Greece, Iceland, Spain and Turkmenistan, to over 250 m^3/ha in Germany, Liechtenstein, Slovakia, Slovenia and Switzerland, all countries with a similar strong and conservative silvicultural tradition. New Zealand, with its large proportion of natural, predominantly broadleaved forests, also has a very high volume of growing stock per hectare. On average, the growing stock increased by approximately 640 million m^3 o.b./ year in the 1990s. The average annual increase for Europe was nearly 330 million m^3 and for North America 260 million m^3. In the CIS growing stock on forest decreased by an average of 23 million m^3/year, and as much as 113 million m^3/year in the Russian Federation alone, as forest was transferred to other land use categories. As will be seen below, fellings were well below increment, so total growing stock increased.

Increment and natural losses. Gross annual increment (GAI) on forest and other wooded land is over 4,670 million m^3 o.b. 80 per cent of that GAI is on forest, where the mean annual increment is 2.1 m^3 o.b./ha or 2.1 per cent of growing stock. Natural losses account for 8.7 per cent of GAI in Europe, 26.7 per cent in the CIS and 20.2 per cent in the USA.

Net annual increment (NAI, GAI less natural losses) of trees on forest and other wooded land in the TBFRA region was about 3,800 million m^3 o.b., of which over 70 per cent was in three countries, the Russian Federation, the USA and Canada. NAI on forest available for wood supply in the TBFRA region is about 2,550 million m^3 o.b., of which 700 million in Europe, 793 million in the CIS and 921 million in North America.

Fellings and removals. Total annual fellings in the TBFRA region were reported to be 1,632 million m^3 o.b., of which over half in North America. The Russian Federation, which accounts for 30 per cent of the region's increment, accounted for only 9 per cent of its fellings. Reported harvest losses accounted for about 12 per cent of total fellings.

FIGURE S.6

Growing stock on forest available for wood supply in the TBFRA area
(Total: 133.7 billion m^3 overbark)

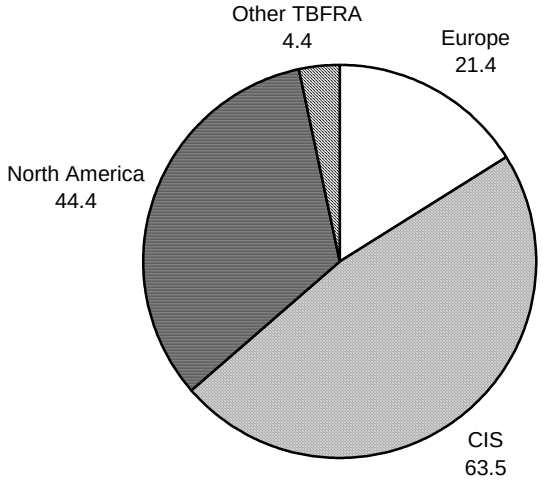
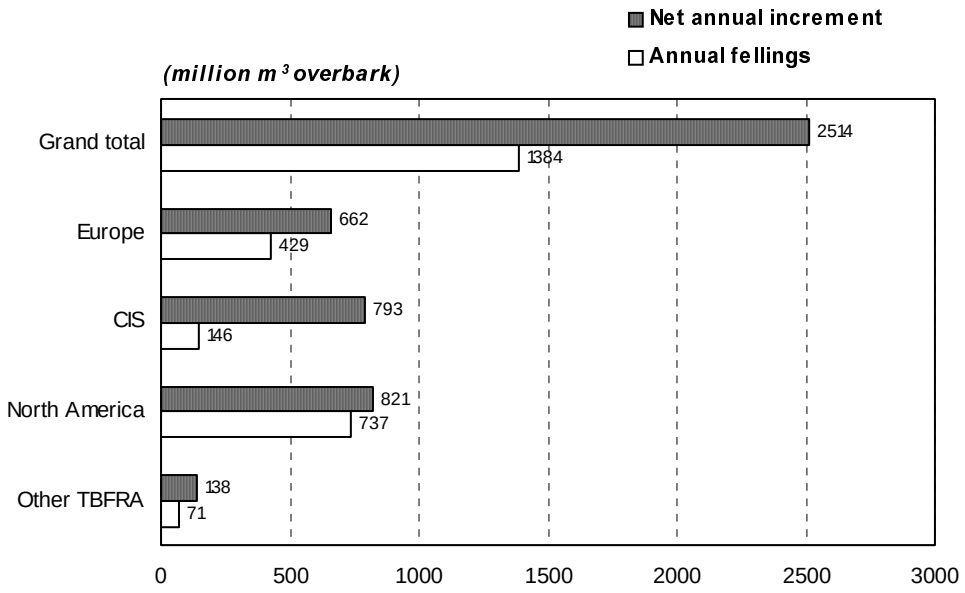


FIGURE S.7

Net annual increment and fellings on forest available for wood supply in the TBFRA area



Removals (fellings less harvesting losses) from the forests of the TBFRA region amounted to nearly 1,220 million m^3 u.b. (underbark), of which 695 million (57 per cent) in North America and 360 million (30 per cent) in Europe.

Balance between increment and fellings. More than half the net growth on forest available for wood supply is harvested, when fellings are compared with NAI (Figure S.7). The sustainability of wood production can be more reliably determined by comparing NAI with fellings of growing stock (i.e. fellings of live trees, excluding fellings of natural losses). For the region as a whole, fellings of growing stock were 52.6 per cent of net annual increment. In North America this ratio is 78.6 per cent and in Europe 59.0 per cent, but in the CIS only 16.8 per cent. The increment of coniferous trees is more intensively used than of broadleaved: the fellings of growing stock/NAI ratio for the TBFRA region as a whole is 62.5 per cent for coniferous, 42.2 per cent for broadleaved.

B. Woody biomass and the carbon cycle

As a contribution to the improvement of knowledge about the role of woody biomass in the carbon cycle, it was decided to devote a special section of the TBFRA-2000 to the collection of relevant information. The rising concentration of carbon dioxide in the atmosphere has heightened interest in research on cycling of carbon at the global level. The atmospheric CO_2 concentration has increased 30 per cent from the preindustrial level of about 280 parts per million (ppm) to the present concentration of nearly 370 ppm. During recent years the concentration has been growing by some 1.5 ppm per year. The increase in the concentration of CO_2 in the atmosphere is predicted to reinforce the greenhouse effect of the atmosphere and consequently lead to worldwide changes in climate. This increase is caused by human activities, mainly by the combustion of fossil fuels and deforestation. Insight into the cycling of carbon is needed in order to predict the development of the concentration of CO_2 in the atmosphere and the potential climatic changes, and to combat the increase in the atmospheric CO_2 concentration by removing CO_2 from the atmosphere and binding it in other stores.

Forest statistics for studying carbon cycling in forests. Forest statistics provide a useful means to quantify the carbon stores and carbon cycles of the tree component of forest ecosystems. Converting stemwood volumes to biomass and carbon is one of the most critical steps in using forest statistics to quantify carbon cycling in trees; in particular the conversion from volume to biomass is considered as a serious source of uncertainty. Despite this, the use of forest statistics in studying carbon cycling in forests has advantages compared with other approaches. The conversion factors

employed by countries for the above-stump biomass vary appreciably but for conifers average 0.52 m.t. per m^3 of stem wood, for broadleaved trees 0.66 m.t./m^3, and for stumps and roots 0.12 m.t./per m^3 of the stem volume. The carbon component of the woody biomass has been taken to be 50 per cent of the total mass.

Carbon store of woody biomass. The carbon store of woody biomass on forest and other wooded land in the TBFRA area at the time of the TBFRA-2000 assessment was estimated at 88 Pg. As much as 47 per cent of this total store was in the CIS countries, 35 per cent in North America, 10 per cent in Europe and 9 per cent in the "Other TBFRA" countries. Three countries, the Russian Federation, USA and Canada, account between them for 80 per cent of the total. The above-stump woody biomass contained 72 Pg of carbon, which was 82 per cent of the total store of woody biomass. The size of the carbon store of woody biomass on FOWL in the TBFRA area, 88 Pg, is about 14 per cent of the carbon store of global vegetation and 6 per cent compared with the store in soils worldwide. It is equivalent to 12 per cent of the amount of carbon in the atmosphere.

Carbon balance of woody biomass. In all TBFRA countries for which data are available, net annual increment has been larger than fellings and, consequently, the carbon store of woody biomass on FOWL has been increasing. The carbon balance of woody biomass, i.e. the rate of change in its carbon store, is calculated as

net annual increment – annual fellings + annual fellings of natural losses.

The increase in the carbon store of the woody biomass on FOWL is estimated at 0.88 Pg/ year or 1.0 per cent. Per unit area, the average increase in the TBFRA area was 0.35 m.t. of carbon/ha/year. The total increase, 0.88 Pg/year, is equivalent to about 16 per cent of the global anthropogenic emissions of CO_2 originating from the combustion of fossil fuels and cement production, to 55 per cent of the emissions resulting from deforestation in the tropics, and to 28 per cent of the present rate of increase in the amount of CO_2 in the atmosphere. In other words, without the increase in the carbon store in the woody biomass in the TBFRA area, the amount and concentration of CO_2 in the atmosphere would be increasing at a rate of 28 per cent more than they are.

BIOLOGICAL DIVERSITY AND ENVIRONMENTAL PROTECTION

The inclusion of questions in the TBFRA-2000 enquiry relating to biological diversity, the "naturalness" of forests and the extent and type of regeneration reflects the increasing interest amongst policy makers and the general public in biodiversity and environmental protection. Given the partly experimental nature of this part of the TBFRA and the difficulties encountered by some countries in providing information, the results should be treated with due caution.

Forest and other wooded land by categories of naturalness. According to the countries' replies, about 55 per cent of forests in the TBFRA area can be considered as undisturbed by man, about 41 per cent as semi-natural and 4 per cent as plantations (Figure S.8). These proportions are heavily influenced by the forest condition in the Russian Federation and Canada, with their huge areas of forest, much of it in remote areas. Excluding these two countries, the proportion of forest in the rest of the TBFRA area that is undisturbed by man is only about 7 per cent, with 89 per cent semi-natural and 4 per cent plantations. The United States and Australia account for much of the undisturbed forest in the rest of the TBFRA area with smaller areas in the Nordic countries, Japan and New Zealand. Concerns about the comparability of certain data mean that the figures for Canada and the Russian Federation should be treated with caution.

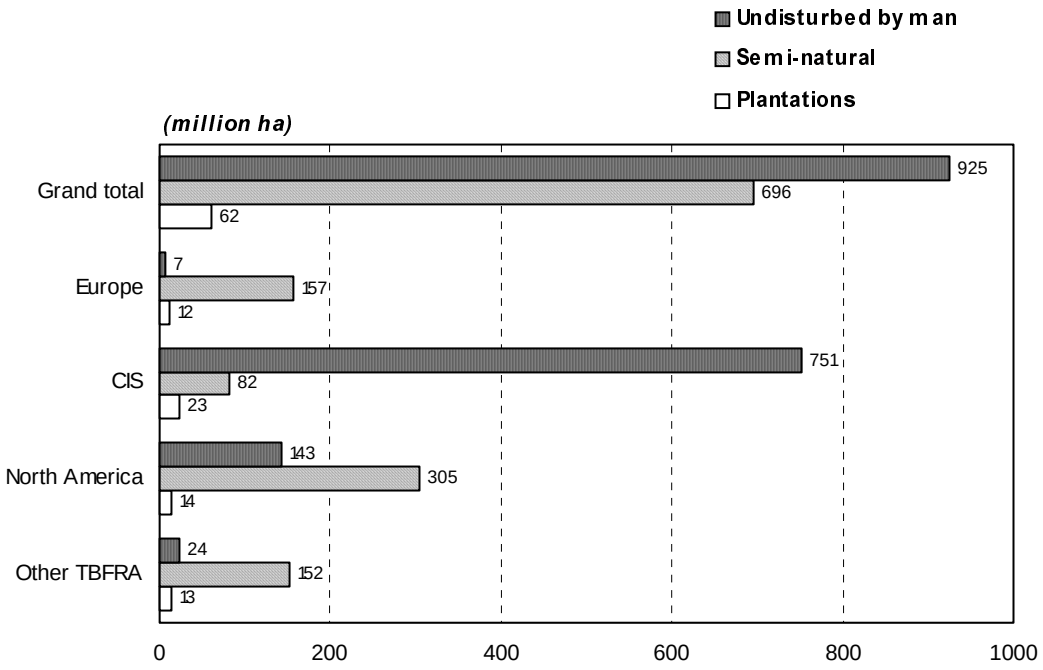
Tree species. The highest numbers of native tree species in the TBFRA area are found in New Zealand, Australia, Japan and the United States, and the lowest in the northern boreal regions. In Europe and central Asia, number of tree species increases towards the south and east.

Protection status. Fears about a decline in natural forest have created a political momentum for an increase in the area of protected forest in order to conserve biodiversity and also related ecological, social and cultural values. Several countries encountered difficulties in providing data according to the IUCN protected areas categories, but their replies were useful in revealing differences of opinion about the categorization of protected forest areas. With regard to IUCN Categories I and II (strict nature reserves, wilderness areas, national parks and natural monuments), replies on which were less ambiguous than on the other categories, about 87 per cent of all the protected forest area occurs in the four major forest countries, the Russian Federation, Canada, the USA and Australia, with the remaining TBFRA countries making up just 13 per cent of the total. These figures must be treated with caution: European countries have traditionally put greater focus on the less strictly protected area categories, particularly IUCN Category V–Protected landscapes, as well as having a large number of rather small protected areas

Reported number of species, including proportion endangered. The possibility of a large number of species of plants and animals disappearing, largely as a result of human actions, has gained official recognition, for example

FIGURE S.8

Forest in the TBFRA area by "naturalness



through the Convention on Biological Diversity. Whilst the majority of forest-occurring species exist in the tropics, concern has also been expressed about the status of some in temperate and boreal regions. Despite the incomplete nature of the data received in response to the TBFRA enquiry, a number of inferences can be drawn. There is a clear perception that significant numbers of wild plant and animal species are endangered, despite the existence of a relatively stable forest estate. Larger animals seem to be more endangered than smaller ones. In the case of plants, on the other hand, more lower plants (mosses and lichens) are listed as endangered than trees and other vascular plants. Invasive species are regarded as an important threat to biodiversity in New Zealand and Australia and as significant in Canada.

Regeneration and extension of forest. Throughout much of the TBFRA area, forest cover is expanding following deforestation in the past. The type of expansion varies from one country to another, for example, from the establishment of plantations of exotic species to natural recolonization of abandoned agricultural land. The largest areas of expansion are in the Russian Federation and the USA, which together account for about 87 per cent of the total in the TBFRA area, there is significant expansion in most European countries as well. At the same time, most countries appear to be regenerating forests. Of the estimated 1.5 million ha of natural colonization of non-forest land every year, over 90 per cent is in the Russian Federation. Other significant areas, including France, Norway and New Zealand, may reflect changing agricultural practices and abandonment of agricultural land. The small amount of recolonization, particularly in Europe, is significant when compared with claims made about the amount of land being removed from agriculture.

Origin of planting material used in the forest. Preliminary results of the enquiry on this issue, which must be treated with caution because of the limited nature of the data, suggest that the large majority of trees being planted in the TBFRA area are of local provenance.

FOREST CONDITION AND DAMAGE TO FOREST AND OTHER WOODED LAND

TBFRA-2000 differs from earlier assessments in that it has sought information not only on the extent of the resource, but also on its condition. There have been particular concerns over the issues of forest condition and forest damage, as the maintenance of forest condition is a clear prerequisite for the sustainable management of forest resources. Consequently, these issues have received considerable attention from both scientists and policy makers.

Information collected for the TBFRA-2000 provides a preliminary assessment, while at the same time highlighting the difficulties associated with making such an assessment.

Causes of damage. The most important reported causes of damage to forests in the boreal and temperate zones are insects and fire. For example, up to 205 million ha of forest were reported to have been damaged by insects and disease in Canada in the period 1986-1995, and almost 29 million ha of Canadian forests were damaged by fire in the same period. Damage caused by grazing and browsing was also widely reported and, in a number of European countries (e.g. Austria, Belgium, Bulgaria, Denmark, and Poland), the area of forest and other wooded land with such damage was greater than from any other identified cause.

Fire. Fire is a major cause of forest damage, although its significance is not directly proportional to either the number of fires or their spatial extent. Forest fires are very important in southern Europe, where a high population density and small-scale forest ownership combine to increase the likely significance of a particular fire.

Defoliation. The reported defoliation figures indicate that defoliation is much more widespread in Europe than in North America. In the USA, the proportions of trees with more than 25 per cent defoliation is generally less than 1 per cent. In Canada, it is generally less than 10 per cent, whereas in Europe in recent years, it has been more than 20 per cent. This almost certainly reflects differences in standards between Europe and North America. The European figures reflect a trend for increasing defoliation. The proportion of trees assessed every year between 1988 and 1997 with more than 25 per cent defoliation has increased from 13.2 per cent in 1988 to 23.1 per cent in 1997. No information is yet available on the cause of this reported increase in defoliation.

The material presented in TBFRA-2000 represents a step forward in the assessment of forest condition at an international scale. It illustrates the diversity of methods used in individual countries to address this important issue, and highlight the gaps in our current understanding of the most important agents damaging forests.

The condition of a forest is best assessed in relation to its most important functions, and these vary from forest to forest. Consequently, any statement about the health of a forest in a country should take into account the functions of those forests. Currently, no methods exist which can be used to do this. Many of the difficulties associated with the identification of the condition of forests in the temperate and boreal zones stem from recent changes in the ways that forests are seen. Issues such as biodiversity, water quality and carbon sequestration have all become much more important than in previous years. However, forest inventory methods have primarily concentrated on the assessment of wood resources. This is still reflected in the data that have been collected for the TBFRA-2000.

PROTECTIVE AND SOCIO-ECONOMIC FUNCTIONS

The goods and services from forests provide a wide range of benefits. The TBFRA-2000 attempts to describe these goods and services more fully than previous assessments. The result is a sometimes bewildering array of products and services, some of which are touched on below.

Protective functions. The protective functions of forests are receiving increasing attention, at least partly in response to international attention to issues such as biodiversity, global climate change, and forest health. A number of countries are exploring approaches to alter or enhance forest inventory systems to better measure the protective functions of forests.

Use of the forest by indigenous or tribal peoples. Forests play an important role in many indigenous and tribal peoples' cultures. The information in response to the TBFRA enquiry was brief, and only begins to describe the importance of these lands to indigenous and tribal peoples. A more complete treatment would require consultation with the tribal peoples and other experts.

Public access. Most countries that responded to the enquiry indicated that the public has access to most public forest and other wooded land for the purposes of recreation and gathering of forest products for personal use. Any restrictions normally affect a small percentage of these lands. Commercial use of public forest and other wooded land normally requires special permits and some type of payment to the State, particularly for the harvest of wood products. The majority of countries in the TBFRA area with privately owned forest have a policy of open public access, sometimes with certain restrictions imposed. A minority of countries allow access only with the permission of the landowner, but even in these countries access is often allowed.

Non-wood goods. Data availability on the quantity of non-wood goods from forests varies widely among countries, but from countries' responses the general trend is clear: first, demand is increasing for most goods and services; second, the lack of supply information limits current ability to manage these resources; and third, existing and potential conflicts between users, combined with the increasing demand, are creating immediate challenges for managers. Commercial demand is the dominant force for wood products, but is less important for many of the non-

wood products. However, the growing demand for "natural" products has spurred commercial interest in products such as mushrooms and medicinal plants. Among the more important non-wood products supplied from the forest that are reported by countries are Christmas trees, cork (from only a few countries), mushrooms, berries, medicinal and herbal plants, decorative foliage, fodder and forage, and hunting and game products. Hunting is more closely regulated than most activities involving the forest and in some countries is considered as a form of utilization of natural resources on a sustained basis and as a means of wildlife management.

Leisure and recreational use. The importance of forests for leisure and recreational use is increasing across the TBFRA area. Forests are often the preferred environment for leisure activities such as picnicking, hiking, camping, horseback riding, and mountain biking. Several countries emphasize the importance of forest and other wooded land in proximity to population centres. Forest and other wooded land are also valued for social benefits not directly related to leisure, such as climate regulation, noise protection, aesthetics, and so on. Most countries report that demand for the cultural, historic, spiritual and scientific values of the forest is increasing.

At best, some countries collect data only on the most important goods and services, or have data on commercial production or exports. The measures of quantity were fairly standard across countries, although it was often not clear whether all types of production were included (particularly for personal use). Personal use often accounts for the largest share of use. However, since that use is not seen as economically important in many countries, there is little incentive to collect data. Additional attention may be directed to this topic in cases where personal use has the potential to harm the resource, or where personal and commercial collections are in conflict.

A number of the goods and services covered in TBFRA-2000 appear to have potential for future assessments. However, any significant progress beyond current information will probably require additional data collection, as well as coordination with organizations that may have data or expertise that is unavailable in the traditional agencies participating in forest assessments.

RELIABILITY AND COMPARABILITY OF THE TBFRA-2000 RESULTS

The systems of nomenclature applied in national forest resources assessments are characterized by tradition and by national information needs and are not standardized internationally. Even identically named attributes may mask different concepts and definitions. A major concern of the TBFRA-2000 was therefore the comparability of data between countries and the reliability of aggregated results. Studies were conducted that aimed at assessing the reliability of information obtained by the aggregation of data from national forest resources assessments. The results of these studies form the basis for analysis of the reliability and comparability of the TBFRA-2000 results.

The reliability of the TBFRA results is mainly affected by two error sources: (1) definition errors; and (2) non-response. In addition, the national reference periods may add some fuzziness to the results. The results of a study of the non-responses and reference periods and an analysis of the definition errors are summarized below.

Results of analysis of non-responses. The response rates by countries to the TBFRA enquiry are generally high, and with respect to non-response rates there is no reason to doubt the reliability of the TBFRA results.

Definition errors. The minimum crown cover threshold of 10 per cent specified by the TBFRA definition is not critical in closed forests. In open forests close to natural timberlines the minimum crown cover is decisive for forest area estimates. Most countries that have forests close to natural timberlines utilize crown cover thresholds of 10 per cent or define forest area in a way that matches approximately the TBFRA definition. A study carried out in Europe and covering EU member states and EFTA countries showed that the TBFRA definition results in an area of the European forest area roughly 1 per cent more than that assessed according to national definitions. The figures presented by TBFRA for forest area are reliable. Except for a few nations, diameter thresholds larger than 0 cm are defined for diameter breast height (d.b.h). However, even if the national figures are not converted towards the TBFRA definition only a small underestimation of standing volume will result. In conclusion, taking also into account the large unit of reference covered by the TBFRA and the primary use of the information provided by the TBFRA, the reliability of the results is more than sufficient.

Reference period. The reference periods of individual nations reporting to the TBFRA enquiry range from 1986 (Germany) to 1998 (Iceland). With the exception of two countries, all national data presented in TBFRA-2000 were assessed during the 1990s. The reported changes in area and growing stock can be utilized as an indicator for potential differences of the status at the reference period and the time when the TBFRA-2000 results were issued. If TBFRA-2000 results for individual nations are cross-checked with the assessment period and the reported changes, the information provided by TBFRA-2000 can be regarded as reliable and comparable with respect to the reference period.

The results from the four largest forest countries. Four countries, the Russian Federation, Canada, the United States of America and Australia, account between them for the predominant share of the TBFRA region's total forest resources. Their share of the area of forest, for example, is over 85 per cent, that of other wooded land nearly 94 per cent, and of most of the other main attributes more than three-fourths. Consequently, the reliability and comparability of their data have an important influence on the overall results of the TBFRA report. Given the very extensive nature of their forest resources, and the remoteness of and related difficulties of surveying a sizeable part of it, it is inevitable that they should have experienced certain problems in compiling as comprehensive and detailed a set of data as called for in the TBFRA enquiry. Without further analysis, it is impossible to assess whether there may be a number of areas where the data may possibly fall short of satisfactory reliability because of problems with definitions, sampling and survey methodologies, adjustment of national data, and so on. Generally speaking, there seems good reason to accept the figures in this report as the best available.

TBFRA AREAS AND FOREST COVER MAPS

Figure M.6 Forest area as a percentage of land area

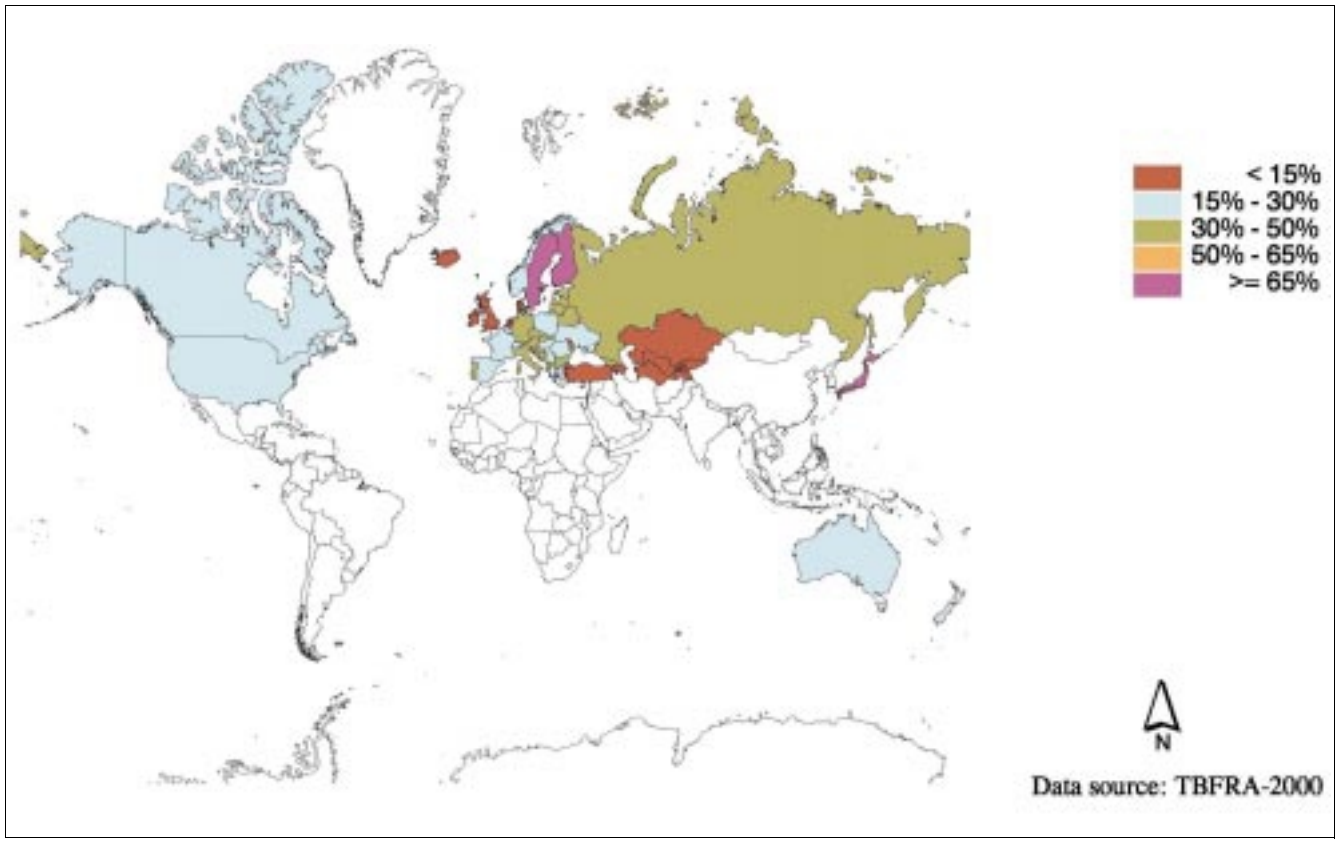


Figure M.7 Forest area as a percentage of area of forest and other wooded land

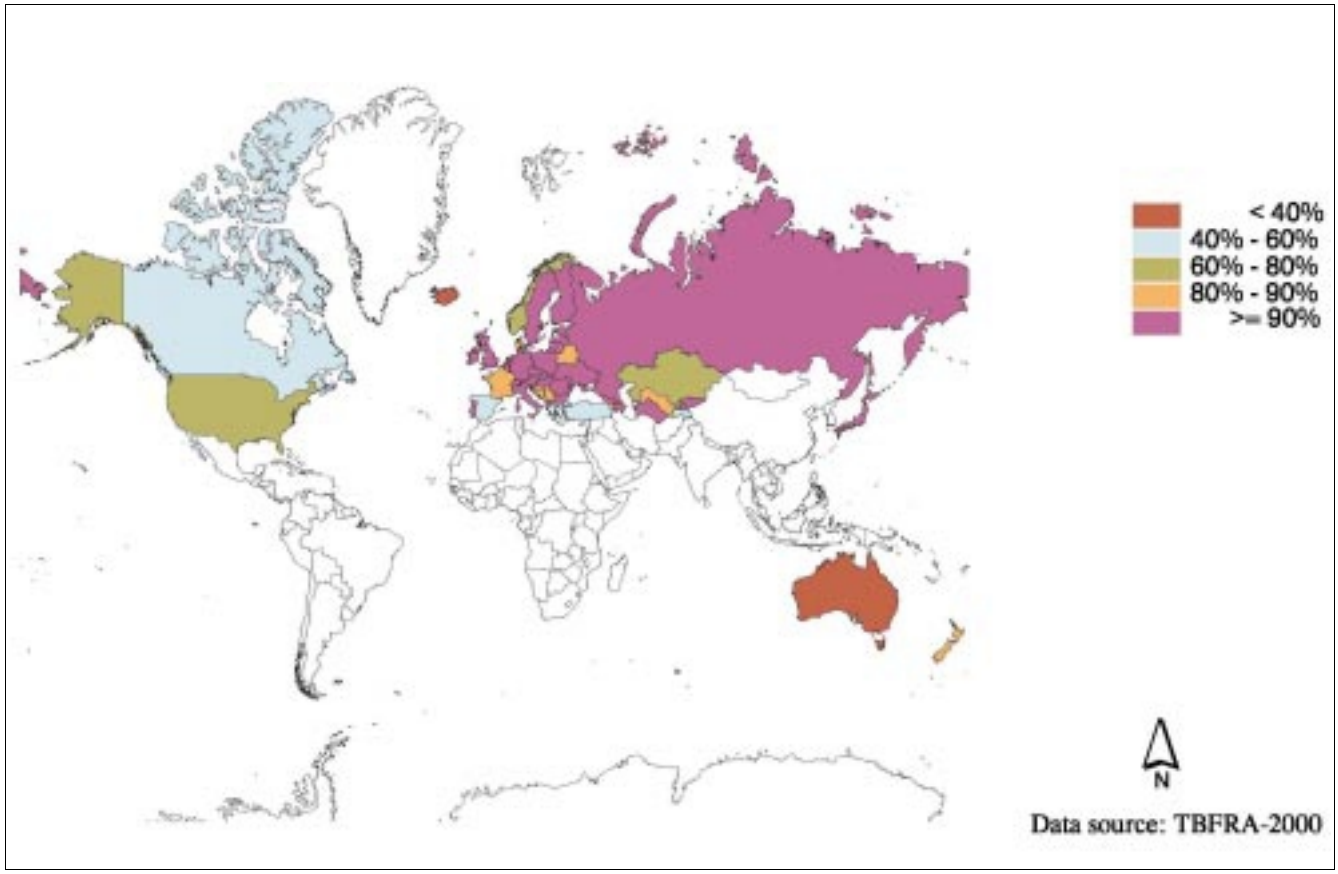


Figure M.8 Forest and other wooded land per capita (ha/capita)

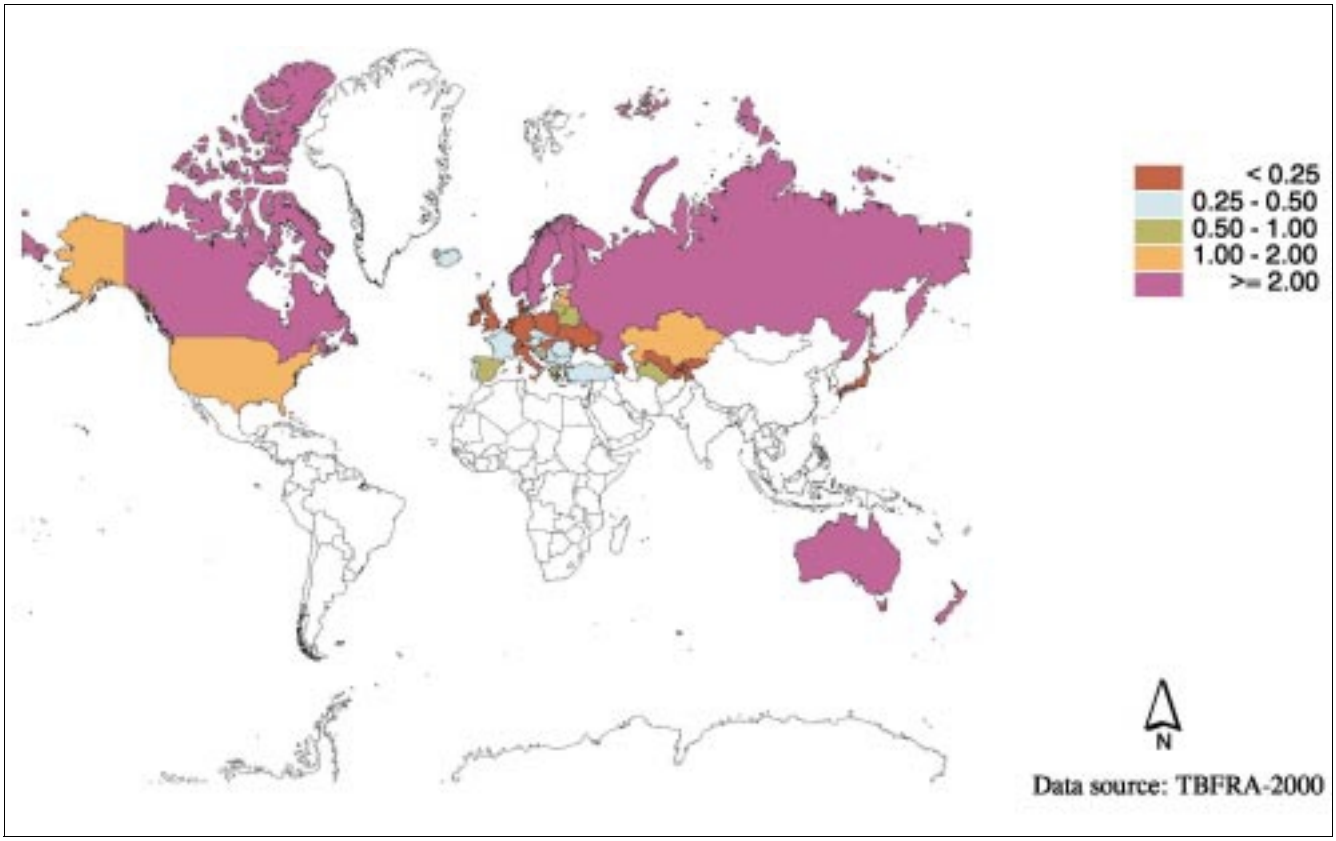


Figure M.9 Average annual change in forest area (per cent)

Figure M.10 Percentage of forest and other wooded land in private ownership

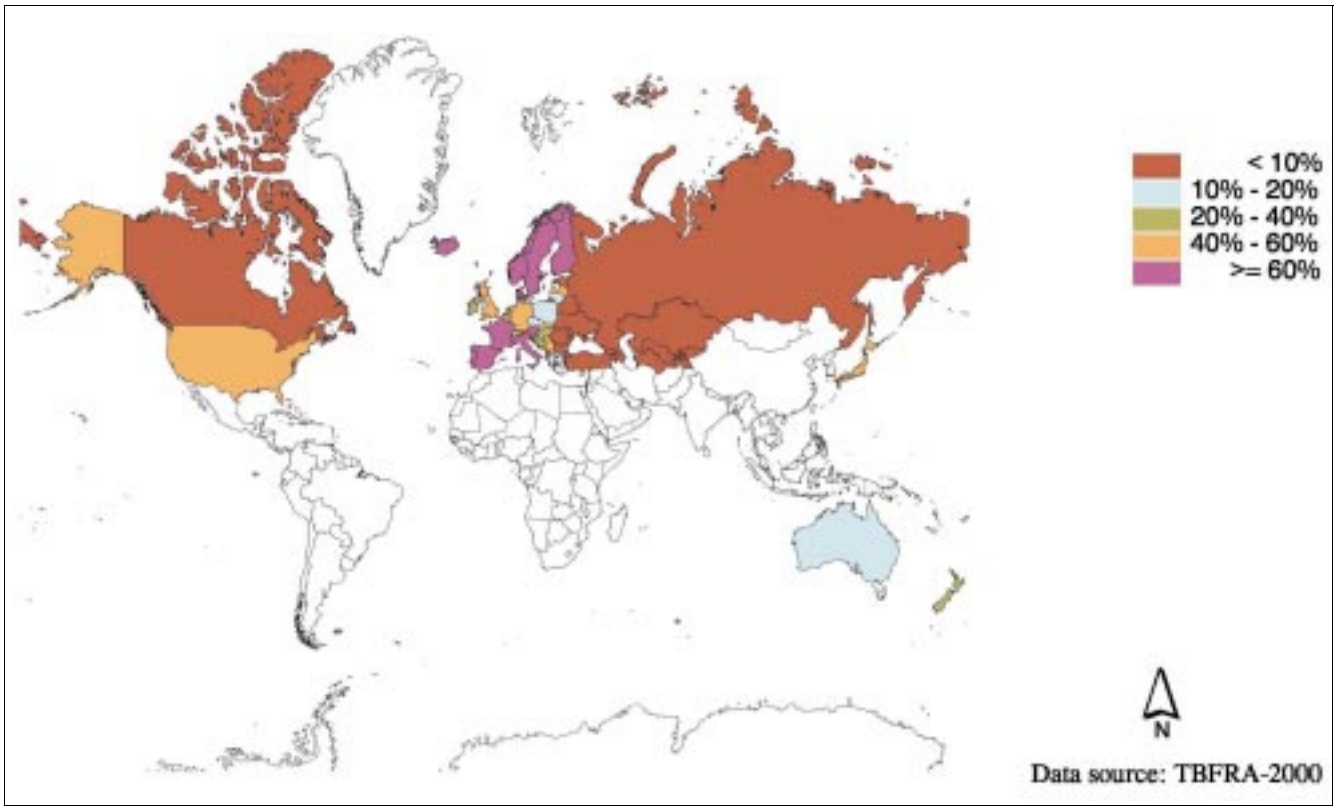


Figure M.11 Growing stock per hectare on forest available for wood supply (m^3 overback/ha)

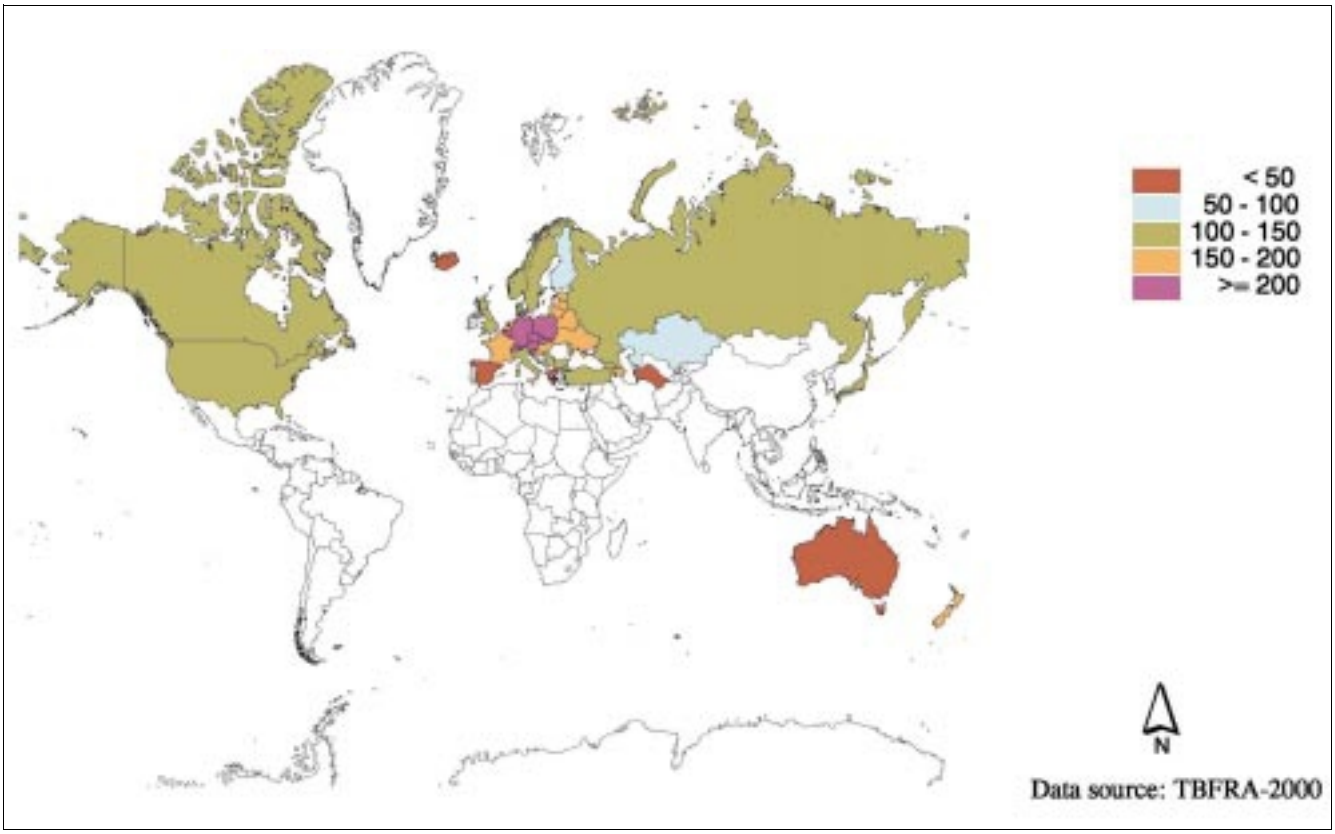


Figure M.12 Net annual increment per hectare on forest available for wood supply (m^3 overback/ha)

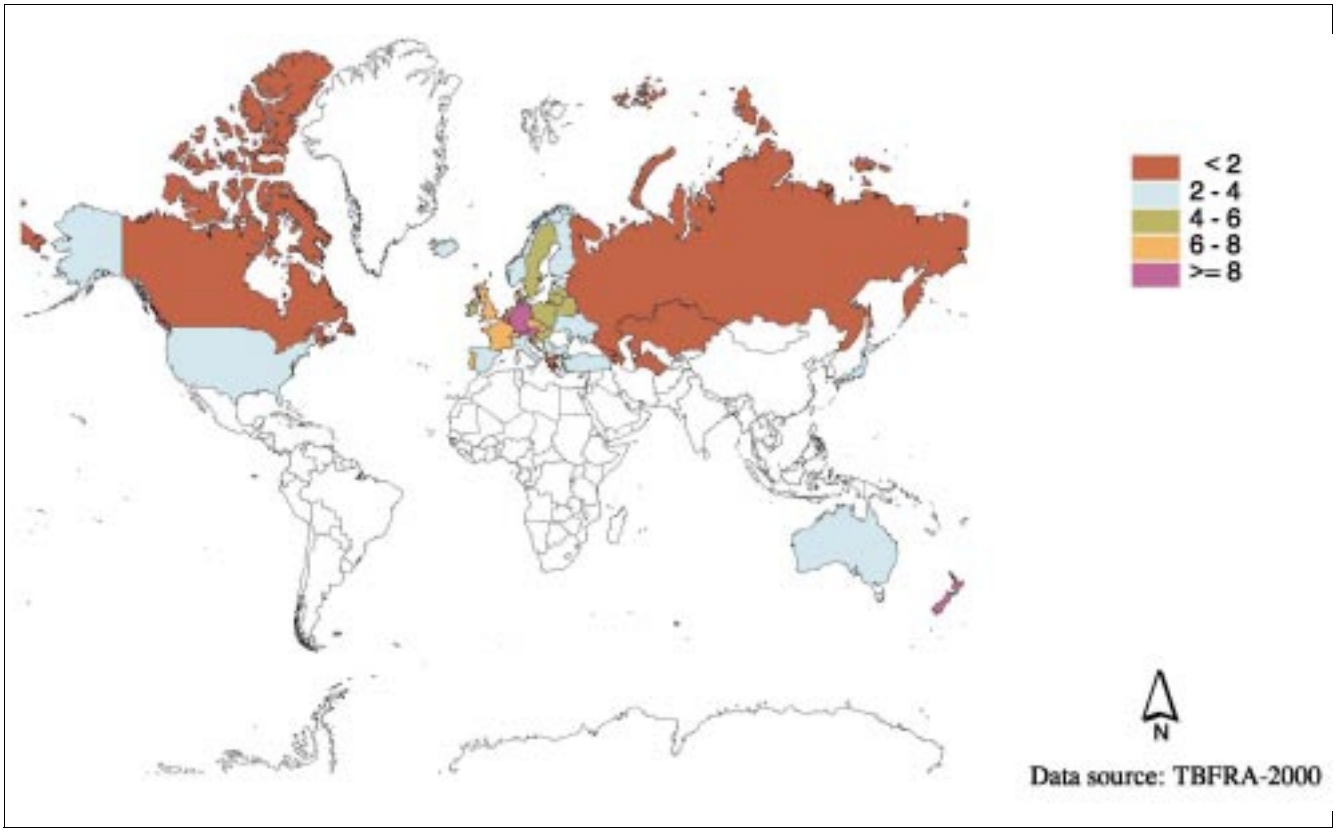


Figure M.13 Fellings as a percentage of net annual increment on forest available for wood supply

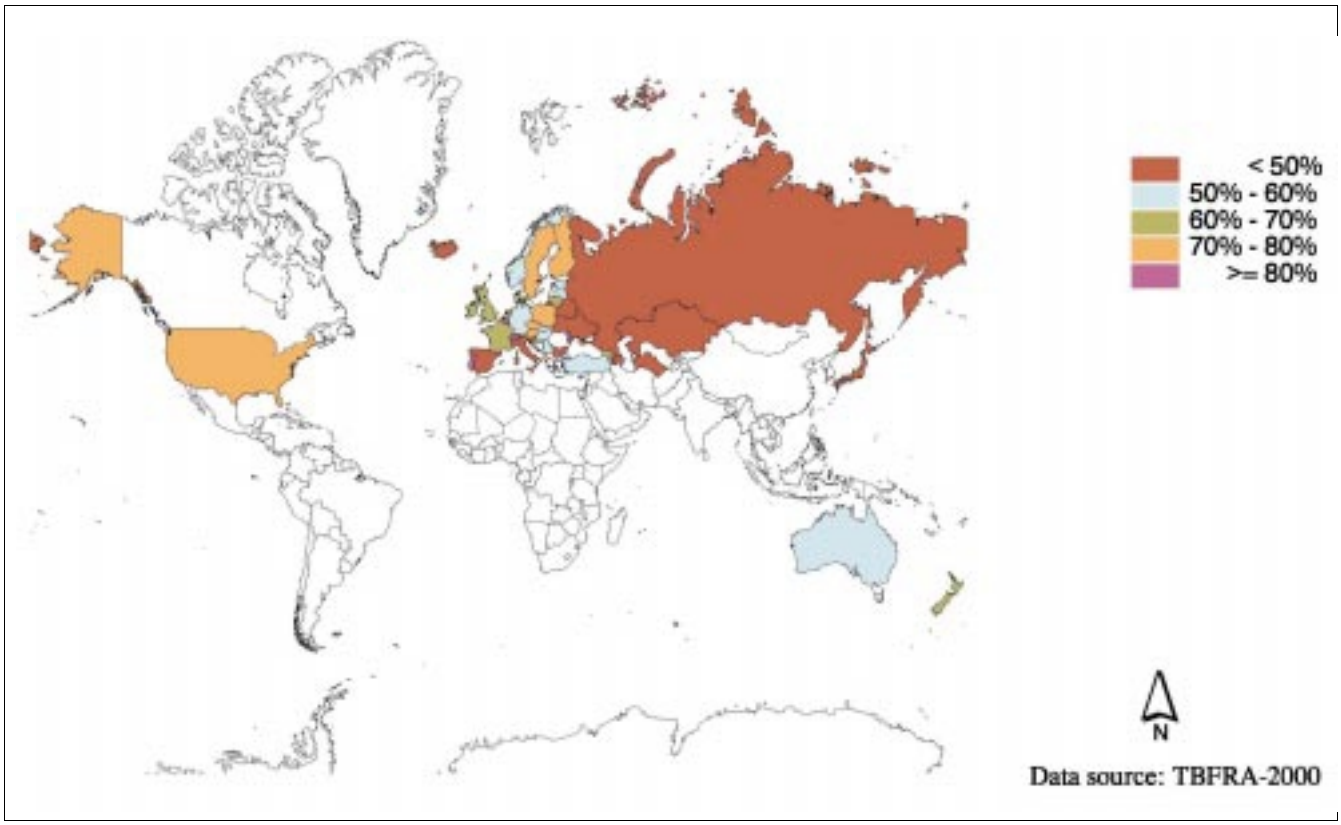


Figure M.14 Forest undisturbed by man as a percentage of total forest

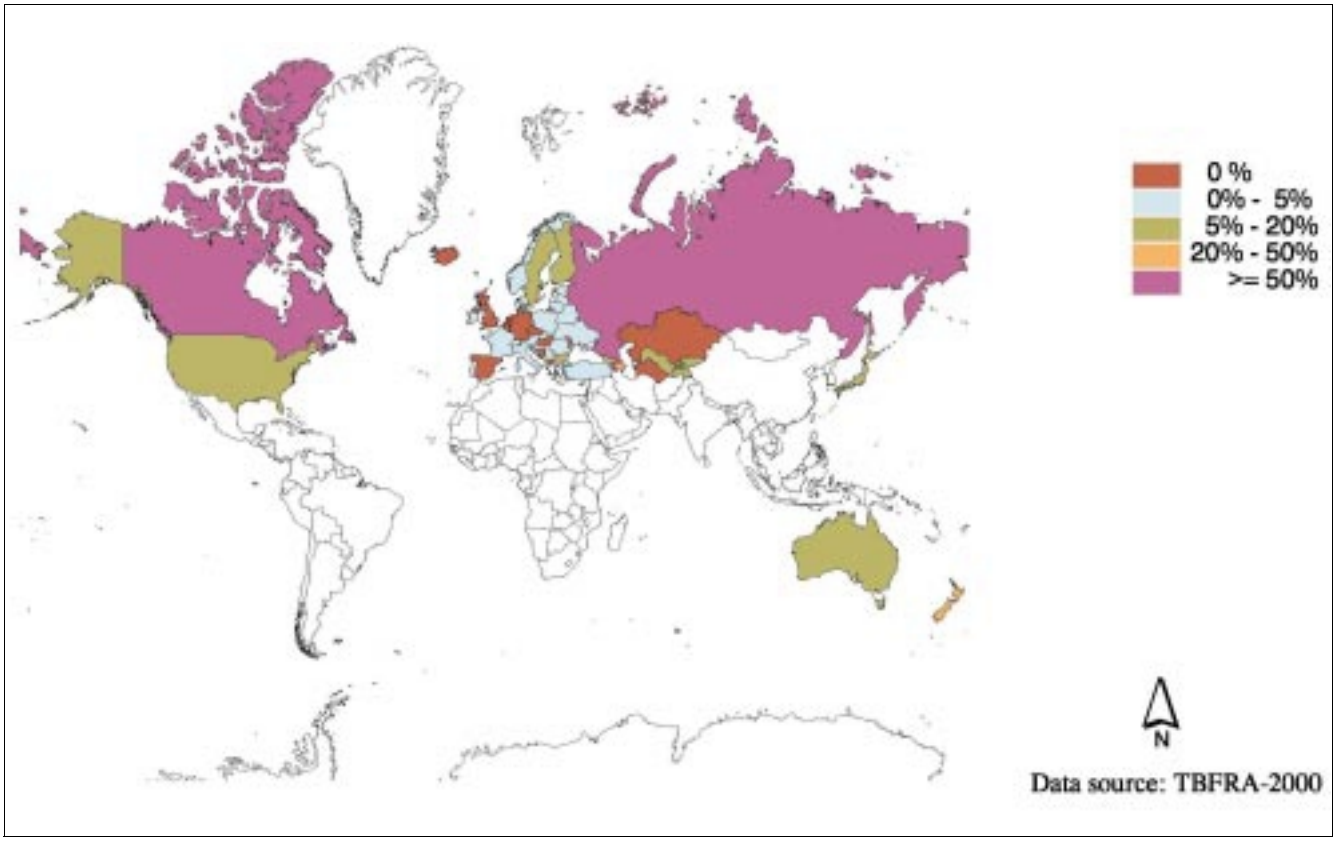
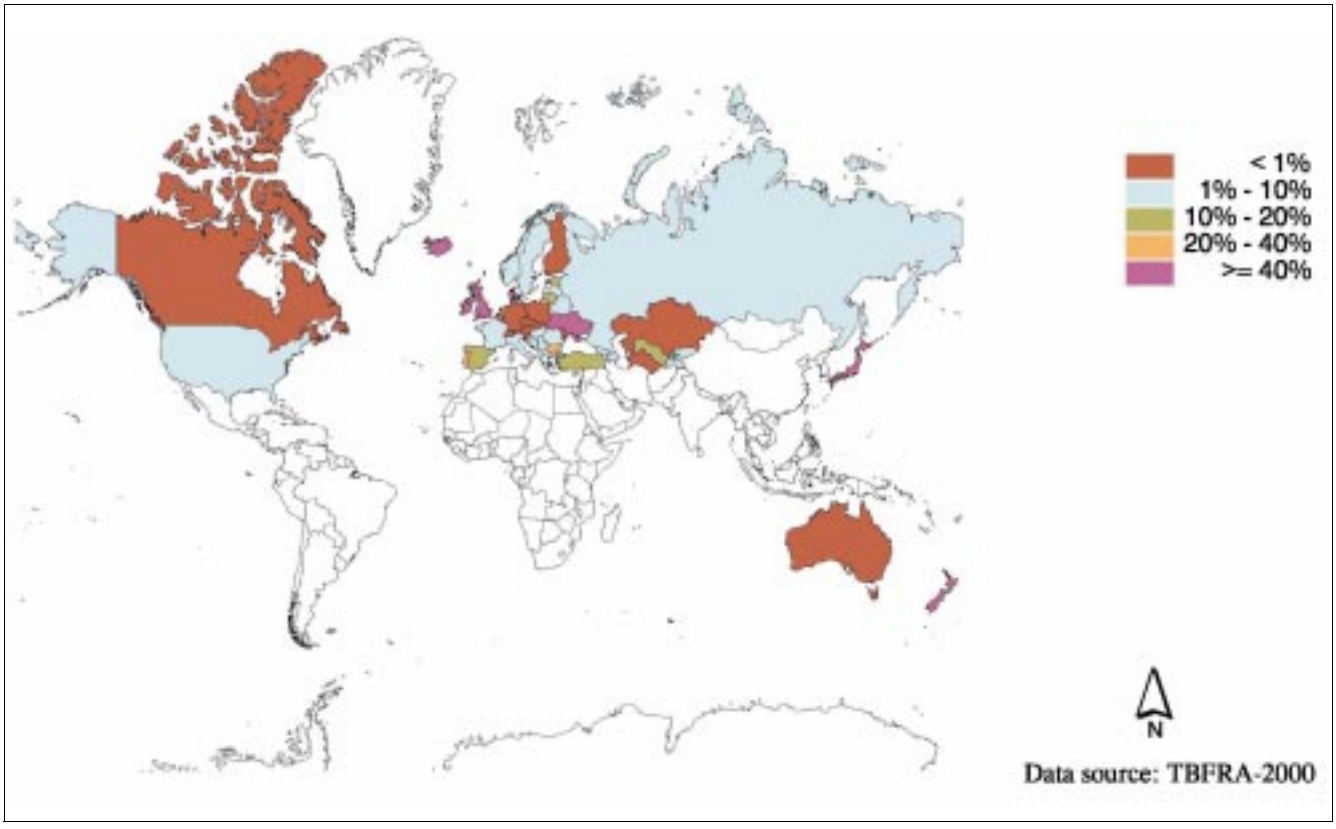


Figure M.15 Plantations as a percentage of total forest



INTRODUCTION

This introduction is intended to provide background information on the objectives and methods of *Forest Resources of Europe, CIS, North America, Australia, Japan and New Zealand* (abbreviated throughout to TBFRA-2000[1]), as well as on the thinking which has been behind its preparation and implementation.

Objectives

It has been recognized for many years that there is a strong need for a set of recent, internationally comparable data on the extent, location, nature, condition and productivity of the forest resource, at a global and regional level. Such a data set is vital input to any serious discussion of, or decision making for, forest policy, wood supply, industry location, protection of biodiversity, climate change, and a whole host of topics linked in one way or another to the forest resource.

FAO is responsible for leading this work at the global level. However, the coverage of temperate and boreal forests in the UN/ECE region and some other industrialized countries has been entrusted to a team in Geneva formed by UN/ECE and FAO. TBFRA-2000 is the latest in a series of surveys of the temperate and boreal industrialized countries carried out from Geneva, of which the first was published in 1947 and the most recent in 1993.

Since UNCED in 1992 and the second pan-European Ministerial Conference on the Protection of Forests in Europe (Helsinki, 1993), the international forest policy community has repeatedly stressed the need for more and better information on the forest resources of all parts of the world. The enlarged format and higher ambitions of TBFRA-2000, compared to its predecessors, is a response to these demands.

The main objective of TBFRA-2000 is, in simple terms, to collect and make available the best possible information on the forest resources of the fifty-five countries it covers, covering practically all aspects and functions of the forest. It is intended in the first place for the use of governments, in all regions, and the international forest policy community, notably participants in the discussion of how to achieve sustainable forest management at the regional and global level (e.g. participants in the Intergovernmental Forum on Forests and its possible successors, as well as, at the regional level, the pan-European and Montreal processes). However, TBFRA-2000 is also intended to be useful to a wide range of other groups, including the scientific/research community, forest industries and NGOs, the conventions on biodiversity and climate change, teachers and students of forest-related topics and, last but not least, the general public. Many of these groups will very probably use TBFRA-2000 data "second hand" i.e. selected or presented by specialists in a more user-friendly form than the basic data provided by TBFRA-2000 itself.

Background and process

Like its predecessors, TBFRA-2000 has been carried out under the auspices of two intergovernmental bodies, the UN/ECE Timber Committee and the FAO European Forestry Commission. The work has been guided by another intergovernmental body, reporting to the Committee and the Commission, the Joint FAO/ECE Working Party on Forest Economics and Statistics. A team of specialists, consisting of experts nominated by their governments to advise the secretariat in carrying out TBFRA-2000 was set up in 1995, and has met regularly to consider methods, presentation, and scope of the enquiry and the publication.

TBFRA-2000 is a part of the global Forest Resources Assessment (FRA) process, led by the FAO Forestry Department: data for industrialized countries of the temperate and boreal zone will be taken directly from TBFRA and inserted into the global FRA data base, so that there will be no duplication of data collection.

It is of the utmost importance that the same terms and definitions be used for all countries, world wide, and in all parts of the FRA. The FAO Forestry Department and ECE/FAO in Geneva have attached the highest priority to achieving this. The first step in the preparation of FRA, including TBFRA-2000, was therefore the Expert Consultation on Global Forest Resources Assessment 2000 at Kotka (Finland) in 1996 (the meeting is known as "Kotka III") which agreed on definitions (notably that of "forest") to be applied in all parts of the global FRA. Definitions and terms for

[1] Because, throughout its preparation, the work was referred to as the Temperate and Boreal Forest Resources Assessment 2000.

use only in TBFRA-2000 were developed within the framework of the global terms. All the terms and definitions used in TBFRA-2000 are reproduced in Appendix I.

Data for TBFRA-2000 were collected from officially designated national correspondents by means of a questionnaire (reproduced in Appendix II). However, before the questionnaire was circulated, there was an extensive and detailed process of consultation with national correspondents and the team of specialists on the scope and format of the questionnaire, notably the scientific relevance and correctness of the questions and whether most countries were in a position to answer. This process of consultation is undoubtedly one of the primary reasons for the very high response rate for TBFRA-2000.

After replies were received, the secretariat team undertook a process of in-depth checking and validation of country replies through an intense dialogue with national correspondents. The dialogue was concentrated on checking adherence of replies to the international definitions and on filling in gaps. The data were then entered in the data base. All TBFRA-2000 "outputs", including the present publication, are generated on the basis of this data base, which will be updated as required. Finally consultants, each a high level expert in his or her field, prepared analytical chapters presenting the main issues, problems and results for each major section of TBFRA-2000. These analytical chapters are accompanied by detailed tables with data by country, as well as the notes and comments supplied with the data by National Correspondents.

In addition to the present volume, there will be other publications derived from TBFRA-2000, including the standard tables of "essential data", presented by country, and further background/supplementary papers which will be issued as "working papers". In addition, the electronic data base containing the whole data set in a format facilitating search, extraction and further analysis of the data will be made widely available.

One feature of the TBFRA-2000 "process" has been the desire to work closely together with a wide variety of partners, to avoid duplication and build on the strengths of each organization. In this way some data have been supplied directly by other organizations e.g. the ICP Forest (International Co-operative Programme on the Assessment and Monitoring of Air Pollution Effects on Forests) under the Working Group on Effects of the Convention on Long-Range Transboundary Air Pollution, which provided the results of its annual survey of forest condition. A number of organizations contributed as members of the team of specialists and co-operated in data collection and analysis.

Source and quality of TBFRA-2000 data

The original data have in all cases been collected at the national level, on the basis of national definitions and measurement and sampling techniques which are in almost all cases different from those agreed internationally for use in FRA and TBFRA-2000. It is thus necessary, in the interests of international comparability, to adjust the national data to fit the international definitions. As a result, data for a country published in TBFRA-2000 will not necessarily correspond to those published in national sources. This is a normal, indeed inevitable, result of adapting national data to improve comparability between countries, and is not a weakness of the TBFRA-2000 data set or of the national data sets. In the TBFRA-2000 process, this adjustment has been carried out by the national correspondents, not by the secretariat team. Inevitably, this adjustment process, while increasing the comparability of and internal consistency of the international data set, has reduced the accuracy of the records, by introducing a supplementary source of error. This problem (inherent in any international data collection effort, in any field) was addressed as follows:

- Correspondents were asked to record how they adjusted the national data to the international definitions and their replies are available in this publication, the data base and the detailed publications. Indeed it has been stressed frequently that the notes and comments are an integral part of the data set, of the same importance as the figures themselves, and should not be separated from those figures;
- They also estimated the range within which the true value is likely to be, which makes it possible to estimate also a range for the regional totals;
- Michael Köhl, leader of the team of specialists, has written an assessment of the reliability and comparability of the TBFRA-2000 results from a scientific perspective.

Thus, the "notes" to the country data, many of which describe the adjustment process and data quality are an essential part of the TBFRA-2000 database, and make it possible for users to make informed judgements about the quality of the data they are using. This transparency on data quality is intended to improve the credibility of the data set as a whole.

All national data in tables or graphs or references to particular countries in the text (except the Executive Summary prepared just before publication) have been submitted to National Correspondents for checking.

It is also evident that there are quite large differences in data quality between different parts of the TBFRA-2000. In general, data quality is highest in the "traditional" areas, such as area of forest, growing stock and increment, and lower in the "newer" parts such as biodiversity, forest condition etc. This is to be expected when the scope of a complex operation like the TBFRA-2000 is widened to include areas not covered beforehand. The secretariat considers that the

data presented in the "newer" parts are highly relevant to the policy debate, and good enough for publication (with explanations of their weak points). In any case, it considers that it is preferable to present data with some documented flaws than to make no information available at all. It also considers that considerable effort should be devoted, at the national and international levels, to refining and standardising concepts and then collecting data in these areas, so that future forest resource assessments can build on the progress made in TBFRA-2000.

Country groups

All the original data in TBFRA-2000 refer to the national level, and are provided by national correspondents. However, for reasons of presentation and understanding, the secretariat considered it necessary to aggregate these data to larger country groups. In TBFRA-2000, data are often presented by *region* (Europe, North America, CIS, "Other TBFRA"[2]) and in some cases by country groups in the interior of these regions. These groupings are listed at the beginning of the study. It should be borne in mind that several criteria are used to make country groupings, such as political affinities (e.g. membership of regional organisations), geographic closeness, or ecological similarity. Furthermore the groups must be of similar sizes, all countries must be included, and each country only once. It is almost impossible to satisfy all these criteria simultaneously, and some anomalies and paradoxes are inevitable. For instance, Denmark has been included, for TBFRA-2000 purposes, in "North-west Europe" because of its proximity to Germany and Netherlands, and ecological similarity to countries to its south, although it is culturally and politically included in the Nordic countries. Readers are asked to bear these considerations in mind when using the data by country group. It is, of course possible to create at any time ad hoc country groups for special purposes by aggregating the national data according to different criteria.

Monitoring change

Changes in the forest resource, whether of extent or of quality, are at the heart of many of the recent forest policy debates, and it is a key requirement for all monitoring of the forest resource that it addresses and measures change. However, this ambition immediately poses several severe methodological problems. In particular, change (in any parameter) is not usually measured directly: rather measurements of the same parameter are taken at different time intervals, but with the same methods and definitions, and then compared. It is essential to separate "changes" due to changes in methods or in definitions from those really arising from changes in the parameter measured. Definitions and methods used in the international forest resource assessment programmes have changed, sometimes significantly over the past decade (not to mention the many more changes at the national level), so it is **not** possible to draw any reliable conclusions from a comparison of TBFRA-2000 data with those in earlier international assessments. Conceivably, correspondents could have been requested to create a complete "shadow" data base for, say, 1990, using the TBFRA-2000 definitions, as baseline for the measurement of change. However, the creation of such a comprehensive "virtual" data set would have represented a huge investment of time, to create information of rather doubtful validity. Correspondents were therefore asked to estimate change for only a very small number of key parameters, which are therefore the only ones for which information on change is available. It is hoped that for future TBFRA and FRA work, it will be possible to maintain stability in the definitions of most of the parameters. This will make it possible in the future to monitor change in a much wider range of parameters.

Next steps

After the publication of this volume in late 1999, the data base will be finalized and a number of detailed follow-up publications prepared. The data for TBFRA-2000 countries will be incorporated into the global FRA data base which will be published in 2000. Then the whole process will be reviewed at the governmental and technical levels and strategic decisions taken as to the direction and methods of future work on forest resource assessment. In any case, FAO, UN/ECE and their many partners will maintain their commitment to providing good quality data on the world's forests to users all over the world.

[2] i.e. Australia, Japan and New Zealand.

RELIABILITY AND COMPARABILITY OF TBFRA-2000 RESULTS[1]

Introduction

At a very early stage of the preparation of the TBFRA-2000 a decision had to be made about the methods of data assessment. Forest resources assessments are regularly carried out at the national level in the majority of countries in the boreal and temperate region. The team of specialists (ToS) formed in 1994 to assist the UN-ECE/FAO Secretariat in preparing the TBFRA-2000 recommended at its first meeting to utilize the data assessed on the national level and combine them to provide information on boreal and temperate forests. A major reason for this decision was the desire to utilize the experience and investment put into forest inventory by countries to a maximum extent.

The systems of nomenclature applied in national forest resources assessments are characterized by tradition and by national information needs and are not standardized internationally. Even identically named attributes may mask different concepts and definitions. A major concern of the TBFRA-2000 was therefore the comparability of data between nations and the reliability of aggregated results. In close co-operation with the European Commission, DG VI (Agriculture, Forestry and Fisheries), Brussels, and the Joint Research Centre (JRC) of the European Commission, Forest Inventory by Remote Sensing (FIRS)-Project, Ispra, studies were conducted that aimed at the reliability of information obtained by the aggregation of data from national forest resources assessments. The results of these studies form the base for this analysis of the reliability and comparability of the TBFRA-2000 results.

Reliability, comparability and related terms

Problems of comparability of national data and the reliability of aggregated results arise mainly because of differences in (1) the national systems of nomenclature, i.e. measurement rules and definitions, and (2) the reference period. Differences in definitions and measurement rules can be made compatible in two different ways: (1) by harmonization and by (2) standardization.

Webster´s comprehensive dictionary, 1995, gives the following definitions related to harmonization and standardization:

- Harmonize: “to make or become harmonious or suitable, accommodate, adapt, agree”
- Harmony: “state of order, agreement or completeness in the relations of things or of parts of a whole to each other”
- Standardize: “to make to or regulate by a standard”
- Standard: “any established measure of extent, quantity, quality or value”

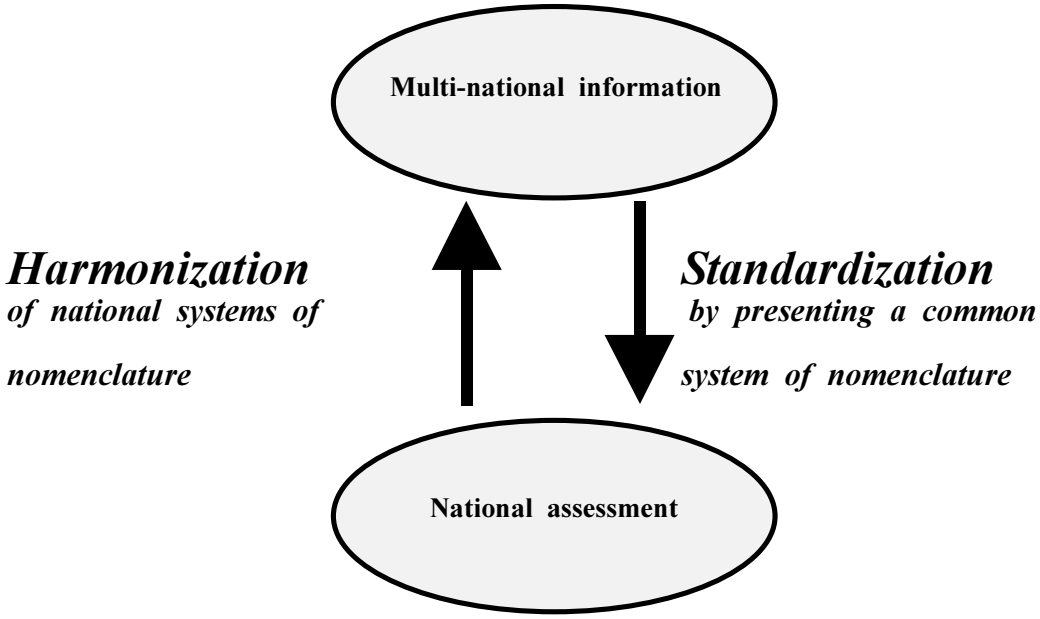
Understanding the distinction between harmonization and standardization is important. Harmonization is based on existing concepts which should be brought together in a way to be more easy to compare. It can be seen as a ‘bottom up approach’ starting from an existing divergence and ending in a state of comparability. Standardization is a totally different concept and does not necessarily consider existing conventions and definitions. Standardization is focusing on a common standard, i.e. a generally accepted and followed system of nomenclature, and can thus be interpreted as a ‘top-down approach’.

When both concepts are related to assessment and monitoring programmes, two approaches of bringing data closer together can be seen in Figure R.1. Harmonization relates to attributes that are already defined in different ways at the national level. The harmonization process seeks for a common agreement on how data can be converted to meet a harmonized definition, which is often the union of similarities of existing definitions, and does not necessarily eliminate all inconsistencies. Standardization introduces a new, common definition or standard that is applied in all national programmes. The standard eliminates all inconsistencies but can be quite different from individual, national approaches. Standardization can be seen as the process necessary for definitions of attributes that are not yet assessed but have to be introduced in national programmes. Harmonization is related to using already existing national systems of definitions but endeavouring to bring the definitions into alignment through incorporating “adjustments” for the known differences.

[1] This chapter was prepared by Mr. Michael Köhl (see Appendix V).

FIGURE R.1

Harmonization and standardization process



In the TBFRA-2000 a harmonization approach was utilized. An expert consultation on the TBFRA-2000 was held in Kotka, Finland, in June 1996 (Kotka III), where national systems of nomenclature were presented and methods for harmonizing these systems were discussed. As a result of those discussions a set of terms and definitions was developed and recommendations for the adjustment of national data were issued (Metla, 1996)[2]. The main objective of these recommendations was to make national data comparable and thus provide reliable information at the multi-national level.

According to the Oxford English Dictionary comparability is the quality of being comparable. Making data comparable means increasing the similarities and eliminating the differences as much as possible. The success in making data comparable affects directly the reliability of the results. Reliability is a term that is used to describe the closeness of obtained results (figures, maps, etc.) to the real situation. It is not a statistical term.

From a statistical point of view the reliability of results can be quantified by giving their precision, accuracy, mean square error or bias. As there is considerable confusion in the use of those terms a short description of the terms as they are used throughout this chapter is given below:

Precision

Precision refers to the size of deviations from the estimated mean, $\hat{\mu}$ obtained by repeated application of a sampling procedure. It is quantified by the standard error or confidence intervals. The precision of a statistical estimate can be increased by increasing the number of observations.

Accuracy

Accuracy refers to the size of deviations from the true mean, μ. Increasing the number of observations does not necessarily increase accuracy.

[2] Metla 1996: Expert Consultation on Global Forest Resources Assessment 2000 (Kotka III), Finnish Forest Research Institute, Research Report No. 620, Helsinki, 369 p.

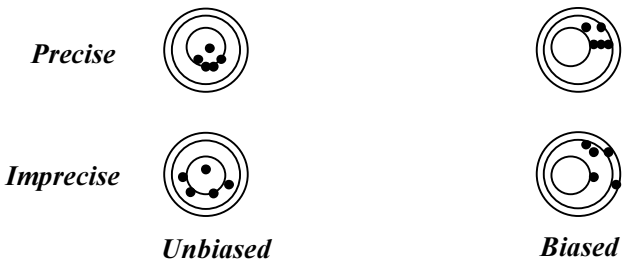
Bias

Bias, B, is directly related to the accuracy of an estimate, as $B=\hat{\mu}-\mu$. A problem in sample based surveys is that the presence of bias, i.e. the lack of accuracy, is often not known.

The effect of precision and bias can be seen in Figure R.2.

FIGURE R.2

Accuracy and precision (after Vanclay, 1994)[3]



Mean square error

A useful measure of reliability is the mean square error (MSE). It combines the precision of an estimate with its squared bias.

Sources of error in forest resources assessments

Environmental data for large units of reference are generally assessed by sample based methods, as full tallies are too time and cost intensive. The objective of a sample based survey is to select a sub-set–the sample–from the population of interest and to estimate population parameters based on probability theory. The parameter estimates differ from the true population value as they are subject to different sources of errors. Those error sources are:

- sampling errors
- assessment errors including measurement and classification errors
- prediction errors caused by models
- non-statistical errors

These types of errors occur in all assessment and monitoring programmes and have been studied intensively (e.g. Hansen et al. 1961, Cunia 1965, Bailar et al. 1977, Päivinen 1987, Groves 1989, Lessler and Kalsbeek 1992, Gertner and Köhl 1993)[4]. If independent surveys, for example national or regional assessments, are combined to calculate statistics for an enlarged unit of reference, another reason for deviations of estimated from true values might occur through differences in the individual definitions. We will refer to this type of error as **definition error.**

Especially in international statistics, the final results are affected by the fact that the nomenclature used for individual attributes varies from country to country. The differences in nomenclature lead to the unfavourable situation that attributes–even if identically named–reflect different concepts. While the different nomenclatures are not error sources in national estimates they may result in considerable bias if data from various nations are combined without

[3] J. Vanclay, 1994: "Modelling Forest Growth and Yield", CAB International, Oxon, U.K., 312 p.

[4] B. Bailar, L. Bailey and J. Stevens, 1977, "Measures of interviewer bias and variance", Journal of Marketing Research, 14, pp. 337-343.
T. Cunia, 1965: "Some Theory on Reliability of Volume Estimates in a Forest Inventory Sample", Forest Science, Vol. 11 (1).
G. Z. Gertner and M. Köhl,, 1992: "An Assessment of Some Non-sampling Errors in a National Survey Using an Error Budget", Forest Science, Vol. 38, No. 3, pp. 525-538.
M. H. Hansen, W. N. Hurwitz and M. Gurney, 1961: "Problems and methods of the sample survey of business", Journal of the American Stat. Association, 41, pp. 173-189.
R. Groves, 1989: "Survey errors and survey costs", John Wiley & Sons, New York, 590 p.
J. Lessler and W. Karlsbeek, 1992: "Non-sampling Error in Surveys", John Wiley & Sons, New York, 412 p.
R. Päivinen, 1987: "Metsän inventoinnin suunnitelumalli", A Planning Model for Forest Inventory, University of Joensuu, Publications in Science 11, 179 p.

adjustment for a common nomenclature. The recommendations given by the expert consultation in 1996 (Metla, 1996)[5] and the terms and definitions used in the TBFRA-2000 are intended to reduce definition errors.

Sampling errors are caused by the fact that the sample does not represent the whole population well enough and are caused by the variability of the observations. Sampling errors can be reduced by increasing the sample size and by introducing a more cost-efficient sampling design (Cochran, 1977, Särndal et al., 1992[6]).

Assessment errors are either measurement errors or classification errors. Measurement errors may be due to careless application of measurement rules or may be caused by measurement instruments. The wrong application of definitions of attributes result in classification errors, i.e. the incorrect assignment of classes to sample elements. Both assessment errors can either be random in nature or one-sided, i.e. biased. Some authors use the term "observer error" for this error source.

Many attributes in forest resources assessments are not directly assessed but are derived from models. Examples for derived attributes are diversity indices of stem volume of single trees. It is assumed that based on the input values the true population value is derived. Models and functions, however, are subject to errors, which are called **prediction errors**.

Non-statistical errors occur everywhere and can be the most serious ones. The origins are human errors in measurement, sampling and the calculation of results. Programming errors belong in this class as well as errors in defining the sampling frame, i.e. the target population is different from the sampling population. In the scope of TBFRA an important source for non-sampling errors is non-response. The results of TBFRA are valid only for the entity of those countries that replied to the questionnaire.

In national reports, sampling errors are usually the only error source that is published. Even if sampling errors are published, only a part of the reliability of figures can be judged. Especially attributes on nominal and ordinal scales may be subject to observer bias. Various error sources may cumulate in figures that are based on models. Gertner and Köhl (1992)[4] showed for standing timber volume estimates in the Swiss national forest survey that small biases in the input variables for timber volume models cause prediction errors that are larger than the corresponding sampling errors.

The reliability of results cannot be related to a single error source. In order to improve the interpretation of survey results and to review the benefit of the retrieved information the total error of estimates has to be quantified – an attempt that results in an '**error budget**' (Gertner and Köhl, 1992)[7] or the '**total sampling design**'[8] (Lessler and Karlsbeek, 1992)[9]. A study carried out in the scope of the implementation of a European Forest Information and Communication System (EFICS) showed that the data quality of national forest resource assessments is relatively high because at the national level the non-sampling errors are given much attention. In most countries of the TBFRA-region assessment procedures, models and analysis tools have been developed that reduce the non-sampling errors to a large extent.

The reliability of the TBFRA results are mainly affected by two error sources: (1) definition errors and (2) non-response. In addition the different national reference periods may add some imprecision to the results. Thus a study of the non-responses and reference periods and an analysis of the definition errors will be presented below.

Analysis of non-responses

Non-response refers to the failure to obtain data on some attributes or entire countries for the set of TBFRA attributes and nations. The non-response rate of the TBFRA can be measured exactly as reports are available that show the countries that did not respond to the questionnaire and attributes that could not be provided by individual countries. It has to be emphasized that many actions were undertaken by the UN-ECE/FAO secretariat to reduce non-responses as much as possible. The actions include the assignment of National Correspondents, meetings of National Correspondents, personal communication and assistance in filling out the questionnaire and converting data to the TBFRA terms and definitions as well as visits to some countries. Due to these efforts the non-response rate has been minimized.

Non-responses by nations

Due to the changes in the former USSR and former Yugoslavia the number of countries included in the TBFRA-2000 increased compared to the FRA 1990 (TZ). For the current TBFRA, 55 countries had to report. Out of these 55 countries five countries did not reply to the questionnaire, i.e. nine percent. Non responding countries were

[5] Metla 1996: Expert Consultation on Global Forest Resources Assessment 2000 (Kotka III), Finnish Forest Research Institute. Research Report No. 620, Helsinki, 369 p.

[6] W. G. Cochran, 1977: "Sampling Techniques", John Wiley & Sons, New York, 428 p.

C. E. Särndal, B. Swenson and J. Wretman, 1992: "Model Assisted Survey Sampling", Springer Verlag, Heidelberg, 694 p.

[7] G. Z. Gertner and M. Köhl, 1995: "Correlated Observer Errors and their Effects on Survey Estimates of Needle-Leaf Loss", Forest Science, Vol. 41, No. 4, pp. 758-776.

[8] In the following both terms are used synonymously.

[9] J. Lessler and W. Karlsbeek, 1992: "Nonsampling Error in Surveys", John Wiley & Sons, New York, 412 p.

Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Kyrgyzstan, Turkmenistan and Uzbekistan. These countries comprise a total land area of 1,210,810 km^2 or 2.2 per cent of the total land area covered by TBFRA. The three countries in Central Asia have a rather small proportion of forest land. Von Maydell (1983)[10] reports forest area proportions of 5.3 per cent for Uzbekistan, 3.3 per cent for Kyrgyzstan and 6.6 per cent for Turkmenistan. Main Table 1 presents figures for forest land of those countries. Given these figures the non-response rate in terms of forest area is 9.57 million ha out of 1,682 million ha or 0.57 per cent.

Non-response by attributes

The terms and definitions utilized in TBFRA are listed in Appendix I. Among those attributes a core set was defined that is regarded as the essential, must-have data. These attributes address the main topics of forest area, other wooded land, growing stock of trees, total woody biomass, net annual increment, annual fellings, annual removals and average annual change. These eight groups are split up in several subgroups resulting in 25 attributes. Out of these 25 attributes further requests were made for nine attributes by specifying figures for coniferous, broadleaved and mixed species forest types for the total forested area and forests available for wood supply. Table R.1 lists the essential TBFRA data together with the number of non-responses. Not included in the non-responses are the five countries that did not return the TBFRA enquiry.

Table R.1 indicates that all nations provided data for forest area and all its subsets. Only Luxembourg representing 0.005 per cent of the forest area covered by TBFRA could not provide information on the area of semi-natural forests and plantations. The area of other wooded land as well as growing stock of trees on total forest land are also attributes for which each nation could provide data. Australia (9.3 per cent of TBFRA's forest area and 83 per cent of the forest area of the "Other TBFRA" countries, i.e. Australia, Japan and New Zealand) is the only country that did not provide information on average annual change of forest area. Attributes related to forest area show an excellent response rate. The same holds with some reservations in the "Other TBFRA" group for changes in forest area.

Attributes related to annual removals show the lowest response rates. Five countries were not able to provide any information, eight countries could not provide information on removals on other wooded land. This reflects problems in the methodology applied to assess removals. Removals cannot be quantified by field assessments but have to be recorded via timber sale statistics or input by wood-processing industries.

Poor response rates were found for annual fellings, removals, growing stock, annual change and net annual increment when these attributes are related to other wooded land. In some countries assessments are carried out only on forest area but not on other wooded land. Those countries had difficulties in providing information for other wooded land.

Four countries could not provide information on biomass, five countries could not give the biomass of stumps and roots. As biomass is strongly related to growing stock any interpretation of biomass figures can be cross-checked with information on growing stock.

Up to six countries had problems to provide information for the species group breakdown of attributes. One reason is that in those countries the percentage of broadleaved, coniferous or mixed species stands is so low that there is no need for separate figures at the national level. Another reason is that there is no distinction made between forests and forests available for wood supply.

Summary (Non-responses)

- The response rates to the TBFRA enquiry are comparatively high, and with respect to non-response rates there is no reason to doubt the reliability of the TBFRA results.
- 5 countries, representing approximately 0.57 per cent of the forest area covered by TBFRA did not respond to the enquiry.
- Attributes related to forest area show an excellent response rate (in terms of forest area 99.5 per cent). The same holds with some reservations in the "Other TBFRA" group for changes in forest area.
- Lowest response rates are observed for annual removals.
- Information on attributes for the unit of reference "other wooded land" could not be provided by up to eight nations out of those which replied to the enquiry.
- Biomass figures were not provided by four countries out of those which replied to the enquiry. As biomass is strongly related to wood volume, any interpretation of biomass figures can be cross-checked by information on growing stock.

[10] H.-J. von Maydell, 1983: "Forst- und Holzwirtschaft der Sowjetunion", Teil 4: Kasachstan und die mittelasiatischen Republiken, Mitteilungen der Bundesforschungsanstalt für Forst- und Holzwirtschaft, No. 140, Hamburg, 313 p.

TABLE R.1

TBFRA essential data and the number of countries not responding

Parameter	Total:	of which:			Forest available for wood supply			
		Coniferous	Broadleaved	Mixed	Total	Coniferous	Broadleaved	Mixed
Forest area	-	-	-	-	-		-	-
Undisturbed by man	-							
Semi-natural	1							
Plantations	1							
Other wooded land	-	3	4	4				
Undisturbed by man	2							
Semi-natural	2							
Growing stock of trees	2							
On forest, total	-	2	2		2	5	5	
other trees (OWL)	4							
Total woody biomass	4							
Trees on forest, total	4	4	4		5			
Stumps and roots	5							
Net annual increment	3							
On forest, total	2	3	3		3	4	4	
On OWL	6							
Annual fellings, total	5							
On forest, total	3	6	6		5	6	6	
On OWL	5							
Annual removals, total	6							
On forest, total	5	6	6		4	6	6	
On OWL	8							
Average annual change								
Forest, total	1				1			
Other wooded land	4							
In growing stock	4				4	5	6	

Shaded: data not regarded as essential.

Reliability of attributes

In national forest resources assessments several hundred attributes are utilized. Some of these attributes such as tree species, stem diameters or tree heights can be directly assessed, but most attributes are derived by models and functions taking directly assessed attributes as input, e.g. single tree volume as a function of stem diameters and tree height.

Each country provides a system of nomenclature including measurement rules, definitions and algorithms for all the attributes that are treated in their national assessments. National systems of nomenclature reflect the national objectives of resource assessment programmes. Many measurement rules are compatible between nations; this is partly due to the activities of the International Union of Forest Research Organisations (IUFRO), which has been looking after standardized assessment rules for more than 100 years and provides guidelines for assessments (e.g. IUFRO, 1959)[11]. Most nomenclatures for attributes show, however, differences between nations. The TBFRA concentrates on 77 attributes, for which definitions have been developed with the objective of uniting national definitions to the maximum extent. Assistance in converting figures based on national definitions to figures according to TBFRA-2000 definitions was provided by the secretariat. The success of converting national figures to the common TBFRA terms and definitions is decisive for the reliability of the TBFRA results.

[11] UFRO, 1959: "The Standardization of Symbols in Forest Mensuration", IUFRO, Wien.

The worst-case scenario: no adjustments

Many of the TBFRA attributes are based on estimates of forest area or single tree volume. Single tree volume is aggregated in different ways to obtain information on growing stock, removals, fellings or changes in growing stock. Forest area is used to relate many attributes to a unit area, e.g. average volume in m^3/ha. The reliability of single tree volume and forest area figures is driving the reliability of many related attributes. Therefore national differences between those two attributes will be investigated in detail below. In order to provide the worst case scenario the investigation is based on national definitions and on no conversions towards the TBFRA terms and definitions being made.

The findings presented below are based on a study carried out in the framework of EFICS (European Forest Information and Communication System). The study was funded by EC-DG VI and carried out in close co-operation with the UN/ECE Timber Section and the European Forest Institute (EFI). The impact of national definitions were studied for the 19 EU and EFTA countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Ireland, Iceland, Liechtenstein, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom), but the results allow a generalization to the region covered by TBFRA. A detailed description of the study can be found in Traub et al. (1997) and in EU (1997)[12].

Forest area

The definition of forest area as used in the TBFRA was agreed upon during the expert consultation held in Kotka, Finland in 1996 and reads as follows:

> *Land with tree crown cover (or equivalent stocking level) of more than 10 percent and area of more than 0.5 ha. The trees should be able to reach a minimum height of 5 m at maturity in situ. May consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground; or of open forest formations with a continuous vegetation cover in which tree crown cover exceeds 10 per cent. Young natural stands and all plantations established for forestry purposes which have yet to reach a crown density of 10 per cent or tree height of 5m are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention or natural causes but which are expected to revert to forest.*
>
> ***Includes**: Forest nurseries and seed orchards that constitute an integral part of the forest; forest roads, cleared tracts, firebreaks and other small open areas within the forest; forest in national parks, nature reserves and other protected areas such as those of special environmental, scientific, historical, cultural or spiritual interest; windbreaks and shelterbelts of trees with an area of more than 0.5 ha and a width of more than 20 m. Rubberwood plantations and cork oak stands are included.*
>
> ***Excludes**: Land predominantly used for agricultural practices.*

This definition can be seen as the lowest common denominator of all national definitions of forest area applied in the TBFRA region. Table R.2 summarizes the quantitative criteria that are used in selected countries to assess their forest area. The quantitative criteria found in definitions for forest area are crown cover[13] (5 per cent to 30 per cent), width of the stand (9 to 50 m) and minimum area (0,01 ha to 2 ha). These quantitative criteria are measured either on aerial photographs or in sample plots on the ground. The Scandinavian countries require a minimum potential increment (at least 1 m^3/ha/year) for the site to be considered as forest area. In many national forest area definitions no specific minimum height is specified, which trees should be able to reach at maturity in situ.

In order to investigate the effect of different national forest area definitions on the estimated extent of forest area a simulation study was carried out. Differences in the spatial distribution of trees and forested patches—as they can be found in the Mediterranean, the Central and the Nordic regions of Europe—were simulated in computer generated forest/non-forest maps. The computer generated forests, representing forest cover patterns in different parts of Europe, were used to simulate the impact of individual national forest area definitions applied in EU and EFTA countries. Only the criteria minimum width, minimum crown cover and minimum area were considered in the simulation study but not the minimum tree height to be reached at maturity. For the given criteria this approach results in a worst-case scenario and can quantify the maximum effect of different national forest area definitions in absolute terms.

Table R.3 displays the effects of applying individual national forest area definitions to other countries and provides results for two different approaches: (1) the forest area differences resulting from the application of an individual national forest area definition with respect to other nations; and (2) differences in forest area estimates for individual nations when other national forest area definitions are applied. The rows in Table R.3 provide information

[12] European Commission 1997: Study on European Forest Information and Communication System (EFICS), Report on Forest Inventory and Survey Systems, European Commission, Luxembourg (2 volumes), 1328 p.

B. Traub, M. Köhl and R. Päivinen, 1997: Simulation Study, in: European Commission, Study on European Forest Information and Communication System (EFICS), Report on Forest Inventory and Survey Systems, Luxembourg.

[13] Proportion of area covered by the vertical projection of tree crowns.

TABLE R.2

Forest area definitions of some selected countries

Country	Minimum width	Minimum crown cover	Minimum area	Minimum production
Australia	-	20 per cent	-	-
Austria	10 m	30 per cent	0.05 ha	-
Belgium[1]	9 m /25 m	-/20 per cent	0.01/ 0.05 ha	-
Denmark	20m	30 per cent	0.5 ha	
Finland	-	-	0.25 ha	1m^3/ha/yr
France	15	500 stems/ha or 10 per cent	0.05 ha	-
Germany	10 m	-	0.1 ha	-
Greece	30 m	10 per cent	0.5 ha	-
Iceland	-	-	0.25 ha	
Ireland	40 m	20 per cent	0.5 ha	4 m^3/ha/yr
Italy	20 m	20 per cent	0.2 ha	-
Japan	-	30 per cent	0.3 ha	-
Liechtenstein	25 m to 50 m^2	100 per cent to 20 per cent	-	-
Luxembourg	-	-	-	-
Netherlands	30	20 per cent	0.5 ha	-
New Zealand[2]	-	20 per cent	0.5 ha	-
Norway	-	-	0.1 ha	1 m^3/ha/yr
Portugal	15 m	10 per cent	0.2 ha	-
Spain	20 m	5 per cent	0.2 ha	-
Sweden	-	-	0.25 ha	1 m^3/ha/yr
Switzerland	25 m to 50 m^2	100 per cent to 20 per cent	-	-
United Kingdom	20 m	20 per cent	0.25 ha	
United States	40 m	10 per cent	0.4 ha	1.4 m^3/ha/yr

[1] Belgium uses separate definitions for the Walloon and Flemish regions.
[2] depending on crown cover.

for the first approach, i.e. differences in estimates of 19 national forest areas if the definition of the country given in the first column would be applied in other countries (e.g. the Austrian forest area definition would overestimate the Danish forest area as assessed according to the Danish forest area definition by 107 km^2). The columns provide information on the second alternative, i.e. the differences of national forest area estimates with respect to the application of other individual national forest area definitions (e.g. the forest area of Austria would be underestimated by 57.5 km^2, if the Danish forest area definition would be applied in Austria and overestimated by 18.4 km^2, if the Finnish forest area definition would be applied).

Applying other countries' forest area definitions to national data results in an overestimation of the national forest area of up to 10 per cent or an underestimation of up to – 6 per cent. The forest area definition of Luxembourg, which does not apply threshold values for the width, minimum area and crown closure of forest patches, leads to the largest forest area figures compared to other national definitions. The forest area definition of Ireland results in the lowest forest area figures, as it incorporates comparatively large threshold values for minimum width (40 m) and minimum area (0.5 ha).

The differences between forest area estimates based on different national forest area definitions are small for central Europe (± 3.6 per cent), as here mainly closed, large forest patches can be found, which are not sensitive to the specified threshold values for crown cover, area and width. In countries close to a natural timberline the differences in estimates forest area are larger, as here threshold values play a decisive role.

If the forest area definition of Ireland would be applied in Western Europe the total forested area would be roughly 5 per cent less. The application of the forest area definition used in Luxembourg would increase the reported Western European forest area by approximately 3 per cent. The definitions of Belgium (Flemish region), Switzerland, Denmark, France, Liechtenstein, Greece, Italy, Ireland, the Netherlands, Portugal, Spain and the UK would lead to a smaller total forest area, while the definitions of Austria, Belgium (Walloon region), Germany, Finland, Iceland, Luxembourg, Norway and Sweden would report a higher total forest area than currently reported. These figures are

based on national forest area definitions without any adjustment to the TBFRA definition of forest area. After adjustment the range of bias will be smaller than the one presented above.

The minimum crown cover specified in the TBFRA forest area definition is 10 per cent. In many European countries higher crown cover thresholds are defined. In areas where forests are growing close to a timber line due to temperature, e.g. in northernmost Europe and in the Alps, or due to rainfall, e.g. in the Mediterranean area, scattered forests types with gradual transitions to other land cover categories occur naturally. Here, a change in the required minimum crown cover might cause a change in the amount of forested area. Crown coverage thresholds have only a minor effect in closed forests, which are typical for the temperate region. Many countries located areas where open forests are widely spread, e.g. in the Mediterranean area or the northern boreal region, have specified a threshold value for crown density of 10 per cent, e.g. France, Portugal, Greece or Alaska, or even less, e.g. 5 per cent in Spain, and thus match the TBFRA definition.

TABLE R.3

Per cent differences of forest area estimates according to national forest area definitions

	A	B1	B2	CH	D	DK	F	FIN	FL	GR	I	IRL	IS	L	N	NL	P	S	SP
A	**0.00**	-0.07	1.69	2.03	-0.00	2.31	0.94	-0.65	2.03	7.73	3.64	2.94	-0.65	-0.69	-0.96	2.41	2.43	-0.04	3.72
B1	0.07	**0.00**	1.76	2.09	0.06	2.43	1.01	-0.54	2.09	8.04	3.95	3.00	-0.54	-0.62	-0.84	2.47	2.50	0.02	4.03
B2	-1.69	-1.76	**0.00**	0.34	-1.69	-0.14	-0.75	-3.11	0.34	2.84	-1.25	1.25	-3.11	-2.38	-3.41	0.72	0.74	-1.73	-1.17
CH	-2.03	-2.09	-0.34	**0.00**	-2.03	-0.83	-1.08	-3.79	0.00	0.97	-3.12	0.91	-3.79	-2.72	-4.10	0.38	0.40	-2.07	-3.04
D	0.00	-0.06	1.69	2.03	**0.00**	2.31	0.95	-0.65	2.03	7.83	3.75	2.94	-0.65	-0.69	-0.96	2.41	2.43	-0.04	3.83
DK	-1.49	-1.55	0.20	0.54	-1.49	**0.00**	-0.54	-2.96	0.54	3.34	-0.75	1.45	-2.96	-2.17	-3.27	0.92	0.95	-1.53	-0.67
F	-0.94	-1.01	0.75	1.08	-0.95	0.98	**0.00**	-1.97	1.08	5.23	1.15	1.99	-1.99	-1.63	-2.29	1.46	1.49	-0.99	1.23
FIN	0.47	0.41	2.16	2.50	0.47	2.96	1.42	**0.00**	2.50	9.29	5.21	3.41	0.00	-0.21	-0.31	2.88	2.90	0.43	5.29
FL	-2.03	-2.09	-0.34	0.00	-2.03	-0.83	-1.08	-3.79	**0.00**	0.97	-3.12	0.91	-3.79	-2.72	-4.10	0.38	0.40	-2.07	-3.04
GR	-2.40	-2.47	-0.71	-0.37	-2.40	-1.44	-1.46	-4.40	-0.37	**0.00**	-4.09	0.53	-4.40	-3.09	-4.70	0.00	0.03	-2.44	-4.01
I	-1.30	-1.36	0.39	0.73	-1.30	0.41	-0.36	-2.55	0.73	4.09	**0.00**	1.64	-2.55	-1.99	-2.86	1.11	1.13	-1.34	0.08
IRL	-2.94	-3.00	-1.25	-0.91	-2.94	-2.31	-1.99	-5.27	-0.91	-2.01	-6.10	**0.00**	-5.27	-3.62	-5.58	-0.53	-0.51	-2.98	-6.02
IS	0.47	0.41	2.16	2.50	0.47	2.96	1.42	0.00	2.50	9.29	5.21	3.41	**0.00**	-0.22	-0.31	2.88	2.90	0.43	5.29
L	0.69	0.62	2.38	2.72	0.69	3.42	1.63	0.46	2.72	10.10	6.02	3.62	0.46	**0.00**	0.16	3.09	3.12	0.65	6.10
N	0.61	0.55	2.30	2.64	0.61	3.27	1.56	0.31	2.64	9.81	5.73	3.55	0.31	-0.08	**0.00**	3.02	3.04	0.57	5.81
NL	-2.40	-2.47	-0.72	-0.38	-2.41	-1.44	-1.46	-4.40	-0.38	-0.02	-4.10	0.53	-4.40	-3.09	-4.71	**0.00**	0.03	-2.45	-4.02
P	-1.03	-1.09	0.66	1.00	-1.03	0.81	-0.08	-2.15	1.00	4.92	0.84	1.91	-2.15	-1.72	-2.46	1.38	**0.00**	-1.07	0.92
S	0.47	0.41	2.16	2.50	0.47	2.96	1.42	0.00	2.50	9.29	5.21	3.41	0.00	-0.21	-0.31	2.88	2.90	**0.00**	5.29
SP	-1.32	-1.39	0.37	0.71	-1.32	0.35	-0.38	-2.61	0.71	4.01	-0.08	1.61	-2.61	-2.01	-2.91	1.08	1.11	-1.36	**0.00**

The forest area definition of Portugal matches the minimum crown cover of 10 per cent specified by the TBFRA definition. If the Portuguese forest area definition would be applied for all EU and EFTA countries, the total forest area as assessed according to national forest area definitions, i.e. without adjustment, would be overestimated by less than 1 per cent. This proves that even without adjustment the national forest area definitions provide reliable figures for the reported units of reference according to the TBFRA definitions.

Volume of standing trees

Single tree volume is a basic input value for the calculation of the volume of growing stock, increment, fellings and removals and can be transformed into woody biomass. The national definitions of wood volume show differences. The volume figures depend on three factors: (1) how small trees are taken into account (minimum threshold value for the diameter at breast height, d.b.h.), (2) starting point of the stem volume included (ground or stump) and (3) end point of the stem volume included (minimum top diameter).

Among the 19 western European countries Switzerland uses the highest d.b.h. threshold value (12 cm) and Finland, Sweden and UK the lowest (0 cm). The minimum top diameter varies from 0 cm (9 countries) to 7.5 cm (Spain). The starting point of the volume is at stump level in 7 countries, the others are using ground level (Table R.4).

Traub et al. (1997)[14] showed that the volume of trees below 12 cm d.b.h. comprises 2-3 per cent of the total volume of the Swiss forests. If the Swiss threshold value (12 cm) is applied in Finnish forests, 13 per cent of the total

[14] B. Traub, M. Köhl and R. Päivinen, 1997: Simulation Study, in: European Commission, Study on European Forest Information and Communication System (EFICS), Report on Forest Inventory and Survey Systems, Luxembourg.

volume reported according to the Finnish definition would be lost. This result shows that threshold values have more importance in those areas where trees with relatively small dimensions cover a high proportion of forest, like in the Nordic and Mediterranean regions. In the UK the volume of the stump is included in the stem volume, in Finland and Sweden stump volume is not included. If UK definitions are used in Finland and Sweden, both countries would gain 5 per cent in volume in their forests.

TABLE R.4

Examples of stem volume definitions (after Traub et al., 1997)[15]

Country	Minimum d.b.h., cm	Minimum top stem diameter, cm	Starting point of volume
Finland[1], Sweden[1], New Zealand	0	0	Stump
Iceland	0[1]	0	Ground
Austria, Netherlands, Portugal	5	0	Ground
Italy	3	0/3	Stump
Norway	5	0	Stump
Germany, Ireland, the United Kingdom	7	7	Ground
France	7.5	7	Ground
Belgium	7	7	stump
Greece	10	0	stump
Liechtenstein	12	0	ground
Spain	7.5	7.5	stump
Switzerland	12	7	ground
Australia	-	-	-
Japan	4	0	ground
Canada			
USA	2.5 - 12	0	stump
	> 12	4 inch	stump

[1] definition for “Forest and other wooded land”.

The TBFRA definition specifies standing volume as follows:

Volume of standing trees, living or dead, above-stump measured overbark to top (0 cm). Includes all trees with diameter over 0 cm (d.b.h.)

***Includes**: Tops of stems, large branches; dead trees lying on the ground which can still be used for fibre or fuel.*

***Excludes**: Small branches, twigs and foliage.*

This definition corresponds with the definitions of Sweden and Finland. In countries specifying a minimum threshold value for d.b.h larger than 0 cm the reported values underestimate standing volume according to the TBFRA definition. The example from Switzerland, where the highest d.b.h.-threshold throughout Europe is applied shows, however, that only a small bias will result, if no adjustments towards the TBFRA definition are made.

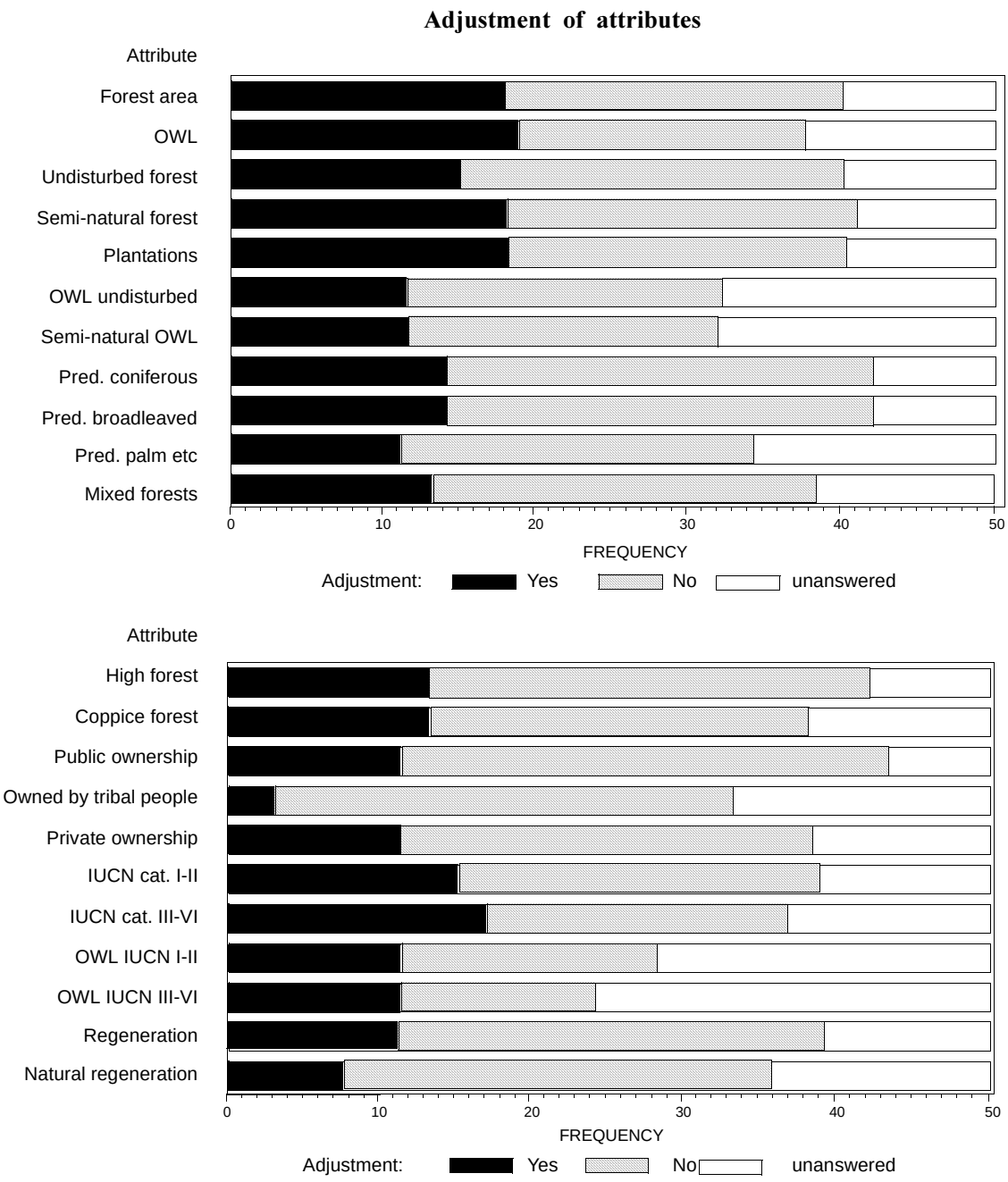
Adjustment of attributes

The reporting countries were asked to apply adjustments, if the national nomenclature diverged from the TBFRA definition. Countries were asked to specify the adjustments applied for 32 out of the 77 attributes assessed by the TBFRA enquiry. Figure R.3 presents information on the adjustment of attributes for the 50 responding countries. More than 30 per cent of those 50 countries applied adjustments for the attributes forest area, other wooded land, forest undisturbed by man, semi-natural forest, plantations, forest in IUCN-categories, total growing stock of forest, growing stock available for wood supply, total above-stump growing stock, and net annual increment on forest available for wood supply. The methods for applying adjustments were discussed in a meeting of the National Correspondents in Geneva in spring 1997. The methods applied to adjust national data to the TBFRA-definitions were reported to and cross-checked by the secretariat. Among the adjustment methods were reference to scientific reports or statistics other

[15] B. Traub, M. Köhl and R. Päivinen, 1997: Simulation Study, in: European Commission, Study on European Forest Information and Communication System (EFICS), Report on Forest Inventory and Survey Systems, Luxembourg.

than results of national forest resource assessments, the application of models or special investigations. In few cases expert opinion was used to adjust figures. The Finnish forest area estimate was for example adjusted to the TBFRA definition by applying a model that utilizes stand density and other parameters assessed in the Finnish national forest resources assessment. In Switzerland a special survey of aerial photographs was conducted to fit the national forest area definition to the TBFRA definition.

FIGURE R.3



For some attributes only a small number of countries applied adjustments. This was mainly due to the fact that national definitions meet the TBFRA definitions (e.g. ownership, regeneration, coppice sprouting, planting or seeding) or the attribute under consideration is matter of concern only in a few countries (e.g. forest owned by tribal peoples).

Data quality in terms of likely range

The reporting countries were asked to give the likely range of values for 32 selected attributes, which were assessed in the enquiry. The range should incorporate errors due to measurement, sampling and adjustment. Table R.5 lists the 32 attributes and the number of countries that provided information on the likely range.

FIGURE R.3 *(continued)*

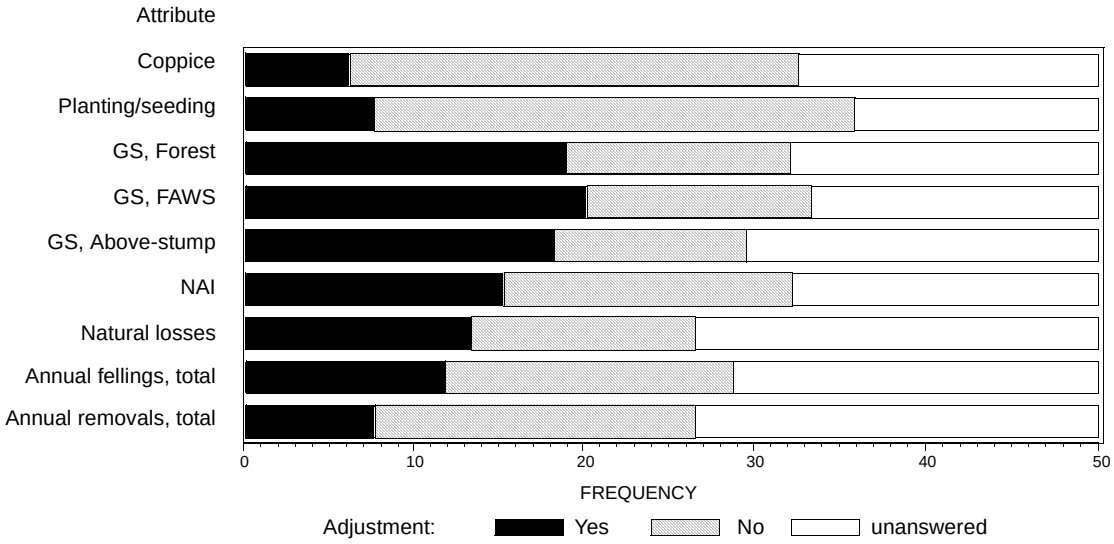


TABLE R.5

Attributes for which likely range was assessed and number of reporting countries

Attribute	Number of countries	Attribute	Number of countries
Forest area [ha]	31	Other wooded land [ha]	21
Forest undisturbed by man [ha]	22	Semi-natural forest [ha]	26
Plantations [ha]	26	Other wooded land undisturbed by man [ha]	14
Semi-natural other wooded land [ha]	16	Predominantly coniferous [ha]	24
Predominantly broadleaved [ha]	27	Predominantly palms, bamboos etc [ha]	-
Mixed forests [ha]	24	High forest available for wood supply [ha]	23
Coppice forest available for wood supply [ha]	18	In public ownership [ha]	24
Owned by tribal peoples [ha]	2	In private ownership [ha]	21
Forest in IUCN categories I-II [ha]	21	Forest in IUCN categories III-VI [ha]	22
OWL in IUCN categories I-II [ha]	7	OWL in IUCN categories III-VI [ha]	8
Regeneration of forest, total [ha]	23	Natural regeneration [ha]	17
Natural regeneration enhanced by planting [ha]	9	Coppice sprouting [ha]	8
Planting or seeding [ha]	18	Growing stock of trees, total [m^3 o.b.]	26
Growing stock of trees on forest available for wood supply [m^3 o.b.]	28	Total above-stump woody biomass [m^3 o.b.]	21
NAI on forests available for wood supply [m^3 o.b.]	24	Natural losses on forests available for wood supply [m^3 o.b.]	18
Annual fellings, total [m^3 o.b.]	19	Annual removals, total [m^3 u.b.]	14

Table R.6 shows that depending on the considered attribute between 2 (Forest owned by indigenous or tribal people) and 35 (Forest Area) countries out of fifty provided information on the likely ranges. For the majority of attributes more than 50 per cent of the reporting countries specified the likely range. The fact that only 3 countries reported values for the attribute “forest owned by indigenous or tribal people” explains the low response for this attribute.

For 7 out of 32 attributes (22 per cent), among which are key attributes such as “forest area”, “other wooded land” or “area of semi-natural forest”, a likely range within ± 5 per cent around the reported value was found. For 19 attributes (56 per cent) the likely range was found to be between ± 10 per cent and 80 per cent of the attributes cover a range of ± 15 per cent within which the reported value is located. The widest range was found for the attribute “total above stump growing stock”, where Australia and the Russian Federation gave very conservative estimates. If those two countries are omitted from the calculations, the likely range shrinks to ± 5 per cent .

TABLE R.6

Likely range for selected attributes

Variable	From (per cent)	To (per cent)	Number of countries
Forest area	97.32	102.79	35
Other wooded land	95.23	105.16	24
Forest undisturbed by man	93.45	106.77	22
Semi-natural forest	95.06	104.50	26
Plantations	97.09	102.80	28
Other wooded land undisturbed by man	94.44	105.57	12
Semi-natural other wooded land	95.18	104.73	18
Predominantly coniferous	88.99	105.89	29
Predominantly broadleaved	89.00	108.49	29
Mixed forests	81.66	118.04	26
High forest available for wood supply	98.29	101.74	26
Coppice forest available for wood supply	91.40	111.20	20
In public ownership	97.00	103.12	26
Owned by tribal peoples	90.85	109.06	2
In private ownership	93.47	106.34	22
Forest in IUCN categories I-II	88.30	105.00	25
Forest in IUCN categories III-VII	84.73	115.79	26
OWL in IUCN categories I-II	89.99	110.03	9
OWL in IUCN categories III-VII	80.07	119.94	9
Regeneration of forest, total	92.78	106.52	25
Natural regeneration	93.81	105.67	20
Natural regeneration enhanced by planting	90.72	107.52	13
Coppice sprouting	91.34	110.28	9
Planting or seeding	94.56	106.15	20
Growing stock of forest, total	88.85	117.46	26
Growing stock of forest available for wood supply	92.12	107.99	28
Total above-stump growing stock	90.57	132.06	21
NAI on forest available for wood supply	94.37	106.31	25
Natural losses on forest available for wood supply	84.81	115.39	19
Annual fellings, total	87.83	112.29	21
Annual removals total, u.b.	88.53	113.47	17

It has to be emphasized that the likely range presented by the TBFRA-2000 includes different sources of errors and is thus not directly comparable to confidence intervals specified in many national forest resource assessments. Confidence intervals include only sampling errors and are therefore narrower than the likely ranges presented in Table R.6. Taking also into account the large unit of reference covered by the TBFRA and the primary use of the information provided by the TBFRA the reliability of the results is more than sufficient.

Summary (Definition errors)

- At the national level forest area is assessed according to quantitative criteria, such as minimum crown cover, minimum area or minimum production.
- The minimum crown cover threshold of 10 per cent specified by the TBFRA definition is not critical in closed forests.
- In open forests close to natural timberlines the minimum crown cover is decisive for forest area estimates.
- Most countries that have forests close to natural timberlines utilize crown cover thresholds of 10 per cent or define forest area in a way that approximately matches the TBFRA definition.

- A study carried out in Europe and covering EU member states and EFTA countries showed that the total by the TBFRA definition is roughly 1 per cent higher than the European forest area assessed according to national definitions. The figures presented for forest area provide reliable results for TBFRA's units of reference.
- The figures presented for forest area provide reliable results for TBFRA's units of reference
- Single tree volume is a basic input value for the calculation of the volume of growing stock, increment, fellings and removals and can be transformed into woody biomass.
- According to the TBFRA definition for standing tree volume all trees with a diameter at breast height (d.b.h.) above 0 cm are included for volume estimates.
- Except for a few nations thresholds larger than 0 cm are defined for d.b.h. Even if the national figures are not converted towards the TBFRA definition only a small underestimation of standing volume will result.
- Taking also into account the large unit of reference covered by the TBFRA and the primary use of the information provided by the TBFRA the reliability of the results is more than sufficient.

Reference period

At the very beginning of the preparatory phase of TBFRA-2000 it was discussed if a common point in time should be specified to which all data should be related. A survey including all western European countries showed that in none of those countries inventory results are updated, even if the assessment periods cover several years. Only Germany specifies a single point in time to which data are related, the data are, however, assessed over a three-year period without any update.

The reference period of individual nations reporting to the TBFRA inquiry are presented in Figure R.4 and range from 1986 (Germany) to 1998 (Iceland). Eleven countries conduct national assessments over a period of several years; for those countries the mean of the reference period is presented in Figure R.4. Most countries (56 per cent) provided data assessed in 1995 and 1996. 80 per cent of the countries provided data for the reference period between 1994 and 1998. Ten countries delivered data that were assessed before 1994. Countries providing data before 1991 are Germany (1986), Azerbaijan (1988), Denmark (1990) and Spain (1990). Data from the North American region relate to 1994 (Canada) and 1992 (USA).

With the exception of two countries all national data presented in TBFRA-2000 were assessed during the 1990s. The differences in reference periods add some imprecision to the results. When the results of TBFRA-2000 are interpreted it has to be taken into account that the national data do not relate to a single point in time but to almost one decade. The reported changes in area and growing stock can be utilized as an indicator for potential differences of the status at the reference period and the time when the TBFRA-2000 results were issued. Given this background information the results of TBFRA-2000 can be regarded as reliable and comparable with respect to the reference period.

Summary (Reference period)

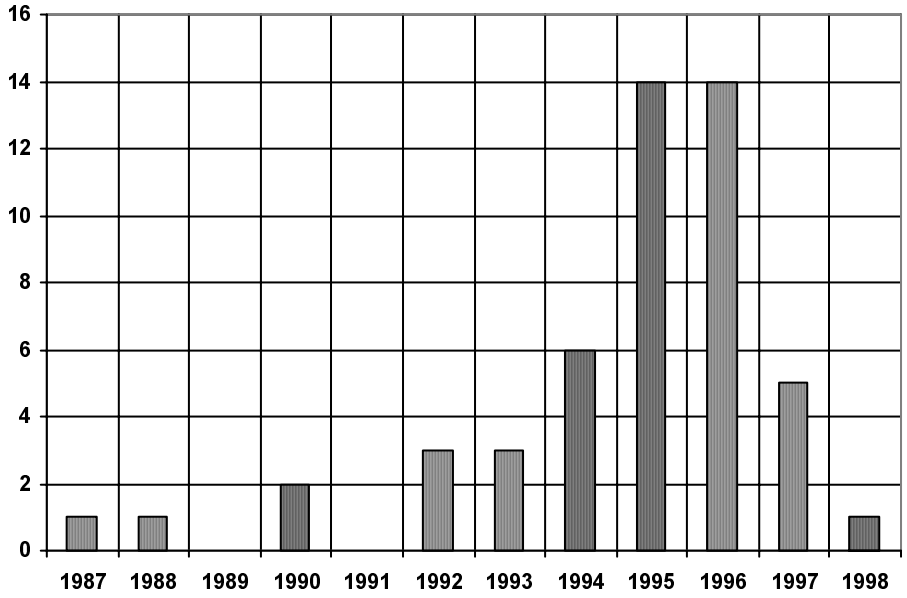
- The reference period of individual nations reporting to the TBFRA inquiry range from 1986 (Germany) to 1998 (Iceland).
- With the exception of two countries all national data presented in TBFRA-2000 were assessed during the 1990s.
- The reported changes in area and growing stock can be utilized as an indicator for potential differences of the status at the reference period and the time when the TBFRA-2000 results were issued.
- If TBFRA-2000 results for individual nations are cross-checked with the assessment period and the reported changes the information provided by TBFRA-2000 can be regarded as reliable and comparable with respect to the reference period.

Note on the results from the four largest forest countries

The above analysis has considered the reliability and comparability of the data provided by the fifty countries that responded to the TBFRA enquiry without considering the relative sizes of their forest resources and therefore the impact of the reliability and comparability of their data on the aggregate results. There is a very wide difference between the largest and smallest countries in terms of their forest resources; in fact four countries, the Russian Federation, Canada, the United States of America and Australia, account between them for the predominant share of the TBFRA region's total. Their share of the area of forest, for example, is over 85 per cent, that of other wooded land

FIGURE R.4

Number of countries per reference date



nearly 94 per cent, and of most of the other attributes discussed in this chapter more than three-fourths. Consequently, the reliability and comparability of their data have an important influence on the overall results of the TBFRA report.

The four countries were not amongst the nineteen (western European) countries covered by the EFICS study, which provided the basis for the analysis in this chapter. Given the very extensive nature of their forest resources, and the remoteness of and related difficulties of surveying a sizeable part of it, it is inevitable that they should have experienced certain difficulties in compiling as comprehensive and detailed a set of data as called for in the TBFRA enquiry. Without further analysis, which is beyond the reach of this report, it is impossible to assess whether there may be a number of areas where the data may possibly fall short of satisfactory reliability because of problems with definitions, sampling and survey methodologies, adjustment of national data, and so on. Generally speaking, there seems good reason to accept the figures in this report as the best available, and the National Correspondents in the four countries deserve full credit for the work they undertook to achieve this result. Nevertheless, in view of the importance of these countries at the TBFRA as well as global level, follow-up work to the TBFRA report could usefully take up this question in more detail.

Acknowledgement

This study was partly financed by the European Commission, DG VI, EFICS project. We thank Robert Flies and Louis du Breil de Pontbriand for the permission to publish results of the EFICS study. The simulation study on forest area was carried out by Dr. Berthold Traub, Swiss Federal Institute for Forest, Snow and Landscape Research, Birmensdorf, Switzerland, and Olaf Kügler, now Yale University, New Haven, USA. Special thanks to Christopher F.L. Prins and Alexander V. Korotkov, UN/ECE, and Dr. Matthias Scheuber, Dresden University of Technology, for helpful discussions and careful reviews of the manuscript.

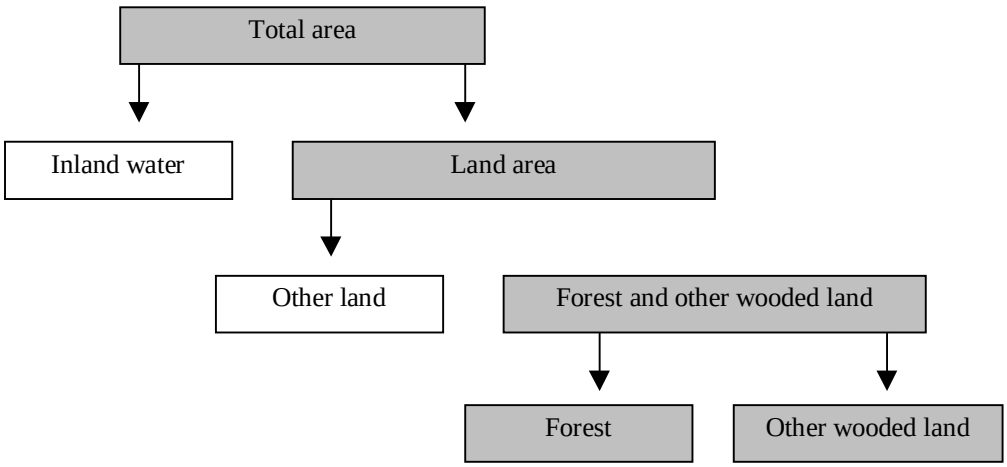
CHAPTER I: AREA OF FOREST AND OTHER WOODED LAND: STATUS AND CHANGES[1]

Overview

Main Tables 1 to 8, which are included in this chapter, provide general information on the area of forest and other wooded land in the fifty-five countries covered by the Temperate and Boreal Forest Resources Assessment 2000 (TBFRA-2000). They contain the data sent by countries in response to *Enquiry Tables 1,3,4* and *7* of the TBFRA-2000 enquiry (see Appendix II), and set out the information describing the extent and basic nature of forest resources and changes to them over time. Such elements as the area of forest and other wooded land, species distribution, availability and non-availability of forest for wood supply and silvicultural systems are relevant for the assessment of the resource's biological diversity, its ability to supply wood and to sequestrate carbon, its vulnerability to certain forms of damage and its ability to perform certain social, protection and other environmental functions. These questions are treated in greater depth in later parts of the assessment.

Main Table 1 takes the total area of countries and sub-divides it into the area of land and inland water. The land area is then sub-divided into the area of forest and other wooded land and other land, the latter consisting of agricultural land, built-on land and other, although these are not separated out in the present assessment. The hierarchical structure of Main Table 1 is shown below (Diagram 1.1):

DIAGRAM 1.1



This table provides the basic information around which the rest of the assessment is built, and accordingly it is very important that the data on these parameters are as comprehensive and comparable as possible. Particular efforts were made, therefore, in drawing up the enquiry for TBFRA-2000, to ensure that the definitions for 'forest' and 'other wooded land' (Appendix I, items 15 and 47) could be applied by all countries, both tropical and temperate and boreal.

In the event, this proved not to be easy. Firstly, it involved changing a key element in the definition used for temperate and boreal countries in previous assessments in order to bring it into line with that used for tropical countries: the minimum tree crown cover for forest was reduced from 20 per cent to 10 per cent. Countries whose national

[1] This chapter was prepared by Mr. Tim Peck (see Appendix V).

inventories were not based on a minimum crown cover of 10 per cent were invited to make the necessary adjustment to the data they reported accompanied by an explanation of how this was done. Most countries complied with this. Switzerland's data, however, are based on the basis of 20 per cent crown cover and Japan's on 30 per cent. Norway indicated that in its National Forest Inventory it makes the distinction between forest and other wooded land on the basis of site productivity and not crown cover, and a number of other countries are reported to do the same, although in the case of Norway the data were recalculated for use in TBFRA-2000 to take account of forest cover. For the purpose of responding to the TBFRA enquiry, the United States defined forest land as consisting of all 'timberland' and 'reserved forest land'. Timberland is defined as forest land capable of producing 1.4 m3/ha/year (productive forest land) and not withdrawn by statute or administrative regulation, while reserved forest land is generally productive but withdrawn from wood supply by administrative regulation. According to the US Forest Service, forest land is defined as "Land at least 10 per cent stocked by forest trees of any size, including land that formerly had such tree cover and that will be naturally or artificially regenerated. Forest land includes transition zones, such as areas between heavily forested and nonforested lands that are at least 10 percent stocked with forest trees and forested areas adjacent to urban or built-up lands. Also included are pinyon juniper and chaparral areas in the West and afforested areas". Australia counted areas with more than 20 per cent crown cover and with trees of a minimum height of 2 m (compared with 5 m in the TBFRA-2000 definition) as forest. This greatly increased the area of its forest compared with previous assessments.

For the purpose of responding to the TBFRA enquiry, the United States defined other wooded land as unproductive forest land not capable of producing 1.4 m^3/ha/year (non-productive forest land). In its own classification it does not distinguish other wooded land *per se*; it is a sub-set of forest land. The situation is similar in Canada, except that it does not quantify the lower limit of productivity. Austria allocated its high altitude dwarf pine areas to other wooded land. Several other countries reported that they either made no distinction between forest and other wooded land or that the areas of the latter were insignificant (Czech Republic, Germany, Hungary, Ireland, Netherlands, Poland). New Zealand included abandoned agricultural land in the process of natural recolonization in other wooded land. Australia's data set for other wooded land was derived by using a coarse national vegetation data set at 5 million scale to select tall and low shrubs and tall, medium and low trees. The result was to class as much as 422 million ha under other wooded land or 55 per cent of Australia's total land area.

The situation as described above illustrates the complexity involved in trying to achieve absolute harmonization at the international level of even the key parameters. It is understandable that countries want to keep their existing national time series based on their own definitions, which may differ from the internationally agreed ones. Nevertheless, thanks to the great efforts of the national TBFRA-2000 correspondents, a considerable degree of harmonization and consistency has been achieved. Deviations from the TBFRA-2000 definitions are mostly considered to fall within or close to the range of error and therefore not to affect the quality of the overall results given in Main Table 1.

Area of forest and other wooded land

The total area of forest and other wooded land in the late 1990s in the fifty-five countries covered by the TBFRA-2000 amounted to 2,478 million ha, of which 1,682 million (68 per cent) were classified as forest and 795 million (32 per cent) as other wooded land. The area of forest in these countries accounted for about half of the world total, which was reported by FAO in its State of World Forestry 1999 as being 3,454 million ha. It is not possible to assess precisely their share of the global area of forest and other wooded land, because of difficulties in collecting data on other wooded land in some tropical countries and uncertainties with regard to the consistency with which the internationally agreed definition of other wooded land was applied by some countries in both the tropical and temperate and boreal regions.

The distribution of forest and other wooded land (FOWL) by country and region is quite different from that of population (Figure 1.1). Thus Europe is the most populated of the four regions presented in the tables (Europe, the Commonwealth of Independent States [CIS], North America, and Australia, Japan and New Zealand, shown in these figures and elsewhere as "Other TBFRA") with 44 per cent of the total for the TBFRA countries of 1.32 billion people, but less than 9 per cent of the area of forest and other wooded land. The CIS has 21 per cent of the population and 38 per cent of the forest and other wooded land.

The CIS countries account for over half of the total area of forest in the TBFRA area with 856 million ha and North America for over one quarter with 462 million ha (Figure 1.2). The distribution of other wooded land (OWL) is quite different: "Other TBFRA" countries account for over half the total area of 795 million ha, with Australia alone having an area of 422 million ha. North America has an area of OWL of 254 million ha or nearly one third of the TBFRA area total. Europe's share of forest is 10 per cent and of OWL 5 per cent.

FIGURE 1.1

Distribution of population (1.32 billion) and of forest and other wooded land (2.48 billion ha) in the regions of the TBFRA

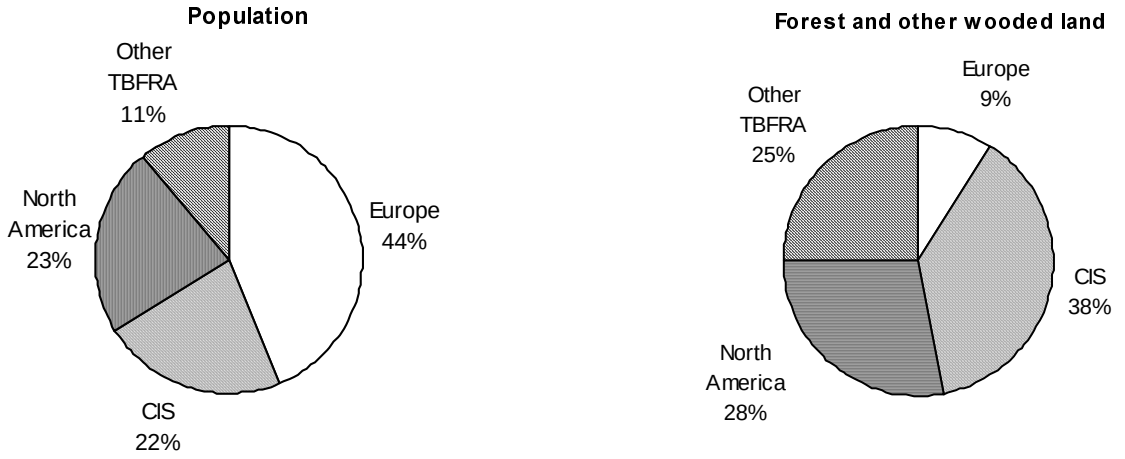
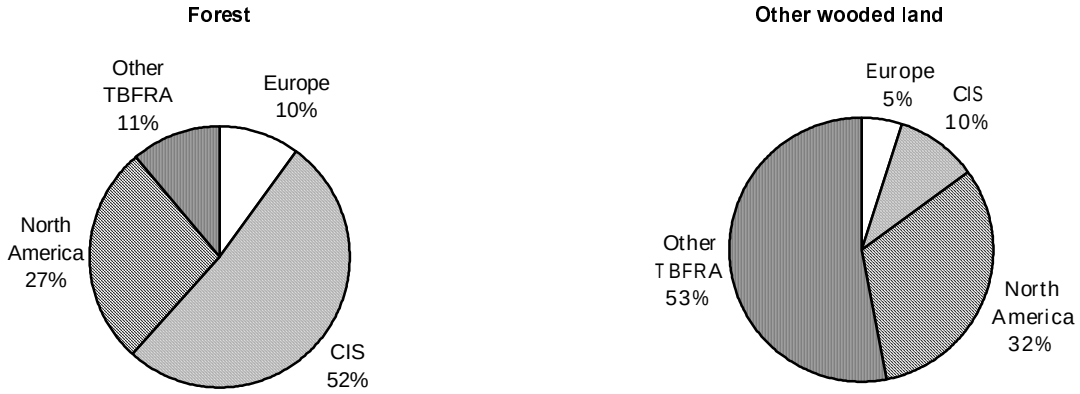


FIGURE 1.2

Distribution of forest and of other wooded land in the TBFRA area by regional groups



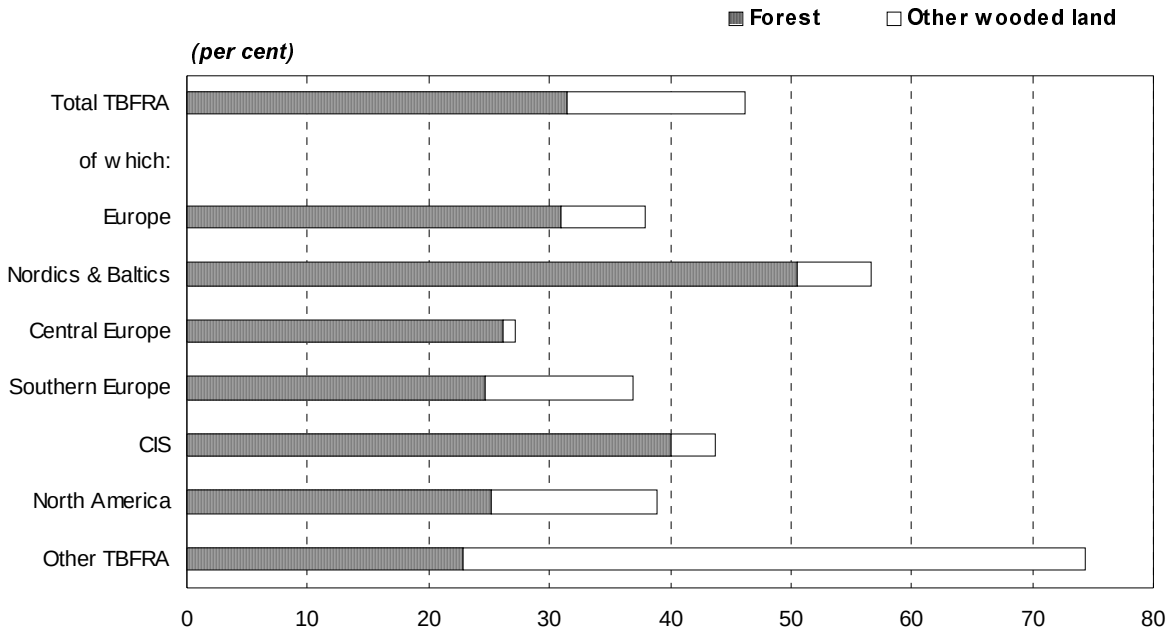
The percentage of land covered by FOWL varies widely from country to country, as seen in Main Table 2. The average for all TBFRA-2000 countries is 46 per cent, while the range is from 76 per cent in Australia, 75 per cent in Finland and 74 per cent in Sweden to little more than 1 per cent in Iceland and Malta. Figure 1.3 shows how the shares of FOWL in total land area vary between regional groups. The share in the "Other TBFRA" countries (74 per cent) is appreciably higher than the TBFRA average; those in Europe and North America are lower (38 per cent and 39 per cent respectively) than the TBFRA average.

Within Europe there is a contrast between the relatively high cover of FOWL in the Nordic countries and the Iberian peninsula (59 per cent and 50 per cent respectively) compared with the low cover in North-Western Europe (11 per cent). Similarly in the CIS, there is a marked contrast between the cover of 54 per cent in the Russian Federation and that in the other CIS countries (10 per cent). As already noted, FOWL cover is particularly high in Australia and Japan, in the former largely due to the extensive area of OWL, in the latter to the high proportion of forest. The share of forest (excluding OWL) in total land area in Japan of 66 per cent is virtually as high as Sweden's and is exceeded only by Finland with 72 per cent (Figure 1.4).

One feature worth drawing attention to is that while in most countries other wooded land accounts for a relatively small part of total FOWL, there are exceptions both in the boreal countries (Canada, Norway) and in the drier, hotter temperate countries (Spain, Greece, FYR Macedonia, Turkey, Cyprus and, above all, Australia). As noted earlier, the area of other wooded land is remarkably high in Australia in absolute terms, 422 million ha, and relative to its total

FIGURE 1.3

Share of forest and other wooded land in total land area in the TBFRA area by regional groups



land area (55 per cent). It accounts for more than half the total of other wooded land in the TBFRA area. Figure 1.5 shows that for the TBFRA area as a whole forest accounts for two-thirds of the total FOWL area and OWL for one third, but even at the regional grouping level, the proportions vary considerably, from 96 per cent forest in central Europe to 31 per cent in "Other TBFRA" countries. At the country or country group level, the contrasts are even more marked, as seen in Figure 1.6, the share of forest ranging from over 99 per cent in Central-Eastern Europe to 27 per cent in Australia.

On a per capita basis, Main Table 2 shows that on average in the TBFRA countries there are about 1.9 ha/cap of FOWL and 1.3 ha/cap of forest, the latter figure being about double the global average. Because of the differences in population density and the areas of FOWL between regions, and even more markedly so between countries, the range of values for FOWL per capita is very wide. Figure 1.7 shows the per capita figures at the regional grouping aggregates. FOWL per capita is above the TBFRA average in all groups except Europe, where at 0.37 ha/cap it is only about one-fifth of the average. In the other groups, it is above the average in North America and "Other TBFRA" only because of the large OWL component in the total.

Figure 1.8 shows the per capita data of forest and other wooded land by country or country group. Within Europe the range is from 3.5 ha/cap in the Nordic countries (with as much as 4.4 ha/cap in Finland) to 0.05 ha/cap in North-Western Europe (0.02 ha/cap in the Netherlands and 0.04 in the United Kingdom). Per capita levels are appreciably higher than the European average of 0.37 ha/cap in the Baltic countries, as well as the Nordic countries, but less than average in the other country groups. There is a marked contrast between the Russian Federation with 6 ha/cap and the other CIS countries with 0.34; between Canada with 14 ha/cap and the United States with 1.1; and in the "Other TBFRA" countries between Australia with 31 ha/cap of which 8.4 of forest, and Japan with 0.2.

The area of forest per capita (as distinct from FOWL per capita) is an indicator, although a rather crude one, of the actual or potential capacity for the forest to satisfy a nation's demand for wood and non-wood products and services and the forest cover is another. There are only seven countries with markedly higher forest per capita than the average for the TBFRA-2000 countries, namely Australia, Canada, Russian Federation, Finland, Sweden, New Zealand, Norway. In the case of Australia and New Zealand, however, a major part of the forest area is classified as not available for wood supply (nearly 90 per cent and 77 per cent respectively). There are many more countries with much lower per capita areas of forest than the average, all of them with the exception of Japan being in Europe and the CIS. In the case of forest cover, the range is from 72 per cent in Finland to little more than zero in Iceland and Malta. Japan is an interesting case: its forest cover is among the highest in the world (66 per cent), which might suggest at first sight that it should be able to satisfy its population's needs for forest products, until it is observed that the figure for its forest area per inhabitant is only 0.2 ha/cap.

FIGURE 1.4

Share of forest and other wooded land in total land area in the TBFRA area by country

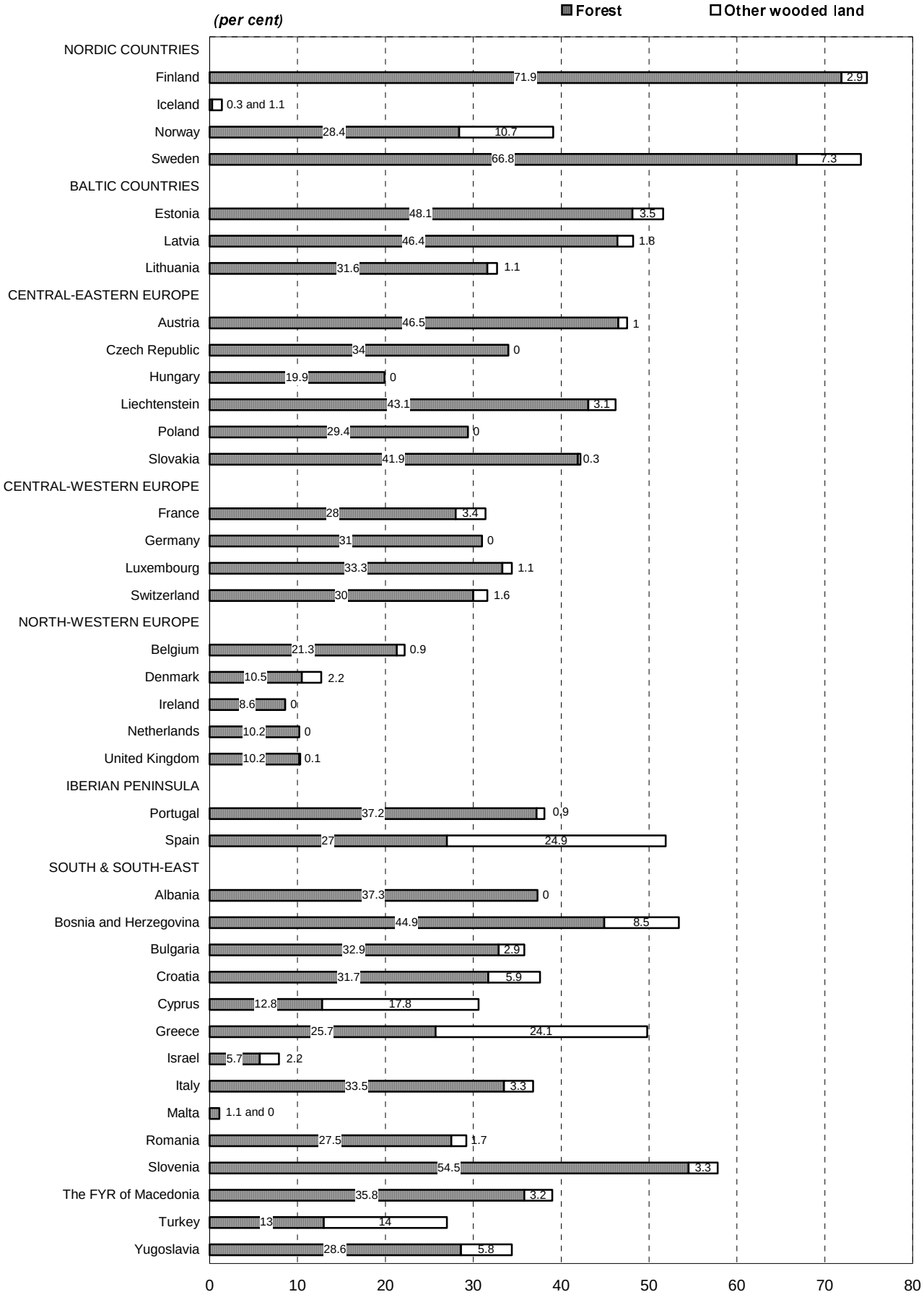


FIGURE 1.4 *(continued)*

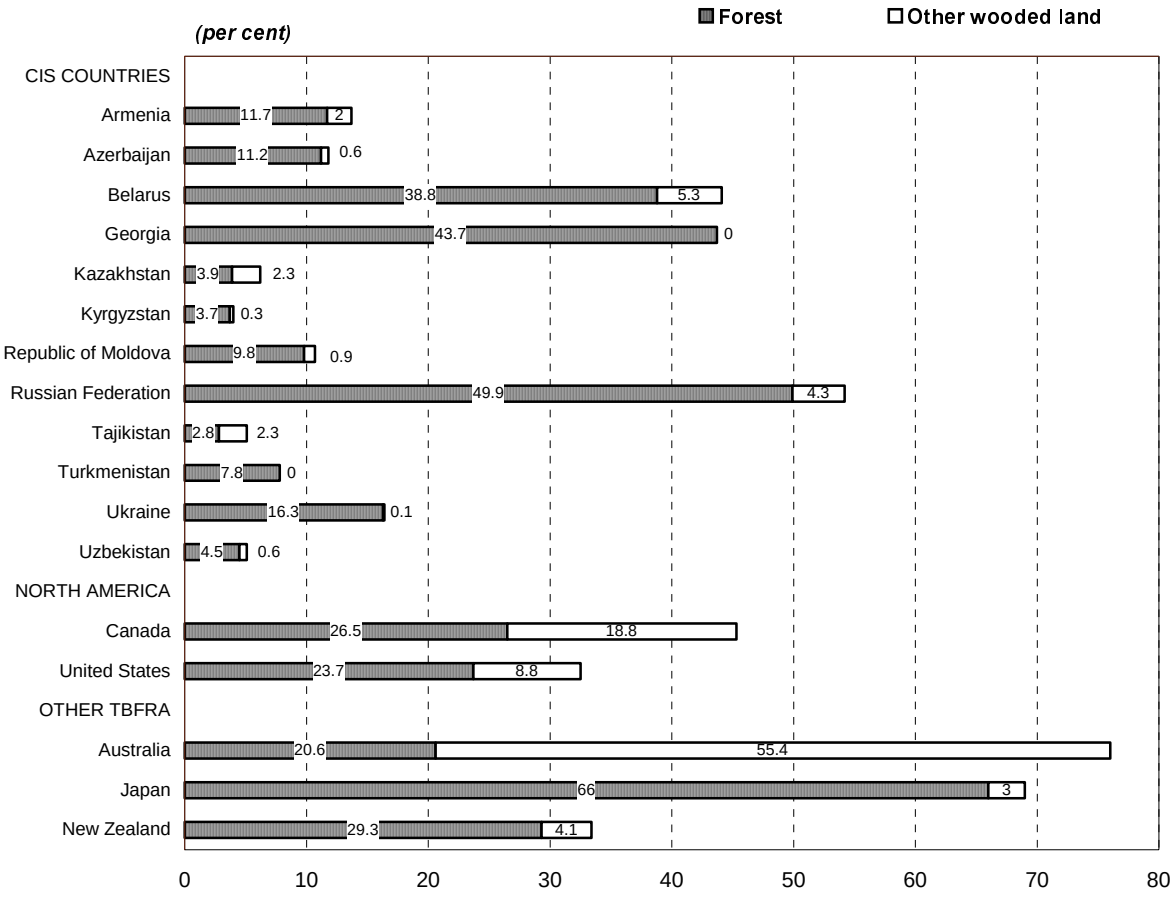


FIGURE 1.5

Shares of forest and of other wooded land in the total area of forest and other wooded land in the TBFRA area by regional groups

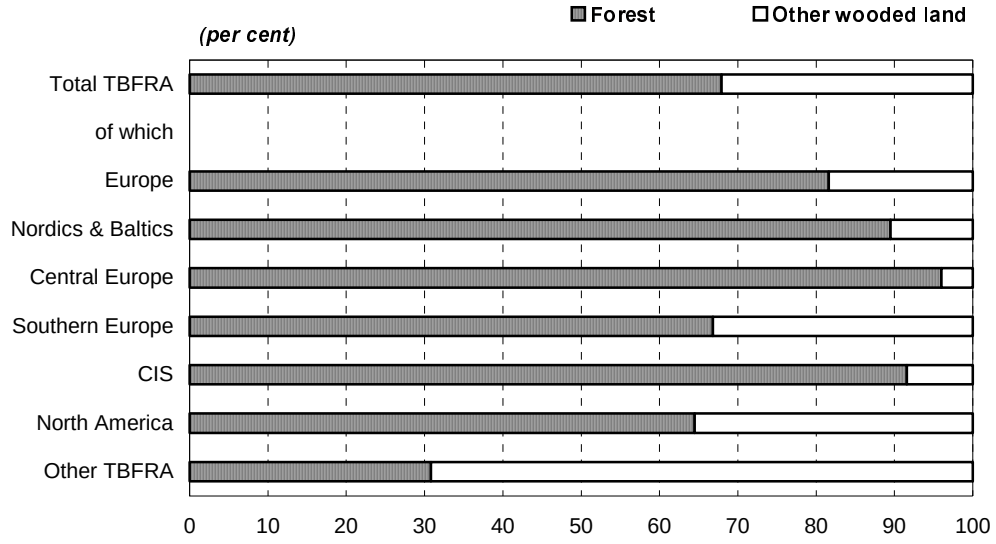


FIGURE 1.6

Shares of forest and of other wooded land in the total area of forest and other wooded land by countries or country groups

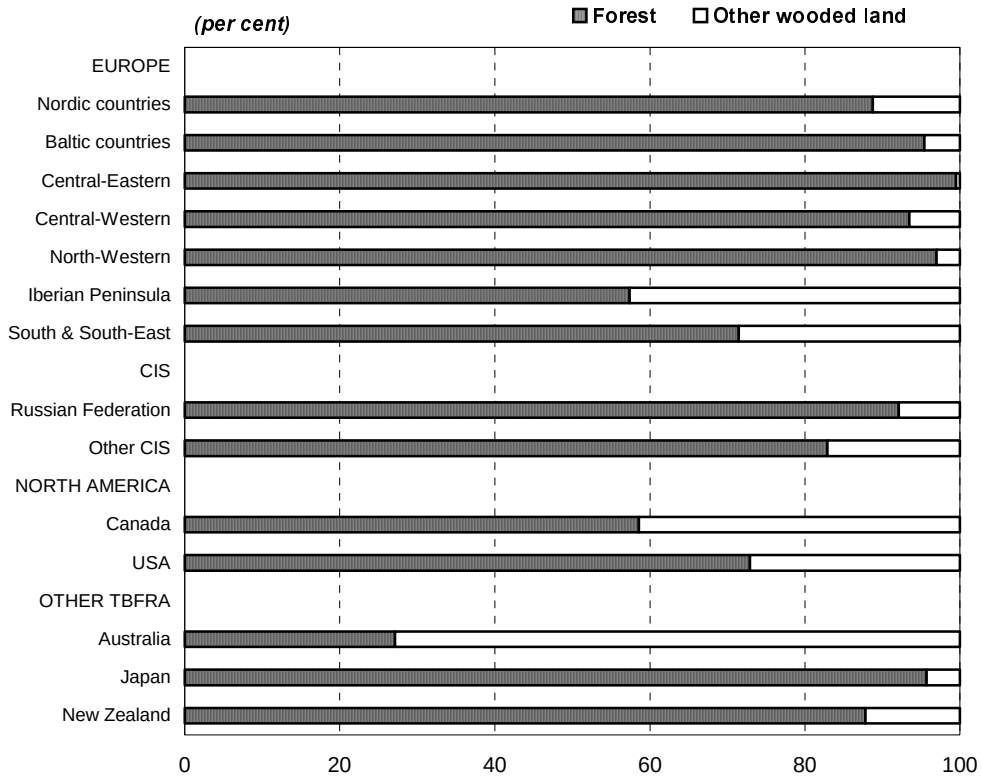
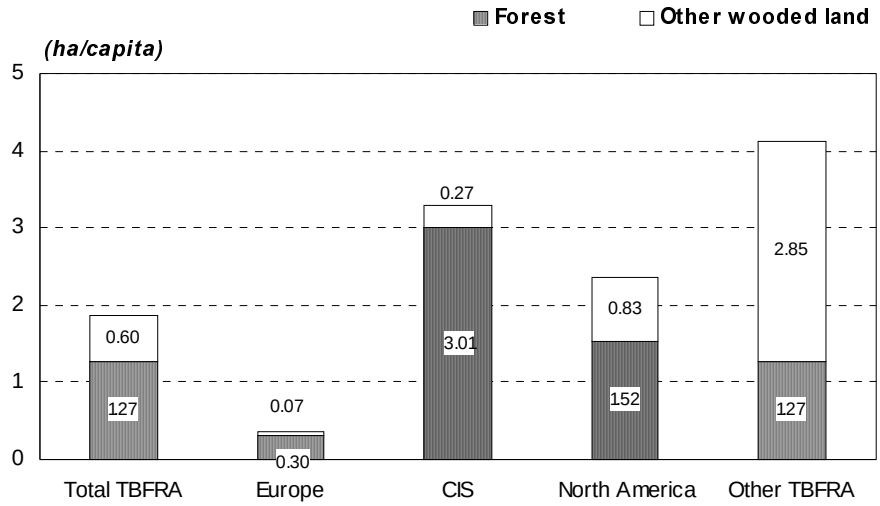


FIGURE 1.7

Forest and other wooded land per inhabitant in the TBFRA area by regional groups

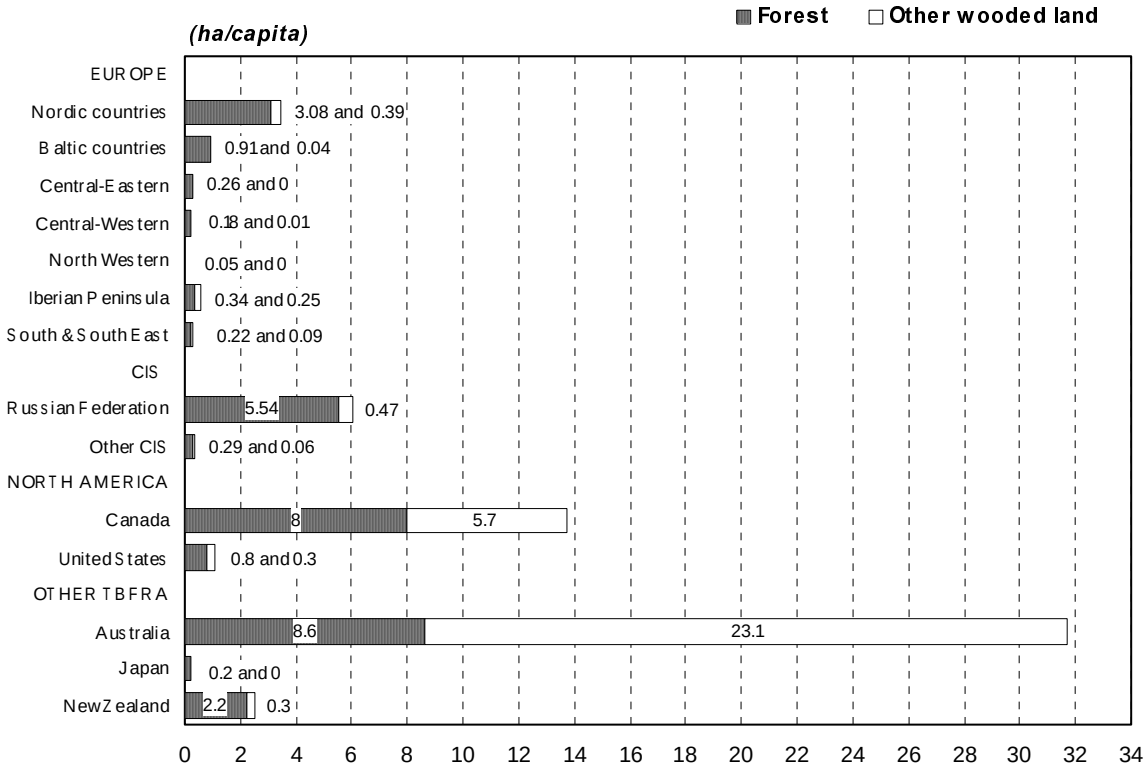


Species composition and distribution

One important change introduced in the TBFRA-2000 enquiry, compared with earlier ones, was to ask for information on "mixed" (i.e. mixed coniferous and broadleaved species) FOWL. Another change, introduced to make the TBFRA enquiry conform with FAO's global assessment but of no importance to TBFRA countries with the

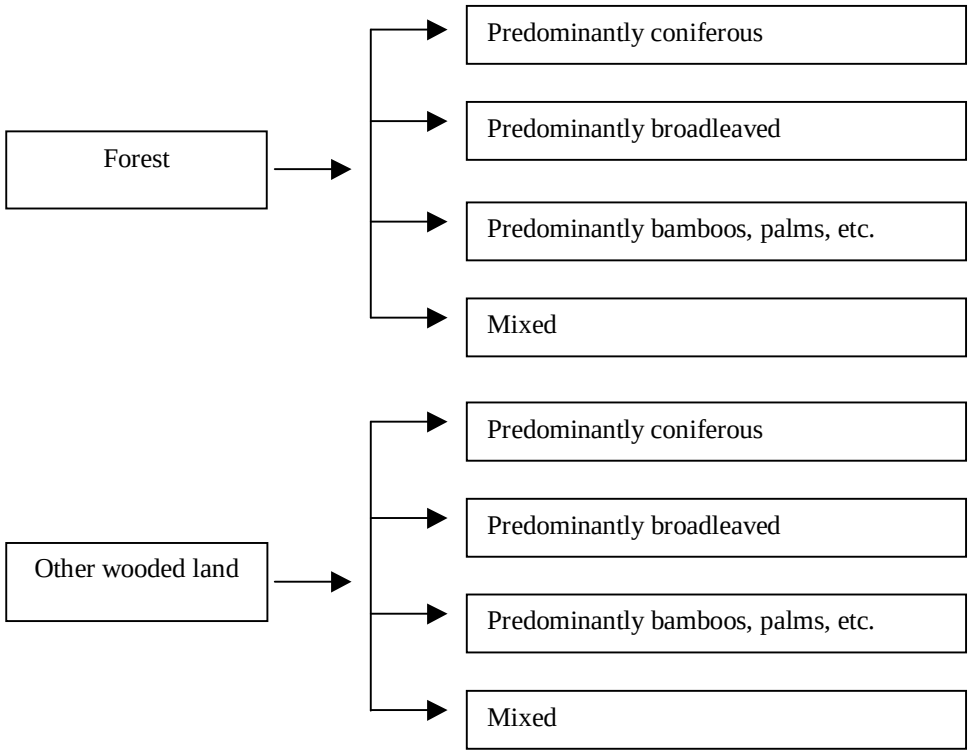
FIGURE 1.8

Forest and other wooded land per inhabitant in the TBFRA area by country and country groups



exception of Japan, was the inclusion of information on bamboos, palms, etc. The definitions for "predominantly coniferous", "predominantly broadleaved", "predominantly bamboos, palms, etc." and "mixed" are given in Appendix I, items 52, 51, 50 and 36 respectively. The hierarchical structure is shown below (Diagram 1.2):

DIAGRAM 1.2



The criterion for distinguishing between these categories was that if 75 per cent or more of the tree crown cover consisted of coniferous or broadleaved species or bamboos, etc., the area should be classified as "predominantly coniferous", "predominantly broadleaved" or "predominantly bamboos, palms, etc." respectively. Any area falling between should be classified as "mixed". The inclusion of the "mixed" category caused problems for a few countries, whose inventories are based on a simple distinction between coniferous and broadleaved areas. These either had to make estimates of the breakdown into the three categories (Denmark), or reported that the area of mixed was negligible (Greece, Turkey). The Russian Federation's inventory uses a criterion of more than 40 per cent coniferous for coniferous stands and more than 60 per cent broadleaved for broadleaved. The adjustment to the TBFRA definitions resulted in about 40 per cent of all stands being classified as mixed. In Norway the limit is 70 per cent rather than 75 per cent; its reported data were not adjusted to the TBFRA definitions.

Main Table 3 contains information on the distribution in forest by species groups for virtually all countries, which is summarized for the TBFRA-2000 area as a whole in Figures 1.9, 1.10 and 1.11; that on the distribution in other wooded land is slightly less complete. The figures show the species distribution by area for forest and other wooded land separately for the TBFRA area and the main regional groupings. For forest, predominantly coniferous holds the largest share, with 785 million ha for the TBFRA area (47 per cent of the total); it has also the largest share in each of the regional groupings except for "Other TBFRA", where predominantly broadleaved is the most important. The area of mixed forest amounted to 452 million ha (27 per cent) of the total forest in the TBFRA area and predominantly broadleaved 445 million ha (26 per cent). For other wooded land, predominantly broadleaved is the largest species group, with about two thirds of the total in the TBFRA area, mainly because of the very large area of this type of vegetation in "Other TBFRA" and more specifically Australia.

Countries' species composition and distribution reflect their geographic location in terms of latitude and the altitude at which their forests are growing. In addition, in those countries where the forest is under intensive management, past policy decisions on afforestation and reforestation have sometimes had an important influence, for example the establishment of coniferous stands, generally monocultures, in temperate areas where the natural composition might have been predominantly broadleaved or mixed.

In the northern hemisphere the boreal forest belt, consisting predominantly of coniferous species, runs across the Russian Federation, Alaska (USA), Canada and the Nordic countries, bounded by the tundra to the north and the temperate zones to the south. In planning the TBFRA-2000 enquiry the possibility was explored of separating boreal from temperate forests statistically, but in practice no internationally accepted definitions could be found to achieve this. As a very rough approximation, it could be said that the northern boreal forests cover approximately 1000 million ha or 60 per cent of the total temperate and boreal forest area. In the northern temperate zones (excluding boreal), broadleaved or mixed forests predominate, although coniferous forests are found in some areas, either naturally at higher elevations or in certain hotter, drier areas, or artificially as a result of afforestation or silvicultural practices. In Australia and New Zealand, broadleaved forests predominate except where exotic coniferous species, such as Radiata pine, have been introduced. It is interesting to note that the broadleaved forests of the southern hemisphere are mostly evergreen, in contrast to the broadleaved deciduous forests generally found in the northern hemisphere.

It is worth noting that in Australia, as much as 47.6 per cent of the total forest area, or around 75 million ha, which lies to the north of the Tropic of Capricorn, is considered to be tropical. Small areas of tropical (or at least sub-tropical) forest may also occur in a few other 'temperate' countries, such as the USA. Conversely, a number of countries not covered by the TBFRA-2000, in both the northern and southern hemispheres, possess substantial areas of temperate forests as, for example, China and the two Koreas in the former and Argentine and Chile in the latter.

At the country level, there is a wide range of species group distribution in forests, as is shown in Main Tables 3 and 4 and Figure 1.12.

FIGURE 1.9

Distribution of forest and of other wooded land in the TBFRA area by species groups

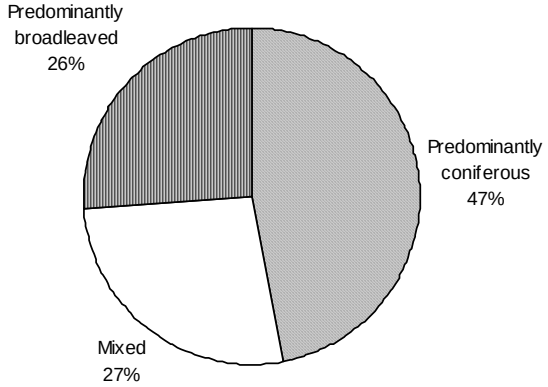


FIGURE 1.10

Distribution of forest and of other wooded land in the TBFRA area by species groups and regional groups

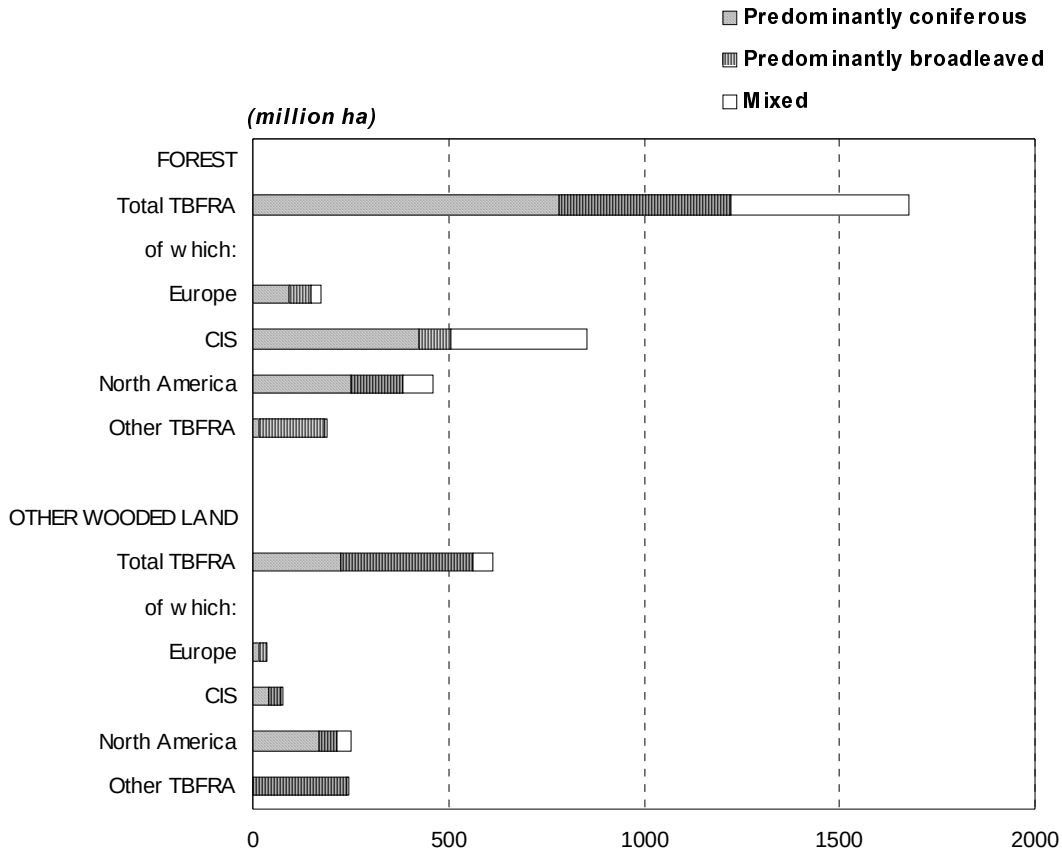


FIGURE 1.11

Distribution of forest and of other wooded land in the TBFRA area by species groups and regional groups

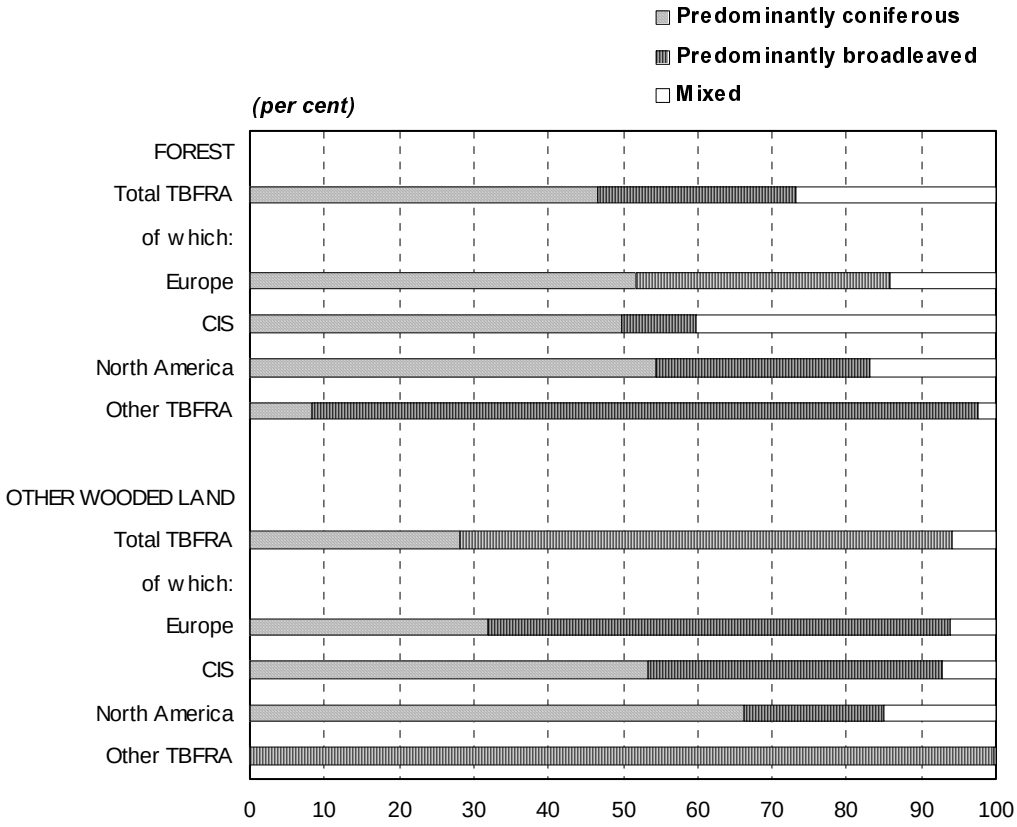


FIGURE 1.12

Distribution of forest by species groups in the TBFRA area by country

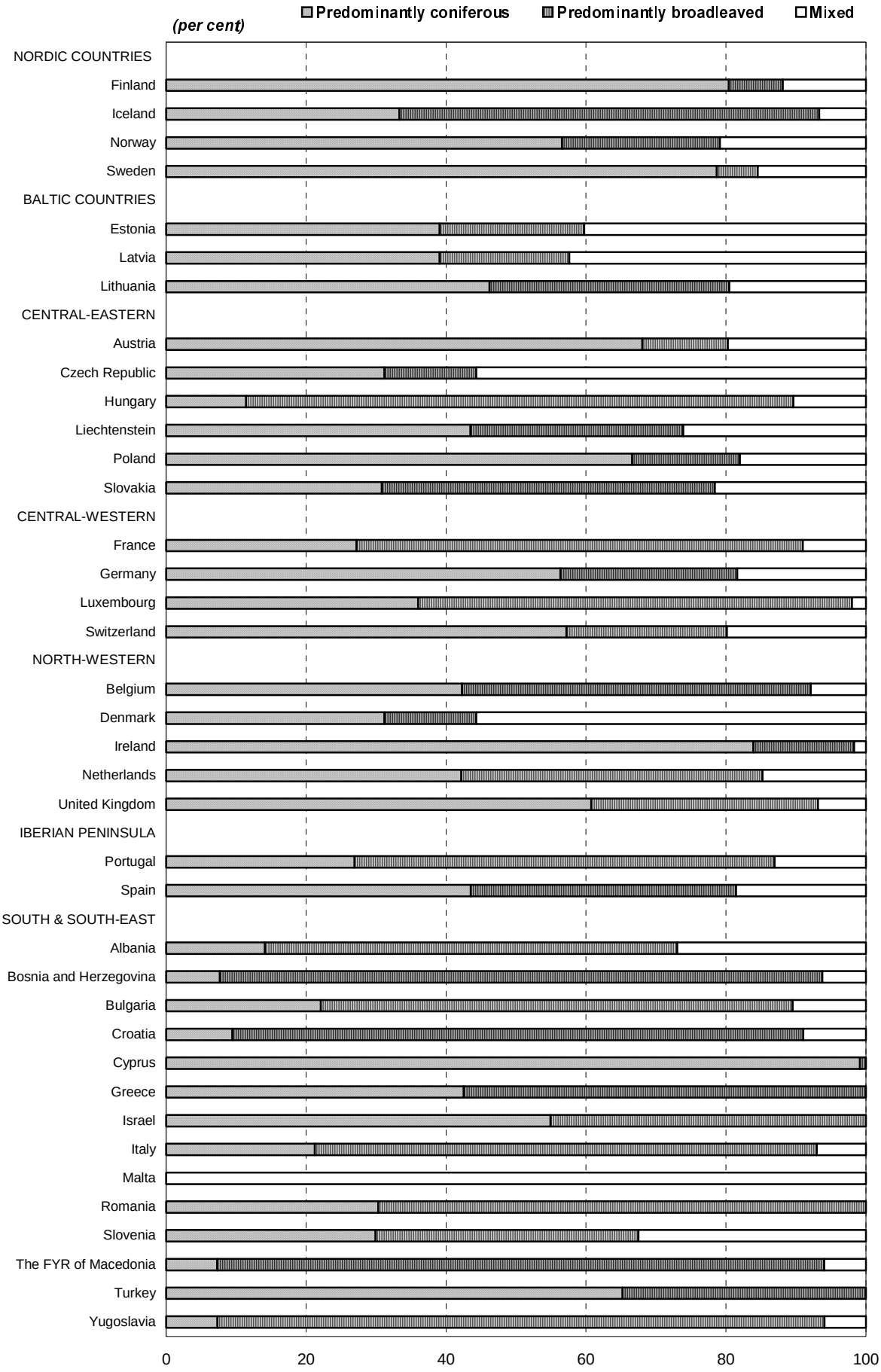
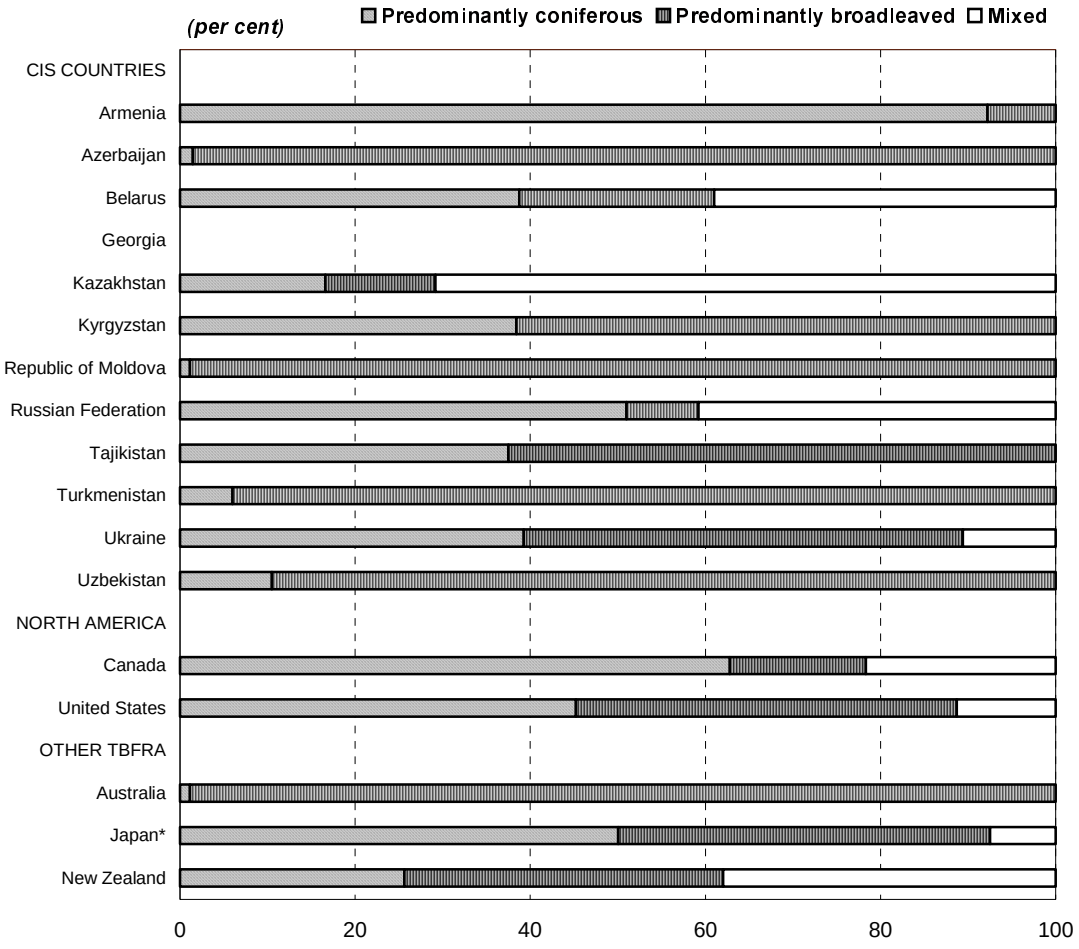


FIGURE 1.12 *(continued)*



* Bamboos in Japan included in predominantly coniferous.

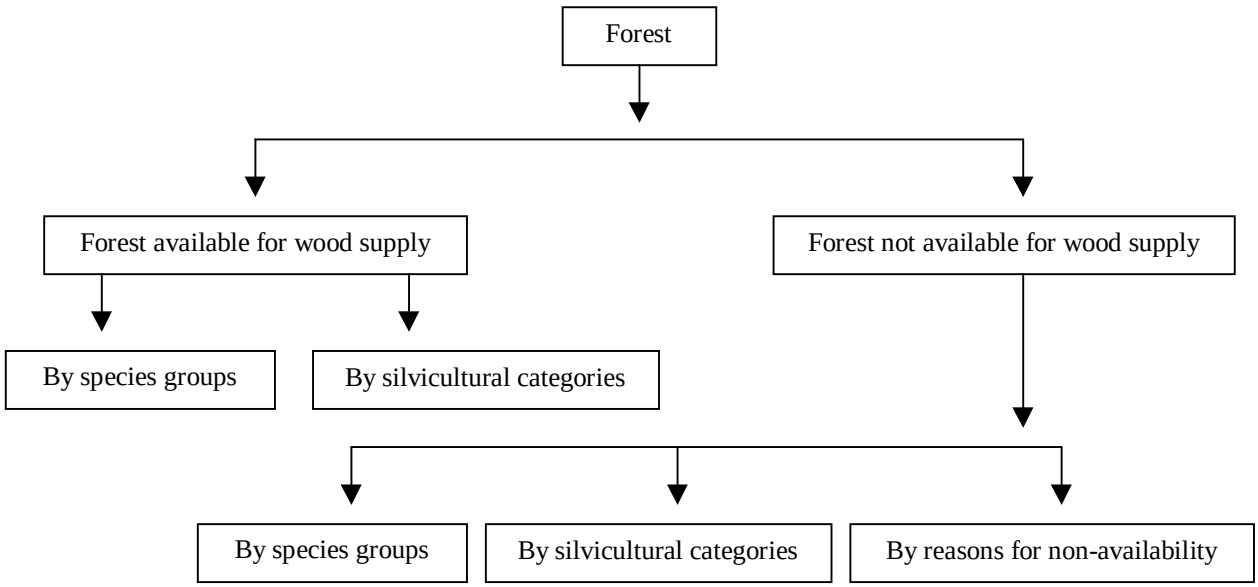
Coniferous species predominate in Cyprus with 99 per cent of the total, while among the major forest countries they account for more than three quarters in Finland and Sweden, 68 per cent in Austria, 63 per cent in Canada and 51 per cent in the Russian Federation. Broadleaved species predominate in several CIS countries (over 90 per cent in Armenia, Azerbaijan, Moldova and Turkmenistan) as well as Australia. In Europe, Yugoslavia has the highest proportion of broadleaved species with 87 per cent, while among other major forest countries there is France with 64 per cent, Romania with 70 per cent and Italy with 72 per cent. In the United States areas of predominantly coniferous and broadleaved are roughly similar with 45 per cent and 44 per cent of the total and 11 per cent mixed.

Forest available and not available for wood supply

In previous assessments, other terms were used to distinguish those areas where it was considered that wood could be harvested from those where it could not. These terms included ‘productive’ and ‘unproductive’, ‘operable’ and ‘inoperable’ and ‘exploitable’ and ‘unexploitable’, the last being the ones used in the 1990 assessment. With the increasing demand for and supply of non-wood goods and services, these terms were felt to be ambiguous (exploitable for what?). It was therefore agreed to adopt the terms ‘available for wood supply’ and ‘not available for wood supply’, to make it clear that the criterion for separating the two was an area’s actual or potential use as a source of wood, which still remains in most forests the single most important output. In practice, the comparability between available for/not available for wood supply in the present assessment and exploitable/unexploitable in the 1990 assessment is probably quite good.

Forest available for wood supply (FAWS) was separated according to (1) species groups, and (2) silvicultural categories, while that not available for wood supply (FNAWS) was separated by three criteria: (1) species groups, (2) silvicultural systems, and (3) the reasons for non-availability. The hierarchical structure is as follows (Diagram 1.3):

DIAGRAM 1.3



Main Table 5 contains information on forest available for wood supply (FAWS) and is in three parts. First, the total area of FAWS is shown for virtually all TBFRA-2000 countries, together with its share of the total forest area. Secondly the total area is broken down by species groups. And thirdly, it is sub-divided between high forest and coppice and coppice with standards.

Figure 1.13 shows the shares of FAWS and FNAWS in the total area of forest by regional groupings. On average in the TBFRA-2000 countries, 63 per cent of the total area is available for wood supply with a range from 85 per cent in Europe to 22 per cent in "Other TBFRA". The majority of European countries have 75 per cent or more of their forest available for wood supply, as do Belarus, USA and Japan (Figure 1.14). Among the other countries the percentage of FAWS is zero in Kyrgyzstan and Tajikistan and 10 per cent or less in Armenia and Australia. The Russian Federation has 64 per cent of its huge forest area classed as FAWS, close to the average for all TBFRA-2000 countries.

FIGURE 1.13

Forest available and not available for wood supply in the TBFRA area by regional groupings

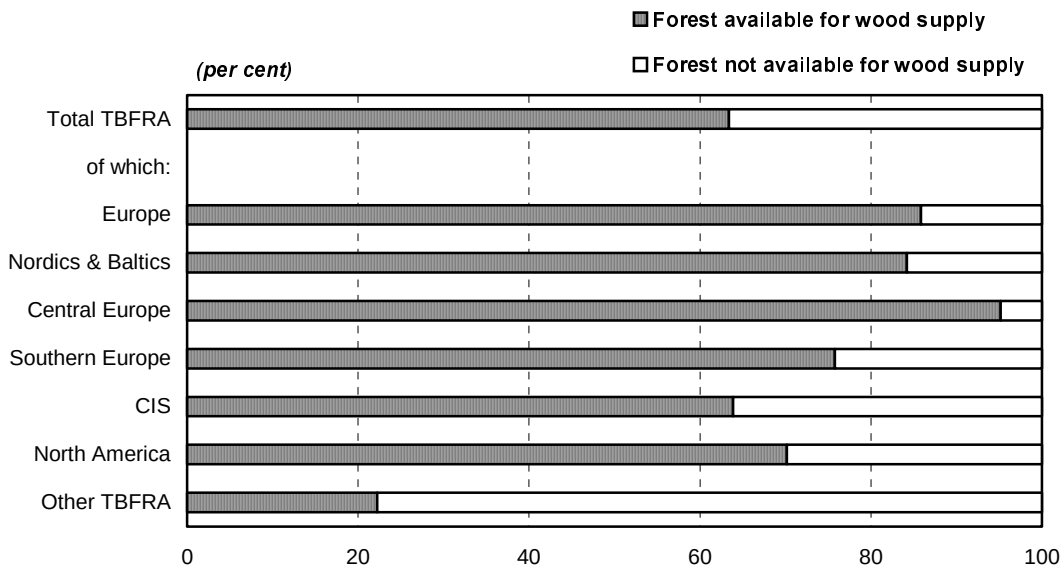


FIGURE 1.14

Share of forest available and not available for wood supply in the TBFRA area by country

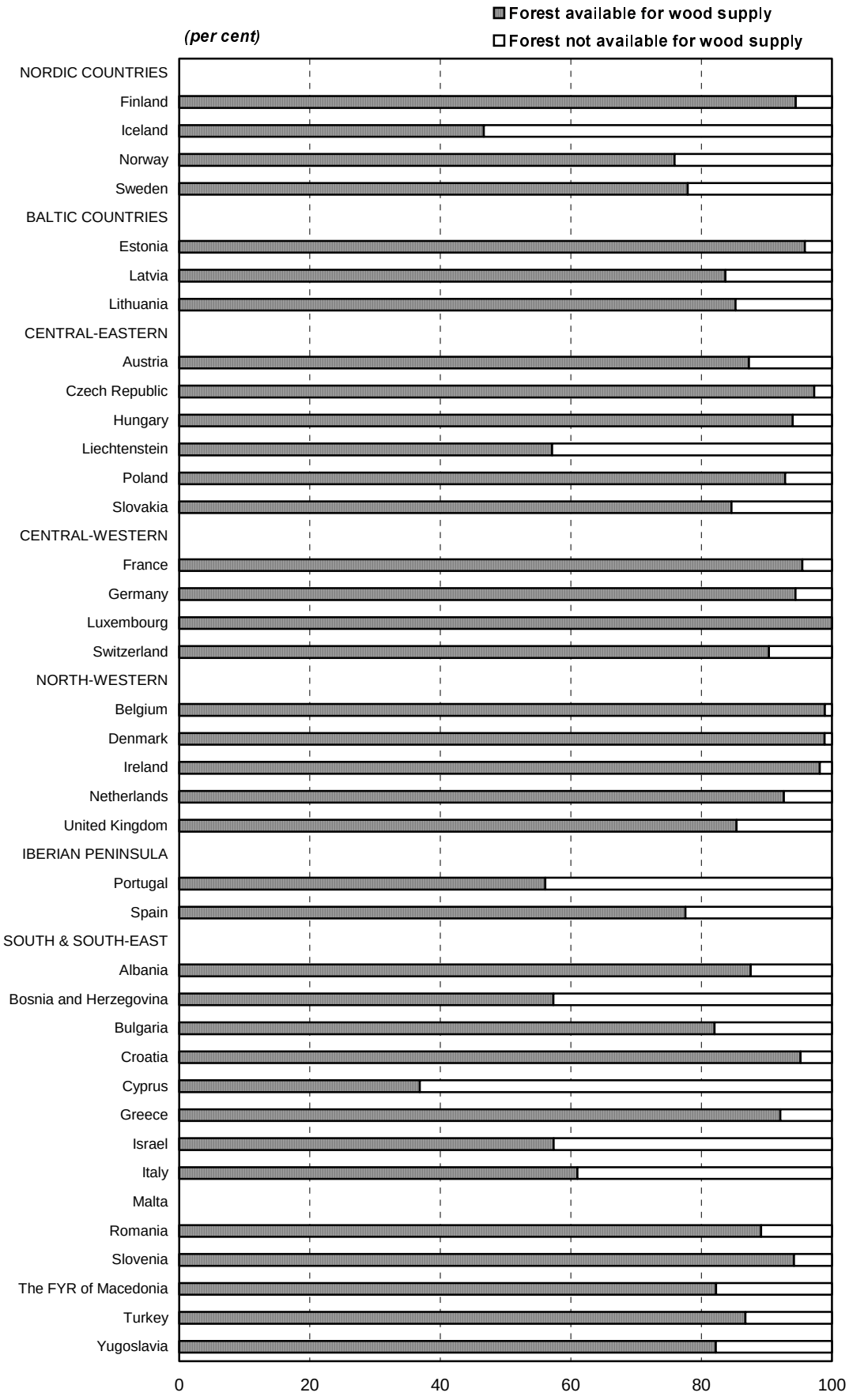
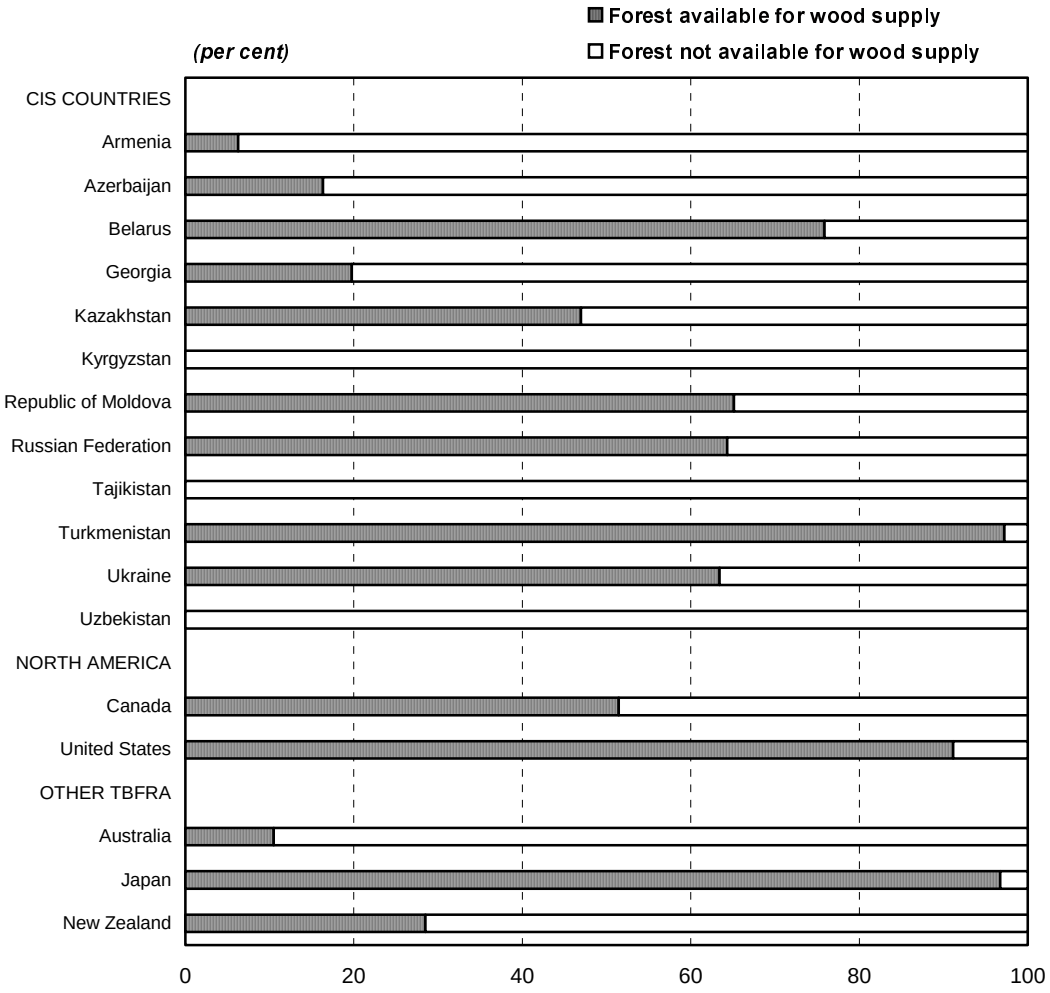


FIGURE 1.14 *(continued)*



It seems that the majority of countries were able to follow the TBFRA definitions of FAWS and FNAWS (see Appendix I, items 14 and 18 respectively). In Australia, FNAWS included 17.6 million ha of National Conservation Reserves and 121.7 million ha not harvested for a combination of ecological and economic reasons. In Germany FAWS was defined as areas with productivity of over 1 m^3/ha/year (Wirtschaftswald) and FNAWS with less than that. Hungary included forest where wood production is the primary function under FAWS and that where a non-wood function or functions has the primary role under FNAWS. Romania estimated FNAWS as being the area without road access, i.e. a haulage distance of more than 2 km on average. In the Russian Federation FAWS includes stands identified as suitable for commercial logging and 'reserved' forests of Group III according to that country's classification system. Slovakia included 332,000 ha of 'special purpose forests' in FAWS, where wood production is a secondary function.

In the TBFRA-2000 countries in aggregate, nearly 97 per cent of the area of FAWS was classified as 'high forest' and less than 3 per cent as 'coppice and coppice with standards' (Main Table 5). The latter are of virtually no importance in North America or "Other TBFRA", apart from a small area in Japan. On the other hand, coppice and coppice with standards account for 16 per cent of the area of FAWS in Europe and cover extensive areas in several countries including France, Italy, Greece, Turkey, Spain and Bulgaria. Other countries with smaller areas but where they account for more than half the total of FAWS include Albania and Yugoslavia. It can be noted that, with the partial exception of France, all these countries are in southern Europe. Coppice and coppice with standards cover large areas in several CIS countries, including the Russian Federation, Ukraine, Kazakhstan and Belarus.

Main Table 6 contains information, in addition to the total area of forest not available for wood supply (FNAWS) and area by species groups and silvicultural categories, also on why forest is not available for wood supply, that is either for conservation/protection reasons or for economic ones. Several countries place the major part of their forests under FNAWS, including Armenia, Azerbaijan, Kyrgyzstan and Tajikistan in the CIS and Australia and New Zealand in "Other TBFRA". Several European countries have 40 per cent or more of FNAWS, including Bosnia and Herzegovina, Cyprus, Iceland, Israel, Liechtenstein and Portugal. Canada has 49 per cent of FNAWS, while the USA's proportion is 9 per cent.

Concerning the reasons for non-availability for wood supply, over 80 per cent of the area of FNAWS in the TBFRA-2000 countries in aggregate is put in the 'for economic reasons' category and less than 20 per cent under 'for

conservation/protection reasons' although this is largely due to the weighting of the very large forest countries, the Russian Federation and Canada with their extensive areas of remote forest. However, in several European countries economic reasons also predominate, including Albania, Cyprus, France, Germany, Italy, Norway and Portugal. For Europe as a whole, nearly two thirds of the area of FNAWS comes into the 'for conservation/protection reasons' category, with Sweden, Finland, Spain and Turkey having most of their FNAWS in this category. The USA and Japan put all their FNAWS under 'for conservation/protection reasons'.

It is not absolutely clear to what extent there is consistency between countries in distinguishing between forest available and not available for wood supply; nor, with regard to the latter, between non-availability for conservation/ protection reasons and for economic ones. There is certainly value in making these distinctions, but it would appear necessary for further research and consultations to be made in order to refine the definitions and to assure that they can be applied in practice in future assessments. The objective should be to reduce the degree of subjectivity that has to be applied by national correspondents to make the distinctions.

Changes in area over time

There are good prospects that sooner or later remote sensing will become an effective means of monitoring changes over time in the area of forest and other wooded land. Satellite images were indeed used on a sampling basis for making estimates of change in tropical forests for the 1990 Global Forest Assessment, but have so far been used to only a limited extent for this purpose in the TBFRA countries. This has been because of the considerable difficulties in obtaining representative coverage of the TBFRA area with accurate enough resolution to allow identification of the land use classes used in the TBFRA. In the absence of data based on remote sensing, and despite the importance attached to information about change expressed at numerous international conferences, it is still proving difficult for some countries to provide reliable information based on traditional inventory methods. One of the problems has been changes in definitions between one assessment and the next. In an attempt to overcome this and other difficulties, the TBFRA-2000 enquiry asked countries to adapt data from an earlier inventory (Reference period 1 in the enquiry, see Appendix I, item 61) to the definitions used in the one on which their reply to the TBFRA-2000 enquiry was based (Reference period 2).

The results, which are set out in Main Tables 7 and 8, should be treated with caution. Not all countries have been able to provide change data, and the very large changes reported by the Russian Federation, which contrast markedly with the smaller ones in most other countries, as well as the lack of change data for Australia, make any attempt at estimating a figure for the TBFRA-2000 countries as a whole not worthwhile. For all the TBFRA countries that were able to provide data, the net average annual increase in the area of forest was roughly 600,000 and of OWL 1.3 million ha. For the European countries there was in aggregate an average annual increase in the area of forest of approximately 500,000 ha and a decrease in that of other wooded land of about 200,000 ha. The countries reporting the largest increases in forest area were Spain, France, Portugal, Turkey, Greece and Italy, all Mediterranean countries with active programmes of afforestation or conversion of other wooded land to forest. Other countries with active planting programmes included Bulgaria, Ireland and the United Kingdom (Figure 1.15). Only a few countries reported a declining trend in the area of forest, including Albania, Belgium, Finland and Yugoslavia; the falls have generally been small (Figure1.16).

FIGURE 1.15

European countries with the largest average annual increases in area of forest during reporting periods

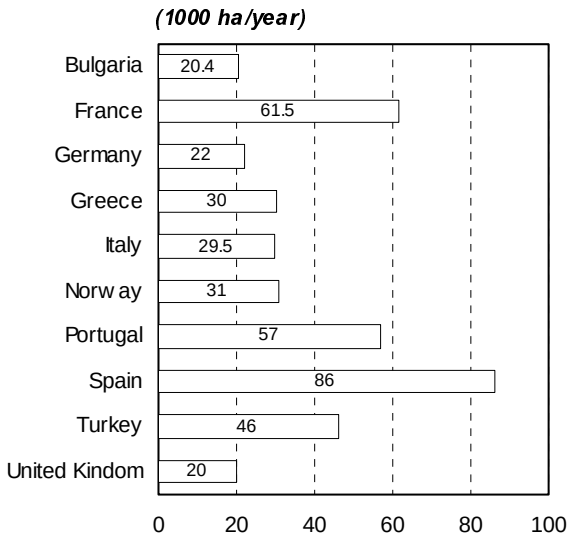
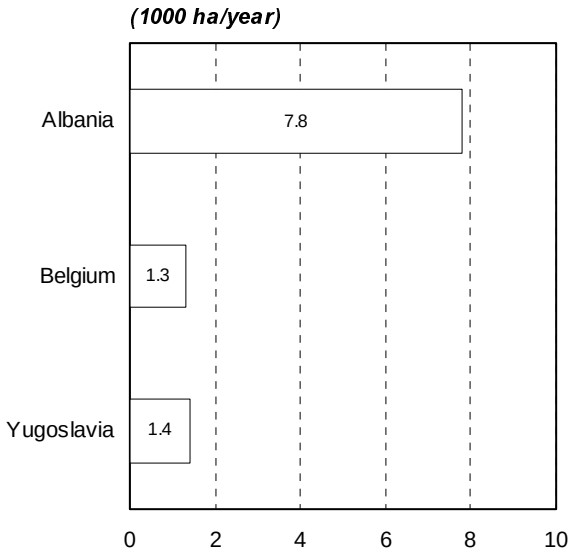


FIGURE 1.16

European countries with average annual decreases in area of forest during reporting periods



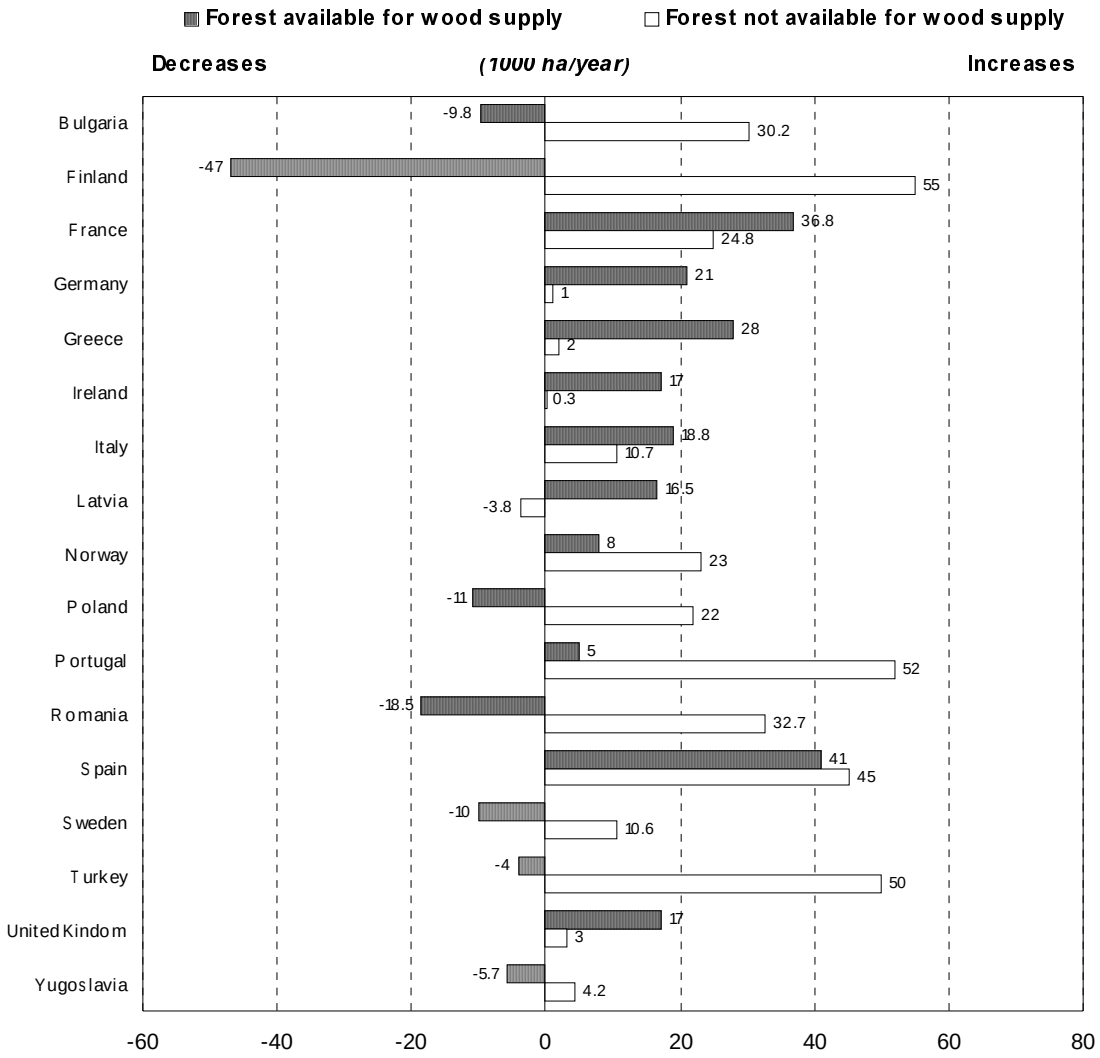
The USA and New Zealand also reported substantial increases in the area of forest, in the case of the USA partly offset by a declining area of other wooded land. In New Zealand a rising trend for other wooded land is attributable to natural colonization by trees of abandoned agricultural land. In Canada it is not possible to determine changes in the area of FOWL with the existing forest inventories, so it has been assumed that the area FOWL has remained constant since 1981. Japan reports a small increase in forest area. Australia was not able to make estimates of change.

In the Russian Federation the area of forest was reported to fall at an average annual rate of 1.1 million ha, while that of other wooded land rose by 1.6 million ha. Transfers have been occurring of State-owned forest to other authorities for non-forestry related purposes, such as the establishment of nature reserves (3.2 million ha) and land for construction. It is also possible that some of the considerable areas clear-felled in the past have not (yet) reverted to forest but only to what could be classified as other wooded land. At the same time, it would seem that areas of other (non-forest) land have either been naturally colonized or planted, for example as windbreaks. In other CIS countries the areas of both forest and other wooded land are reported to have been increasing, the most notable cases being in Belarus and Kazakhstan.

Main Table 8 shows the changes in areas of forest available and not available for wood supply. Given the increasing emphasis in many countries' policies towards non-wood services of the forest, such as nature conservation and protection, it could have been expected that these would be reflected in the respective changes in the areas of FAWS and FNAWS. Several European countries do indeed report an increasing trend in FNAWS, more or less offset by a decline in FAWS, including Finland, Poland, Romania and Sweden (Figure 1.17). In others, most of the increase was in FNAWS (Bulgaria, Norway, Portugal, Turkey). In France and Spain the increase was more evenly divided between the two. For the reporting countries of Europe in aggregate, the average annual increase in FNAWS was over 380,000 ha compared with one of about 110,000 for FAWS.

FIGURE 1.17

Average annual changes in forest available for wood supply and forest not available for wood supply in selected European countries during reporting periods



Summary and conclusions

A. Main findings

1. ***General.*** The total area of forest and other wooded land (FOWL) in the 55 TBFRA-2000 countries in the late 1990s was nearly 2.5 billion ha or somewhat less than half the total land area. Nearly half of the forest was classified as predominantly coniferous and nearly two thirds of it as available for wood supply. With the main exception of the Russian Federation, net changes in the area of FOWL have not been very large. More specifically:

2. ***Area of forest and other wooded land.*** The total area of forest and other wooded land (FOWL) in the late 1990s in the 55 countries covered by the TBFRA-2000 amounted to 2,478 million hectares. Of this, 1,682 million (68 per cent) were classified as forest and 795 million (32 per cent) as other wooded land. Thirty-eight percent of the total area of FOWL was located in the CIS countries, 29 per cent in North America, 25 per cent in "Other TBFRA" countries (Australia, Japan, New Zealand) and 9 per cent in Europe. There was on average about 1.9 ha per capita of FOWL, of which 1.3 ha/cap. of forest, the latter being about double the global average. At the country level, the range is very wide, from 31 ha of FOWL per capita in Australia and 14 ha/cap. in Canada to virtually nil in Malta. On average in the TBFRA area FOWL covered 46 per cent of the total land area, ranging from 76 per cent in Australia, 75 per cent in Finland and 74 per cent in Sweden to little more than 1 per cent in Iceland and Malta. Australia's area of other wooded land is remarkable in absolute terms (422 million ha), and for its share of Australia's total land area (55 per cent). It accounts for more than half the total of other wooded land in the TBFRA area.

3. ***Species composition and distribution.*** For the TBFRA countries in aggregate the species distribution in forest on an area basis was as follows: predominantly coniferous 47 per cent, predominantly broadleaved 26 per cent, mixed coniferous and broadleaved 27 per cent; with a small area (in Japan) of predominantly bamboos, palms, etc. About three quarters of the coniferous area lies in the northern boreal belt, while broadleaved or mixed forests predominate in the temperate areas of the northern and southern hemispheres.

4. ***Forest available and not available for wood supply.*** About 63 per cent of the total area of forest in the TBFRA countries is classified as available for wood supply (FAWS). The proportion of FAWS is high in Europe (85 per cent) and low in "Other TBFRA" (22 per cent). About 97 per cent of all FAWS is categorized as high forest;coppice and coppice with standards is of importance in some countries, mainly in southern Europe. Approximately 80 per cent of the total area of forest not available for wood supply (FNAWS) is considered to fall into this category for economic reasons and 20 per cent for conservation/protection reasons. The importance of the 'economic reasons' category is largely due to the figures for the Russian Federation and Canada with their vast areas of remote forest. For Europe as a whole nearly two-thirds of FNAWS come under 'conservation/protection reasons' and the USA and Japan put all their FNAWS into this category.

5. ***Changes in area over time.*** Because not all countries could provide data on changes and there are doubts about the consistency of data between countries, it is not possible to give an estimate of the average annual change in area of FOWL for the TBFRA countries as a whole. Data from reporting countries show an average annual increase in FOWL of about 1.95 million ha, of which over 600,000 ha in forest and over 1.3 million ha in OWL. The largest reported changes were in the Russian Federation with an average annual decline in the area of forest of 1.1 million ha and a rise in that of other wooded land of 1.6 million. For European countries in total the average annual increase in the area of forest is estimated at nearly 500,000 ha and a decrease in that of other wooded land of about 200,000, mainly due to conversion to forest. There were substantial increases in forest area in the USA and New Zealand; in Canada the area was assumed to remain more or less unchanged. From the available data, it is estimated that the average annual increase in the area of FNAWS in Europe was more than three times that of FAWS. Even though individual countries' trends were different, it appears that in many there was a transfer of areas of FAWS to FNAWS reflecting shifting policies in favour of non-wood goods and services, which was partly offset by afforestation and conversion of other wooded land to establish FAWS.

B. Conclusions

1. On the basis of a preliminary analysis of the data provided by countries for Main Tables 1 to 8 in this chapter, it appears that the quality of the statistics is generally good, meaning that the figures can be considered reliable and that there is mostly an acceptable level of comparability between countries. A partial exception to the reliability of data is that of change in area over time. National correspondents are to be warmly congratulated for the immense efforts they have made to achieve these satisfactory results. This has involved them sometimes in making certain assumptions, where 'hard' data were not available, in order to adjust data from the national inventories to fit into the TBFRA framework and definitions.

2. In reality, there is often no clear demarcation line between forest and other wooded land, nor between other wooded land and other (non-wooded) land, so that no definition of these categories is likely to be entirely satisfactory. Most countries, however, appear to have been able to report figures of the area of forest that conform with the TBFRA definition, although the change, compared with previous temperate region assessments, in the

minimum tree crown cover from 20 per cent to 10 per cent caused problems for a few. On the other hand, several countries, particularly but not only those outside Europe, have encountered problems in producing data on the area of other wooded land that conform to the TBFRA definition.

3. The introduction of the item 'mixed' (species composition) did not cause serious problems for most countries. One disadvantage of introducing the 'mixed' category is that it is no longer possible to derive data of growing stock and increment per hectare by species groups, only totals.

4. There are three reasonably distinct components of temperate and boreal forest and other wooded land: the boreal zone; the hotter, drier (Mediterranean-type) zone; and, in between, the cool, moist temperate zone. Each has its particular ecological characteristics. Internationally agreed definitions do not exist, which would allow data to be separated into these three categories.

5. It would seem that there were some inconsistencies between countries in the way that they interpreted the TBFRA definitions of forest available for wood supply and forest not available for wood supply, which reduces the possibility of making reliable inter-country comparisons. The same comment relates to the reasons for the non-availability of forest for wood supply. It has to be borne in mind that forest available for wood supply is in most instances also providing non-wood goods and services, which may to some extent limit its wood supply function. Conversely, forest not available for wood supply may, under particular circumstances, e.g. after fire or storm damage, be a source of wood. In some cases non-availability for wood supply may be for a combination of conservation/protection and economic reasons. The allocation of areas to 'not available for economic reasons' appears to be made at present often on a subjective and non-comparable basis.

6. Information on changes in area over time is one of the most important items needed by policy makers and managers, but for some TBFRA countries is still proving difficult to provide. This situation is likely to improve, provided the key definitions of forest and other wooded land remain unchanged between one assessment and the next. New technologies, notably remote sensing, should also contribute significantly to improve data in this area, and research needs to be actively pursued. They will not be able to answer all questions, however, for example changes in forest use, as distinct from forest cover, such as between forest available for, and not available for, wood supply.

7. Generally speaking, it appears that the terms and definitions agreed upon for use in the TBFRA-2000 enquiry, at least those figuring in this chapter, were satisfactory in the sense that most countries' data conformed to them or could be adjusted to them. In some cases the definitions may have been ambiguous or lacking in clarity. Refinements to these should be possible without jeopardizing the important principle of keeping changes to an absolute minimum in order to allow countries to have confidence in adapting national definitions to the international ones and to achieve comparability between one assessment and the next.

8. While the TBFRA-2000 has revealed that there are still areas in need of improvement so far as quality, comparability and consistency of data are concerned, even for some of the basic parameters, it is also clear that good progress has been made compared with previous assessments, thanks in large part to the excellent spirit of cooperation and support for the secretariat within the Team of Specialists and among the national correspondents.

TABLE 1

Overall land classification and population

Country	Reference period	Total area	Land area	Inland water	Forest and other wooded land	Forest	Other wooded land	Other land	Population
		(1000 ha)							(1000)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Albania ©	1995	2,875	2,759	115	1,030	1,030	0	1,729	3,119
Austria ©	1992-96	8,387	8,252	135	3,924	3,840	84	4,328	8,140
Belgium ©	1997	3,053	3,030	22	672	646	26	2,358	10,141
Bosnia and Herzegovina ©	1995	5,120	5,073	47	2,710	2,276	434	2,363	3,675
Bulgaria	1995	11,098	10,895	202	3,903	3,590	314	6,992	8,336
Croatia	1996	5,654	5,592	62	2,105	1,775 ①	330 ①	3,487	4,481
Cyprus ©	1996	925	916	9	280	117	163	636	771
Czech Republic ©	1995	7,887	7,728	159	2,630	2,630	0	5,098	10,282
Denmark ©	1990	4,309	4,239	70	538	445	93 ①	3,701	5,270
Estonia ©	1996	4,523	4,187	336	2,162	2,016	146	2,025	1,429
Finland ©	1991-96	33,814	30,454	3,360	22,768	21,883 ①	885 ①	7,686	5,154
France ©	1997	54,919	54,148	771	16,989	15,156 ①	1,833 ①	37,159	58,683
Germany ©	1987	35,702	34,613	1,089	10,740	10,740	0	23,873	82,133
Greece ©	1992	13,196	13,076	120	6,513	3,359	3,154	6,563	10,600
Hungary ©	1996	9,303	9,093	210	1,811	1,811 ①	0	7,282	10,116
Iceland ©	1998	10,295	9,024	1,271	130	30 ①	100 ①	8,894	276
Ireland	1996	7,029	6,890	139	591	591	0	6,299	3,681
Israel	1997	2,195	2,150	45	170	122	48	1,980	5,984
Italy ©	1995	30,132	29,412	720	10,842	9,857 ①	985 ①	18,570	57,369
Latvia ©	1997	6,459	6,222	237	2,995	2,884	111	3,227	2,424
Liechtenstein	1995	16	16	0	7	7	0.50	9	32
Lithuania ©	1996	6,530	6,267	263	2,050	1,978	72	4,217	3,694
Luxembourg	1994-97	259	258	1	89	86 ①	3 ①	169	422
Malta ©	1996	31.6	31.6	0	0.347	0.347	0	31	384
Netherlands ©	1992-96	3,735	3,388	347	339	339	0	3,049	15,678
Norway ©	1994-96	32,376	30,625	1,751	12,000	8,710 ①	3,290 ①	18,625	4,419
Poland ©	1992-96	31,268	30,435	833	8,942	8,942 ①	0 ①	21,493	38,718
Portugal ©	1995	9,204	9,105	99	3,467	3,383	84	5,638	9,869
Romania ©	1992-97	23,839	22,949	890	6,680	6,301	379	16,269	22,474
Slovakia ©	1996	4,903	4,810	93	2,031	2,016 ①	15 ①	2,779	5,377
Slovenia ©	1996	2,027	2,016	11	1,166	1,099 ①	67 ①	850	1,993
Spain ©	1990	50,596	50,055	541	25,984	13,509 ①	12,475 ①	24,071	39,628
Sweden ©	1992-96	45,218	40,843	4,375	30,259	27,264 ①	2,995 ①	10,584	8,875
Switzerland ©	1993-95	4,129	3,916	213	1,234	1,173	61	2,682	7,299
The FYR of Macedonia ©	1995	2,571	2,531	40	988	906	82	1,543	1,999
Turkey ©	1996	77,945	76,729	1,216	20,713	9,954	10,759	56,016	62,866
United Kingdom ©	1995	24,410	24,088	322	2,489	2,469 ①	20 ①	21,599	58,649
Yugoslavia	1995	10,217	10,112	105	3,480	2,894	586	6,632	10,635
Total: Europe		**586,149**	**565,930**	**20,219**	**215,422**	**175,829**	**39,593**	**350,508**	**585,075**
of which: EU 15		**323,963**	**311,852**	**12,111**	**136.204**	**113,567**	**22,637**	**175,648**	**374,292**
Armenia ©	1996	2,974	2,846	128	392	334 ①	58 ①	2,454	3,536
Azerbaijan	1988	8,642	8,342	300	990	936	54	7,352	7,669
Belarus ©	1994-97	20,760	20,285	475	8,936	7,865 ①	1,071 ①	11,349	10,315
Georgia ©	1995	6,970	6,831	139	2,988	2,988	0	3,843	5,059
Kazakhstan	1993	272,490	272,490	0	16,673	10,504	6,169	255,817	16,319
Kyrgyzstan ©	1995	19,850	19,700	150	797	729	68	18,903	4,643
Republic of Moldova ©	1997	3,385	3,309	75	355	324	31	2,954	4,378
Russian Federation ©	1993	1,709,761	1,637,733	72,028	886,538	816,538 ①	70,000 ①	751,195	147.434
Tajikistan ©	1995	14,310	14,270	40	730	400	330	13,540	6,015
Turkmenistan ©	1995	48,800	48,100	700	3,754	3,754	0	44,346	4,309
Ukraine	1996	60,355	57,936	2,419	9,494	9,458 ①	36 ①	48,442	50,861
Uzbekistan ©	1988	44,740	42,540	2,200	2,170	1,909	261	40,370	23,574
Total: CIS		**2,213,036**	**2,134,382**	**78,654**	**933,817**	**855,739**	**78,078**	**1,200,564**	**284,112**
Canada ©	1994	997,061	921,543	75,518	417,584	244,571	173,013	503,959	30,563
United States of America ©	1992	980,963	915,941	65,022	298,135	217,333	80,802	617,806	274,028
Total: North America		**1,978,024**	**1,837,484**	**140,540**	**715,719**	**461,904**	**253,815**	**1,121,765**	**304,591**
Australia ©	1990-94	768,230	760,926	7,304	578,467	156,877 ①	421,590 ①	182,459	18,709
Japan ©	1995	37,780	36,460	1,320	25,146	24,064	1,082	11,314	126,281
New Zealand ©	1996	27,574	27,053	521	9,040	7,940	1,100	18,013	3,796
Total: Other TBFRA		**833,584**	**824,439**	**9,145**	**612,653**	**188,881**	**423,772**	**211,786**	**148,786**
Grand total		**5,610,792**	**5,362,234**	**248,558**	**2,477,611**	**1,682,353**	**795,258**	**2,884,623**	**1,322,564**

© See notes and comments in Chapter I.

① Adjustment to achieve conformity with TBFRA definitions carried out by the National Correspondent.

Source: for the Population data: ***World Population Prospects, the 1998 Revision*** (ESA/P/WP.150, 24 November 1998), United Nations, Department of Economic and Social Affairs, Population Division, Table A.16 "Annual interpolated mid-year population by major area, region and Country: 1995-2015".

Note: Population data for Turkey and Australia are National data.

TABLE 2

Forest and other wooded land: comparative data

Country	Total land/ capita	Forest and OWL		Forest			Other wooded land	
		Per cent of land area	Forest and OWL/capita	Per cent of land area	Per cent of forest and OWL	Forest/ capita	Per cent of land area	OWL/ capita
	(ha/cap)	(Per cent)	(ha/cap)	(Per cent)		(ha/cap)	(Per cent)	(ha/cap)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania	0.88	37.3	0.33	37.3	100.0	0.33	0.0	0.00
Austria	1.01	47.6	0.48	46.5	97.9	0.47	1.0	0.01
Belgium	0.30	22.2	0.07	21.3	96.1	0.06	0.9	0.00
Bosnia and Herzegovina	1.38	53.4	0.74	44.9	84.0	0.62	8.5	0.12
Bulgaria	1.31	35.8	0.47	32.9	92.0	0.43	2.9	0.04
Croatia	1.25	37.6	0.47	31.7	84.3	0.40	5.9	0.07
Cyprus	1.19	30.6	0.36	12.8	41.8	0.15	17.8	0.21
Czech Republic	0.75	34.0	0.26	34.0	100.0	0.26	0.0	0.00
Denmark	0.80	12.7	0.10	10.5	82.7	0.08	2.2	0.02
Estonia	2.93	51.6	1.51	48.1	93.2	1.41	3.5	0.10
Finland	5.91	74.8	4.42	71.9	96.1	4.25	2.9	0.17
France	0.92	31.4	0.29	28.0	89.2	0.26	3.4	0.03
Germany	0.42	31.0	0.13	31.0	100.0	0.13	0.0	0.00
Greece	1.23	49.8	0.61	25.7	51.6	0.32	24.1	0.30
Hungary	0.90	19.9	0.18	19.9	100.0	0.18	0.0	0.00
Iceland	32.70	1.4	0.47	0.3	23.1	0.11	1.1	0.36
Ireland	1.87	8.6	0.16	8.6	100.0	0.16	0.0	0.00
Israel	0.36	7.9	0.03	5.7	71.8	0.02	2.2	0.01
Italy	0.51	36.9	0.19	33.5	90.9	0.17	3.3	0.02
Latvia	2.57	48.1	1.24	46.4	96.3	1.19	1.8	0.05
Liechtenstein	0.50	46.3	0.23	43.1	93.2	0.22	3.1	0.02
Lithuania	1.70	32.7	0.55	31.6	96.5	0.54	1.1	0.02
Luxembourg	0.61	34.4	0.21	33.3	96.8	0.20	1.1	0.01
Malta	0.08	1.1	0.001	1.1	100.0	0.001	0.0	0.00
Netherlands	0.22	10.0	0.02	10.0	100.0	0.02	0.0	0.00
Norway	6.93	39.2	2.72	28.4	72.6	1.97	10.7	0.74
Poland	0.79	29.4	0.23	29.4	100.0	0.23	0.0	0.00
Portugal	0.92	38.1	0.35	37.2	97.6	0.34	0.9	0.01
Romania	1.02	29.1	0.30	27.5	94.3	0.28	1.7	0.02
Slovakia	0.89	42.2	0.38	41.9	99.3	0.37	0.3	0.00
Slovenia	1.01	57.8	0.59	54.5	94.3	0.55	3.3	0.03
Spain	1.26	51.9	0.66	27.0	52.0	0.34	24.9	0.31
Sweden	4.60	74.1	3.41	66.8	90.1	3.07	7.3	0.34
Switzerland	0.54	31.5	0.17	30.0	95.1	0.16	1.6	0.01
The FYR of Macedonia	1.27	39.0	0.49	35.8	91.7	0.45	3.2	0.04
Turkey	1.22	27.0	0.33	13.0	48.1	0.16	14.0	0.17
United Kingdom	0.41	10.3	0.04	10.2	99.2	0.04	0.1	0.00
Yugoslavia	0.95	34.4	0.33	28.6	83.2	0.27	5.8	0.06
Total: Europe	**0.97**	**38.1**	**0.37**	**31.1**	**81.6**	**0.3**	**7.0**	**0.07**
of which: EU 15	**0.83**	**43.7**	**0.36**	**36.4**	**83.4**	**0.3**	**7.3**	**0.06**
Armenia	0.80	13.8	0.11	11.7	85.2	0.09	2.0	0.02
Azerbaijan	1.09	11.9	0.13	11.2	94.5	0.12	0.6	0.01
Belarus	1.97	44.1	0.87	38.8	88.0	0.76	5.3	0.10
Georgia	1.35	43.7	0.59	43.7	100.0	0.59	0.0	0.00
Kazakhstan	16.70	6.1	1.02	3.9	63.0	0.64	2.3	0.38
Kyrgyzstan	4.24	4.0	0.17	3.7	91.5	0.16	0.3	0.01
Republic of Moldova	0.76	10.7	0.08	9.8	91.3	0.07	0.9	0.01
Russian Federation	11.11	54.1	6.01	49.9	92.1	5.54	4.3	0.47
Tajikistan	2.37	5.1	0.12	2.8	54.8	0.07	2.3	0.05
Turkmenistan	11.16	7.8	0.87	7.8	100.0	0.87	0.0	0.00
Ukraine	1.14	16.4	0.19	16.3	99.6	0.19	0.1	0.00
Uzbekistan	1.80	5.1	0.09	4.5	88.0	0.08	0.6	0.01
Total: CIS	**7.51**	**43.8**	**3.29**	**40.1**	**91.6**	**3.01**	**3.7**	**0.27**
Canada	30.15	45.3	13.66	26.5	58.6	8.00	18.8	5.66
United States of America	3.34	32.5	1.09	23.7	72.9	0.79	8.8	0.29
Total: North America	**6.03**	**39.0**	**2.35**	**25.1**	**64.5**	**1.52**	**13.8**	**0.83**
Australia	40.67	76.0	30.92	20.6	27.1	8.39	55.4	22.53
Japan	0.29	69.0	0.20	66.0	95.7	0.19	3.0	0.01
New Zealand	7.13	33.4	2.38	29.3	87.8	2.09	4.1	0.29
Total: Other TBFRA	**5.54**	**74.3**	**4.12**	**22.9**	**30.8**	**1.3**	**51.4**	**2.85**
Grand total	**4.05**	**46.2**	**1.87**	**31.4**	**67.9**	**1.3**	**14.8**	**0.60**

TABLE 3

Forest and other wooded land by species groups

Country	Reference period	Forest				Other wooded land			
		Predominantly coniferous	Predominantly broadleaved	Predominantly bamboos, palms, etc.	Mixed	Predominantly coniferous	Predominantly broadleaved	Predominantly bamboos, palms, etc.	Mixed
		(1000 ha)				(1000 ha)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Albania ©	1995	146	607	0	278	0	0	0	0
Austria	1992-96	2'613	470	0	757	84	0	0	0
Belgium ©	1997	273	322	0	51	0	25	0	2
Bosnia and Herzegovina ©	1995								
Bulgaria	1995	793	2,421	0	376	150	163	0	0
Croatia	1996	168	1,448	0	159	0	330	0	0
Cyprus	1996	116	1	0	0	0	0	0	163
Czech Republic ©	1995	820	346	0	1,464	0	0	0	0
Denmark ©	1990	168 ①	111 ①	0 ①	166 ①			0	
Estonia	1996	788 ①	416 ①	0 ①	812 ①	29	80	0	37
Finland ©	1991-96	17,596	1,692	0	2,595	762	123	0	0
France ©	1997	4,124	9,667	0	1,365	92	1,649	0	92
Germany ©	1997	6,052	2,715	0	1,973	0	0	0	0
Greece ©	1992	1,429	1,930	0	0	0	3,154	0	0
Hungary ©	1996	207 ①	1,416 ①	0	188 ①	0	0	0	0
Iceland	1998	10 ①	18 ①	0 ①	2	0	100	0	0
Ireland	1996	496	85	0	10	0	0	0	0
Israel	1997	67	55	0	0	0	48	0	0
Italy	1995	2,094 ①	7,071 ①	0 ①	692 ①	209	707	0	69
Latvia	1997	1,127	534	0	1,223	0	111	0	0
Liechtenstein	1995	3.0	2.10	0	1.80	0.20	0.20	0	0.10
Lithuania	1996	914	678	0	386	6	39	0	27
Luxembourg	1994	31 ①	53 ①	0 ①	2 ①	0	3	0	0
Malta	1996	0	0	0	0.347	0	0	0	0
Netherlands ©	1992-96	143	146	0	50	0	0	0	0
Norway ©	1994-96	4,930	1,962	0	1,818	702	2,407	0	181
Poland ©	1992-96	5,955 ①	1,377 ①	0	1,610 ①	0	0	0	0
Portugal	1995	911	2,031	0	441	0	39	0	45
Romania ©	1990-97	1,909	4,392	0	0	0	379	0	0
Slovakia ©	1996	621 ①	960 ①	0 ①	435 ①	2	8	0	5
Slovenia ©	1996	329 ①	413 ①	0	357 ①	29	30	0	8
Spain	1990	5,879 ①	5,123 ①	0 ①	2,507 ①	3,743	7,484	0	1,248
Sweden ©	1992-96	21,452	1,599	0	4,213	2,077	412	0	506
Switzerland ©	1997	671	269	0	233	15	38	0	8
The FYR of Macedonia ©	1995								
Turkey ©	1996	6,492	3,462	0	0	4,617	6,142	0	0
United Kingdom ©	1995	1,500 ①	800 ①	0	169	0	20	0	0
Yugoslavia ©	1995	212	2,511	0	171	43	507	0	35
Total: Europe									
of which: EU 15		**64,761**	**33,816**	**0**	**14,990**			**0**	
Armenia	1996	308	26	0	0	10	32	0	16
Azerbaijan ©	1988	14	922	0	0	7	47	0	0
Belarus	1994-97	3,046 ①	1,751 ①	0 ①	3,067 ①	108	854	0	110
Georgia ©	1995								
Kazakhstan	1993	1,742	1,320	0	7,442	438	113	0	5,618
Kyrgyzstan ©	1988	280	449	0	0	0	68	0	0
Republic of Moldova	1997	4	320	0	0	0	31	0	0
Russian Federation ©	1993	416,434 ①	66,912 ①	0 ①	333,192 ①	41,000	29,000	0	0
Tajikistan ©	1995	150	250	0	0	100	230	0	0
Turkmenistan ©	1995	225	3,529	0	0	0	0	0	0
Ukraine	1996	3,711	4,745	0	1,002	7	29	0	0
Uzbekistan ©	1988	200	1,709	0	0				
Total: CIS									
Canada ©	1994	153,533 ①	38,007 ①	0 ①	53,031 ①	107,000	28,000	0	38,013
United States of America ©	1992	98,253	94,506	0	24,574	61,360	19,158	0	284
Total: North America		**251,786**	**132,513**	**0**	**77,605**	**168,360**	**47,158**	**0**	**38,297**
Australia ©	1990-94	1,751	155,127	0	0				
Japan	1995	11,963 ①	10,158 ①	152 ①	1,788 ①				
New Zealand ©	1996	2,035	2,891	0	3,014	0	0	0	1'100
Total: Other TBFRA		**15,749**	**168,176**	**152**	**4,802**				
Grand total									

© See notes and comments in Chapter I.
① Adjustment to achieve conformity with TBFRA definitions carried out by the National Correspondent.

TABLE 4

Forest and other wooded land by species groups: comparative data

Country	Reference period	Per cent of forest				Per cent of other wooded land			
		Predominantly coniferous	Predominantly broadleaved	Predominantly bamboos, palms, etc.	Mixed	Predominantly coniferous	Predominantly broadleaved	Predominantly bamboos, palms, etc.	Mixed
		(Per cent)				(Per cent)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Albania	1995	14.1	58.9	0.0	27.0				
Austria	1992-96	68.0	12.2	0.0	19.7	100.0	0.0	0.0	0.0
Belgium	1997	42.3	49.8	0.0	7.9	0.0	94.2	0.0	5.8
Bosnia and Herzegovina	1995								
Bulgaria	1995	22.1	67.4	0.0	10.5	47.9	52.1	0.0	0.0
Croatia	1996	9.5	81.6	0.0	9.0	0.0	100.0	0.0	0.0
Cyprus	1996	99.1	0.9	0.0	0.0	0.0	0.0	0.0	100.0
Czech Republic	1995	31.2	13.2	0.0	55.7				
Denmark	1990	37.8	25.0	0.0	37.2			0.0	
Estonia	1996	39.1	20.6	0.0	40.3	19.9	54.8	0.0	25.3
Finland	1991-96	80.4	7.7	0.0	11.9	86.1	13.9	0.0	0.0
France	1997	27.2	63.8	0.0	9.0	5.0	90.0	0.0	5.0
Germany	1997	56.4	25.3	0.0	18.4				
Greece	1992	42.5	57.5	0.0	0.0	0.0	100.0	0.0	0.0
Hungary	1996	11.4	78.2	0.0	10.4				
Iceland	1998	33.3	60.0	0.0	6.7	0.0	100.0	0.0	0.0
Ireland	1996	83.9	14.4	0.0	1.7				
Israel	1997	54.9	45.1	0.0	0.0	0.0	100.0	0.0	0.0
Italy	1995	21.2	71.7	0.0	7.0	21.2	71.8	0.0	7.0
Latvia	1997	39.1	18.5	0.0	42.4	0.0	100.0	0.0	0.0
Liechtenstein	1995	43.5	30.4	0.0	26.1	40.0	40.0	0.0	20.0
Lithuania	1996	46.2	34.3	0.0	19.5	8.3	54.2	0.0	37.5
Luxembourg	1994	36.0	62.0	0.0	2.0	0.0	100.0	0.0	0.0
Malta	1996	0.0	0.0	0.0	100.0				
Netherlands	1992-96	42.2	43.1	0.0	14.7				
Norway	1994-96	56.6	22.5	0.0	20.9	21.3	73.2	0.0	5.5
Poland	1992-96	66.6	15.4	0.0	18.0				
Portugal	1995	26.9	60.0	0.0	13.0	0.0	46.4	0.0	53.6
Romania	1990-97	30.3	69.7	0.0	0.0	0.0	100.0	0.0	0.0
Slovakia	1996	30.8	47.6	0.0	21.6	13.3	53.3	0.0	33.3
Slovenia	1996	29.9	37.6	0.0	32.5	43.3	44.8	0.0	11.9
Spain	1990	43.5	37.9	0.0	18.6	30.0	60.0	0.0	10.0
Sweden	1992-96	78.7	5.9	0.0	15.5	69.3	13.8	0.0	16.9
Switzerland	1997	57.2	22.9	0.0	19.9	24.6	62.3	0.0	13.1
The FYR of Macedonia	1995								
Turkey	1996	65.2	34.8	0.0	0.0	42.9	57.1	0.0	0.0
United Kingdom	1995	60.8	32.4	0.0	6.8	0.0	100.0	0.0	0.0
Yugoslavia	1995	7.3	86.8	0.0	5.9	7.4	86.6	0.0	6.0
Total: Europe									
of which: EU 15		**36.8**	**19.2**	**0.0**	**8.5**				
Armenia	1996	92.2	7.8	0.0	0.0	17.2	55.2	0.0	27.6
Azerbaijan	1988	1.5	98.5	0.0	0.0	13.3	86.7	0.0	0.0
Belarus	1994-97	38.7	22.3	0.0	39.0	10.1	79.7	0.0	10.2
Georgia	1995								
Kazakhstan	1993	16.6	12.6	0.0	70.8	7.1	1.8	0.0	91.1
Kyrgyzstan	1988	38.4	61.6	0.0	0.0	0.0	100.0	0.0	0.0
Republic of Moldova	1997	1.1	98.9	0.0	0.0	0.0	100.0	0.0	0.0
Russian Federation	1993	51.0	8.2	0.0	40.8	58.6	41.4	0.0	0.0
Tajikistan	1995	37.5	62.5	0.0	0.0	30.3	69.7	0.0	0.0
Turkmenistan	1995	6.0	94.0	0.0	0.0				
Ukraine	1996	39.2	50.2	0.0	10.6	19.4	80.6	0.0	0.0
Uzbekistan	1988	10.5	89.5	0.0	0.0				
Total: CIS									
Canada	1994	62.8	15.5	0.0	21.7	61.8	16.2	0.0	22.0
United States of America	1992	45.2	43.5	0.0	11.3	75.9	23.7	0.0	0.4
Total: North America		**54.5**	**28.7**	**0.0**	**16.8**	**36.4**	**10.2**	**0.0**	**8.3**
Australia	1990-94	1.1	98.9	0.0	0.0				
Japan	1995	49.7	42.2	0.6	7.4				
New Zealand	1996	25.6	36.4	0.0	38.0	0.0	0.0	0.0	100.0
Total: Other TBFRA		**8.3**	**89.0**	**0.1**	**2.5**				
Grand total									

TABLE 5

Forest available for wood supply by species groups and silvicultural categories

Country	Reference period	Forest available for wood supply		By species groups				By silvicultural categories		
		Total	Per cent of total forest area	Predominantly coniferous	Predominantly broadleaved	Predominantly bamboos palms, etc.	Mixed	High forest	High forest as per cent of total FAWS	Coppice & coppice with standards
		(1000 ha)	(Per cent)	(1000 ha)				(1000 ha)	(Per cent)	(1000 ha)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Albania ©	1995	902	87.6	127	537	0	239	404	44.8	498
Austria	1992-96	3,352	87.3	2,125	470	0	757	3,256	97.1	96
Belgium ©	1997	639	99.0	272	317	0	50	556	87.0	83
Bosnia and Herzegovina ©	1995	1,305	57.3							
Bulgaria	1995	3,124	87.0	746	2,029	0	349	1,868	59.8	1,255
Croatia	1996	1,690	95.2	149	1,399	0	142	1,198	70.9	492
Cyprus	1996	43	36.9	43	0	0	0	43	100.0	0
Czech Republic ©	1995	2,559	97.3	786	340	0	1,433	2,555	99.8	4
Denmark ©	1990	440	98.9	168	106	0	166	438	99.5	2
Estonia	1996	1,932	95.8	746	401	0	785	1,932 ①	100.0	0 ①
Finland ©	1991-96	20,675	94.5	16,810	1,324	0	2,541	20,675 ①	100.0	0 ①
France ©	1997	14,470	95.5	3,992	9,194	0	1,284	7,648	52.9	6,822
Germany ©	1987	10,142	94.4	5,852	2,515	0	1,775			
Greece ©	1992	3,094	92.1	1,315	1,779	0	0	1,000	32.3	2,094
Hungary ©	1996	1,702	94.0	201	1,340	0	161	1,201 ①	70.6	501 ①
Iceland	1998	14	46.7	8	5	0	1	14 ①	100.0	0 ①
Ireland	1996	580	98.1	492	78	0	10	580	100.0	0
Israel ©	1997	70	57.4	40	30	0	0	40	57.1	30
Italy	1995	6,013	61.0	1,278	4,313	0	422	2,616 ①	43.5	3,397 ①
Latvia	1997	2,413	83.7	907	458	0	1,048	2,413	100.0	0
Liechtenstein	1995	4	58.0	2	1	0	2	4	100.0	0
Lithuania	1996	1,686	85.2	752	594	0	340	1,686	100.0	0
Luxembourg	1994	86	100.0	31	53	0	2	73	84.6	13
Malta	1996	0	0.0	0	0	0	0	0		0
Netherlands ©	1992-96	314	92.6	134	131	0	49	308	98.1	6
Norway ©	1994-96	6,609	75.9	4,103	1,085	0	1,421	6,609	100.0	0
Poland ©	1992-96	8,300	92.8	5,528	1,278	0	1,494	8,300	100.0	0
Portugal	1995	1,897	56.1	849	704	0	344	1,201	63.3	696
Romania ©	1990	5,617	89.1	1,702	3,915	0	0	5,248	93.4	369
Slovakia ©	1996	1,706	84.6	488	846	0	372	1,647 ①	96.5	59
Slovenia ©	1996	1,035	94.2	310	389	0	336	925 ①	89.4	110 ①
Spain	1990	10,479	77.6	4,452	4,366	0	1,661	8,845 ①	84.4	1,634 ①
Sweden ©	1992-96	21,236	77.9	17,378	887	0	2,971	21,220	99.9	16
Switzerland ©	1993-95	1,060	90.4	597	245	0	218	980	92.5	80
The FYR of Macedonia ©	1995	745	82.2							
Turkey ©	1996	8,635	86.7	5,547	3,088	0	0	6,911	80.0	1,724
United Kingdom ©	1995	2,108	85.4	1,454	518	0	136	2,088	99.1	20 ①
Yugoslavia ©	1995	2,379	82.2	187	2,038	0	154	1,172	49.2	1,207
Total: Europe		**149,056**	**84.8**							
of which: EU 15		**95,525**	**84.1**	**56,603**	**26,755**	**0**	**12,167**			
Armenia	1996	21	6.3	0	21	0	0	21	100.0	0
Azerbaijan ©	1988	153	16.3	0	153	0	0	141	92.2	12
Belarus	1994	5,966	75.9	2,309	1,330	0	2,327	5,071 ①	85.0	895 ①
Georgia ©	1995	591	19.8	118	473	0	0	527	89.3	63
Kazakhstan	1993	4,933	47.0	1,428	1,207	0	2,298	3,607	73.1	1,326
Kyrgyzstan ©	1988	0	0.0	0	0	0	0			
Republic of Moldova	1997	211	65.1	4	207	0	0	55 ①	25.8	156 ①
Russian Federation ©	1993	525,191	64.3	267,847	42,016	0	215,328	516,391	98.3	8,800
Tajikistan ©	1995	0	0.0	0	0	0	0	0		0
Turkmenistan ©	1995	3,650	97.2	219	3,431	0	0			
Ukraine	1996	5,999	63.4	2,455	2,797	0	747	4,608 ①	76.8	1,391 ①
Uzbekistan ©	1988	0	0.0	0	0	0	0			
Total: CIS		**546,714**	**63.9**	**274,379**	**51,635**	**0**	**220,700**			
Canada ©	1994	125,863	51.5	68,114	28,098	0	29,651	125,863 ①	100.0	0 ①
United States of America ©	1992	198,123	91.2	84,322	89,462	0	24,339	198,123	100.0	0
Total: North America		**323,986**	**70.1**	**152,436**	**117,560**	**0**	**53,990**	**323,986**	**100.0**	**0**
Australia ©	1990-94	16,438	10.5	1721	14,717	0	0	16,438	100.0	0
Japan	1995	23,276	96.7					23,226 ①	99.8	56 ①
New Zealand ©	1996	1,851	23.3	1,517	128	0	206	1,851	100.0	0
Total: Other TBFRA		**41,565**	**22.0**					**41,515**	**99.9**	**56**
Grand total		**1,061,321**	**63.1**							

© See notes and comments in Chapter I.

① Adjustment to achieve conformity with TBFRA definitions carried out by the National Correspondent.

TABLE 6

Forest not available for wood supply by species groups, silvicultural categories and reasons for non-availability

Country	Reference period	Forest not available for wood supply		By species groups				By silvicultural categories		By reasons for non-availability	
		Total	Per cent of total forest area	Predominantly coniferous	Predominantly broadleaved	Predominantly bamboos, palms, etc.	Mixed	High Forest	Coppice & coppice with standards	For conservation/ protection reasons	For economic reasons
		(1000 ha)	Per cent	(1000 ha)				(1000 ha)		(1000 ha)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Albania ©	1995	128	12.4	19	70	0	39	67	61	29	99
Austria	1992-96	488	12.7	488	0	0	0	488	0	488	0
Belgium ©	1997	7	1.0	1	5	0	1	3	3	7	0
Bosnia and Herzegovina ©	1995	971	42.7								
Bulgaria	1995	466	13.0	47	392	0	27	375	91	265	201
Croatia	1996	85	4.8	19	49	0	17	65	20	85	0
Cyprus	1996	74	63.1	73	1	0	0	73	1	11	63
Czech Republic ©	1995	71	2.7	34	6	0	31	71	0	71	0
Denmark ©	1990	5	1.1	0	5	0	0	5	0	5	0
Estonia	1996	84	4.2	42	15	0	27	84	0	61	23
Finland ©	1991-96	1,208	5.5	786	368	0	54	1,208	0	1,208	0
France ©	1997	686	4.5	132	473	0	81	686	0	0	686
Germany ©	1987	598	5.6	200	200	0	198			83	515
Greece ©	1992	265	7.9	114	151	0	0	165	100	142	123
Hungary ©	1996	109	6.0	6	76	0	27	57	52	68	41
Iceland	1998	16	53.3	2	13	0	1	16	0	2	14
Ireland	1996	11	1.9	4	7	0	0	11	0	6	5
Israel	1997	52	42.6	27	25	0	0	2	50	10	42
Italy	1995	3,844	39.0	816	2,758	0	270	2,052	1,792	1,855	1,989
Latvia	1997	471	16.3	220	76	0	175	471	0	471	0
Liechtenstein	1995	2.90	42.0	1.40	1.20	0	0.30	2.1	0.8	1.5	1.4
Lithuania	1996	292	14.8	162	84	0	46	292	0	249	43
Luxembourg	1994	0	0.0	0	0	0	0	0	0	0	0
Malta	1996	0.347	100.0	0	0	0	0.347	0.347	0	0.347	0
Netherlands ©	1992-96	25	7.4	9	15	0	1	25	0	3	22
Norway ©	1994-96	2,101	24.1	827	877	0	397	2,101	0	114	1,987
Poland ©	1992-96	642	7.2	427	99	0	116	642	0	398	244
Portugal	1995	1,486	43.9	62	1,327	0	97	1,485	1	76	1,410
Romania ©	1990	684	10.9	207	477	0	0	0	0		
Slovakia ©	1996	310	15.4	133	114	0	63	306	4	310	0
Slovenia ©	1996	64	5.8	19	24	0	21	54	10	52	12
Spain	1990	3,030	22.4	1,427	757	0	846	1,211	1,819	2,727	303
Sweden ©	1992-96	6,028	22.1	4,074	712	0	1,242	6,028	0	5,180	848
Switzerland ©	1993-95	113	9.6	74	24	0	15	107	4	7	106
The FYR of Macedonia ©	1995	161	17.8								
Turkey ©	1996	1,319	13.3	945	374	0	0	1,250	69	1,319	0
United Kingdom ©	1995	361	14.6	46	282	0	33	361	0	75	286
Yugoslavia ©	1995	515	17.8	25	473	0	17	118	397	515	
Total: Europe		**26,773**	**15.2**								
of which: EU 15		**18,042**	**15.9**	**8,159**	**7,060**	**0**	**2,823**			**11,855**	**6,187**
Armenia	1996	313	93.7	308	5	0	0	203	110	102	211
Azerbaijan ©	1988	783	83.7	14	769	0	0	743	40	633	150
Belarus	1994	1,899	24.1	738	421	0	741	1,614	285	1,719	180
Georgia ©	1995	2,398	80.2								
Kazakhstan	1993	5,571	53.0	314	113	0	5,144	1,964	3,607	590	4,981
Kyrgyzstan ©	1988	729	100.0	280	449	0	0			600	129
Republic of Moldova	1997	113	34.9	0	113	0	0	40	74		
Russian Federation ©	1993	291,347	35.7	148,587	24,896	0	117,864	280,847	10,500	23,691	267,656
Tajikistan ©	1995	400	100.0	150	250	0	0	210	190	360	40
Turkmenistan ©	1995	104	2.8	6	98	0	0			104	0
Ukraine	1996	3,459	36.6	1,256	1,948	0	255	2,194	1,265	3,445	14
Uzbekistan ©	1988	1,909	100.0	200	1,709	0	0				
Total: CIS		**309,025**	**36.1**								
Canada ©	1994	118,708	48.5	85,419	9,909	0	23,380	118,708	0	19,664	99,044
United States of America ©	1992	19,210	8.8	13,931	5,044	0	235	19,210	0	19,210	0
Total: North America		**137,918**	**29.9**	**99,350**	**14,953**	**0**	**23,615**	**137,918**	**0**	**38,874**	**99,044**
Australia ©	1990-94	140,439	89.5	30	140,410	0	0				
Japan	1995	788	3.3							788	0
New Zealand ©	1996	6,089	76.7	518	2,763	0	2,808	6,089	0	5,573	516
Total: Other TBFRA		**147,316**	**78.0**								
Grand total		**621,032**	**36.9**								

© See notes and comments in Chapter I.

TABLE 7

Changes over time in area of forest and other wooded land

Country	Reference period 1	Reference period 2	Forest			Other wooded land		
			Period 1	Period 2	Average annual change	Period 1	Period 2	Average annual change
			(1000 ha)		(±1000 ha)	(1000 ha)		(±1000 ha)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	1957	1995	1,328	1,030	-7.80	0	0	0.00
Austria ©	1986-90	1992-96	3,794	3,840	7.70	84	84	0.00
Belgium	1982	1997	665	646	-1.26	25	26	0.10
Bosnia and Herzegovina ©	1990	1995	2,276	2,276	0.00	434	434	0.00
Bulgaria	1985	1995	3,386	3,590	20.38	298	314	1.60
Croatia	1986	1996	1,758	1,775	2.00	333	330	-0.10
Cyprus	1980-90	1990-98	117	117	0.00	163	163	0.00
Czech Republic ©	1986	1995	2,625	2,630	0.50	0	0	0.00
Denmark ©	1976	1990	434	445	0.98	85	113	2.00
Estonia	1988	1996	1,916	2,016	12.50	102	146	5.50
Finland	1980-89	1991-96	21,805	21,883	8.00	1,085	885	-20.00
France ©	1987	1997	14,540	15,156	61.60	2,015	1,833	-18.20
Germany ©	1961	1987	10,162	10,740	22.00	0	0	0.00
Greece ©	1964	1992	2,512	3,359	30.00	3,960	3,154	-29.00
Hungary ©	1990	1996	1,768	1,811	7.20	0	0	0.00
Iceland ©	1990	1998	25	30	0.60	100	100	0.00
Ireland	1987	1996	421	591	17.00	0	0	0.00
Israel ©	1990	1997	82	122	5.00	25	48	2.90
Italy ©	1980	1995	9,415	9,857	29.50	1,427	985	-29.50
Latvia	1988	1997	2,757	2,884	12.70	143	111	-3.20
Liechtenstein	1975	1995	5.30	6.90	0.08	0.50	0.50	0.00
Lithuania	1987	1996	1,930	1,978	4.80	64	72	0.80
Luxembourg	1994	1997	86	86	0.00	3	3	0.00
Malta	1993	1996-1996	0.347	0.347	0.00	0	0	0.00
Netherlands ©	1988-92	1992-96	334	339	1.00	0	0	0.00
Norway ©	1980-86	1994-96	8,300	8,710	31.00	3,100	3,290	15.00
Poland ©	1987-91	1992-96	8,886	8,942	11.00	0	0	0.00
Portugal ©	1985	1995	2,814	3,383	57.00	389	84	-31.00
Romania ©	1955	1990	5,772	6,301	14.70			
Slovakia ©	1988	1996	1,961	2,016	6.88	15	15	0.00
Slovenia ©	1986	1996	1,077	1,099	2.20	67	67	0.00
Spain	1970	1990	11,786	13,509	86.00	13,830	12,475	-68.00
Sweden ©	1985-89	1992-96	27,260	27,264	0.60	2,975	2,995	2.90
Switzerland	1983-85	1993-95	1,130	1,173	4.30	56	61	0.50
The FYR of Macedonia ©	1990	1995	906	906	0.00		82	
Turkey	1963 72	1973-96	8,856	9,954	46.00	11,343	10,759	-24.00
United Kingdom ©	1980	1995	2,174	2,469	20.00	20	20	0.00
Yugoslavia	1979	1995	2,918	2,894	-1.45		586	
Total: Europe					**512.71**			**-191.70**
of which: EU 15					**340.12**			
Armenia	1983	1996	292	334	4.20	35	58	2.30
Azerbaijan ©	1983	1988	870	936	13.00	52	54	0.40
Belarus	1988	1994	6,327	7,865	256.20	857	1,071	35.60
Georgia ©	1990	1995	2,988	2,988	0.00	0	0	0.00
Kazakhstan	1988	1993	9,310	10,504	239.00	5,787	6,169	76.00
Kyrgyzstan ©	1988	1993	729	843 ②	22.80	68	68	0.00
Republic of Moldova	1988	1997	318	324	0.65	31	31	0.00
Russian Federation ©	1988	1993	821,988	816,538	-1,090.00	62,105	70,000	1,579.00
Tajikistan ©	1988	1995	386	400	2.00	330	330	0.00
Turkmenistan ©	1990	1995	3,754	3,754	0.00	0	0	0.00
Ukraine	1988	1996	9,213	9,458	31.00	35	36	0.10
Uzbekistan ©	1988	1995	1,909	1,946 ②	4.58	261		
Total: CIS			**858,085**	**855,890**	**-516.57**	**69,561**		**1,693.40**
Canada ©	1980	1994	244,571	244,571	0.00	173,013	173,013	0.00
United States of America ©	1987	1992	214,391	217,333	588.00	81,597	80,802	-159.00
Total: North America					**588.00**			**-159.00**
Australia ©		1994		156,877			421,590	
Japan ©	1986	1995	24,033	24,064	3.40	1,222	1,214	-0.90
New Zealand ©	1986	1996	7,552	7,940	39.00	1,000	1,100	10.00
Total: Other TBFRA								
Grand total								

© See notes and comments in Chapter I.
② The data are different than in ***enquiry table 1*** "Total area by main classes" for forest

TABLE 8

Changes over time in area of forest available and not available for wood supply

Country	Reference period 1	Reference period 2	Forest					
			Available for wood supply			Not available for wood supply		
			Period 1	Period 2	Average annual change	Period 1	Period 2	Average annual change
			(1000 ha)		(±1000 ha)	(1000 ha)		(±1000 ha)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	1957	1995	1,328	902	-11.20	0	128	3.40
Austria ©	1986-90	1992-96	3,331	3,352	3.50	463	488	4.20
Belgium	1982	1997	659	639	-1.32	6	7	0.05
Bosnia and Herzegovina ©	1990	1995	1,305	1,305	0.00	971	971	0.00
Bulgaria	1985	1995	3,222	3,124	-9.80	164	466	30.18
Croatia	1986	1996	1,674	1,690	2.00	84	85	0.10
Cyprus	1980-90	1990-98	43	43	0.00	74	74	0.00
Czech Republic ©	1986	1995	2,546	2,559	1.30	79	71	-0.80
Denmark ©	1976	1990	433	440	0.51	1	5	0.33
Estonia	1988	1996	1,844	1,932	11.00	72	84	1.50
Finland	1980-89	1991-96	21,150	20,675	-47.00	655	1,208	55.00
France ©	1987	1997	14,102	14,470	36.80	438	686	24.80
Germany ©	1961	1987	9,590	10,142	21.00	572	598	1.00
Greece ©	1964	1992	2,314	3,094	28.00	198	265	2.00
Hungary ©	1990	1996	1,685	1,702	2.90	83	109	4.30
Iceland ©	1990	1998	10	14	0.50	15	16	0.10
Ireland	1987	1996	413	580	17.00	8	11	0.30
Israel ©	1990	1997	53	70	2.10	29	52	2.90
Italy ©	1980	1995	5,731	6,013	18.80	3,684	3,844	10.70
Latvia	1988	1997	2,248	2,413	16.50	509	471	-3.80
Liechtenstein	1975	1995	3	4	0.07	3	3	0.02
Lithuania	1987	1996	1,652	1,686	3.40	278	292	1.40
Luxembourg	1994	1997	86	86	0.00	0	0	0.00
Malta	1993	1996-1996	0	0	0.00	0.347	0.347	0.00
Netherlands ©	1988-92	1992-96	306	314	1.60	28	25	-0.60
Norway ©	1980-86	1994-96	6,500	6,609	8.00	1,800	2,101	23.00
Poland ©	1987-91	1992-96	8,357	8,300	-11.00	529	642	22.00
Portugal ©	1985	1995	1,846	1,897	5.00	968	1,486	52.00
Romania ©	1955	1990	4,950	5,617	-18.50	822	684	32.70
Slovakia ©	1988	1996	1,700	1,706	0.75	261	310	6.13
Slovenia ©	1986	1996	1,013	1,035	2.20	64	64	0.00
Spain	1970	1990	9,658	10,479	41.00	2,128	3,030	45.00
Sweden ©	1985-89	1992-96	21,306	21,236	-10.00	5,954	6,028	10.60
Switzerland	1983-85	1993-95	1,003	1,060	5.70	127	113	-1.40
The FYR of Macedonia ©	1990	1995	745	745	0.00	161	161	0.00
Turkey	1963-72	1973-96	8,730	8,635	-4.00	126	1,319	50.00
United Kingdom ©	1980	1995	1,854	2,108	17.00	320	361	3.00
Yugoslavia	1979	1995	2,470	2,379	-5.67	448	515	4.20
Total: Europe					**128.14**			**384.30**
of which: EU 15					**131.90**			**208.38**
Armenia	1983	1996	20	21	0.10	272	313	4.10
Azerbaijan ©	1983	1988	181	153	-5.60	689	783	18.90
Belarus	1988	1994	5,392	5,966	95.60	936	1,899	160.50
Georgia ©	1990	1995	591	591	0.00	2,398	2,398	0.00
Kazakhstan	1988	1993	4,397	4,933	107.00	4,913	5,571	132.00
Kyrgyzstan ©	1988	1993	0	0	0.00	729	843	22.80
Republic of Moldova	1988	1997	204	211	0.65	113	113	0.00
Russian Federation ©	1988	1993	572,979	525,191	-9,557.60	249,009	291,347	8,467.60
Tajikistan ©	1988	1995	0	0	0.00	386	400	2.00
Turkmenistan ©	1990	1995	3,650	3,650	0.00	104	104	0.00
Ukraine	1988	1996	6,120	5,999	-15.00	3,093	3,459	46.00
Uzbekistan ©	1988	1995	0	0	0.00	1,909	1,909	4.58
Total: CIS					**-9374.85**			**8858.48**
Canada ©	1980	1994	125,863	125,863	0.00	118,708	118,708	0.00
United States of America ©	1987	1992	195,596	198,123	505.00	18,795	19,210	83.00
Total: North America					**505.00**			**83.00**
Australia ©		1994		16,438			140,439	
Japan ©	1986	1995	23,267	23,276	1.00	766	788	2.44
New Zealand ©	1986	1996	1,461	1,851	39.00	6,091	6,089	0.00
Total: Other TBFRA								
Grand total								

© See notes and comments in Chapter I.

NOTES AND COMMENTS RELATING TO CHAPTER I

Main Tables	Comments

Albania

1, 2

Enquiry Table 1: The share of Albania's forests in total land area has been decreasing for the last 50 years because the rate of deforestation for transfer to agriculture land was larger than increases and because of the exclusion of much forest area due to changed definition of forest in the later forest inventories (a lot of forest area, mainly of small bushes and degraded forest areas changed utilization, primarily for pasture of goats, etc.).

3, 4, 5, 6

Enquiry Table 3: The trends since the 1950s were as follows:

The coniferous forests increased, the broadleaved and mixed forests decreased and forests not available for wood supply increased. The coniferous forests increased as a result of reforestation mainly with black pine and Mediterranean pines (Aleppo pine, Stone pine, Maritime pine) while the broadleaved and mixed forests decreased as a result of deforestation to provide more arable land and because the area of forests not available for wood supply increased.

5, 6

Enquiry Table 4: The larger part of the Albanian forest area is composed of coppice with standards.

7, 8

Enquiry Table 7: By comparing the figures for 1957 and 1995, the trends were as follows:

– There were reductions in the area of total forest and forest available for wood supply (respectively, from 1,328,000 ha in 1957 to 1,030,000 ha in 1995 and, from 1,328,000 ha in 1957 to 902,100 ha 1995).

– There was an increase in the area of forest not available for wood supply (from zero in 1957 to 127,900 ha in 1995).

The annual average reduction of the total area was 7,800 ha and of the forest available for wood supply was 11,200 ha, while the annual average increased for forest not available for wood supply was 3,400 ha.

Armenia

1, 2

Enquiry Table 1: Method of adjustment to TBFRA definition: recalculation of the national forest survey data, and rough estimates for OWL were done by the national correspondent (areas involved are rather small).

Australia

1, 2

Enquiry Table 1: The definition of forest used in this report is: An area, incorporating all living and non-living components, that is dominated by trees having usually a single stem and a mature or potentially mature stand height exceeding two metres and with existing or potential crown cover of overstorey strata about equal to or greater than 20 per cent.

This definition is different from previous definitions used in Australia in several important ways:

1. The minimum potential crown cover to qualify an area of trees as forest has been set at 20 per cent. This is generally equivalent to the widely used lower boundary of woodland. Thus, woodlands are now included in the definition of forest where they were formerly excluded. This change in definition adds about 112 million hectares to the total forest estate previously report for Australia.

2. The definition refers to "usually" single stemmed trees and sets the lower tree height limit at two metres.

This allows the inclusion of the mallee formation, Australia's multi-stemmed Eucalyptus trees, in the definition. The full definition, which requires that vegetation be of tree formation, excludes shrublands even if they are higher than two metres.

Using the Tropic of Capricorn as the boundary to divide tropical and temperate forests, 47.6 per cent is tropical and 52.4 per cent temperate (no boreal).

The definition of other wooded land used in this report: Data on other wooded land were derived by using a coarse national vegetation data set at 5 million scale to select tall shrubs and tall, medium and low trees. This data set does not separately identify forests where Callitris glaucophylla (Cypress Pine, which is Australia's major native softwood) is the dominant or sub-dominant canopy species. From this vegetation data set (Commonwealth of Australia 1990, J. A. Carnahan) areas were included in "other

wooded land" where projected foliage cover was less than 10 per cent (this is equivalent to a crown cover of 0.25 to 25 per cent). The following were included: Tall, Medium and Low Trees (>30, 10-30 and <10m respectively) and Tall Shrubs (>2m). The Tall Shrubs category excludes eucalyptus as these were included under 'forest' as Mallees.

3, 4, 5, 6

Enquiry Table 3: Forest available for wood supply:

Across Australia, State Agency assessments for all forest types within State Forest tenures result in a proportion of 54.47 per cent of forested land being available for wood supply. This proportion has been applied to forested land in other tenures, where no other data exist, to infer the area available for wood supply.

These statistics do not take into account the location of processing facilities or road access. They should therefore only be used as indicative figures.

Significant work is currently being undertaken to quantify the potential forest resources on private land within existing commercial regions.

Forest not available for wood supply, and reasons: Of the forest which is not available for wood supply, Nature Conservation Reserves protect 17.6 million ha. A further 121.7 million ha are not harvested for both economic and protection reasons. The greater proportion of State Forest which is not harvestable is likely to be for conservation reasons. The greater proportion of other tenures combined which are not harvestable is likely to be for economic reasons.

5, 6

Enquiry Table 4: The high forest figure for "High forest" includes a certain amount of natural coppicing in response to harvesting or natural damage.

7, 8

Enquiry Table 7: No data on change are available at present. The National Land Cover Change Project is currently in progress. On completion at the end of 1998, three data sets will be produced : baseline, 1990 and 1995. These will be useful for assessing change in land cover.

Austria

1, 2

Enquiry Table 1: The 1986-1990 assessment of the Austrian Forest Inventory did not distinguish between forest and other wooded land. Therefore a reliable estimate on other wooded land data was of no practical use for the TBFRA-1990. Additionally, such data had been unavailable for decades.

Therefore in the 1992-1996 assessment of the Austrian Forest Inventory, the terms and definitions were expanded and fit to the TBFRA-2000 terms and definitions.

Austrian other wooded land is the "dwarf-pine-belt" (*Pinus mugo* var.), which is mainly in high mountainous regions (see also comments on table 7 "Changes in area of forest and other wooded land over time by main categories" and table 21 "Protection").

7, 8

Enquiry Table 7: The data for the previous reference are adapted to the TBFRA-2000 definition of "forest" and "other wooded land".

In the TBFRA-1990 the forest area (3,877,000 ha) includes other wooded land (see also comments on table 1 "Total area by main classes"). However, it has been assumed that the area of other wooded land, which is mainly in high mountain regions, does not change too much–it was estimated to remain stable between the two reference periods.

Therefore: TBFRA-1990: 3,878,000 ha - 84,000 ha = 3,794,000 ha.

TBFRA-2000: 3,924,000 ha - 84,000 ha = 3,840,000 ha (table 1 "Total area by main classes")

The data on "average annual change between reference periods" are calculated results of the assessment periods 1986-1990 and 1992-1996 of the Austrian Forest Inventory, which is based on permanent plots.

Azerbaijan

3, 4, 5, 6

Enquiry Table 3: Figures not adjusted for lack of objective data. Significant areas of forest (783,000 ha) are not suitable for cutting from an environmental and economic standpoint.

5, 6

Enquiry Table 4: Unadjusted - no factual data for recent years.

7, 8

Enquiry Table 7: There were changes between the base periods, especially in forest not available for wood supply.

Belarus

1, 2

Enquiry Table 1: "Forest" includes land:

1. Covered in trees (main and other forest-forming species), non-continuous forest growth, nurseries and plantations;
2. Not covered in trees–openings, slashes, dead stands, cuttings, clearings.

"Other wooded land" includes areas of shrubs and bushes.

The distribution of land by the land categories adopted in the Russian State forest resource census (GULF) is shown in supplementary table which is available in the secretariat.

3. The accuracy of the geodesic measurements made for forestry applications ("Instructions on the conduct of forestry operations in Russia's forest resources," Vols. I and II, (Moscow, VNIITslesresurs, 1995) was used in determining the likely range.

Belgium

1, 2

Enquiry Table 1: Forest land areas (items 1.4 to 1.6 in this table) are estimated by a count of grid points. Errors on those estimations are calculated according to the Zöhrer formula (1970) for a probability p=0.95.

3, 4, 5, 6

Enquiry Table 3: The criterion for differentiating between coniferous, broadleaved and mixed is the land area and not the crown cover.

Bosnia and Herzegovina

1, 2

Enquiry Table 1: Source for Total area, and Forest area: Data provided by the Forest authorities of Bosnia and Herzegovina (through the Permanent Mission of Bosnia and Herzegovina in Geneva) in their reply to the concise enquiry for SOFO-1997 (15.08.1996).

Source for Inland water and Land area: Information is the secretariat estimates based on different sources.

The figure for the Other wooded land area is the secretariat estimate on the basis of 16 per cent of the area of FOWL (in Croatia 15.6 per cent; in Yugoslavia 16.8 per cent).

Information on managed other wooded land is not available.

3, 4, 5, 6

Enquiry Table 3: The data for "Forest available for wood supply" and for "Forest not available for wood supply" are the secretariat estimates based on the information from different literature sources.

7, 8

Enquiry Table 7: The data for Forest are the secretariat estimates based on the information from different literature sources.

Canada

1, 2

Enquiry Table 1: Canada's Forest Inventory 1991 (CanFI91), 1994 version is the authoritative national database on the distribution and structure of the forest resource. CanFI91 is a spatially referenced database containing the best information available in 1991. The main numerical change to the database in 1994 was the incorporation of new source data from the province of Quebec.

The inventory is aggregated from many sources. Over the years the specifications of the modern source inventories have become more complete, and most provinces and territories have programs of periodic inventory renewal for the active areas of forest management. The oldest source inventories, with the most missing values in the data, tend to occur in more remote areas.

Canada's Forest Inventory takes advantage of existing data available in the inventory organizations of the provincial and territorial forest services, and uses very economical methods for aggregation to the national level. It represents the best information available at the time. It and its source inventories are not time-series entities, and users are advised that mathematical differences between successive inventories are not necessarily due to real change during that 5-year period.

Reference Sources:

"Total area": Canada Year Book 1992, total area of Canada.

"Inland water": Freshwater area from Canada Year Book 1992.

"Forest and other wooded land": Forest land + timber productive forest + timber unproductive forest (CanFI land classes 1, 2, and 3) This number is almost 36 million hectares smaller than the estimate reported in FRA1990 because that figure, from Canada's Forest Inventory 1986, included an estimate of 55 million hectares of forest land in uninventoried portions of Quebec, Ontario and Manitoba. This estimate was replaced in the 1991 national forest inventory by low intensity samples of the previously uninventoried area. The historical estimates were considerably larger than the new estimates, resulting in an apparent reduction in the forest area.

"Forest": Timber productive forest land (CanFI land class 1).

"Other wooded land": Forest land (unspecified productivity) + timber unproductive land (CanFI land classes 2 and 3).

"Other land": Calculated residual, i.e., Land area–Forest & other wooded land = Other land.

3, 4, 5, 6

Enquiry Table 3: Reference Source: Canada's Forest Inventory.

"Forest, total": From Table 1, Timber productive forest land (CanFI land class 1)

"Predominantly coniferous": Timber productive forest land of softwood forest type + the softwood part of the missing value forest type, assigned according to the proportions of the classified forest type + the softwood part of the nonstocked and unproven stocking class (forest type not available), assigned according to the proportions of the classified forest type.

"Predominantly broadleaved": Timber productive forest land of hardwood forest type + the hardwood part of the missing value forest type, assigned according to the proportions of the classified forest type + the hardwood part of the nonstocked and unproven stocking class (forest type not available), assigned according to the proportions of the classified forest type.

"Predominantly bamboos, palms, etc".: Not applicable.

"Mixed": Timber productive forest land of mixedwood forest type + the mixedwood part of the missing value forest type, assigned according to the proportions of the classified forest type + the mixedwood part of the nonstocked and unproven stocking class (forest type not available), assigned according to the proportions of the classified forest type.

"Forest available for wood supply": Accessed nonreserved timber productive forest land, with adjustments downward in BC, Alberta, and Nova Scotia (provided by provincial forestry authorities) .

"Predominantly coniferous on Forest available for wood supply": Accessed nonreserved timber productive forest land of softwood forest type + the softwood part of the missing value forest type, assigned according to the proportions of the classified forest type + the softwood part of the nonstocked and unproven stocking class (forest type not available), assigned according to the proportions of the classified forest type (Adjusted as above in "Forest available for wood supply).

"Predominantly broadleaved": Accessed nonreserved timber productive forest land of hardwood forest type + the hardwood part of the missing value forest type, assigned according to the proportions of the classified forest type + the hardwood part of the nonstocked and unproven stocking class (forest type not available), assigned according to the proportions of the classified forest type (Adjusted as above in "Forest available for wood supply").

"Predominantly bamboos, palms etc." on forest available for wood supply: Not applicable.

"Mixed" on Forest available for wood supply: Accessed nonreserved timber productive forest land mixedwood forest type + the mixedwood part of the missing value forest type, assigned according to the proportions of the classified forest type + the mixedwood part of the nonstocked and unproven stocking class (forest type not available), assigned according to the proportions of the classified forest type (Adjusted as above in Forest available for wood supply).

"Forest not available for wood supply": Calculated residual, i.e., Forest, total–Forest available for wood supply = Forest not available for wood supply.

"For conservation/protection reasons on Forest not available for wood supply: Reserved timber productive forest (Adjusted as above in Forest available for wood supply).

"For economic reasons" on Forest not available for wood supply: (Accessed reserved timber productive forest + non-accessed timber productive forest) - Reserved timber productive forest (Adjusted as above in Forest available for wood supply).

"Other wooded land": (From table 1) Forest + timber unproductive forest (CanFI land classes 2 and 3).

Predominantly coniferous, broadleaved, bamboos, palms etc., and mixed: There is no basis for estimating this value because timber unproductive forest land is not classified as to forest type, age class, etc. in CanFI. See below for supplementary information. The distribution of other wooded land areas by species group in the table is the secretariat's estimate based on the assumption that the proportion of coniferous, broadleaved and mixed species groups on other wooded land is similar to that of on forest land.

Supplementary information:

Other wooded land–The following information, provided by the Ontario Ministry of Natural Resources, is illustrative of the situation in Canada:

The area figure provided for "other wooded land" consists of the sum of non-productive land features, namely treed muskeg, open muskeg, brush and alder, and rock. Protection forest site class 4, a category under "productive forest" within the Forest Resource Inventory (FRI) database is also included in "other wooded land" In terms of relative abundance, treed muskeg (~35 per cent) is the single largest category within the "other wooded land" class, followed by brush and alder (~20 per cent), protection forest site class 4 (~15 per cent), and rock (~10 per cent).

The majority of non-productive lands and protection forest site class 4 exist in northern Ontario where coniferous vegetation dominates the landscape. Coniferous vegetation is most dominant in the treed muskeg, rock, and protection forest site class 4 categories, while deciduous vegetation dominates the brush and alder category and have a significant presence in the protection forest site class 4 category. Mixedwood conditions occur infrequently within the "other wooded land" class, but do occur within the protection forest site class 4 and rock categories.

The primary coniferous tree species occupying "other wooded lands" are black spruce and jack pine, while the primary deciduous species growing within "other wooded lands" are trembling aspen and white birch. Mixedwood conditions, where they occur, are often composed of black spruce, jack pine, trembling aspen, and birch in the boreal regions of Ontario, and a combination of white pine, red pine, white birch, trembling aspen, red maple, sugar maple, and red oak in the temperate parts of Ontario.

5, 6

Enquiry Table 4: Forest inventories in Canada do not distinguish between high forest and coppice and coppice and standards. The entire timber productive forest area is assumed to be high forest.

7, 8

Enquiry Table 7: In the annual report to Parliament on the state of Canada's forests, the correspondents assume that the forest land base remains constant and that the impact of fires, pests, harvesting, etc. is reflected in changes to the age-class distribution and stocking. We are not able to make estimates of the changes sought in table 7 "Changes in area of forest and other wooded land over time by main categories" and will not support estimates made by another body.

Cyprus

1, 2

Enquiry Table 1: Official estimated data.

There exists supportive information on the "National Forest Inventory Results" in the reply to the enquiry, which is available at the secretariat.

Czech Republic

1, 2

Enquiry Table 1: Definitions for parameters used in the TBFRA-2000 enquiry are close to those of the Czech Republic; therefore, no adjustments considered necessary.

3, 4, 5, 6

Enquiry Table 3: In the Czech forestry database, the two categories of forest areas are registered:

(i) area of forest stands = an area of land actually covered by forest trees and temporary unstocked areas, and (ii) area of forest [= TBFRA-2000 forest] = the same area as above plus land without trees that is permanently used for forestry purposes (forest roads, cleared tracks, etc.).

Most of the registered data are based on the area of forest stands. These are adjusted here and in the other tables using a difference coefficient: area of forest = 2,630 thousands of ha; area of forest stands = 2,584 thousands of ha; coefficient for stands area multiplication = 1.0178

Data on predominance within inventory units have been specially processed for the TBFRA-2000. The average area of one inventory unit is 2.23 ha. The Forestry database contains data on civil forests only [area of forest stands]. These were adjusted to the total forest area including military forests [see *Enquiry Table 13* for details].

The area of protection forests is mentioned as the forest not available for wood supply. Protection forest [Czech forest category 2] includes: 2a–forests on extremely unfavourable sites, 2b–forests on tree line that protect forests below the line, exposed mountain ridge tops, protection forests in localities endangered by avalanches etc., 2c–forests in the zone of mountain dwarf pine, 2d–soil protection forests. Felling in the category is significantly limited if allowed at all. The other forests including major parts of the national parks are regenerated with human intervention [felling] and the wood is available. The area of forest stands in the forest category 2 is 70 thousand ha forming 2.71 per cent of the total area.

The true area of forest not available for wood supply could be within 70 and 115 thousands of ha because a part of the category has been registered as the sub-category 3e–forest damaged by air pollution. The precise area will be known by 1999. In this range, about 5 thousand ha are forest stands in national parks where disturbance of natural processes will be not allowed [the size is still undergoing change].

Concerning the economic problems with small wood coming from thinning of young forest stands, these are not included. Non economic stands [from the point of view of rotation period] are located in forest category 2.

7, 8

Enquiry Table 7: Forest not available for wood supply = Czech forest category 2 protected forest. That category is overlapped [hidden] by the forests damaged by air pollution.

Denmark

1, 2

Enquiry Table 1: Estimates on other wooded land have not been included in former FAO-statistics for Denmark. This time an estimate has been made mainly for two reasons: one is the change in the FAO-definitions on other wooded land which are regarded as more precise and thus useable for Denmark, another is the reality that the total area of other different reasons mentioned below.

Therefore comparisons with previous FAO-statistics can not be made on the item "other wooded land".

The area of other wooded land is based on a number of estimations: The whole group consists of different types of area within the TBFRA-definition but outside the normal Danish definition of forest, that would say area with woody plants which are or in a short time will be higher than 10 m, wider than 20 m, have a crown-cover of more than 50 per cent, and is more than 0.5 ha.

In Denmark, other wooded land consists of: Shelterbelts and windbreaks: Ministry for Food, Agriculture and Fisheries, The Structure-directorate, estimates, that the total amount of these make up about 40,000 km with an average width of 6 m: Total: 24.000 ha

As mentioned the total area of shelterbelts and windbreaks is estimated very roughly. The proportion of these areas is anyhow increasing as public subsidies for wider broadleaved shelterbelts with supplementary broadleaved groves are enchanged.

Wild-life-planting: National Forest and Nature Agency, Bureau for Hunting and Wildlife-administration, have estimated this area to be: 6,000 ha

The estimate is based on the statistics on the last 20-25 years public subsidies given.

Planting of Christmas trees outside forests: The private organisation for Christmas trees "Juletræsforeningen" estimates this area as 1.5 times the registrated area within forests according to the "Skove og Plantager i 1990", published by Danmarks Statistik and Skov- og Naturstyrelsen, including conifers other than *Abies nordmannia* and *A. procera*: 30,000 ha

This area excludes Christmas-trees within forests–these stands are parts of the total forest area (445.391 ha). Scrubs along slopes etc, according to National Forest and Nature Agency, Bureau of the Administration of Nature: 20,000 ha

The very rough estimate is based on studies of about 4 maps at the scale 1:25.000 in Mid-Jutland. Overlap with the other types of other wooded land can only be expected to a very limited extent. Different planting along major roads, etc, a very rough estimate by Bureau of Forestry Management Planning: 13,000 ha

Total: 93,000 ha

There is an inconsistency with table 2.5-2.7 where it seems that "other wooded land" can be either undisturbed by man or semi-natural (as pointed out in the meeting of the National Correspondents in Geneva in November 1997): In the Danish delimination of the vegetation-type as described above most other wooded land is not undisturbed by man–actually a large part of the other wooded land in Denmark is intensely managed.

3, 4, 5, 6

Enquiry Table 3: Figures on forests which are mainly broadleaved, mainly coniferous or mixed do not exist for Denmark.

The figures in the table are calculated in the following way:

First the figures are calculated for state forests. The state forests are spread all over the country but with a considerable variation of appearance. This will be taken into account in the following.

A central database for the state forests ("CSR") contains information on every stand, forest, forest-district and so on. In the head groups Dune-districts ("kli'"), Heather-districts ("hede"), old forest in the west (gamle skovegne west) and old forests in the east ("gamle skovegne øst") totals on forests with less than 25 per cent, between 25 and 75 per cent. and over 75 per cent broadleaves have been calculated.

For somewhat similar regions (counties: Norjjylland, Viborg, Ringkjøbing and Ribe, Fyn, Århus, Vejle and Sønderjylland, respectively Bornholm, Frederiksborg, Vestsjælland, Roskilde, Storstrøm and København), the proportions between state- and privately owned forests have been calculated. The first part of the state forests 'dune-districts' have not been included in this calculation, although these areas almost only contain state forests. This calculation was based on: Danmarks Statistik and Skov- og Naturstyrelsen: Skove og Plantager 1990.

Totals for Denmark of forests which are mainly broadleaved, mainly coniferous or mixed have then finally been calculated by a combination of the composition of these three forest types in the state forests with the composition between state- and privately owned forests.

The estimate is based on two assumptions: 1. the proportion broadleaved/coniferous/mixed forest is the same in state and privately owned forests–no aspects argue against this assumption, and 2. the borderlines between counties and the main-grouping of state forests do not affect the final calculation - it is not strictly correct, but it does not affect the main lines of the result.

Forests not available for wood supply: The figure on forests not available for wood supply is calculated for 1996 and contains:

private forests: 46 reserves with an total of 1147 ha.

public owned forests: 246 reserves with a total of 3937 ha.

total 292 reserves with 5086 ha.

These figures are given to EFI 'European Forest Institute' investigations on Europe's natural forests by the national Forest and Nature Agency.

Known deviations from the TBFRA-2000 definitions: In the 1990 FAO/ECE Forest Resources Assessment a total Danish forest area of 466,000 ha (forests including open areas in accordance with the forest statistic of 1976) was divided into 316,000 ha coniferous forests and 150,000 ha broadleaved forests. These figures are based on stands and not on forests and the group 'mixed forests' did not occur in the 1990-investigation.

If the figures based on the 1976 Danish forest statistic should be compared with the next and newest 1990-forest statistic (stand-based figures) it could look like this:

Conifers: 1976: 269,000 ha, 1990: 268,000 ha

Broadleaved: 1976 : 137,000 ha, 1990: 143,000 ha

(the figures in the 1990 FAO/ECE are adjusted in relation to the 1976 Danish forest statistics.).

The calculation done in this table concerning division of the Danish forest area into < 25 per cent / 25-75 per cent / 75 per cent categories on broadleaved/conifers has not been done before and the precision is therefore difficult to estimate.

5, 6

Enquiry Table 4: No valid information exists on the area of coppice. Due to the forest law coppice is only allowed if there is an old habit on the area or if special permission is given by the authorities.

The figures on coppice are estimated based on interview's with state forest district where most coppice exists. The special and local historic oak-bushes ('egekrat') are not included in the estimate. It is presumed that all coppice is rejuvenated every 20-40 year–if not the stand will not be regarded as coppice.

7, 8

Enquiry Table 7: The two latest forest statistics are from 1990 and 1976 respectively.

In 1976 all areas belonging to forestry-holdings, including much agriculture land, was listed. The same group of holdings was included in the 1990 statistics but the figures were 'cleaned' for areas which were not forestry or areas in close connection to forestry. The figure for the previous period is thus calculated in a way that the amount of non-wooded area (help-areas etc.) is relatively the same as in the 1990 forest statistics. The amount of areas not available for wood supply in the previous period is estimated at the same magnitude as forests undisturbed by man in that period.

Other wooded land: the figures are comparable with the rest of TBFRA.

In the estimate on the average change in other wooded areas, it is assumed that the average rotation time for such areas mentioned under table 1 is 30 years except for scrub along slopes etc., which do not have any specific rotation time.

Important:

In the period afforestation due to a number of Government activities has increased considerably. A main aim for the next forest statistics would presumably be to give good estimates for this activity. It is assumed that the annual average afforestation in the mid-1990s has been about 1,900 ha and afforestation at the moment has the amount of about 2,500 ha.

Estonia

1, 2

Enquiry Table 1: Other wooded land includes shrubs, bushes and non-agricultural land covered with trees.

Finland

1, 2

Enquiry Table 1: For each field plot, the expected canopy coverage between 0 and 30 per cent, the actual coverage was estimated by means of modelling and partly aerial photographs interpretation.

3, 4, 5, 6

Enquiry Table 3: The differences between the total areas and the sums of the classes is due to the open regeneration areas (on forest land 308,000 ha and on forest land available for wood supply 307,000 ha). The predominant species is determined on the basis of the volume distribution of the species. In Finland, the difference with the TBFRA-classification is of minor importance.

France

1, 2

Enquiry Table 1: Forests also include poplar stands of between 0.05 and 0.5 hectares.

Other wooded land: this refers to heathland in the sense of the land use survey, and is defined as "Formations generally of large extent. Grassy vegetation most often makes up the bulk of the plant life, but 25 per cent at least of the ground cover consists of woody or semi-woody plants such as ferns, heather, broom and gorse... Wooded areas represent less than 10 per cent of the total.

Likely range: 95 per cent confidence sampling errors.

3, 4, 5, 6

Enquiry Table 3: Species composition was assessed per stand.

Likely range: i.e. estimates of area at the 95 per cent confidence level.

Sources: "Forest, total" to Forest, "Mixed": Land use survey (TERUTI), 1997.

All rows under "Forest available for wood supply" and for the row "Forest not available for wood supply": Forest area broken down in line with the data from the national forest inventory available as at 31 December 1997 (period 1980-1996).

"Predominantly coniferous; broadleaved; bamboos, palms, etc.; and Mixed" on other wooded land: Estimate provided by the National Correspondent. The conifers on other wooded land are mainly junipers.

5, 6

Enquiry Table 4: "Coppice and coppice with standards" on forest available for wood supply: The area of coppice and coppice with standards is shrinking by 0.8 per cent per year.

"Coppice and coppice with standards" on forest not available for wood supply: Apart from a few thousand hectares near large towns, the forest not available for wood supply is very largely high forest in mountain areas.

Likely range: i.e. estimates of area at the 95 per cent confidence level.

7, 8

Enquiry Table 7: Source for "Forest" and "Other wooded land": Land use survey (TERUTI), 1987 and 1997. To make them comparable with the 1997 data, 409,700 hectares of forests have been added to the 1987 figures and 75,800 hectares of other wooded land have been taken away. This adjustment corresponds to a shift that occurred in 1991-1992 in the annual TERUTI surveys, due to a change in the TERUTI sample at that time.

"Forest available for wood supply" and "Forest not available for wood supply": breakdown of forest area follows the national forest inventory figures available as on 31 December 1987 (period 1973-1986) and 31 December 1997 (period 1980-1996).

Georgia

1, 2

Enquiry Table 1: About 98 per cent of the Georgian State Forests are located on mountain slopes reaching an elevation of 2300-2500 m, of which 76.5 per cent of forests grow above 500 m, and 80 per cent are on the steep slopes of mountains.

3, 4, 5, 6

Enquiry Table 3: Secretariat estimates based on the information that coniferous species occupy about 20 per cent of forest area of the country (and comprise about 30 per cent of growing stock).

5, 6

Enquiry Table 4: "Coppice and coppice with standard": Data are available on oak coppice only (as provided by the Ministry of Environment of Georgia in 1996).

7, 8

Enquiry Table 7: According to the information received from the State Department of Forest Management of Georgia (23.08.1996), "no significant changes have taken place during the period 1990-1995, except that the total growing stock was 434 million m^3 in 1996 (to compare with 421.2 million m^3 in 1990, see table 17 "Change in growing stock on forest available for wood supply")"

Germany

1, 2

Enquiry Table 1: The survey year 1987 was chosen as it is the sampling year of the Federal forest inventory, which provided the key data.

Reference year (1987): For 1987 the areas of the Federal Republic of Germany, as of 3 October 1990, and the former GDR areas were added together.

Other wooded land: Not surveyed separately in Germany, but completely insignificant in terms of area.

Adjustment: Definition varies. Yet in terms of the forest structure, both definitions will probably lead to areas only slightly varying from each other.

The likely range (taking account of errors due to measurement, sampling and adjustment): Estimated in relation to the sampling error of the federal forest inventory in the old Läender.

3, 4, 5, 6

Enquiry Table 3: "Forest not available for wood supply": A very rough estimate was made for forest not available for wood supply (equal shares of coniferous/broadleaved/mixed), in order to get a total for all forest. (FAWS = "Wirtschaftswald" defined as over 1 m^3/ha/year).

Stands with more than 90 per cent coniferous or broadleaved are classified as predominantly coniferous/broadleaved stands, stands with less than 90 per cent are mixed stands. The way the data-collection is conducted leads to a tendency to show pure stands.

5, 6

Enquiry Table 4: Since the survey in the former GDR did not differentiate between high forest and coppice, the data do not allow a differentiation.

7, 8

Enquiry Table 7: Average annual change between reference periods for forest available for wood supply and for forest not available for wood supply: A very rough estimate was made of the rate of change by category: + 21,000 a year for FAWS and + 1,000 a year for FNAWS, making it possible to calculate back to 1961 data.

Greece

1, 2

Enquiry Table 1: Definitions used in the Greek forest inventory of 1992 correspond closely with those of the TBFRA.

3, 4, 5, 6

Enquiry Table 3: There are some areas of mixed forest but they are relatively unimportant (the national inventory does not distinguish this category.

7, 8

Enquiry Table 7: We consider the data for the 1992 survey to be more accurate and may not be totally comparable with those of 1964, which were assessed using a different methodology.

Hungary

1, 2

Enquiry Table 1: All data in this enquiry relate to 1 January 1996.

In the absence of a country-wide land cover survey, there is no reliable information available on the area of OWL. Regarding the definitions applied in TBFRA 2000, approximately 4,000 ha would fall into the OWL category, but for consistency reasons, it is included here and in the other tables in the area of "Forest".

"Forest": known deviations left after adjustment:

– Minimum area >=1500 m^2 instead of 5000 m^2.

– Tree crown cover >= 30 per cent in open forest formations instead of 10 per cent. Not adjustable, but expected to cause negligible effect on the true values.

In Hungary, all forest resources area statistics, except that of primary forest functions, relate to stocked and temporarily unstocked (i.e. under regeneration) forests. The unstocked areas constituting integral parts of the forest according to the TBFRA 2000 definition are registered separately. These areas were added to the area of forests by proportionally distributing them between the different forest categories:

$$\text{Area X}_{\text{TBFRA}} = \text{Area X}_{\text{National}} + \text{Unstocked}_{\text{TBFRA}} * \frac{\text{Area X}_{\text{National}}}{\text{Total Area}_{\text{National}}} * 100$$

This method was applied in all the tables which are concerned with the definition of "Forest".

There is an area about 4,000 ha (i.e. 0.22 per cent) recorded as forest in the national statistics, which would fall into the category of other wooded land regarding the 0.5 ha area limit of the TBFRA definitions. Given the fact that there is no reliable information on land cover available from those areas, which fall outside the sphere of competence of the forestry administration, adjustment was not carried out here, and these areas are displayed as forest in this enquiry. The above value is considered in the likely range values where possible.

This applies to all tables where "other wooded land" is mentioned.

3, 4, 5, 6

Enquiry Table 3: "Forest available" and "not available for wood supply" categories are not used in the national forestry statistics. National categories are: "Forest with production primary function" and "Forest with non-production primary function". In order to bridge this gap "Forest not available for wood supply" was computed from inventory raw data as described below:

For conservation/protection reasons = area of forest reserves and strictly protected areas

For economic reasons = Hunting reserves, seed orchards, steep slopes, forests with indefinite rotation period.

"Forest available..." is of course an inverted value. Based on this grouping area and volume, data were calculated from the raw data.

Please refer to comments in *Enquiry Table 1* "Total area by main classes" for the definition of "Forest" and "Other wooded land" and *Enquiry Table 3* "Forest and OWL according to availability of wood supply" for the definition of "Forest not available for wood supply".

7, 8

Enquiry Table 7: Data were recalculated from 1990 using the TBFRA-2000 definitions.

Iceland

1, 2

Enquiry Table 1: Inland waters include glaciers.

7, 8

Enquiry Table 7: Less total FOWL than in TBFRA1990 due to new survey, not a real decrease.

Israel

5, 6

Enquiry Table 4: The data are calculated by estimation only.

7, 8

Enquiry Table 7:

1) "Forest": Forest plantation rate is 2500 ha/year.

2) "Forest not available for wood supply" and "Other wooded land": The main change is because of new mapping and change in the traditional land use, which lets vegetation grow.

Italy

1, 2

Enquiry Table 1: Information on managed other wooded land is not available.

7, 8

Enquiry Table 7: The data on "change" are the secretariat's estimates based on ISTAT publications. They differ from the Forest Inventory data used for compiling other tables of the enquiry, because the latter include approximately 2 million hectares of abandoned farmland which are in the process of natural colonization to forest.

Japan

1, 2

Enquiry Table 1: The data for "forest and other wooded land" and "other land" are dependent on different statistics which were inventoried on different definitions and dates. Forest with a crown cover of less than 30 per cent is classified under other wooded land in Japan.

7, 8

Enquiry Table 7: The forest areas which are temporarily unstocked as a result of human intervention are included in 1995 and not included in 1986. Forest area in 1986 excluded temporarily unstocked area, and temporarily unstocked area was included in other wooded land in 1986.

Kyrgyzstan

1, 2

Enquiry Table 1: Source: Information is the secretariat estimates based on various literature sources and analysis of the situation in neighbouring countries.

3, 4, 5, 6

Enquiry Table 3: Information on Forest available for wood supply and Forest not available for wood supply, and for conservation/protection reasons on forest not available for wood supply the secretariat estimate is based on information from different literature sources, including the article "Forest biodiversity and forest genetic resources in the Kyrgyz Republic", T. S. Mussuraliev, FAO, 1997.

7, 8

Enquiry Table 7: Information on Forest is secretariat estimates based on information from different literature sources, including the article "Forest biodiversity and genetic resources in the Kyrgyz Republic", T. S. Mussuraliev, FAO, 1997.

Latvia

1, 2

Enquiry Table 1: Forest area according to State Land Service statistical information is 2,858,000 ha. This figure does not correspond to terms and definitions used here. At the same time it seems that some thousand hectares of forests, converted from agriculture lands and other wooded land to forest, are not yet inventoried as forest and not included in figure of forest area.

Other wooded land includes area covered by shrubs and bushes. There are some 300,000 hectares of bogs in Latvia. This area has not been included either under "forest" or under "other wooded land", because it does not correspond to definitions of the existing classes. However bogs are partly covered by sparsely located trees in Latvia.

Lithuania

1, 2

Enquiry Table 1: Forest land area according to stand-wise inventory is 1,938,000 ha (computerized up-date 01.01.1996). Difference is the result of different interpretation of land area covered by forest by Land Fund Assessment.

Malta

1, 2

Enquiry Table 1: With the exception of a few clumps of oaks and tamarix all woodland is man made or at the most regeneration of man-made woodlands.

Netherlands

1, 2

Enquiry Table 1: Source: CBS, 1993 on 1.1,1.2 and 1.3. Statistiek van het bodemgebruik 1993. Centraal Bureau voor de Statistiek.

There exists supportive information on "Types of area of forest and other wooded land" in tabular form in the reply to the enquiry, which is available at the secretariat.

The difference between forest land definition of TBFRA-2000 and the definition used in the HOSP-project is: TBFRA: 10 per cent coverage while HOSP-project uses 20 per cent coverage. The 20 per cent coverage is according to the former definition

used in the Global Forest Resource Assessment 1990. No corrections in the HOSP figures are made: the forest area with a coverage of 10-20 per cent is negligible.

The likely range is more dependent on whether all area is accounted for than a matter of sampling design. The area covered by the HOSP-project has a confidence-interval at 95 per cent level of about 4 per cent. The area not monitored is estimated with no possibility to estimate the accuracy.

General comments:

The forest inventory system in the Netherlands consists of an area census which is periodically carried out, and a survey of growing stock, growth and removals which is carried out every year since 1988. A complete description of the inventory system in the Netherlands can be found in the EFICS study: Reports on forestry inventory and survey systems, European Commission, 1997.

The area census (National Forest Area Survey, 1980-1983) is an integral survey of all forest area that meets the FAO-definition from 1980 (more then 0.5 ha and at least 20 per cent crown coverage).

For this enquiry the forest area definition has been changed in such a way that the crown coverage has to be at least 10 per cent. The change in definition of forest land does not have any impact on the forest area in the Netherlands: The forest area with a crown coverage of 10-20 per cent is negligible.

On the basis of the monitoring system HOSP, basic data for section I (*Enquiry Tables 1 to 7*) section II (*Enquiry Tables* 11 and 12) and section III (*Enquiry Tables 13 to 17*) could be provided. Data for these tables on areas not covered by HOSP are provided by the National Forest Area Survey.

3, 4, 5, 6

Enquiry Table 3: The difference in definition is:

TBFRA-2000: In mixed forest neither coniferous or deciduous species account for more than 75 per cent of crown coverage. The HOSP-definition for mixed forests is a proportion of less then 80 per cent in stead of 75 per cent.

No adjustments are made since the differences are considered as negligible.

The estimate of the total area of forest available for wood supply according to the new definition is provided herewith. There exists supportive information on the "different forest type and areas considered as available", in tabular form, in the reply to the enquiry, which is available at the secretariat.

5, 6

Enquiry Table 4: The known area of coppice and coppice with standards is excluded from the 314,000 ha forest available for wood supply.

7, 8

Enquiry Table 7: Sources: 1. Daamen, W.P. 1993. Oogst uit dunning. HOSP-cyclus 1: periode 1988-1992. Daamen Schoonderwoerd Miedema & de Klein, Rapport 41.

2. Daamen, W.P. 1996. Velling en oogst HOSP-cyclus 2: periode 1992-1996. Daamen Schoonderwoerd & de Klein, Rapport 70.

Since no data are available on areas not covered by HOSP these areas are assumed constant.

New Zealand

1, 2

Enquiry Table 1: New Zealand does not have a formal forest inventory system as used in many of the countries in the TBFRA2000 grouping. This is a result of a set of circumstances which has lead New Zealand to rely almost entirely on the creation of a forest estate based on introduced species for its wood supply purposes over the last 100 years. The absence of a formal NFI over all the New Zealand forest estate has meant that for many of the tables in the Enquiry informed estimates have had to be provided, rather than relying entirely on directly measured survey data.

The development of this planted production forest estate has been based on the technology of short-rotation plantation forestry. Short rotation forest management requires a commitment to good forest inventory data for wood supply forecasting purposes. For primarily national wood supply forecasting purposes New Zealand has evolved a high-level National Exotic Forest Description (NEFD) system which regularly updates the characteristics of the plantation estate in terms of the key variables for wood supply forecasting work. The system used has taken account of the ownership structure of the plantation estate and the record-keeping that forestry companies maintain. It is described more fully in the publication A National Exotic Forest Description as at 1 April 1996, (Ministry of Forestry, 1996). Two accompanying publications NEFD Regional Yield Tables as at 1 April 1995 (Ministry of Forestry, 1996) and NEFD National and Regional Wood Supply Forecasts 1996 (Ministry of Forestry, 1996) show how the results of the NEFD work are used.

The bulk of the remaining New Zealand indigenous forest (4.9 million hectares out of a total 6.4 million hectares of indigenous forest) continues to be State-owned but is legislatively protected in the form of national parks, forest parks, reserves and other mechanisms from being logged for wood supply. In 1996 only 142,000 hectares of State-owned indigenous forest were available for timber production and this is now subject to close public scrutiny with increasing pressures being brought to bear for these forests to no longer be available for timber production.

In 1996 an amendment to the Forests Act 1949 came into force which required private forest owners wishing to utilize their indigenous forests for timber production to manage them in accordance with an approved sustainable management plan or permit. There were an estimated 124,000 hectares of privately-owned indigenous forest which were potentially commercially available for timber production if the owners managed these forests in accordance with an approved plan. The booklet Indigenous Forestry–

Sustainable Management (Ministry of Forestry and New Zealand Farm Forestry Association, 1998) gives fuller details of the current situation with respect to New Zealand's indigenous forests.

Several other publications–The Vegetative Cover of New Zealand (PFJ Newsome, 1987); New Zealand Institute of Forestry Handbook (1995); New Zealand Country Report - Montreal Process Criteria and Indicators for the Conservation and Sustainable management of Temperate and Boreal Forests (Ministry of Forestry, 1997); Forestry Sector Issues (Ministry of Forestry, 1996); and Environmental Effects of Planted Forests in New Zealand (JP Maclaren, 1996) provide further background on the New Zealand forestry situation.

The source for the data in this table is primarily mapping data from the New Zealand Department of Survey and Land Information, and informed estimates by the Ministry of Forestry. No adjustments to the key parameter of forest have been made because it was considered in the New Zealand context that the TBFRA-2000 criteria would be met in most cases because of the intense crown cover of both the indigenous forests and the plantation forests and the heights to which the trees grow. It has not been possible to determine whether the minimum area of 0.5 ha has always been met, where it is not met, the area estimates would be considered to be under-estimates. For other wooded land this parameter is largely what is regarded in New Zealand as scrub in transition to high forest. With the removal of subsidies to agriculture, land which was predominantly used in the past for livestock grazing is quickly reverting to scrub in the absence of grazing pressures. This land is also available for the establishing of plantation forests on suitable sites. As work is currently in progress to complete the New Zealand Land Cover Database (NZLCDB) using SPOT satellite images taken in January and February 1996 the estimates of the area for forest and other wooded land may be subject to change, especially that for other wooded land. The large error range on this latter estimate reflects a lack of reliable measuring in the past for this parameter. For both these parameters the ranges are estimates of the likely ranges and are not based on statistical sample error ranges.

Progress with completing the NZLCDB has meant that all the North Island is now available for cross-checking the estimates but this work is not yet complete for the South Island. It is just possible that the South Island may be complete by the end of 1998 (certainly 80 per cent will be) and that a first set of revisions could be supplied. The North Island, although not having the largest forest area, does have the majority of other wooded land (as reverting scrub).

3, 4, 5, 6

Enquiry Table 3: The sources for the data in this table are informed estimates made by the Ministry of Forestry using historical records and other current NEFD data. No adjustment was considered to be needed to meet the TBFRA-2000 definitions. The error ranges are estimates of the likely ranges and are not based on statistical sample error ranges.

As information on "Other wooded land" was uncertain, no attempt was made to split it into coniferous and broadleaved etc. Hence the use of the .. symbol. Zero (0) could be put in Predominantly coniferous and broadleaved–certainly at the 000 hectare level. This has been done in the revised table. The question as to whether coniferous species readily re-colonize abandoned grazing land as well as broadleaves is difficult to answer. Typically, if the re-colonisation is with indigenous species the succession is through broadleaf (hardwood) species such as manuka or kanuka (see list in Table 9) until some conifers (podocarps) begin to emerge. The resulting forest at this stage could be regarded as mixed. It is difficult to determine whether a "pure" indigenous conifer stand could emerge, after a sufficiently long period of time. There are forest areas where rimu (a conifer) is dominant but usually it grows in association with other species. Similarly with kauri. The reference Indigenous Forestry–Sustainable Management (Ministry of Forestry and New Zealand Farm Forestry Association, 1998) gives further discussion on how the natural forests grow and the associations between species. The exotic species *Pinus contorta* readily colonizes areas by wilding spread and for this reason it is listed in *Enquiry Table 10* as a problematic introduced species. *Pinus radiata* is normally hand planted rather than allowed to re-germinate and does not spread "naturally" to abandoned farm land.

5, 6

Enquiry Table 4: The sources for the data in this table are informed estimates made by the Ministry of Forestry using historical records and other current NEFD data. Adjustments were not required to meet the TBFRA2000 definition. The error range is an estimate of the likely range and is not based on statistical sample error ranges.

7, 8

Enquiry Table 7: The source for this table was the Ministry of Forestry using historical records and current NEFD data. The area in other wooded land has been increasing over the decade since the removal of subsidies to livestock farming. The consequential reduction in grazing pressures on the land has allowed regeneration through scrub to occur.

Norway

1, 2

Enquiry Table 1: The national definitions of forest and other wooded land are based on production capacity, not on crown cover. As crown cover is being assessed on every sample plot of the National Forest Inventory, a new forest area has been calculated, taking into consideration the FAO definition. The revised forest area is considerably higher than the forest area according to the national definition. The northernmost county (Finnmark) is not being covered by the National Forest Inventory, and this county's forest area is taken from the Census of Agriculture and Forestry 1989 (Statistics Norway).

Thus, forest area has been calculated in the following way:

Forest, national definition (National Forest Inventory) + forest, Finnmark county (Statistics Norway) + forest with a production capacity less than 1 m^3 o.b./ha/year, having crown cover more than 10 per cent (NFI) + forest roads, small open areas etc. (NFI)

Other wooded land is calculated as: total forest and other wooded land (Norwegian Mapping Authority)–forest area (FAO definition, as described above).

3, 4, 5, 6

Enquiry Table 3: The limit between the different tree species groups is 70 per cent instead of 75, as specified in the definitions. Our national forest inventory also applies a rule that the volume distribution should be decisive for tree species classification in older stands, while crown cover should be taken into consideration in young forest. No attempts have been made to adjust for these deviations from the guidelines.

5, 6

Enquiry Table 4: It is assumed that the occurrence of coppice and coppice with standards in Norway is negligible.

7, 8

Enquiry Table 7: Data for previous reference period are "informed estimates", and not inventory results.

Poland

1, 2

Enquiry Table 1: In Poland there exist areas which correspond to the TBFRA definition of other wooded land. The way in which they are reported in Polish statistics makes it impossible to separate out those areas as a whole. A short review of those areas, according to the TBFRA criteria, is supplied below.

Due to the Polish definitions, the minimum area of forest should be at least 0.1 ha. Up to now there are no data evaluating the share of forest tracts greater than 0.1 ha and less than 0.5 ha. The total number of those forest tracts is big, but we are of the opinion that the area occupied by them is not significant, therefore this item has not been specified. Small forest tracts are reported in the forest category.

Also data concerning potential tree height are not available; the areas where trees are not able to reach 5 m in situ in TBFRA 2000 Questionnaire are included in the forest category too.

In the Polish land use system the category of "woodlots" exists (217 thousand ha in 1996), but there is no other information about the use and resources of those areas. This category was not included either in the forest or in the other wooded land. Since the FRA 1990, on the basis of new information from the National Forest Inventory, small pieces of forest, riverine bushes etc. have been regarded as trees outside the forest.

"Forest": In the Polish classification, forest roads, nurseries, etc. are excluded from the forest. For the needs of TBFRA 2000, those areas (193 thousand ha in 1996) were incorporated into forests. "Grounds linked with forestry" (according to the Polish definition), occur in the state-owned forests only.

Other comments:

The numbers presented in the Table are averages of data for the years 1992 to 1996. The accuracy of forest area assessment depends on ownership. In the State Forests enterprise (comprising the majority of State owned forests) that accuracy is high–about 1,000 ha; for other forests information could not be very precise, therefore the possible error was evaluated at 200,000 hectares.

3, 4, 5, 6

Enquiry Table 3: 3.2–Predominantly coniferous, 3.3–Predominantly broadleaved, 3.5–Mixed.

In the Polish management system, stands are grouped into two classes: predominantly coniferous and predominantly broadleaved. A breakdown into coniferous, broadleaved and mixed is adopted in our site assessment system, but this information could not be useful, because it refers primarily to the potential and not to the real stand type.

Therefore, especially for the needs of TBFRA, specific calculations were done. The source database was the set of assessment records of the stand inventory of State Forests enterprise for the period of the last 10 years. According to the species composition and the TBFRA criteria, each of about 2 million stands was assigned to one of the three groups mentioned. The results of that query: 66.6 per cent of predominantly coniferous, 18.0 per cent of mixed and 15.4 per cent of predominantly broadleaved were accepted as the coefficients for further calculations, for all forests in Poland.

Forest available for wood supply is the difference between Forest, total and the area of Forest not available for wood supply.

Forest not available for wood supply is the sum of forest not available for wood supply for conservation and protection reasons and forest not available for wood supply for economic reasons. There are no such classes in the Polish management system; for the needs of this questionnaire the TBFRA definitions had been interpreted and subsequently the decision on what Polish categories should be included, or matched with those of TBFRA was undertaken. The averages of 1992 and 1996 data are reported in these categories.

Forest not available for wood supply for conservation and protection reasons. In this class the following forest areas are included:

- forest areas of National Parks,
- forest areas of nature reservations (outside of National Parks),
- refuges of protected animals,
- areas of forests on boggy sites,
- forest on the soil model areas,
- protected forests constituting valuable fragments of native nature–outside National Parks and nature reservations.

Forests not available for wood supply for economic reasons are the forests where fellings are severely limited for the reasons other than protection. The following forest areas are included in this class:

– inaccessible forests,

– forests in the timberline zone,

– national defence forests,

– State owned forests beyond the State Forests enterprise and National Parks (managed by other Ministries than the Ministry of Environmental Protection, Nature Resources and Forestry).

5, 6

Enquiry Table 4: Coppice occurs in Poland but its area is not known. According to the experts, its total extent is decreasing and amounts to a few thousand ha.

7, 8

Enquiry Table 7: Forest acreage shares (17.1 - 17.3) in the Previous reference period were calculated in the similar way like for Latest reference period - as an average of 1987 and 1991 data.

Portugal

1, 2

Enquiry Table 1: Total area includes continental Portugese area, as well as the islands of Azores and Madiera. Terms and definitions employed in the Portuguese National Forest Inventory:

Forest stands: Forest formations constituted by woody trees with a single main stem or in the case of coppice with several stems having a more or less definite crown with tree crown cover with more than 10 per cent, area more than 0.5 ha and width more than 15 m: the trees should be able to reach a minimum height of 5m at maturity.

7, 8

Enquiry Table 7: Concerning the previous reference period, the area values were adjusted to the TBFRA2000 definitions.

Republic of Moldova

1, 2

Enquiry Table 1: The background material used in the compilation of this assessment consisted of data from the State Forestry Inventory of 1988, the national report on the state of Moldovan forests (1997), yearly data from the land register and forest monitoring exercise, the national report on the state of the environment in the Republic of Moldova in 1997 and material from the State forestry agencies.

All forests in the Republic are the property of the State (art. 127 of the Constitution, art. 6 of the Forest Code).

Private ownership of woodland is permitted where forest has been planted on land that is private property.

All forests, land intended for afforestation and made available for forestry needs, operations and/or management, and unproductive land encompassed in forestry activities together constitute the country's forest resources.

The system used for the qualitative and quantitative assessment of the status of the forest resources is the State forestry inventory, based on a synchronous compilation of valuation data from the forestry survey and changes over the period under review.

The forestry survey is conducted once every ten years. All forests in the Republic are taken into account. Synchronous surveys have been carried out in 1957, 1965, 1975 and 1985. Since 1992, surveys have been conducted at individual forestry enterprises–35,000 to 49,000 hectares per year. The survey conducted on 1 January 1998 covered 200,000 hectares of forest resources. The last State forestry inventory was conducted in 1988.

A national report on the state of the Republic's forests was produced and published in 1997, updating qualitative and quantitative data on a number of components of the State inventory.

A State forestry inventory is planned for 1998, with the data being published in 1999.

All Moldovan forests are assigned to Category I, as performing exclusively environment-protection functions. Depending on the particular functions they serve, they are grouped into the following forest-protection categories:

(*a*) Water-retention, soil-retention, environmental protection and protecting sites of national value;

(*b*) Pollution-abatement and recreational;

(*c*) Gene-pool maintenance (forest reservations, national parks, natural monuments etc.).

The main features of the forest survey (wood and non-wood resources) are shown in the tables. Given the country’s circumstances, the significance of both wood and non-wood resources, the influence they have and the functions they serve will grow in the future. To meet needs, the area of land occupied by forest must be increased, and reconstruction measures must be taken to improve and raise forest output.

As agricultural reform – land privatization - has progressed, the expansion of wooded land has slowed.

State forestry agencies are concentrating their main efforts on improving the age and species mix and productivity and on substituting local, indigenous species for introduced varieties (white acacia, coniferous species). This should increase the hardiness of the country's timber stands and preserve the biological diversity of the forests.

These and other principles governing forestry activities are laid down in the Forestry Code that was adopted and took effect in December 1996.

The notion of sustainable forest development is central to the Republic's programme for the development of its forest resources.

There are plans to draw up a strategy in 1998 for the sustainable development of the forestry sector, enlisting the aid of international organizations and experts.

Romania

1, 2

Enquiry Table 1: According to the definition given in our "Forest Code", forest is considered land covered by forest vegetation with an area of more than 0.25 ha. In order to approximate the TBFRA definition of the forest, the item "Forest" includes lands needed for culture (nurseries, orchards...), for production (game food...), for administration (forest roads, fire breaks...) and temporarily excluded from the "forest fund". These are separately recorded in our statistics and in addition to forest area make "forest fund".

"Other wooded land" defines forests owned by different state owners outside the "forest fund"–which are not characterized to be statistical parameters.

3, 4, 5, 6

Enquiry Table 3: Estimates for Predominantly coniferous and Predominantly broadleaved on Forest, total, and on Forest available for wood supply are made by the secretariat.

For the data on Forest not available for wood supply, the data are estimated area of the forest land without road access (with a hauling distance more than 2 km, on average).

5, 6

Enquiry Table 4: The data for "Forest available for wood supply" include also the forest area without road access (with an average hauling distance of more than 2 km).

7, 8

Enquiry Table 7: Source: Report prepared by the Forestry Institute.

Russian Federation

1, 2

Enquiry Table 1: National classification of the Forest Fund Lands is given in the original reply from the Russian Federation.

"Forest" includes land:

1. Wooded land (main and other forest-forming tree species), non-continuous forest growth, nurseries and plantations;
2. Unwooded land–openings, slashes, dead stands, cuttings, clearings

"Other wooded land" includes areas of shrubs and bushes.

The distribution of land by the land categories adopted in the Russian State Forest Resource Census (GULF) is shown in the supplementary table (in the original reply) which is available at the secretariat.

3. The accuracy of the geodesic measurements made for forestry applications ("Instructions on the conduct of forestry operations in Russia's forest resources," Volumes I and II, (Moscow, VNIITslesresurs, 1995) was used in determining the likely range. The maximum errors assumed were: forest: +- 2 per cent, other wooded land: +- 5 per cent.

The scheme of the national classification of the Forest Fund Lands is given in the original reply from the Russian Federation (in Russian, available from the secretariat).

3, 4, 5, 6

Enquiry Table 3: Distribution by species groups is estimated by the National Correspondent.

Under the current forestry instructions, predominantly coniferous stands/coniferous forest management embrace forest in which conifers account for not less than 4 units, or at least 40 per cent of stocks. Broadleaved stands include forests in which broadleaved species predominate (over 60 per cent of stocks). Mixed stands do exist and account for more than about 40 per cent of total forest area, but cannot be identified precisely on the basis of the information available. The "predominantly coniferous" and "predominantly broadleaved" stands by the FAO method, as well as the likely range of error are determined on the basis of estimates. The areas of the different categories of land shown in the table were compiled on enterprise by enterprise basis. "Forest available for wood supply" includes stands identified as suitable for exploitation (commercial logging) and the "reserved" forests of group III.

5, 6

Enquiry Table 4: In forestry inventory documents, coppice is identified only under broadleaved forest management. This includes coppice oak, maple, wych elm and other varieties of elm. The area of coppice forest is obviously low given that broadleaved forest is often formed both from coppices and from seedings; but it is not possible with the data available to differentiate between the two. The likely range for category "Coppice and coppice with stands" on forest available for wood supply was determined on the basis of an expert appraisal by Dr. A. N. Filipchuk.

7, 8

Enquiry Table 7: GULF data for 1988 have been converted to the TBFRA-2000 classification system. The decline in forest area between 1988 and 1993 is the result of transfers of land from the Russian State Forest Service to other authorities for non-forestry-related purposes (Establishment of nature reserves covering 3.2 million hectares, allocation of land for construction of

various kinds and so forth.) Forestry inventory has also resulted in a clearer definition of the categories of land in the country's forest fund resources.

Slovakia

1, 2

Enquiry Table 1: Data concerning the total area of the Slovak Republic (SR) are taken from "Statistical yearbook on the land resources in SR according to the data in the Cadastre of real estates on 1 January 1997" (Office of Geodesy, Cartography and Cadastre of SR, 1997).

The data on the area of forest (forest land resources) are taken from the Permanent Forest Inventory", status to December 31, 1996 (PIL 96), Lesoprojekt Zvolen.

3, 4, 5, 6

Enquiry Table 3: Source: Data were taken from PIL (PFI) 96, tab. AO - LPF and tab. CO - stand land according to the category of forests. "Forest, total" includes forest land (1,998,000 hectares) and "white" areas (28,000 hectares) according to the definition of "Forest". Data on Forest, Total–"Predominantly coniferous, broadleaved, bamboos, palms, mixed etc." were calculated from JPRL (unit of area stand arrangement of forest) of Lesoprojekt as follows: "Predominantly coniferous" with the share of coniferous tree species more than 75 per cent, "Predominantly broadleaved" with the share of broadleaved tree species more than 75 per cent, "Predominantly bamboos, palms etc." other stands, mixed.

Stand land was re-calculated to the forest land by the coefficient calculated from the ratio of the total forest area in Slovakia and stand area.

Data for "forest available for wood supply" are taken from the area of the forest categories H (commercial forests) + Z (areas delimited from the agricultural land resources to the forest land resources which are intended for afforestation) + U (special purpose forests) + "white" areas (pieces of land included into the agricultural land resources covered by forest tree species), reduced by the area of 16,000 hectares of the special purpose forests according to the nature protection degrees 4 and 5 with impossible or very limited fellings (as published in Linderová et al.: Quantification of increased costs and detriment due to ensuring the public-beneficial functions. Final report of the reference task, LVU Zvolen, 1997, 46 pp).

The special purpose forests mentioned as the forest available for wood supply (332,000 hectares) are mainly intended for fulfilling of the public benefit functions and their production function is just secondary.

Data for Forest available for wood supply–Predominantly coniferous, broadleaved, bamboos, palms etc., and mixed were calculated from units of area stand arrangement of forests (JPRL in Slovak) of Lesoprojekt, in the same way as for Forest, total–Predominantly coniferous, broadleaved, bamboos, palms etc., and were adjusted from the stand land to the forest land area.

Data for "Forest not available for wood supply" are obtained from the area of the forest category O (protection) + 16,000 hectares of the special purpose forests with impossible or very limited felling. These are for protection and conservation purposes. Non-availability for economic reasons is not significant in our country. Data are also adjusted from the stand land to the forest land area.

Data for Other wooded land–Predominantly coniferous, broadleaved, bamboos, palms, etc., and mixed are not available. An estimate of these has been provided using a method of the overlapping maps: Tree species composition of forests in Slovakia (Bucha, Bothar, Vladovic, Menus; 1997) and Agricultural soil of ´N´category for agricultural ecosystems unsuitable in compliance with the cadastres of Slovakia (Durkovic et al., 1997).

5, 6

Enquiry Table 4: Data were taken from PIL (PFI) 96 (tab. CO, p. 3) with the adjustment as in *Enquiry Table 3* in "Forest available for wood supply" and "Forest not available for wood supply" and they were calculated from the stand land to the forest land.

7, 8

Enquiry Table 7: Data for the previous reference period were taken from the Total Forest Management Plan of Lesoprojekt (SLHP) 1988 as follows: "Forest"–total forest land resources from tab. A1 (p.1), "Forest available for wood supply" from tab. C1 (p. 6) for the category of forest H+Z+U, "Forest not available for wood supply" also from tab. C1 for the forest category O. Stand area was converted to the forest land area by the coefficient calculated as the ratio of the total forest area of SR and stand area.

Slovenia

1, 2

Enquiry Table 1: Expert assessments are based on the data from the forest management plans.

3, 4, 5, 6

Enquiry Table 3: Parameter estimates are based on the data from the Forest management plans and National Forest Inventory ("NF" is based on 712 permanent sampling plots (double stage sampling with tracts)).

5, 6

Enquiry Table 4: Forest management plans are used for "Forest available for wood supply" and "Forest not available for wood supply". Data for "Available for wood supply"–"High forest, and Coppice and coppice with standards" are based on the "NFI".

7, 8

Enquiry Table 7: According to the data from the forest management plans and "NFI" in 1996.

Spain

1, 2

Enquiry Table 1: Adjustment process: Adjustment for area of forest from 20 per cent to 10 per cent of the land area covered by trees.

Sweden

1, 2

Enquiry Table 1: FRA2000: 1992-1996

FRA1990: 1985-1989 (is updated where it is needed to the definitions of FRA2000)

Enquiry Table 1: Parameters "Forest" and "Other wooded land" have been composed of different land-use classes according to Swedish definitions and other data source available.

Area "Forest and other wooded land" in total protected areas and the high mountains has been estimated by means of remote sensing techniques.

Units:

m^3 o.b. = stem volume above the felling cut (which is 1 per cent of tree height), including the top of the tree and the bark.

m^3 u.b. = stem volume above the felling cut (which is 1 per cent of tree height), including the top of the tree but excluding the bark.

For both o.b. and u.b. the top is excluded when it comes to removals and harvest (for example in *Enquiry Table 16* "Fellings & Removals).

Tree = according to definition, but the interpretation is: trees are able to reach the height 5 m when the soil fertility and the surrounding environment is optimal.

Species mixture = based on percentage of basal area instead of percentage of tree crown cover to classify into species mixture classes for stands > 7 m height. For stands (that is plots) <= 7 m the proportion of the main stems (which should not be taken away if a pre-commercial thinning took place) are used instead.

Areas:

Forest: The TBFRA-2000 definition. is "land with a tree crown cover of more than 10 per cent and area of more than 0.5 ha. The trees should be able to reach a minimum height of 5 m at maturity...". Sweden has instead used "... all land with a tree crown cover of more than 20 per cent plus half of the land with a tree crown cover ranging from 1 per cent to 20 per cent, and area more than 0.25 ha ...". This is due to the fact that our field inventories have conducted their measurements according to these definitions during the period 1983-1987 and from this period we can use quotients between the different crown cover classes that can be used for the present reference period.

Other wooded land: The TBFRA-2000 definition is "Land either with a tree crown cover of 5-10 per cent.. height of 5 m at maturity in situ; or a crown cover of more than 10 per cent of tree not able to reach a height of 5 m at maturity in situ ...". Sweden will instead use "...a quarter of the land with a tree crown cover ranging from 1-20 per cent ...", and we will also use areas larger than 0.25 ha and we do not consider the width of the area.

For the standing stock and related figures all trees > 0 cm are included. For fellings and removals all stumps > 4 cm are included and for trees up to 4 cm a correction is done.

3, 4, 5, 6

Enquiry Table 3:

See *Enquiry Table 1* "Total area by main classes" for the definition of "Forest" and "Other wooded land".

Forest not available for wood supply (and other wooded land not available for wood supply):

1) For conservation/protection reasons: National parks, nature reserves, all sub-alpine birch forests, all low productive forest with a production capacity less than 1 m^3o.b./ha/year. Also areas (if not already excluded above) that are classified as protection forests or forests for recreation or near cities.

2) For economic reasons: Areas which are classified as power-lines and/or road/railroad areas. Areas situated more than 2000 m from a public or forest road or forest areas with a combination of steepness > 50 per cent or a "very rough" ground structure. Also areas (if not already excluded above) with definite technical hindrances are excluded.

Special comment on areas voluntarily set aside for environmental and/or nature conservation purposes:

The above protection/conservation areas are due to "hard" legislation reasons, etc. However, Swedish forestry has radically changed the environmental/nature conservation policy in the last ten years. As a result land-owners of all sizes are setting small and large areas aside as (more or less) private reserves. The latest data on these areas, voluntarily excluded from wood supply, tell us that about 2-4 per cent of the productive forest (production > 1 m^3 o.b./ha/year) areas are set aside as "special care areas" (> 0.5 ha per object). This adds up to about 450,000-900,000 ha. Also, when the final fellings are to be done about 5 per cent of the final felling areas are voluntarily set aside as "special care plots" (0.01-0.5 ha operation). Assuming that this "trend" will hold in the long run, then the accumulated "special care plots" will approach about 1,000,000 ha in a 100-year period.

As we do not know about the future (the trends are constantly changing) and as neither the "special care areas" nor the "special care plot" has any "hard" legislative protection, we are including them into the FRA 2000 category "Forest available for wood supply".

5, 6

Enquiry Table 4: See notes to *Enquiry Table 1* "Total area by main classes" for the definition of "Forest" and "Other wooded land".

Coppice: Only willow bio-energy plantations are included.

7, 8

See notes to the *Enquiry Table 1* "Total area by main classes" for the definition of "Forest" and "Other wooded land".

Reference period 1985-1989 updated according definitions FRA2000.

Source: Swedish University of Agricultural Sciences/Department of Forest Resource Management and Geomatics. Section of Forest Survey / BSc (For) Hans Toet.

The changes in *Enquiry Table 7* have a low accuracy and might not be valid at all. The reason for this is that the area sampling method used in our National Forest Survey holds a large area estimate random error component. And when it comes to area changes (if the changes are moderate) the random error component might (as in this case) be larger than the presented "chang" figures. Therefore the presented figures are also calibrated "ad hoc" somewhat to better correspond to reality. This has also given effects on *Enquiry Table 17* "Changes in area of forest and other wooded land over time by main categories".

Switzerland

1, 2

Enquiry Table 1: Forest: The figures of forest area refer to the forest area definition of the Swiss NFI. The application of the TBFRA Definition will lead to an increase of about 20,000 ha (1.7 per cent). This result was derived from a remeasured sample of 5,000 plots on the air photos interpreted for the second Swiss NFI. In the given statistics for Switzerland, it was decided not to consider this result because the reliability for smaller units than the total forest area of Switzerland is unknown.

Forest area definition: The definition is given in the EFICS study (Report on forestry inventory and survey systems, Volume 2), and depends on the following measures derived from air photos: Width: at least 25m with canopy closure of 100 per cent and 50m with crown cover of 20 per cent. The functional relation between crown cover and minimum width is explained in the above mentioned report. Canopy closure: at least 20 per cent. Minimum top height: 3m (exception: afforestation, young growth, mountain alder, mountain pine.

Information on the managed other wooded land is not available.

3, 4, 5, 6

Enquiry Tables 3 and 5: Forest area available for wood supply:

Generally, the total forest area of Switzerland is available for wood supply if one follows the definition of TBFRA.

Exceptions are protected areas which amount to 7,000 ha in Switzerland. The amount of 103,000 ha which was estimated not to be available for wood supply for economic reasons is based on expert opinions from WSL and ETHZ researchers.

There is a broad consensus that from the economic point of view, it is not meaningful to harvest those stands regularly at all. However logging actually was, is and will be done to some extent with cable crane and helicopter in those "remote areas".

5, 6

Enquiry Table 4: Forest available for wood supply--Coppice and coppice with standards, and Forest not available for wood supply--Coppice and coppice with standards: Figures do not originate from the NFI database but were derived from the figures in High forest of Forest available for wood supply, and High forest of Forest not available for wood supply.

Tajikistan

1, 2

Enquiry Table 1: Source for land area figures: http://www.odci.gov/CIA/publications/factbook/ti.html

Information on forest and other wooded land has been received from the TBFRA-2000 National Correspondent Mr. G. A. Avsalov, Director General of the Forest Association "Tajikles", in reply to the Table of the TBFRA Essential Data, 20.11.1998.

3, 4, 5, 6

Enquiry Table 3: Source for Conservation/protection reasons on forest not available for wood supply: Secretariat estimate based on the information from different literature sources.

Practically all forests are in mountainous area, and not available for wood supply for conservation (protection) or economic reasons; Forest area of the so called "1st Group";

Sources for Forest available for wood supply, and Forest not available for wood supply: Information from the TBFRA-2000 National Correspondent Mr. G. A. Avsalov.

5, 6

Enquiry Table 4: Source for High forest on forest not available for wood supply: Secretariat estimates based on different literature sources of information.

7, 8

Enquiry Table 7: Information on "forest" is from the TBFRA-2000 National Correspondent Mr. G. A. Avsalov.

The FYR of Macedonia

1, 2

Enquiry Table 1: Source for Total area, and Forest: Data for Forest and Other wooded land are provided by the Statistical office of the former Yugoslav Republic of Macedonia in their reply to the concise enquiry for SOFO-1997 (30.08.1996).

Source for Total area, Inland water, Land area and Other land: Information is the secretariat estimates based on literature sources and the evaluation of the situation in neighbouring countries.

3, 4, 5, 6

Enquiry Table 3: The data for Forest available for wood supply, Forest not available for wood supply and for Other wooded land are the secretariat estimates based on the information from different literature sources.

7, 8

Enquiry Table 7: The data for Forest are the secretariat estimates based on the information from different literature sources.

Turkey

1, 2

Enquiry Table 1: The first regular forest inventories were done between 1963-1972. According to forest management planning system, each year roughly 10 per cent of the forest land is re-inventoried. The new figures are the product of latest forest management plans by 1996 (5 per cent of forest land has still not been re-inventoried). When the two inventory cycles are compared (1963-1972 and 1973-1996) we witnessed an increase in total FOWL and the forest area, a decrease in OWL.

Please also note that definition of forest in Turkey includes the Other Wooded land also. The definition is as following:

"All tree and tree formations communities together with their land are forest. Except for land covered with steppe vegetation, marshes and wetland covered with bushes, city park areas, cemeteries, private lands with tree cover which is not grown in surrounding forests naturally, land out of forest borders with an area of less than 3 hectares."

Forest land is also classified according to its crown cover. Therefore Turkey has no difficulty to comply with the forest and other wooded land definitions of TBFRA.

3, 4, 5, 6

Enquiry Table 3: With regard to the classification by species groups, we divide the forest into three classes: pure coniferous, pure broadleaved, and mixed. Please note that 8.4 per cent of the figures of predominantly coniferous and 2.8 per cent of the figures of predominantly broadleaved forest are related with mixed (conifers and broadleaved) forests. In other words 11.2 per cent of the total forest and other wooded land is mixed forest.

5, 6

Enquiry Table 4: In high forests available for wood supply, our forest management planning system uses both age and diameters classes methods. In coppices and coppices with standards, coppice-planning system is used.

Turkmenistan

1, 2

Enquiry Table 1: Source for Total area, Forest and other wooded land: Data provided by the Ministry of Natural Resources Utilization and Environmental Protection of Turkmenistan in their reply to the concise enquiry for SOFO-97 (12.08.1996).

Source for Inland water, Land area, and Other land: Secretariat estimates based on different literature sources.

Turkmenistan covers a territory comparable to the size of France with a population of 4.2 million. The Kara-Kum Desert covers big parts of the country, and irrigated land represents 1.3 million hectares.

3, 4, 5, 6

Enquiry Table 3: Secretariat estimates on the basis of analysis of the available data on growing stock volume by species groups. The categories "exploitable" and "unexploitable" are used for the estimates for "availability for wood supply" and "not available for wood supply" respectively.

5, 6

Enquiry Table 4: Data on high forests and coppice are not available. About 80-90 per cent of the country are the sand deserts (the main one is Kara-Kum). Fertile land is only about 3 per cent of the territory. Cultivation oases are from ancient times located around the rivers Murgab and Tejen, and along the northern highlands of Kapet Dag mountains.

7, 8

Enquiry Table 7: Data provided by the Ministry of Natural Resources Utilization and Environmental Protection of Turkmenistan in their reply to the concise enquiry for SOFO-97 (12.08.1996).

Secretariat estimates based on different literature sources.

United Kingdom

1, 2

Enquiry Table 1: The United Kingdom definition of forest is minimum 20 per cent crown cover, minimum area 0.25 ha, but this gives similar area.

Other wooded land is estimate of wood pastures.

Source: Annual Abstract of Statistics; Forest from Census of Woodland 1980, adjusted to 1995 using annual administrative data.

3, 4, 5, 6

Enquiry Table 3:

Conifer = GB (Great Britain) conifer high forest + NIFS (Northern Ireland Forest Service) conifer + 10 NI private–half of mixed; broadleaved by subtraction.

Available for wood supply estimated using same assumptions as production forecast.

Mixed is 20-80 per cent mix, not 25-75 per cent, some estimated over larger area than single stand.

Broadleaved: Data adjusted: Estimate for all broadleaved, then subtracted half of estimate for mixed.

Mixed: Data adjusted: Estimate = around 7 per cent of forest total, based on recent air photography.

5, 6

Enquiry Table 4: Source: Census of Woodland 1980 adjusted to 1995 using admin data.

High forest available for wood supply: Data not adjusted; but increased by 20 to balance 20 decrease in estimate for coppice.

The figure for Coppice is a new estimate; previous estimate (published in Forestry Facts & Figures) was 40,000 ha. It is assumed that all coppice is available for wood supply.

7, 8

Enquiry Table 7:

1980 = 2108 GB from Census + 66 Northern Ireland; "Forest not available for wood supply" is estimate using same methodology as 1995.

United States of America

1, 2

Enquiry Table 1: The data in this report represent the 50 States and do not include the Commonwealth of Puerto Rico, USA Virgin Islands, Commonwealth of the Northern Marianas, or the Trust Territory of the Pacific Islands. Future assessments will provide these data.

Forest land [1.5] consists of all timberland and all reserved forest land. Timberland is defined as forest land available for wood supply, capable of producing 1.4 m^3/ha/year, and not withdrawn by statute or administrative regulation. Reserved forest is generally productive but withdrawn from wood supply by statute or administrative regulation. Much of the land reported as "other forest land" in this report may be classified as "forest land" in future reports as new statewide inventories are completed and establish proper classification parameters to conform explicitly to TBFRA definitions.

Other wooded land [1.6] is currently defined as unproductive forest land: forest land not capable of producing 1.4 m^3/ha/year. In the northern boreal regions of the continental USA and Alaska, the primary tree species occupying "other wooded lands" are jack pine, black spruce, aspen and white birch. In the interior and coastal west regions of the continental USA the primary tree species occupying "other wooded lands" are scrub oaks, pinyon juniper, chapparal, and mesquite. The USA has begun placing inventory samples on all such lands since 1995 and subsequent assessments will place many of these wooded lands in the forest category. It will take 10 years to complete a full inventory of these lands.

IMPORTANT NOTES on reported area and volume estimates

The reader is cautioned that there are important differences between the numbers provided in this report and those found in domestic USA reports. Terms used in the TBFRA such as "forest land" and "growing stock" are the same terms used in the USA but the meanings have subtle differences. Please read the following notes and understand these differences.

Forest land area–By USA Forest Service definition, forest land is at least 10 per cent stocked by forest trees, and at least 0.5 hectare in size. This is similar to the FAO definition, which defines forest land as land with tree crown cover of more than 10 per cent and minimum size of 0.5 ha. In general, the USA definition is considered to be compliant with the TBFRA 2000 definition for productive forest land. However, much of the land presented in this report for the USA as 'Other wooded land' may in fact be "Forest land" by the TBFRA definition. Full inventory data for these lands to assure compliance with the TBFRA definition is currently underway but will not be available for 3 to 5 years. The lands reported as "Other wooded land' in this report are generally of low productivity (less than 1.4 m^3/ha/year) and listed as "unproductive forest" or "other forest land" in USA reports. The USA response is generally consistent with the Canadian response for this land category.

Other wooded land area–"Other wooded land" in this report is primarily unproductive forest land, not capable of producing 1.4 m^3 per hectare of industrial wood annually. Most of this land will probably be re-classified as forest land in future TBFRA Assessments. See discussion of forest land above.

3, 4, 5, 6

Enquiry Table 3:

Forest land [3.1] consists of all timberland and all reserved forest land. Timberland is defined as forest land available for wood supply, capable of producing 1.4 m^3/ha/year, and not withdrawn by statute or administrative regulation. Reserved forest is generally productive but withdrawn from wood supply by statute or administrative regulation. Much of the land reported as "other forest land" in this report may be classified as "forest land" in future reports as new statewide inventories are completed and establish proper classification parameters to conform explicitly to TBFRA definitions.

Other wooded land [3.14] is currently defined as unproductive forest land. Forest land not capable of producing 1.4 m^3/ha/year. In the northern boreal regions of the continental USA and Alaska, the primary tree species occupying "other wooded lands" are jack pine, black spruce, aspen and white birch. In the interior and coastal west regions of the continental USA the primary tree species occupying "other wooded lands" are scrub oaks, pinyon juniper, chapparal, and mesquite. The USA has begun placing inventory samples on all such lands since 1995 and subsequent assessments will place many of these wooded lands in the forest category. It will take 10 years to complete a full inventory of these lands.

Predominant forest composition is based on forest cover type classification of species presently forming a plurality of the all-live tree stocking. Conifer is assumed to mean all relatively pure conifer cover types, broadleaved is assumed to mean all relatively pure broadleaved cover types, and mixed is assumed to mean cover types where up to 75 percent of the cover is one of these two broad cover groups. Examples of mixed types in the USA are oak-pine and oak-gum-cypress.

IMPORTANT NOTES on reported area and volume estimates

There are important differences between the numbers provided in this report and those found in domestic United States reports. Terms used in the TBFRA such as 'forest land' and 'growing stock' are the same terms used in the United States but the meanings have subtle differences. The following notes explain these differences.

Forest Available for Wood Supply–In the context of this report "available for wood supply" means only that the forest land is not withdrawn from timber production by law or administrative regulation. Actual availability, at any given time, will vary by ownership objectives. For instance, on public lands in the USA such as National Forest System lands, availability of forest land for timber production is further restricted in the planning process by determining if it is currently 'suitable' for timber management. Suitability varies based on factors such as available markets, accessibility, aesthetic restrictions, conservation restrictions, higher value alternative uses, and many other considerations. Private industrial forests are also subject to restrictions in the corporate planning process. The nearly 10 million non-industrial private forest landowners have management objectives perhaps as diverse as their numbers. Thus, in general, the values reported here as "available for wood supply" will overstate the actual area and volume available for wood supply by the cumulative restrictions of the forest planning process. For example, current plans suggest that perhaps only 1/3 of the available National Forest lands and, according to a recent private ownership study in the USA, only 1/3 of privately owned forest lands have timber management as a primary objective.

5, 6

Enquiry Table 4: Forest inventories in the United States do not distinguish between high forest and coppice or coppice with standards. The entire area of forest available for wood supply is assumed to be high forest. While a large area of the aspen forest in the United States is regenerated by root suckering after harvest, it is not monitored as a specific method of regeneration.

7, 8

Enquiry Table 7: Source: Smith, W. Brad; Joanne l. Faulkner; and Douglas S. Powell. 1994. Forest Statistics of the United States, 1992 .

Metric Units. Gen. Tech. Rep. NC-168: USDA Forest Service, St. Paul, MN. 147 p.

Waddell, K.L.; Oswald, D.O.; Powell, D.S. 1989. Forest Statistics of the United States, 1987. Resour, Bull. PNW-RB-168.

Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 106 p.

Data in the *Enquiry Table 7* show the current allocation of land in the "other wooded land" classification based on productivity (less than 1.4 m^3/ha/year) and not percent of tree cover as per TBFRA definition. As new state inventories are completed, much of what is currently labelled "other wooded land" may be re-classified as "forest land". This will cause an artificial shift to appear in future reports for these categories in both area and volume statistics.

Uzbekistan

1, 2

Enquiry Table 1: Source for land area figures: http://www.odci.gov/cta/publications/factbook/uz.html

Source for Forest, and Other wooded land: Secretariat estimates based on literature sources.

3, 4, 5, 6

Enquiry Table 3: Source for Conservation/protection reasons on forest not available for wood supply: Secretariat estimates based on the information from different literature sources.

The area under *Juniperus spp*. (coniferous) amounts to 183.4 thousand ha. The area with predominantly *Haloxylon spp.* (broadleaved) amounts to 1450 thousand ha, or 75 per cent of the total forest area.

7, 8

Enquiry Table 7: Information on Forest is from the article "Biological diversity and genetic resources of forest in Uzbekistan", FAO, 1997 by A.K. Kayimov and E.S. Alexandrovsky.

Yugoslavia

3, 4, 5, 6

Enquiry Table 3: Mixed Forest of broadleaved: 107,380 ha; Mixed Forest of coniferous: 64,963 ha; Mixed Forest of broadleaved and coniferous: 171,343 ha.

5, 6

Enquiry Table 4: "Forest not available for wood supply–Coppice and coppice with standards" include the Maguis area of 14,645 ha and an area of coppice, scrub and brushland which covers 209,882 ha in Montenegro.

CHAPTER II: OWNERSHIP AND MANAGEMENT STATUS OF FOREST AND OTHER WOODED LAND[1]

Overview

Information on the ownership and management status of forest and other wooded land in the 55 countries covered by the TBFRA-2000 is contained in Main Tables 9 to 24. This type of information is important as an indicator of the authority determining the uses to which the land may be put and the intensity in the way it is managed and used. Designation of land ownership is dependent on a cadastral or legal system which clearly demarcates territory. Such a system exists in most of the countries of the boreal and temperate regions, although in some of them uncertainties about legal ownership still persist. For the purpose of the TBFRA–2000 enquiry ownership is divided into three broad categories:

- Public ownership
- Private ownership
- Owned by indigenous or tribal peoples

These categories are defined in Appendix I under items 60, 58 and 26 respectively. Earlier assessments recognized only two ownership categories: public and private. By the time the FAO Global Forest Assessment 2000 was being prepared, however, it had become evident that in a number of countries, mostly in tropical regions but including several in the TBFRA area, ownership by indigenous or tribal peoples needed to be distinguished separately. The results show that in the TBFRA area this category of ownership of forest and other wooded land occurs in four countries (Australia, Canada, New Zealand, USA), although in New Zealand it is not yet possible to state the area concerned because the legal processes of determining ownership are still taking place. A similar situation exists in Canada which has, however, provided preliminary data.

Ownership status

The countries of the Commonwealth of Independent States (CIS) reported that all their forest and other wooded land came under public, in fact State, ownership (Main Tables 9 and 10). In some of them, however, as in most or all of the European countries with economies in transition, there is an on-going process of privatization or restitution. Figure 2.1 shows the sub-division of the area of forest and other wooded land in the TBFRA-2000 area, excluding the CIS countries, by type of ownership; and Figure 2.2 shows the same for forest and other wooded land separately.

For the TBFRA-2000 countries in aggregate, forest and other wooded land (FOWL) in public ownership amounted to 1.98 billion ha or 80 per cent of the total area. FOWL in private ownership amounted to about 437 million ha (18 per cent), while that owned by indigenous or tribal peoples covered, on the basis of incomplete information, about 62 million ha or between 2 and 3 percent. As seen in Figure 2.1, when the CIS countries with their 100 per cent public ownership are excluded, the percentages become 68 per cent in public ownership, 28 per cent in private and 4 per cent owned by indigenous or tribal peoples. The percentages change slightly in favour of private ownership when forest is taken alone (Figure 2.2): 61 per cent, 37 per cent, 2 per cent respectively. On the other hand, public ownership of other wooded land is much more pronounced, the percentages being 76 per cent, 18 per cent and 6 per cent respectively. In Australia, which accounts for more than half of all other wooded land in the TBFRA area, public ownership accounts for 70 per cent of the total and ownership by indigenous or tribal peoples for 20 per cent.

The area of forest in private ownership in Europe amounted to 96 million ha or 55 per cent of the total (Main Table 11). In western European countries, i.e. excluding those with economies in transition, the proportion of private ownership rises to 66 per cent. Thus western Europe, together with the USA and Japan, differs from the rest of the countries in the TBFRA area where public ownership accounts for a larger share of the total. The relatively high proportion of forest in private ownership in western Europe is a consequence of the long standing pattern of land ownership established over the centuries.

[1] This chapter was prepared by Mr. Tim Peck (see Appendix V).

FIGURE 2.1

Area of forest and other wooded land in the TBFRA area (excluding CIS) according to ownership

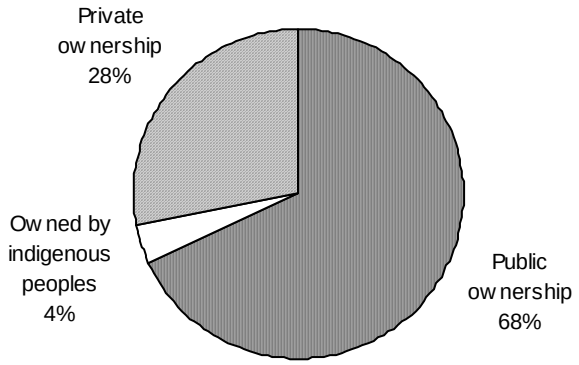


FIGURE 2.2

Area of forest and other wooded land in the TBFRA area (excluding CIS)

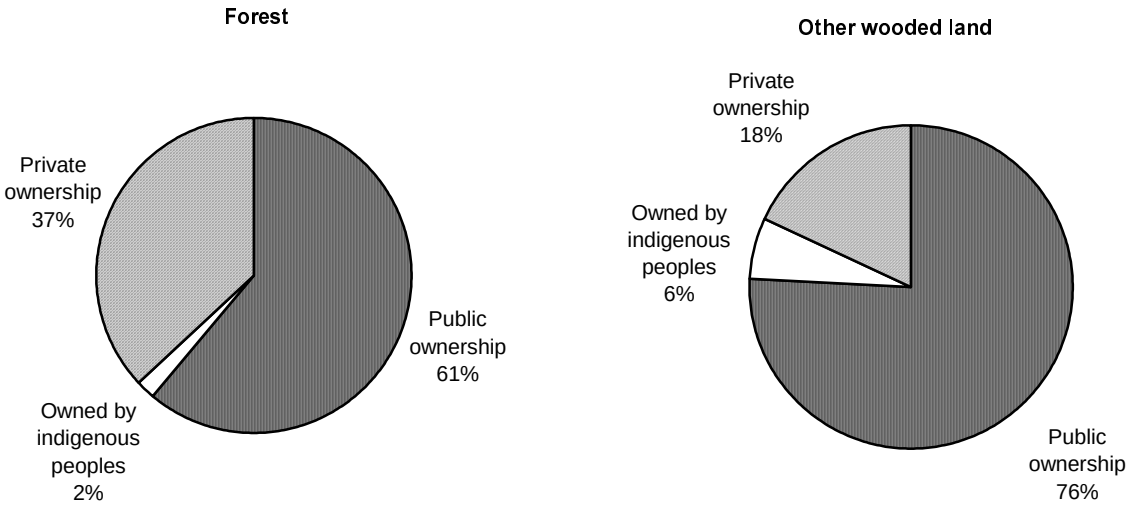


Figure 2.3 shows the proportions of the three ownership categories at the country group or country level. Canada, USA, Australia and New Zealand have forest owned by indigenous or tribal peoples, and these areas could increase in the future once the ownership of areas under claim is settled. In the case of New Zealand it is not yet possible to give any figures of ownership by indigenous or tribal peoples and the areas affected have been included under public ownership.

Canada's 90 per cent public ownership of forest is in contrast with its neighbour's, the USA, of 33 per cent. In the former most of the forest is owned by the Provinces and the situation varies considerably from one Province to another. In some countries, including Canada and Australia, publicly owned forest may be privately managed either for wood production or, in Australia's case, also for grazing.

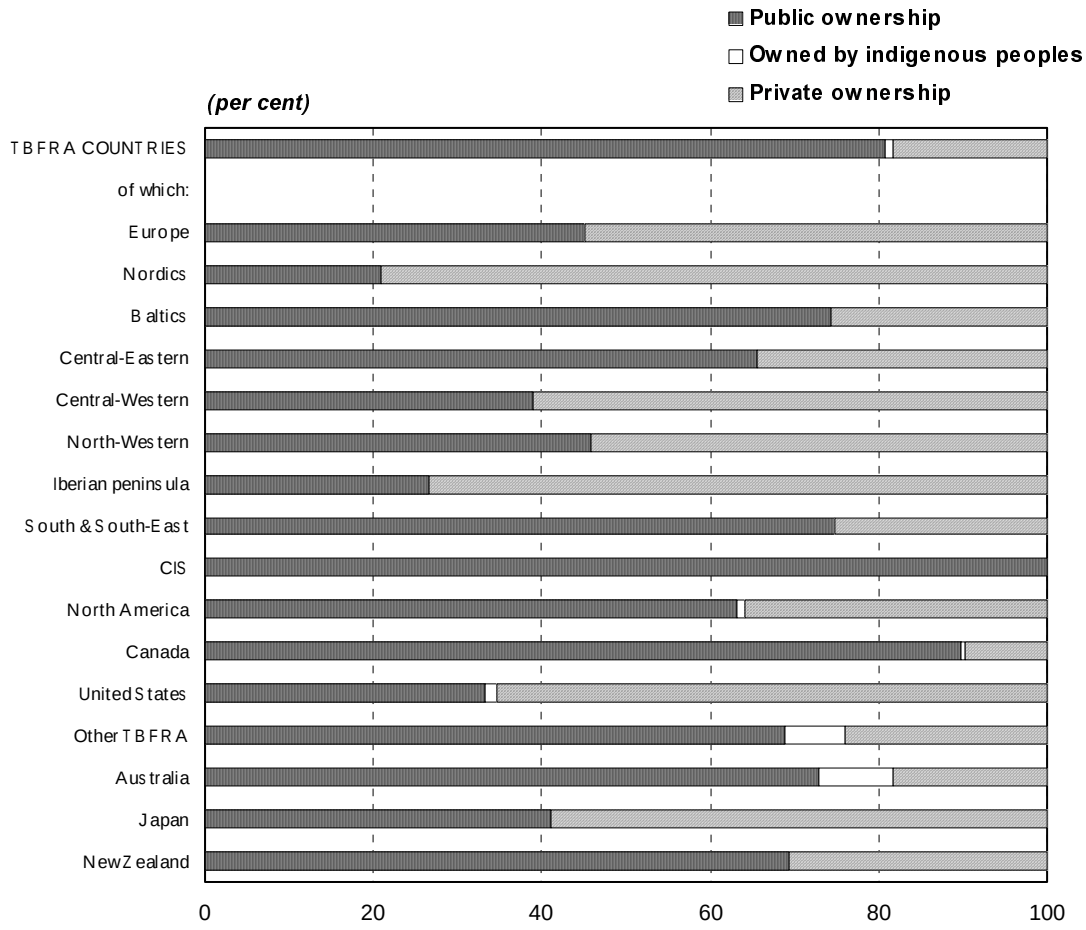
In the countries of the CIS, forest was still all 100 per cent publicly owned in the period for which the information was reported. In several of them, as well as in most of the European countries in transition from centrally planned to forms of market economies, the privatization or restitution process is in evolution. While in some, such as Poland and Yugoslavia, some private ownership did exist in recent times, in others it did not (Albania, Bulgaria, Romania). It is noteworthy that in such countries as Hungary, Latvia and Slovakia private ownership has already grown to account for a third or more of the total (Figure 2.4).

Portugal has the highest proportion of private forest with nearly 93 per cent, followed by Norway, Sweden and Austria. Among other market economy countries, private ownership of forest is relatively low in Cyprus, Greece, Israel, Liechtenstein and above all Turkey. The marked variations in the relative importance of the three ownership categories have arisen as a result of historical and political influences.

FIGURE 2.3

Forest in the TBFRA area by regional groupings, country groups or countries and main ownership categories

(per cent of total forest area)



In Australia the public ownership category contains a substantial area (66 million ha) of leasehold tenure, which is publicly owned but privately managed.

Ownership of forest available for wood supply

Information in greater detail on ownership was asked for in the TBFRA-2000 enquiry only for forest available for wood supply (FAWS) which, however, accounts for the major part (63 per cent) of the total forest area in the TBFRA countries in aggregate. The hierarchical structure in *Enquiry Table 5* and Main Table 12 of this review was as follows:

DIAGRAM 2.1

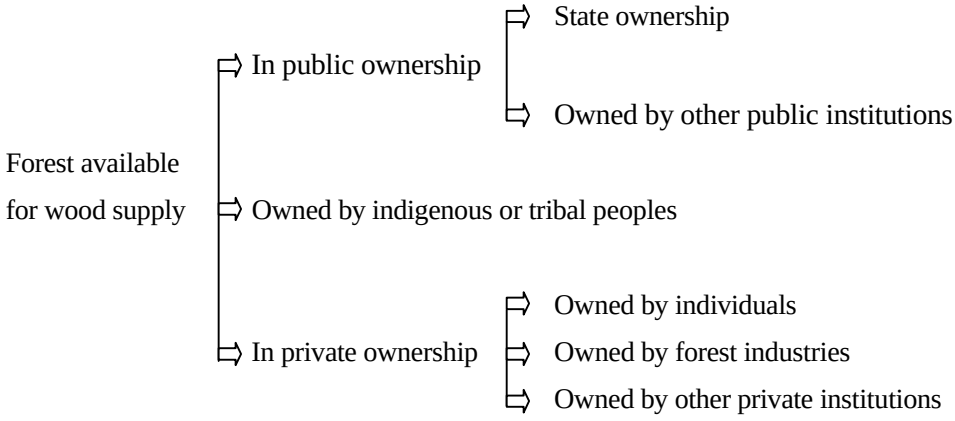
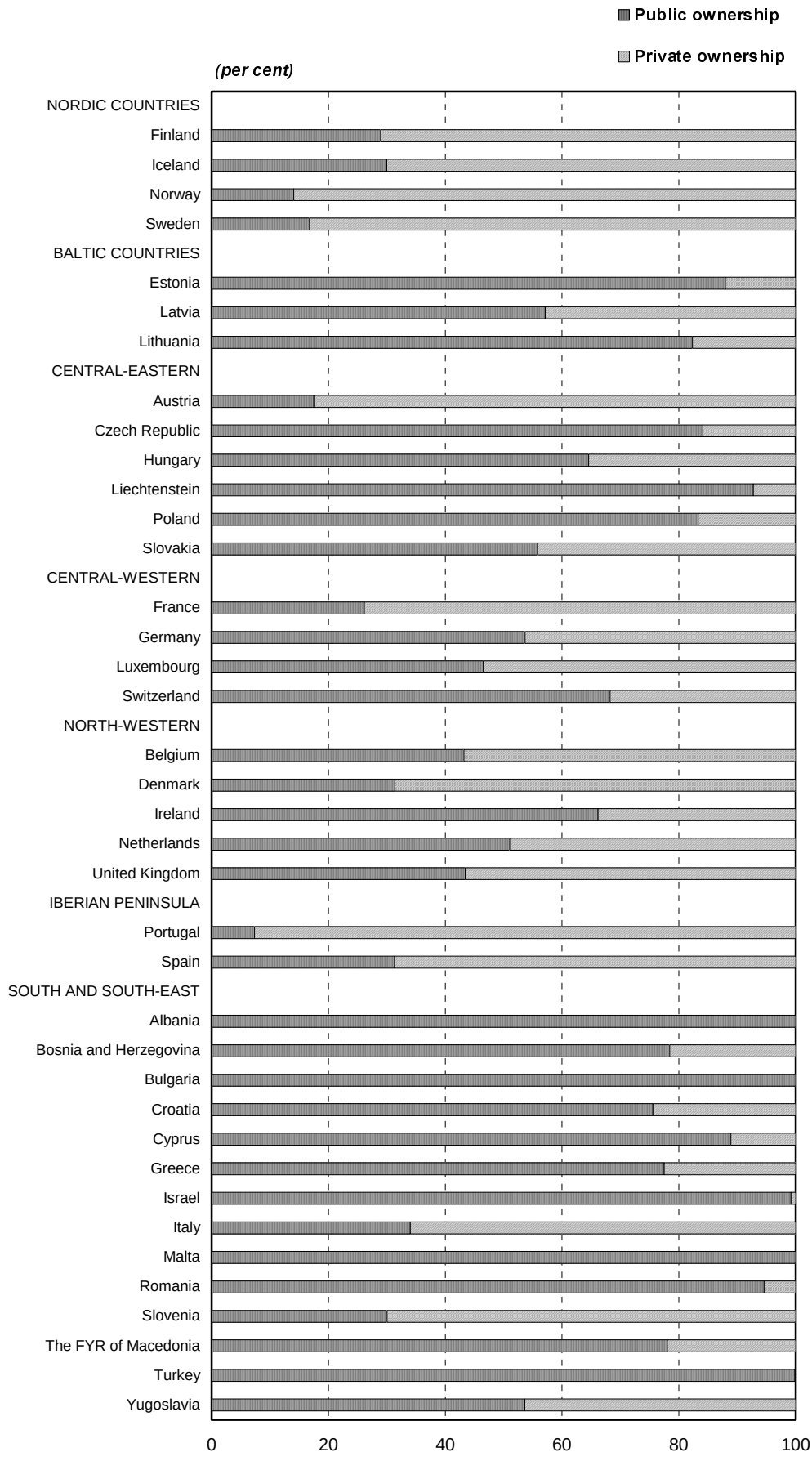


FIGURE 2.4

Share of forest in European countries by main ownership categories



The definitions used in the TBFRA-2000 enquiry for categories of ownership, as given in Appendix I, were basically the same as those in the previous enquiry, although in the case of ownership by individuals the definition made clear that this applied not only to individuals and families that combine forestry with agriculture (farm forests) or who live in or near their forest holdings, but also to the increasingly important category of owners who live elsewhere (absentee owners). A few countries experienced problems in fitting their data into the TBFRA framework. For example, Greece has areas that are co-owned by the State and individuals or that have other forms of co-ownership: these were included under private ownership. Slovakia included areas owned by churches under 'other public institutions', whereas the TBFRA definition places such areas under 'other private institutions'.

The results on ownership of forest available for wood supply are set out in Main Table 12 and show that most countries were able to provide the degree of detail called for. There is considerable variation in the pattern of ownership of FAWS within the TBFRA area. In the 55 countries in the area, State ownership accounts for over 750 million ha of the total area of FAWS or about 72 per cent, but this is heavily influenced by the 100 per cent State ownership in the CIS countries. Figure 2.5 shows the ownership pattern when the CIS countries, as well as Australia, for which data are not available, are excluded. State ownership and ownership by individuals both account for two fifths of the total and ownership by forest industries for not quite one tenth. The remaining one tenth is held by all other categories of ownership.

FIGURE 2.5

Forest available for wood supply by ownership categories in the TBFRA area, excluding CIS countries and Australia

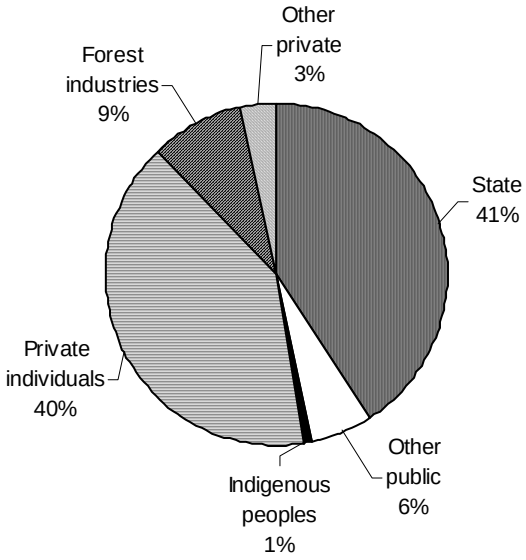


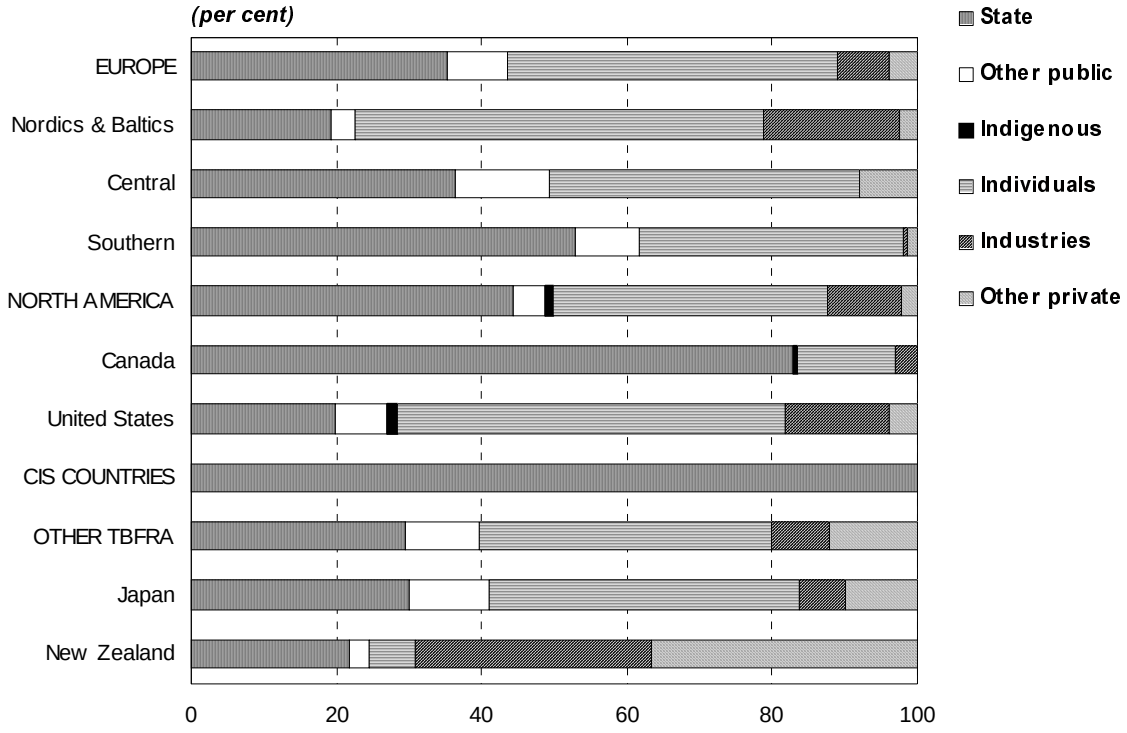
Figure 2.6 shows the distribution at the country group or country level. Apart from the CIS countries, State ownership is particularly important in Canada (83 per cent of the total) and southern Europe (53 per cent), and less important (less than one fifth) in the Nordic and Baltic countries and the USA. Ownership by private individuals accounts for more than half of the total in the Nordic and Baltic countries and the USA and is least important in New Zealand and Canada (6 per cent and 14 per cent respectively). Ownership by forest industries is relatively most important in New Zealand (33 per cent), followed by the Nordic and Baltic countries (19 per cent) and the USA (14 per cent). It is negligible in the countries of central and southern Europe in aggregate (Portugal is an exception), and not very important in Canada (3 per cent).

For the next most important category, ownership by public institutions other than the State, the countries of central Europe with 13 per cent and Japan with 11 per cent have the highest proportions of this type of ownership. In the category of ownership by other private institutions, only New Zealand has a high proportion of the total, 37 per cent, although the actual areas are quite large in the USA, central Europe and Japan.

With regard to public ownership of FAWS, it is estimated that 96 per cent of the total area in this category is in State ownership in the TBFRA countries in aggregate, Australia excluded, and that 4 per cent is owned by other public institutions. State ownership includes ownership by national or regional, e.g. provincial, bodies, the latter being notably the case in Canada, or State-owned commercial enterprises, as in Ireland. In several countries ownership by other public institutions, meaning cities, municipalities, communes and so on, is of considerable importance. Those where this type of ownership accounts for more than half of publicly owned FAWS include Belgium (75 per cent), France (61 per cent), Italy (82 per cent), Luxembourg (76 per cent), Portugal (88 per cent), Spain (98 per cent), Sweden

FIGURE 2.6

Share of forest available for wood supply in the TBFRA area by country groups or countries and ownership categories excluding Australia (per cent of total forest available for wood supply)



(79 per cent) and Switzerland (99 per cent) (see Figure 2.7). Nineteen per cent of Europe's FAWS in public ownership is owned by other (than State) public institutions.

For privately owned FAWS (Figure 2.8), in the TBFRA-2000 area as a whole (excluding Australia) individuals owned approximately 77 per cent, forest industries 17 per cent and other private institutions 6 per cent of the total. There are only a few countries where ownership by forest industries accounts for a sizeable share of the total of FAWS. These include Sweden and the USA, with 44 per cent and 20 per cent respectively of all privately owned FAWS, as well as Finland, Norway, Portugal, Canada, Japan and New Zealand. Ownership by other private institutions, for example religious and educational bodies and pension and investment funds, is of importance in terms of area in the USA, Japan, France, Finland and New Zealand.

In some, including the Netherlands and the United Kingdom, ownership by nature conservation societies has been increasing. In the USA, several private institutions and enterprises, such as mining companies, own large tracts of forest. As noted earlier, private ownership in any form had yet to appear in any of the CIS countries in the period to which their data refer, but in several that situation is changing.

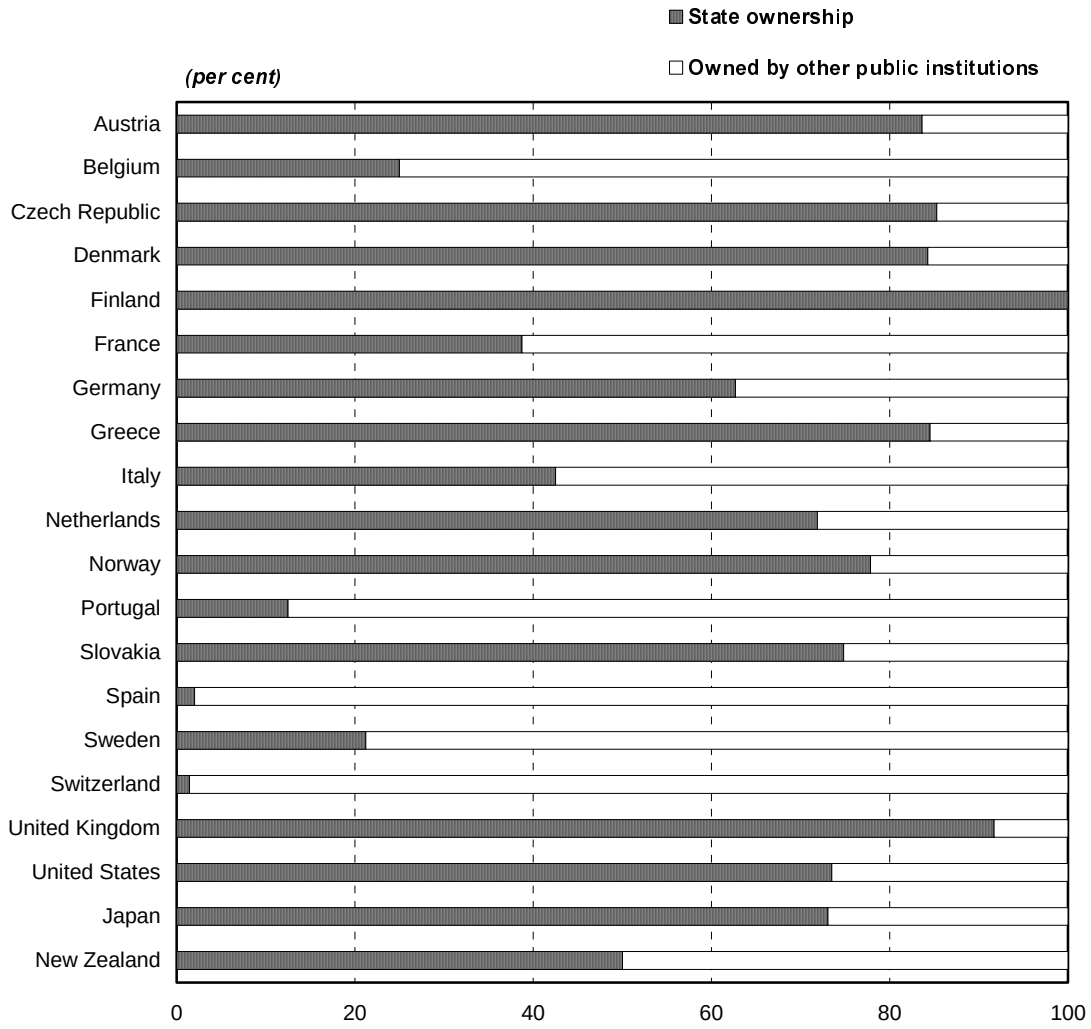
Among the countries not shown in Figures 2.7 and 2.8, it is recalled that ownership in the CIS countries is 100 per cent State. For Germany the breakdown of privately owned FAWS is not available, but it is reported that most is owned by individuals.

Management status

Main Tables 9 to 10 contain information on the management status of forest and other wooded land in total, and Main Tables 15 to 17 that of forest. The term 'managed' as applied to forest and other wooded land is defined in Appendix I under item 35, but because of the complexity of this issue, it is worth repeating here: "*Forest and other wooded land which is managed in accordance with a formal or an informal plan applied regularly over a sufficiently long period (5 years or more). The management operations include the tasks to be accomplished in individual forest stands (e.g. compartments) during the given period*". It has to be stated that arriving at a commonly acceptable definition of 'managed' was difficult for the FAO/ECE Team of Specialists on the Temperate and Boreal Forest Resource Assessment 2000. In the past, it had usually been understood to mean 'managed for wood production', but in view of the increasing relative and absolute importance of other non-wood goods and services, it was considered necessary for this assessment to expand the definition to cover management for these as well. It had also to be

FIGURE 2.7

Share of types of ownership in publicly owned forest available for wood supply in selected countries



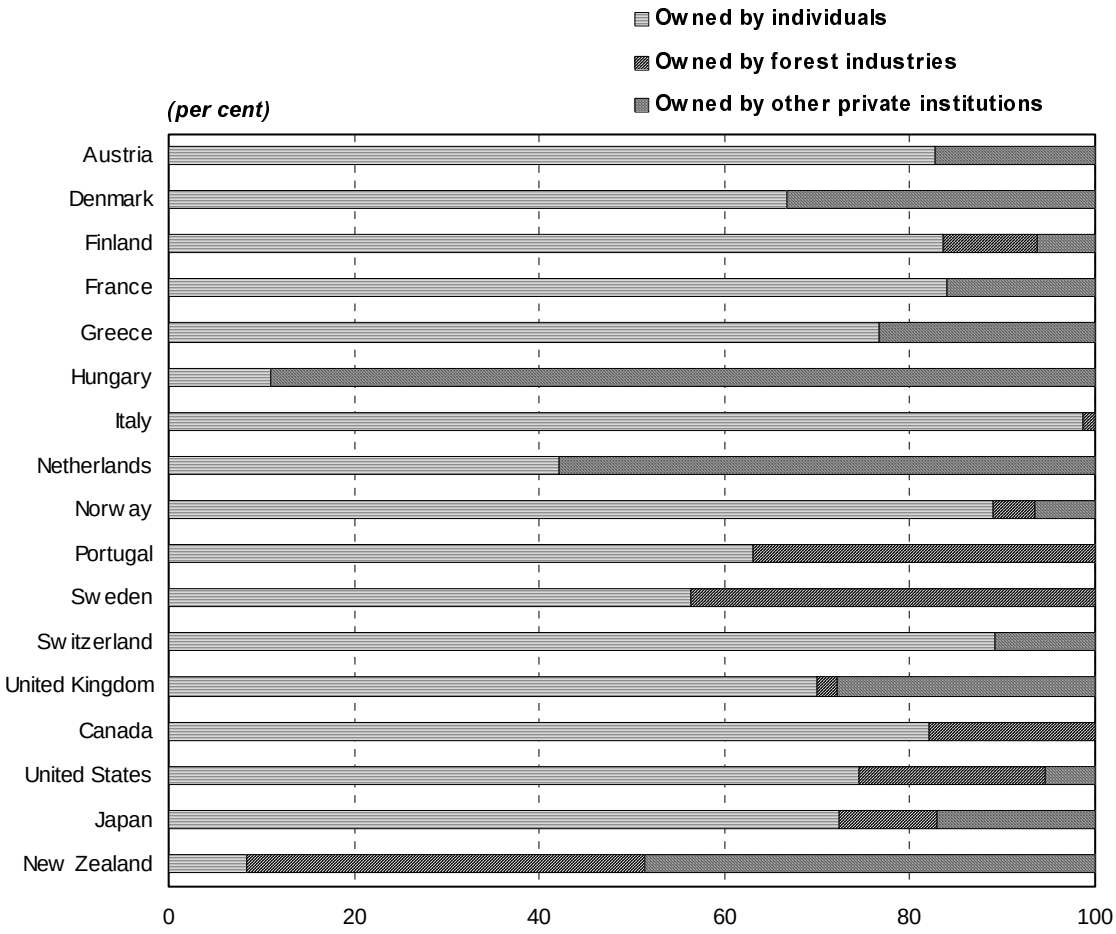
recognized that, although management was often carried out in accordance with an officially approved management plan, this was not always the case, especially in the private sector; the absence of such a plan did not necessarily mean lack of adequate management. On top of this, the Team of Specialists considered that a decision not to manage an area at all, for example to preserve it as a wilderness area or nature reserve, also qualified it as being "managed".

Thus there were several different aspects or levels of management to be taken into account by National Correspondents in determining the extent of management of forest and other wooded land. Understandably, some found difficulties in applying the definition, and careful analysis is needed to assess the degree of comparability between countries' data. Examples of possible deviations from the definition are found in Azerbaijan, where it is assumed that because all FOWL is State-owned, it is therefore managed. In Australia, the data on managed forest include areas managed for wood production, while in New Zealand they cover plantations. Norway found it difficult to estimate the area to put under 'managed'; even if no written plans exist, owners may have their own ideas and concepts for managing their forests. Furthermore, certain areas regarded as not suitable for wood production may often be utilized (and managed) for other purposes such as hunting, fishing or recreation.

Main Table 9 shows countries' total areas of forest and other wooded land that are managed according to ownership status. For the TBFRA-2000 countries in aggregate the area under management is approximately 86 per cent of total FOWL; the proportion is higher (89 per cent) for FOWL in public ownership and less for that in private ownership (49 per cent). The CIS countries report all but 1.1 million ha (1.2 per cent) of their areas of FOWL as being managed. If they are excluded from the TBFRA-2000 total, the proportion of FOWL being managed falls to 77 per cent and that of publicly owned FOWL to 80 per cent.

FIGURE 2.8

Share of types of ownership in privately owned forest available for wood supply in selected countries



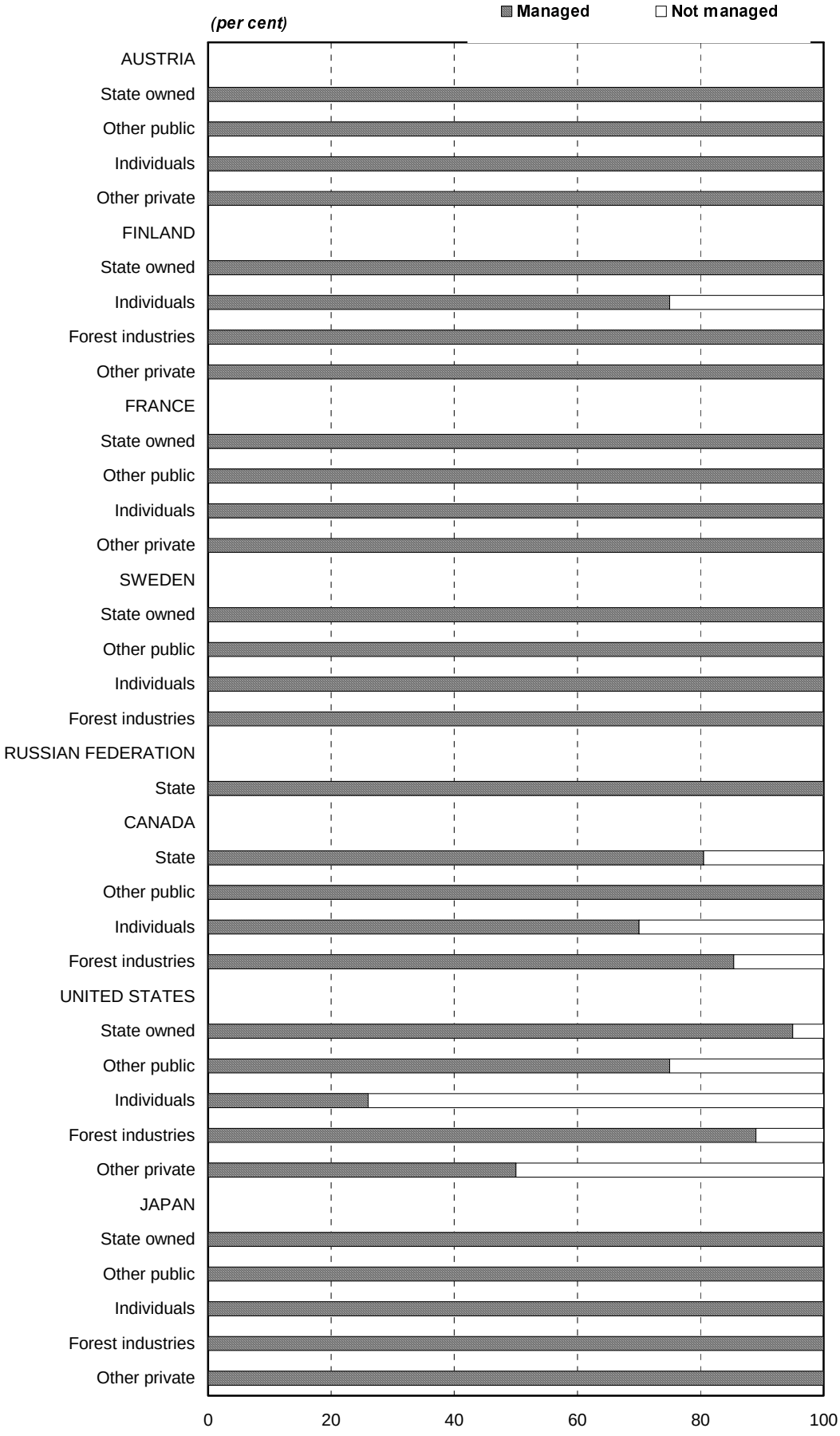
Data on management are separated for forest and for other wooded land in Main Table 14. This shows, not surprisingly, that the proportion of managed forest is on average in the TBFRA countries appreciably higher (94 per cent) than of managed other wooded land (78 per cent). The proportions of forest and OWL that are managed in European countries average 88 per cent and 63 per cent respectively and in North America 65 per cent and 42 per cent respectively, while those of the CIS and "Other TBFRA" countries are almost 100 per cent for both. The marked difference between the data for the Russian Federation and Canada, both with extensive areas of remote FOWL, calls into question whether there is consistency in the way in which the definition of 'managed' has been interpreted and highlights the problem, alluded to earlier, of finding a meaningful and workable international definition.

Main Table 15 shows the proportion of forest available for wood supply that is managed under the different ownership categories. On average for the 55 TBFRA countries the proportion of FAWS in public ownership that is managed is considerably higher (96 per cent) than that in private ownership (62 per cent). This is the result of, on the one hand, the almost 100 per cent management of public FAWS in the CIS countries and, on the other hand, the relatively low proportion of privately owned FAWS under management in the USA (40 per cent), which is the country with by far the largest area of this category. Within the private sector in the USA there is also a marked contrast between the proportion of managed FAWS owned by the forest industries (89 per cent) and that owned by individuals (26 per cent). Figure 2.9 shows the proportion of managed FAWS in total FAWS by ownership category in some of the major wood-producing countries. It is interesting to note that the majority of these countries consider that their FAWS in all ownership categories, even ownership by individuals, are managed, the main exceptions being Canada and the USA.

Main Table 16 provides data on the ownership of forest not available for wood supply and the proportion of that which is managed. As a general observation, it would seem that the proportion of FNAWS that countries consider to be under management is about as high as that of FAWS. However, because the area of FNAWS in most countries is low compared to that of FAWS, the area under management of the former is correspondingly small, roughly 560 million ha, of which the Russian Federation accounts for more than half.

FIGURE 2.9

Proportion of forest available for wood supply that is managed by ownership categories in selected countries



Holdings of forest and other wooded land

Information about the area and number of holdings by size classes is contained in Main Tables 18 to 24. The definition of 'holding' has to cover the rather different concepts relating to public and private holdings. The basic concept is that a holding consists of one or more parcels of forest and other wooded land which constitute a single unit from the point of view of management or utilization (Appendix I, item 24). The concept is generally easier to apply for ownership by individuals (or families), although the problems of collecting information on this ownership category are very great, given the large numbers of private owners in many of the countries of the TBFRA area. When applied to other categories of holdings, the definition may become more difficult to apply in a way that is consistent between countries. In the case of State holdings, one could argue that there is only one holding per country even if the parts of it are scattered. The definition indicated that in such cases a holding should be defined as an area forming a major management unit administered by a senior official, e.g. a Regional Forestry Officer. As administrative structures differ between countries, however, consistency is probably lacking in the understanding of what is a major management unit or a senior official. Similar difficulties may arise with regard to the holdings of other corporate bodies, public or private, and of forest industries. In the case of the latter the definition indicates that a holding may constitute a number of separated properties which are, however, managed according to one corporate strategy. Only a few countries have given explanations of how they have interpreted, or deviated from, the definition. Armenia, for example, indicates that its reported (State) holdings are forest districts, which are the smallest unit for decision making. Austria and Germany do not have information on private holdings of less than one ha. Spain has included information on public holdings with private ones.

The breakdown chosen for the enquiry into size classes of holdings is similar to that used in previous assessments, although the presentation of countries' data in the tables has been simplified by grouping all public holdings of less than 10 ha into one class and all private holdings of more than 10,000 ha also into one class. A number of countries reported that they either did not have information on holdings by size class or that their size class categories were different from those of the TBFRA. Despite these limitations, Main Tables 18 to 24 contain much information that is useful for the analysis of forest ownership structures and hence of the social and economic importance of FOWL within the broader land use context.

Taking into account that a few countries' data are missing, it is estimated that in Europe there are approximately 87,000 holdings of FOWL in public ownership and 10.7 million in private ownership. In parenthesis, it may be noted that the number of private holdings in Europe reported in the present assessment is considerably lower than reported previously. To some extent this may be due to an actual reduction in the number of holdings but it seems probable that in some countries holdings of less than one hectare have been excluded from the present assessment, which could make a difference of several million in the total number in Europe. The average size of public holdings in Europe is about 1,200 ha and that of private ones 10.6 ha. Details for individual countries are given in Main Table 18, which shows that there is considerable variation in the average size of holdings. In the USA the number of public holdings is reported as 64, giving an average size of 1.99 million ha, and the number of private holdings, which includes those of forest industries, as 9.94 million with an average size of 17.2 ha. Corresponding figures for Japan are 3,467 public holdings with an average size of nearly 3,050 ha and 2.86 million private holdings with an average size of 5 ha.

Particularly from the point of view of assessing the economic viability of holdings for wood production, the size class distribution is of interest. As a generalization it may be assumed that the smaller the size of a holding, the more problematic it is to operate it as a profitable wood-producing (or other type of) enterprise. This does not mean that the owners do not benefit from the property in other ways, such as hunting, recreation or the gathering of mushrooms, nuts and berries. Figures 2.10, 2.11, 2.12 and 2.13 show for four European countries the size class distribution for public and private holdings. The figures for the Czech Republic, France and Italy are probably rather typical, so far as private holdings are concerned, of the many European countries in central and southern Europe with large numbers of small owners. In the Czech Republic less than 3 per cent of the private owners own more than half of the area of forest and other wooded land, or put the other way round, 83 per cent of them own less than half (47 per cent) of the area. For France the situation is quite similar: 96 per cent of the private owners own 41 per cent of the area; and in Italy 89 per cent of them own 29 per cent of the area. In Norway the ownership is more evenly distributed over the size classes, but still 40 per cent of private owners hold only 3 per cent of the area. The distribution is somewhat similar in Finland and Sweden.

For all countries, in almost all cases, the distribution curves (for both area and number of holdings) for public forests are to the right of those for private forests. As would be expected, the average size of public holdings is considerably larger than the average size of private holdings, in the four countries, and in the TBFRA-2000 countries as a whole.

FIGURE 2.10

CZECH REPUBLIC: Size-class distribution of area and number of holdings of forest and other wooded land

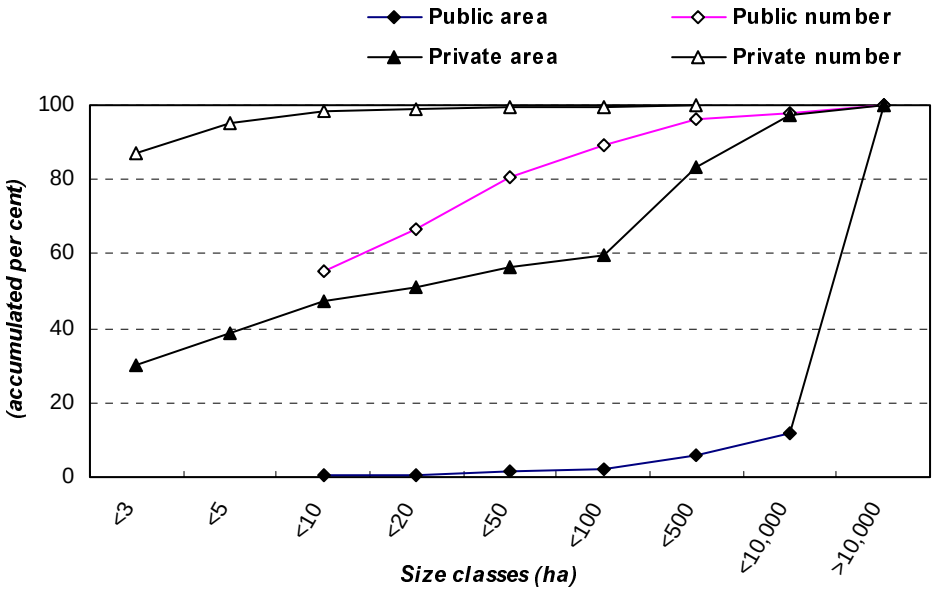
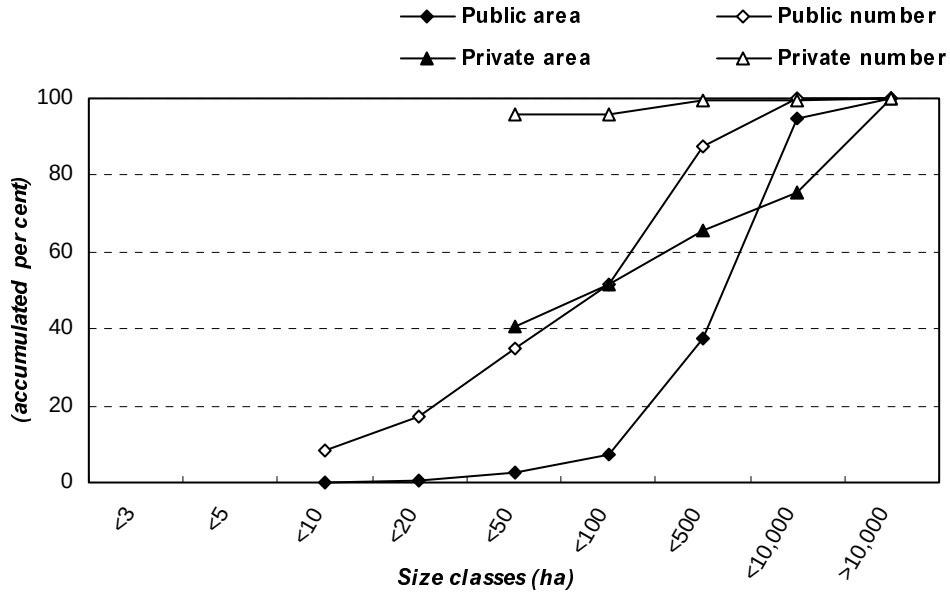


FIGURE 2.11

FRANCE: Size-class distribution of area and number of holdings of forest and other wooded land



Note: Data on private ownership relate to forest only and not FOWL.

FIGURE 2.12

ITALY: Size-class distribution of area and number of holdings of forest and other wooded land

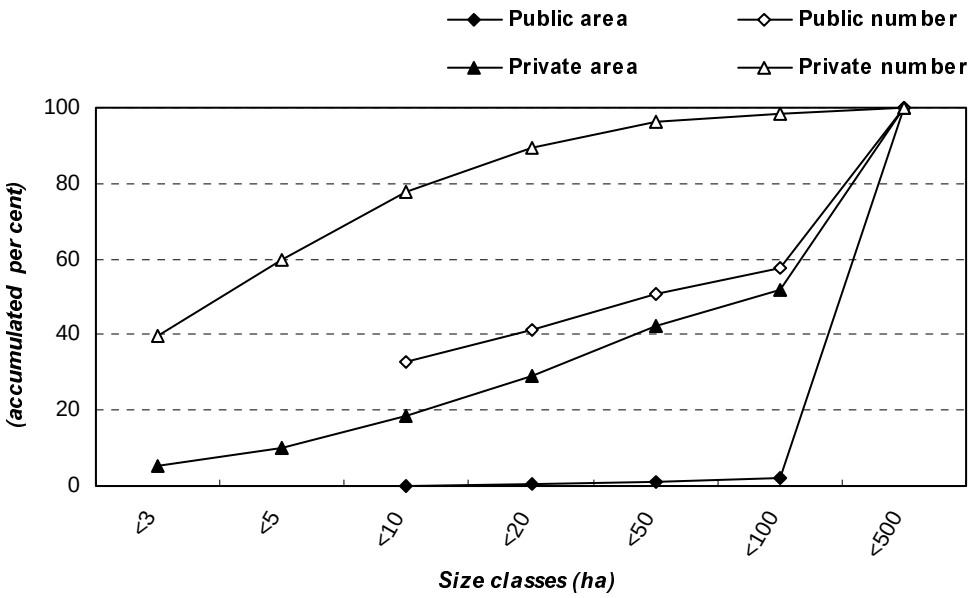
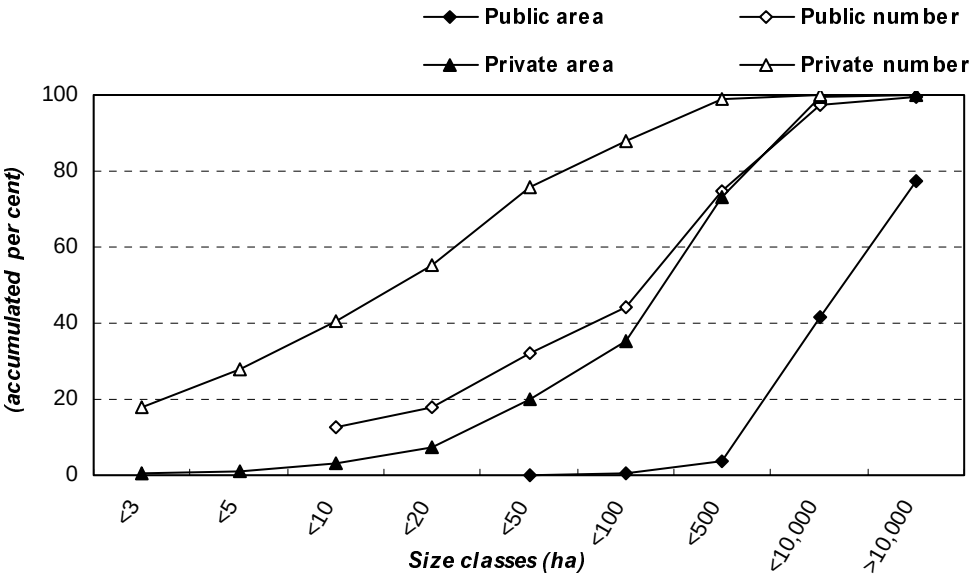


FIGURE 2.13

NORWAY: Size-class distribution of area and number of holdings of forest and other wooded land



Summary and conclusions

A. Main findings

1. ***General***. Public ownership accounted for nearly 80 per cent of the total area of forest and other wooded land in the TBFRA-2000 countries in aggregate: 100 per cent in the CIS countries and 68 per cent in the others. For forest available for wood supply in countries other than the CIS; State ownership and ownership by individuals each accounted for two fifths of the total and ownership by forest industries for nearly one tenth. Between 80 and 90 per cent of the area of forest and other wooded land in the TBFRA-2000 countries in aggregate is under management. More specifically:

2. ***Ownership status***. Information about the ownership status of forest and other wooded land was available from virtually all TBFRA-2000 countries, apart from some missing data on ownership by indigenous or tribal peoples in a few countries, where claims are in process. It is contained in Main Tables 9 to 17. The ownership pattern is

changing in many of the countries of Europe and the Commonwealth of Independent States (CIS) whose economies are in transition to forms of market economy, where the process of privatization or restitution is continuing and where therefore the information provided may be partly out of date. For the 55 TBFRA countries in aggregate, approximately 1.97 billion ha or 80 per cent of the area of FOWL was in public ownership, 435 million ha or 18 per cent in private ownership and approximately 62 million ha (between 2 and 3 per cent) owned by indigenous or tribal peoples. All FOWL in the CIS countries was still in public ownership in the periods for which the data were reported. If these countries are excluded, the proportions for the rest of the TBFRA area are 68 per cent in public ownership, 28 per cent private and 4 per cent owned by indigenous or tribal peoples. In western Europe, i.e. excluding countries with economies in transition, the proportion in private ownership is 66 per cent and this part of Europe together with the USA, to an even greater extent than the USA and Japan, differs from the rest of the TBFRA area where public ownership predominates. Canada, USA, Australia and New Zealand have FOWL owned by indigenous or tribal peoples, but New Zealand has included these areas with public ownership pending completion of the claims processes.

3. ***Ownership of forest available for wood supply.*** Most countries could provide information on ownership of FAWS broken down into a number of categories. For the TBFRA countries in aggregate it is estimated that State ownership and ownership by individuals each account for two fifths of the total and ownership by forest industries for not quite one tenth. The remaining one tenth is held by all other categories of ownership. 96 per cent of FAWS in public ownership is owned by the State. In several European countries ownership by other public bodies, such as municipalities and communes, accounted for more than half the publicly owned area; this was the case in France, Italy, Spain and Sweden among the larger forest countries. Under private ownership, it is estimated that about 77 per cent of FAWS is owned by individuals, 17 per cent by forest industries and 6 per cent by other private institutions. Ownership by forest industries occurs mainly in North America, the Nordic countries, Portugal, Japan and New Zealand. Ownership by other private institutions is important in terms of area in the USA, Japan, France, Finland and New Zealand.

4. ***Management status.*** It is estimated that about 86 per cent of FOWL in the TBFRA countries in aggregate is managed; the proportion is higher for FOWL in public ownership (89 per cent) than in private (49 per cent). The CIS and "Other TBFRA" countries report that virtually all of their FOWL is being managed. In Canada 52 per cent of FOWL is managed. On average in the TBFRA countries the proportion of FAWS in public ownership that is managed is considerably higher (96 per cent) than that in private ownership (62 per cent). This is a result of, on the one hand, the almost 100 per cent management of public FAWS in the CIS countries and, on the other hand, the relatively low proportion of privately owned FAWS under management in the USA (40 per cent), which is the country with by far the largest area in this category. It would seem that the proportion of FNAWS that countries consider to be under management is about as high as that of FAWS.

5. ***Holdings of forest and other wooded land.*** Although most countries were able to provide data of the area and number of holdings by size class, there are enough gaps to make it impossible to estimate figures for the TBFRA area as a whole (Main Tables 18 to 24). For Europe, it is estimated that there were about 77,000 holdings in public ownership and 10.7 million in private ownership. The average size of public holdings was 1,200 ha and that of private holdings 10.6 ha. In the USA the number of public holdings was 64, giving an average size of 1.99 million ha; the number of private holdings was 9.94 million with an average size of 17.2 ha. In most countries the size class distribution of private holdings results in a high proportion of owners owning a small proportion of the total area. There are several million private owners in Europe with holdings of less than 3 ha.

Conclusions

1. The information contained in Main Tables 9 to 17 on the ownership and management status of forest and other wooded land is important as an indicator of the authority determining the uses to which the land may be put and the intensity in the way it is managed and used. Most TBFRA countries have a cadastral or legal system that clearly demarcates ownership; in a few, doubts about legal ownership still persist. In others, notably those with economies in transition and those with indigenous or tribal peoples, important changes in the ownership structure of FOWL are currently taking place, which the currently available data are not able to reflect.

2. With regard to ownership by individuals, which is the most important ownership category after State ownership in the TBFRA countries in aggregate, significant changes in the pattern are occurring, notably the increasing proportion of absentee owners. The classification of ownership followed in TBFRA-2000 does not allow such changes to be monitored.

3. The sometimes wide disparities in countries' replies on the proportion of FOWL that is managed, which are not entirely explainable by differences in national situations, suggest that there is a lack of uniformity in the way in which the TBFRA definition has been interpreted and applied, notably the distinction between managed for wood supply only and for all forest functions, and between management according to approved working plans and less formal forms of management. There is also uncertainty as to whether the recommendation that areas where a

decision has been made not to manage them at all should be included in the 'managed' category could be followed in all cases.

4. Judging by the information contained in Main Tables 18 to 24 on holdings of forest and other wooded land, countries sometimes seem to have applied the definition of 'holdings' of FOWL in different ways, especially as applied to State holdings and those of forest industries. Also with regard to holdings by individuals, consistency is sometimes lacking on whether holdings of less than one hectare have been included or excluded. The present classification does not allow for the ownership of FOWL by absentee owners to be distinguished separately.

5. The above findings suggest that, while there is no need for substantial changes in the definitions of ownership and management, which would be undesirable anyway as discussed in the conclusions of Chapter I, some refinements might be introduced for use in future assessments that would make it easier for National Correspondents to provide consistent and comparable data.

6. Information on the ownership and management of FOWL is important as a basis for policies related to the social and economic elements of sustainable forest management as well as environmental ones. Especially for small private properties, it is costly, difficult and sometimes sensitive to collect. Future work on the collection and dissemination of information on ownership and management could benefit from increased co-operation between the public and private sectors and non-governmental organizations at national and international level.

TABLE 9

Ownership and management of forest and other wooded land in total

Country	Reference period	Forest and other wooded land			of which: Managed			
		In public ownership	owned by indigenous or tribal peoples	In private ownership	Total	In public ownership	Owned by indigenous or tribal peoples	In private ownership
		(1000 ha)						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	1995	1,030	0	0	406	406	0	0
Austria ©	1992-96	712	0	3,212	3,924	712	0	3,212
Belgium	1997	289	0	383	672	289	0	383
Bosnia and Herzegovina ©	1995	2,125	0	584	2,007 ①	1,709 ①	0	298 ①
Bulgaria	1995	3,903	0	0	3,590	3,590	0	0
Croatia	1996	1,651	0	454	1,560	1,328	0	232
Cyprus	1996	162	0	118	280	162	0	118
Czech Republic	1996	2,212	0	418	2,630	2,212	0	418
Denmark ©	1990	153	0	386	538	153	0	386
Estonia ©	1996	1,978	0	184	1,129	952	0	177
Finland	1991-96	6,772	0	15,996	19,494	6,772	0	12,722
France ©	1995-97	4,228	0	12,761	15,419	4,228	0	11,191
Germany ©	1987	5,762	0	4,978	10,740	5,762	0	4,978
Greece ©	1992	5,331	0	1,182	2,539	2,125	0	414
Hungary ©	1996	1,169	0	642	1,811	1,169	0	642
Iceland ©	1985	39	0	91	13	8	0	5
Ireland	1996	391	0	200	551	385	0	166
Israel ©	1996	168	0	2	122	121	0	1
Italy ©	1995	3,687	0	7,155	1,117 ①	1,110 ①	0	7 ①
Latvia ©	1997	1,678	0	1,317	2,995	1,678	0	1,317
Liechtenstein ©	1995	6.9	0	0.5	7.4	6.9	0	0.5
Lithuania ©	1997	1,683	0	367	1,958	1,593	0	365
Luxembourg	1994-97	41	0	47	10	10	0	0
Malta	1996	0.347	0	0	0.347	0.347	0	0
Netherlands ©	1992-96	173	0	166	339	173	0	166
Norway ©	1989	2,936	0	9,064	9,292	2,248	0	7,044
Poland ©	1992-96	7,449	0	1,493	8,942	7,449	0	1,493
Portugal ©	1995	267	0	3,200	1,206	247	0	959
Romania ©	1990	6,320	0	360	6,680	6,320	0	360
Slovakia ©	1996	1,133	0	898	1,988	1,117	0	871
Slovenia ©	1996	347	0	819	1,099	330	0	769
Spain ©	1985-95	5,608	0	20,376	17,682	5,296	0	12,386
Sweden ©	1992-96	6,147	0	24,112	30,259	6,147	0	24,112
Switzerland ©	1993-95	850	0	384	1,153 ①	784 ①	0	369 ①
The FYR of Macedonia ©	1995	707 ①	0	199 ①	948	707 ①	0	199 ①
Turkey ©	1996	20,695	0	18	20,713	20,695	0	18
United Kingdom ©	1995	1,072	0	1,417	2,319	1,072	0	1,247
Yugoslavia ©	1995	1,982	0	1,498	3,309	1,982	0	1,327
Total: Europe		**100,858**	**0**	**114,482**	**179,442**	**91,048**	**0**	**88,352**
of which: EU 15		**40,633**	**0**	**95,571**	**106,810**	**34,481**	**0**	**72,328**
Armenia	1996	392	0	0	392	392	0	0
Azerbaijan ©	1988	990	0	0	990	990	0	0
Belarus ©	1997	8,936	0	0	8,368	8,368	0	0
Georgia ©	1995	2,988	0	0	2,438	2,438	0	0
Kazakhstan	1993	16,673	0	0	16,673	16,673	0	0
Kyrgyzstan ©	1988	797	0	0	797	797	0	0
Republic of Moldova	1997	355	0	0	355	355	0	0
Russian Federation ©	1993	886,538	0	0	886,538	886,538	0	0
Tajikistan ©	1995	730	0	0	730	730	0	0
Turkmenistan ©	1995	3,754	0	0	3,754	3,754	0	0
Ukraine	1996	9,494	0	0	9,494	9,494	0	0
Uzbekistan	1998	2,170	0	0	2,170	2,170	0	0
Total: CIS		**933,817**	**0**	**0**	**932,699**	**932,699**	**0**	**0**
Canada ©	1994	388,927	1,451	27,206	224,546	203,611	909	20,026
United States of America ©	1992	127,120	6,922	164,093	180,571	113,435	4,707	62,429
Total: North America		**516,047**	**8,373**	**191,299**	**405,117**	**317,046**	**5,616**	**82,455**
Australia ©	1990-94	410,342	53,517	114,609	578,467	410,342	53,517	114,609
Japan ©	1995	10,573	0	14,573	25,146	10,573	0	14,573
New Zealand ©	1996	5,514 ①	0 ①	2,426 ①	6,912	5,514 ①	0	1,398 ①
Total: Other TBFRA		**426,429**	**53,517**	**131,608**	**610,525**	**426,429**	**53,517**	**130,580**
Grand total		**1,977,152**	**61,890**	**437,389**	**2,127,783**	**1,767,222**	**59,133**	**301,387**

© See notes and comments in Chapter II

① Only Forests.

TABLE 10

Ownership and management of forest and other wooded land in total: comparative data

Country	Reference period	Forest and other wooded land			of which: Managed			
		In public ownership	Owned by indigenous or tribal peoples	In private ownership	Total	In public ownerhsip	Owned by indigenous or tribal peoples	In private ownership
		(Per cent of total 'forest and other wooded land')			(Per cent of total 'FOWL')	(Per cent of total 'public')	(Per cent of total 'indigenous or tribal peoples')	(Per cent of total 'private')
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	1995	100.0	0.0	0.0	39.4	39.4		
Austria ©	1992-96	18.1	0.0	81.9	100.0	100.0		100.0
Belgium	1997	43.0	0.0	57.0	100.0	100.0		100.0
Bosnia and Herzegovina ©	1995	78.4	0.0	21.6	74.1 ④	80.4 ⑤		51.0 ⑦
Bulgaria	1995	100.0	0.0	0.0	92.0	92.0		
Croatia	1996	78.4	0.0	21.6	74.1	80.4		51.1
Cyprus	1996	57.9	0.0	42.1	100.0	100.0		100.0
Czech Republic	1996	84.1	0.0	15.9	100.0	100.0		100.0
Denmark ©	1990	28.4	0.0	71.6	100.0	100.0		100.0
Estonia ©	1996	91.5	0.0	8.5	52.2	48.1		96.2
Finland	1991-96	29.7	0.0	70.3	85.6	100.0		79.5
France ©	1995-97	24.9	0.0	75.1	90.8	100.0		87.7
Germany ©	1987	53.6	0.0	46.4	100.0	100.0		100.0
Greece ©	1992	81.9	0.0	18.1	39.0	39.9		35.0
Hungary ©	1996	64.5	0.0	35.5	100.0	100.0		100.0
Iceland ©	1985	30.0	0.0	70.0	10.0	20.5		5.5
Ireland	1996	66.2	0.0	33.8	93.2	98.5		83.0
Israel ©	1996	98.8	0.0	1.2	71.8	72.0		50.0
Italy ©	1995	34.0	0.0	66.0	10.3 ④	30.1 ⑤		0.1 ⑦
Latvia ©	1997	56.0	0.0	44.0	100.0	100.0		100.0
Liechtenstein ©	1995	93.2	0.0	6.8	100.0	100.0		100.0
Lithuania ©	1997	82.1	0.0	17.9	95.5	94.7		99.5
Luxembourg	1994-97	46.7	0.0	53.3	11.6	24.9		0.0
Malta	1996	100.0	0.0	0.0	100.0	100.0		
Netherlands ©	1992-96	51.0	0.0	49.0	100.0	100.0		100.0
Norway ©	1989	24.5	0.0	75.5	77.4	76.6		77.7
Poland ©	1992-96	83.3	0.0	16.7	100.0	100.0		100.0
Portugal ©	1995	7.7	0.0	92.3	34.8	92.5		30.0
Romania ©	1990	94.6	0.0	5.4	100.0	100.0		100.0
Slovakia ©	1996	55.8	0.0	44.2	97.9	98.6		97.0
Slovenia ©	1996	29.8	0.0	70.2	94.3	95.1		93.9
Spain ©	1985-95	21.6	0.0	78.4	68.0	94.4		60.8
Sweden ©	1992-96	20.3	0.0	79.7	100.0	100.0		100.0
Switzerland ©	1993-95	68.9	0.0	31.1	93.4 ④	92.2 ⑤		96.1 ⑦
The FYR of Macedonia ©	1995	71.6 ①	0.0	20.1 ③	96.0	100.0 ⑤		100.0 ⑦
Turkey ©	1996	99.9	0.0	0.1	100.0	100.0		100.0
United Kingdom ©	1995	43.1	0.0	56.9	93.2	100.0		88.0
Yugoslavia ©	1995	57.0	0.0	43.0	95.1	100.0		88.6
Total: Europe		**46.8**	**0.0**	**53.1**	**83.3**	**90.3**		
of which: EU 15		**29.8**	**0.0**	**70.2**	**78.4**	**84.9**		**75.7**
Armenia	1996	100.0	0.0	0.0	100.0	100.0		0.0
Azerbaijan ©	1988	100.0	0.0	0.0	100.0	100.0		0.0
Belarus ©	1997	100.0	0.0	0.0	93.6	93.6		0.0
Georgia ©	1995	100.0	0.0	0.0	81.6	81.6		0.0
Kazakhstan	1993	100.0	0.0	0.0	100.0	100.0		0.0
Kyrgyzstan ©	1988	100.0	0.0	0.0	100.0	100.0		0.0
Republic of Moldova	1997	100.0	0.0	0.0	100.0	100.0		0.0
Russian Federation ©	1993	100.0	0.0	0.0	100.0	100.0		0.0
Tajikistan ©	1995	100.0	0.0	0.0	100.0	100.0		0.0
Turkmenistan ©	1995	100.0	0.0	0.0	100.0	100.0		0.0
Ukraine	1996	100.0	0.0	0.0	100.0	100.0		0.0
Uzbekistan	1998	100.0	0.0	0.0	100.0	100.0		0.0
Total: CIS		**100.0**	**0.0**	**0.0**	**99.9**	**99.9**		**0.0**
Canada ©	1994	93.1	0.3	6.5	53.8	52.4	62.6	73.6
United States of America ©	1992	42.6	2.3	55.0	60.6	89.2	68.0	38.0
Total: North America		**72.1**	**1.2**	**26.7**	**56.6**	**61.4**	**67.1**	**43.1**
Australia ©	1990-94	70.9	9.3	19.8	100.0	100.0	100.0	100.0
Japan ©	1995	42.0	0.0	58.0	100.0	100.0		100.0
New Zealand ©	1996	61.0 ①	0.0 ②	26.8 ③	76.5	100.0 ⑤		57.6 ⑦
Total: Other TBFRA		**69.6**	**8.7**	**21.5**	**99.7**	**100.0**		**99.2**
Grand total		**79.8**	**2.5**	**17.7**	**85.9**	**89.4**		

© See notes and comments in Chapter II.
① Public forest in per cent of total forest and other wooded land
② Tribal forest in per cent of total forest and other wooded land
③ Private forest in per cent of total forest and other wooded land
④ Managed forest in per cent of total forest and other wooded land
⑤ Managed public forest in per cent of total public forest
⑥ Managed tribal forest in per cent of total tribal forest
⑦ Managed private forest in per cent of total private forest

TABLE 11

Ownership of forest and of other wooded land

Country	Reference period	Forest			Other wooded land		
		In public ownership	Owned by indigenous or tribal peoples	In private ownership	In public ownership	Owned by indigenous or tribal peoples	In private ownership
		(1000 ha)					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Albania ©	1995	1,030	0	0	0	0	0
Austria ©	1992-96	672	0	3,168	40	0	44
Belgium	1997	279	0	367	10	0	16
Bosnia and Herzegovina ©	1995	1,785	0	491	340	0	93
Bulgaria	1995	3,590	0	0	314	0	0
Croatia	1996	1,341	0	434	310	0	20
Cyprus	1996	104	0	13	58	0	105
Czech Republic	1996	2,212	0	418	0	0	0
Denmark ©	1990	140	0	306 ①	13	0	80
Estonia ©	1996	1,841	0	175	137	0	9
Finland	1991-96	6,332 ①	0 ①	15,551 ①	440	0	445
France ©	1995-97	3,965	0	11,191	263	0	1,570
Germany ©	1987	5,762	0	4,978	0	0	0
Greece ©	1992	2,603	0	756	2,728	0	426
Hungary ©	1996	1,169 ①	0	642 ①	0	0	0
Iceland ©	1985	9	0	21	30	0	70
Ireland	1996	391	0	200	0	0	0
Israel ©	1996	121	0	1	47	0	1
Italy ©	1995	3,352 ①	0 ①	6,505 ①	335	0	650
Latvia ©	1997	1,647	0	1,237	31	0	80
Liechtenstein ©	1995	6	0	1	1	0	0
Lithuania ©	1997	1,628	0	350	55	0	17
Luxembourg	1994-97	40	0	46	1	0	2
Malta	1996	0.347	0	0	0	0	0
Netherlands ©	1992-96	173	0	166 ①	0	0	0
Norway ©	1989	1,226 ①	0	7,484 ①	1,710	0	1,580
Poland ©	1992-96	7,449 ①	0	1,493 ①	0	0	0
Portugal ©	1995	248	0	3,135	19	0	65
Romania ©	1990	5,961	0	340	359	0	20
Slovakia ©	1996	1,124 ①	0	892 ①	9	0	6
Slovenia ©	1996	330 ①	0	769 ①	17	0	50
Spain ©	1985-95	4,235	0	9,274	1,373	0	11,102
Sweden ©	1992-96	4,565	0	22,699	1,582	0	1,413
Switzerland ©	1993-95	800	0	373	50	0	11
The FYR of Macedonia ©	1995	707	0	199		0	
Turkey ©	1996	9,939	0	15	10,756	0	3
United Kingdom ©	1995	1,072 ①	0	1,397 ①	0	0	20
Yugoslavia ©	1995	1,552	0	1,342	430	0	156
Total: Europe		**79,401**	**0**	**96,428**		**0**	
of which: EU 15		**33,829**	**0**	**79,738**	**6,804**	**0**	**15,833**
Armenia	1996	334	0	0	58	0	0
Azerbaijan ©	1988	936	0	0	54	0	0
Belarus ©	1997	7,865	0	0	1,071	0	0
Georgia ©	1995	2,988	0	0	0	0	0
Kazakhstan	1993	10,504	0	0	6,169	0	0
Kyrgyzstan ©	1988	729	0	0	68	0	0
Republic of Moldova	1997	324 ①	0	0	31	0	0
Russian Federation ©	1993	816,538	0	0	70,000	0	0
Tajikistan ©	1995	400	0	0	330	0	0
Turkmenistan ©	1995	3,754	0	0	0	0	0
Ukraine	1996	9,458	0	0	36	0	0
Uzbekistan	1998	1,909	0	0	261	0	0
Total: CIS		**855,739**	**0**	**0**	**78,078**	**0**	**0**
Canada ©	1994	219,399 ①	1,076 ①	24,096 ①	169,528	375	3,110
United States of America ©	1992	72,425	3,147	141,761	54,695	3,775	22,332
Total: North America		**291,824**	**4,223**	**165,857**	**224,223**	**4,150**	**25,442**
Australia ©	1990-94	114,568	13,627	28,683	295,774	39,890	85,926
Japan ©	1995	9,863 ①	0	14,201 ①	710	0	372
New Zealand ©	1996	5,514	0	2,426			
Total: Other TBFRA		**129,945**	**13,627**	**45,310**			
Grand total		**1,356,909**	**17,850**	**307,595**			

© See notes and comments in Chapter II.
① Adjustment to achieve conformity with TBFRA definitions carried out by the National Correspondent .

TABLE 12

Ownership of forest available for wood supply

Country	Reference period	In public ownership			Owned by indigenous or tribal peoples	In private ownership			
		Total	State ownership	Other public institutions		Total	Owned by individuals	Owned by forest industries	Owned by other private institutions
		(1000 ha)							
(1)	(2)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Albania ©	1995	902	902	0	0	0	0	0	0
Austria ©	1992-96	550	460	90	0	2,802	2,315	0	487
Belgium	1997	276	69	207	0	364	352	1	10
Bosnia and Herzegovina ©	1995	1,023	1,023	0	0	282	282	0	0
Bulgaria	1995	3,124	3,124	0	0	0	0	0	0
Croatia	1996	1,257	1,255	2	0	433	433	0	0
Cyprus	1996	43	43	0	0	0	0	0	0
Czech Republic	1996	2,141	1,826	315	0	418	418	0	0
Denmark ©	1990	140	118	22	0	301	200	0	100
Estonia ©	1996	1,757	1,752	5	0	175	170	0	5
Finland	1991-96	5,164	5,164	0	0	15,511	12,936	1,613	962
France ©	1995-97	3,787	1,467	2,320	0	10,683	8,983	0	1,700
Germany ©	1987	5,406	3,390	2,016	0	4,736	4,736	0	0
Greece ©	1992	2,404	2,032	372	0	690	529	0	161
Hungary ©	1996	1,079	1,070	9	0	623	69	0	554
Iceland ©	1985	4	4	0	0	10	10	0	0
Ireland	1996	380	380	0	0	200	200	0	0
Israel ©	1996	69	69	0	0	1	1	0	0
Italy ©	1995	2,044	372	1,672	0	3,969	3,917	52	0
Latvia ©	1997	1,333	1,237	96	0	1,080	1,080	0	0
Liechtenstein ©	1995	4	0	4	0	1	1	0	0
Lithuania ©	1997	1,391	1,386	5	0	295	295	0	0
Luxembourg	1994-97	40	10	31	0	46		0	
Malta	1996	0	0	0	0	0	0	0	0
Netherlands ©	1992-96	160	115	45	0	154	65	0	89
Norway ©	1989	853	664	189	0	5,756	5,123	261	372
Poland ©	1992-96	6,806	6,730	76	0	1,493	1,460	0	33
Portugal ©	1995	200	25	175	0	1,697	1,497	200	0
Romania ©	1990	5,283	5,283	0	0	334	334	0	0
Slovakia ©	1996	969	725	244	0	737	308	0	429
Slovenia ©	1996	310	285	25	0	725	725	0	0
Spain ©	1985-95	1,931	39	1,892	0	8,548	8,000	48	500
Sweden ©	1992-96	1,904	404	1,500	0	19,332	10,916	8,416	0
Switzerland ©	1993-95	700	10	690	0	360	321	0	39
The FYR of Macedonia ©	1995	581	581	0	0	164	164	0	0
Turkey ©	1996	8,620	8,620	0	0	15	14	0	1
United Kingdom ©	1995	965	885	80	0	1,143	800	25	318
Yugoslavia ©	1995	1,208	1,185	23	0	1,171	1,171	0	0
Total: Europe		**64,807**	**52,704**	**12,104**	**0**	**84,247**		**10,616**	
of which: EU 15		**25,351**	**14,930**	**10,421**	**0**	**70,175**		**10,355**	
Armenia	1996	21	21	0	0	0	0	0	0
Azerbaijan ©	1988	153	153	0	0	0	0	0	0
Belarus ©	1997	5,966	5,966	0	0	0	0	0	0
Georgia ©	1995	591	591	0	0	0	0	0	0
Kazakhstan	1993	4,933	4,933	0	0	0	0	0	0
Kyrgyzstan ©	1988	0	0	0	0	0	0	0	0
Republic of Moldova	1997	211	211	0	0	0	0	0	0
Russian Federation ©	1993	525,191	525,191	0	0	0	0	0	0
Tajikistan ©	1995	0	0	0	0	0	0	0	0
Turkmenistan ©	1995	3,650	3,650	0	0	0	0	0	0
Ukraine	1996	5,999	5,999	0	0	0	0	0	0
Uzbekistan	1998	0	0	0	0	0	0	0	0
Total: CIS		**546,714**	**546,714**	**0**	**0**	**0**	**0**	**0**	**0**
Canada ©	1994	104,370	104,215	155	640	20,853	17,126	3,727	0
United States of America ©	1992	53,215	39,115	14,100	3,147	141,761	105,745	28,513	7,503
Total: North America		**157,585**	**143,330**	**14,255**	**3,787**	**162,614**	**122,871**	**32,240**	**7,503**
Australia ©	1990-94	9,413			4	7,020			
Japan ©	1995	9,540	6,975	2,565	0	13,736	9,931	1,470	2,335
New Zealand ©	1996	453	403	50	0	1,398	117	603	678
Total: Other TBFRA		**19,406**			**4**	**22,154**			
Grand total		**788,513**			**3,791**	**269,015**			

© See notes and comments in Chapter II.

TABLE 13

Ownership of forest and of forest available for wood supply: comparative data

Country	Forest			Forest available for wood supply (FAWS)		
	In public ownership	Owned by indigenous or tribal peoples	In private ownership	In public ownership	Owned by indigenous or tribal peoples	In private ownership
	(Per cent of total forest)			(Per cent of FAWS)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Albania	100.0	0.0	0.0	100.0	0.0	0.0
Austria	17.5	0.0	82.5	16.4	0.0	83.6
Belgium	43.2	0.0	56.8	43.1	0.0	56.9
Bosnia and Herzegovina	78.4	0.0	21.6	78.4	0.0	21.6
Bulgaria	100.0	0.0	0.0	100.0	0.0	0.0
Croatia	75.5	0.0	24.5	74.4	0.0	25.6
Cyprus	88.9	0.0	11.1	100.0	0.0	0.0
Czech Republic	84.1	0.0	15.9	83.7	0.0	16.3
Denmark	31.4	0.0	68.6	31.7	0.0	68.2
Estonia	91.3	0.0	8.7	90.9	0.0	9.1
Finland	28.9	0.0	71.1	25.0	0.0	75.0
France	26.2	0.0	73.8	26.2	0.0	73.8
Germany	53.6	0.0	46.4	53.3	0.0	46.7
Greece	77.5	0.0	22.5	77.7	0.0	22.3
Hungary	64.5	0.0	35.5	63.4	0.0	36.6
Iceland	30.0	0.0	70.0	28.6	0.0	71.4
Ireland	66.2	0.0	33.8	65.5	0.0	34.5
Israel	99.2	0.0	0.8	98.6	0.0	1.4
Italy	34.0	0.0	66.0	34.0	0.0	66.0
Latvia	57.1	0.0	42.9	55.2	0.0	44.8
Liechtenstein	92.8	0.0	7.2	87.5	0.0	12.5
Lithuania	82.3	0.0	17.7	82.5	0.0	17.5
Luxembourg	46.7	0.0	53.3	46.7	0.0	53.3
Malta	100.0	0.0	0.0	0.0	0.0	0.0
Netherlands	51.0	0.0	49.0	51.0	0.0	49.0
Norway	14.1	0.0	85.9	12.9	0.0	87.1
Poland	83.3	0.0	16.7	82.0	0.0	18.0
Portugal	7.3	0.0	92.7	10.5	0.0	89.5
Romania	94.6	0.0	5.4	94.1	0.0	5.9
Slovakia	55.8	0.0	44.2	56.8	0.0	43.2
Slovenia	30.0	0.0	70.0	30.0	0.0	70.0
Spain	31.3	0.0	68.7	18.4	0.0	81.6
Sweden	16.7	0.0	83.3	9.0	0.0	91.0
Switzerland	68.2	0.0	31.8	66.0	0.0	34.0
The FYR of Macedonia	78.0	0.0	22.0	78.0	0.0	22.0
Turkey	99.8	0.0	0.2	99.8	0.0	0.2
United Kingdom	43.4	0.0	56.6	45.8	0.0	54.2
Yugoslavia	53.6	0.0	46.4	50.8	0.0	49.2
Total: Europe	**45.2**	**0.0**	**54.8**	**43.5**	**0.0**	**56.5**
of which: EU 15	**29.8**	**0.0**	**70.2**	**26.5**	**0.0**	**73.5**
Armenia	100.0	0.0	0.0	100.0	0.0	0.0
Azerbaijan	100.0	0.0	0.0	100.0	0.0	0.0
Belarus	100.0	0.0	0.0	100.0	0.0	0.0
Georgia	100.0	0.0	0.0	100.0	0.0	0.0
Kazakhstan	100.0	0.0	0.0	100.0	0.0	0.0
Kyrgyzstan	100.0	0.0	0.0	0.0	0.0	0.0
Republic of Moldova	100.0	0.0	0.0	100.0	0.0	0.0
Russian Federation	100.0	0.0	0.0	100.0	0.0	0.0
Tajikistan	100.0	0.0	0.0	0.0	0.0	0.0
Turkmenistan	100.0	0.0	0.0	100.0	0.0	0.0
Ukraine	100.0	0.0	0.0	100.0	0.0	0.0
Uzbekistan	100.0	0.0	0.0	0.0	0.0	0.0
Total: CIS	**100.0**	**0.0**	**0.0**	**100.0**	**0.0**	**0.0**
Canada	89.7	0.4	9.9	82.9	0.5	16.6
United States of America	33.3	1.4	65.2	26.9	1.6	71.6
Total: North America	**63.2**	**0.9**	**35.9**	**48.6**	**1.2**	**50.2**
Australia	73.0	8.7	18.3	57.3	0.02	42.7
Japan	41.0	0.0	59.0	41.0	0.0	59.0
New Zealand	69.4	0.0	30.6	24.5	0.0	75.5
Total: Other TBFRA	**68.8**	**7.2**	**24.0**	**46.7**	**0.0**	**53.3**
Grand total	**80.7**	**1.1**	**18.3**	**74.3**	**0.4**	**25.3**

TABLE 14

Managed forest and other wooded land by ownership categories

Country	Forest				Other wooded land			
	Total	In public ownership	Owned by indigenous or tribal peoples	In private ownership	Total	In public ownership	Owned by indigenous or tribal peoples	In private ownership
	(1000 ha)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	406	406	0	0	0	0	0	0
Austria ©	3,840	672	0	3,168	84	40	0	44
Belgium	646	279	0	367	26	10	0	16
Bosnia and Herzegovina ©	2,007	1,709	0	298			0	
Bulgaria	3,590	3,590	0	0	0	0	0	0
Croatia	1,531	1,299	0	232	29	29	0	0
Cyprus	117	104	0	13	163	58	0	105
Czech Republic	2,630	2,212	0	418	0	0	0	0
Denmark ©	445	140	0	306	93	13	0	80
Estonia ©	1,125	950	0	175	4	2	0	2
Finland	18,609	6,332	0	12,277	885	440	0	445
France ©	15,156	3,965	0	11,191	263	263	0	0
Germany ©	10,740	5,762	0	4,978	0	0	0	0
Greece ©	2,009	1,691	0	318	530	434	0	96
Hungary ©	1,811	1,169	0	642	0	0	0	0
Iceland ©	13	8	0	5	0	0	0	0
Ireland	551	385	0	166	0	0	0	0
Israel ©	122	121	0	1	0	0	0	0
Italy ©	1,117	1,110	0	7			0	
Latvia ©	2,884	1,647	0	1,237	111	31	0	80
Liechtenstein ©	6.9	6.4	0	0.5	0.5	0.5	0	0
Lithuania ©	1,938	1,588	0	350	20	5	0	15
Luxembourg	10	10	0	0	0	0	0	0
Malta	0.347	0.347	0	0	0	0	0	0
Netherlands ©	339	173	0	166	0	0	0	0
Norway ©	7,147	1,051	0	6,096	2,145	1,197	0	948
Poland ©	8,942	7,449	0	1,493	0	0	0	0
Portugal ©	1,201	242	0	959	5	5	0	0
Romania ©	6,301	5,961	0	340	379	359	0	20
Slovakia ©	1,988	1,117	0	871	0	0	0	0
Slovenia ©	1,099	330	0	769	0	0	0	0
Spain ©	11,694	4,193	0	7,501	5,988	1,103	0	4,885
Sweden ©	27,264	4,565	0	22,699	2,995	1,582	0	1,413
Switzerland ©	1,153	784	0	369			0	
The FYR of Macedonia ©	906	707	0	199	42		0	
Turkey ©	9,954	9,939	0	15	10,759	10,756	0	3
United Kingdom ©	2,319	1,072	0	1,247	0	0	0	0
Yugoslavia ©	2,723	1,552	0	1,171	586	430	0	156
Total: Europe	**154,335**	**74,291**	**0**	**80,044**			**0**	
of which: EU 15	**95,941**	**30,591**	**0**	**65,349**			**0**	
Armenia	334	334	0	0	58	58	0	0
Azerbaijan ©	936	936	0	0	54	54	0	0
Belarus ©	7,577	7,577	0	0	791	791	0	0
Georgia ©	2,438	2,438	0	0	0	0	0	0
Kazakhstan	10,504	10,504	0	0	6,169	6,169	0	0
Kyrgyzstan ©	729	729	0	0	68	68	0	0
Republic of Moldova	324	324	0	0	31	31	0	0
Russian Federation ©	816,538	816,538	0	0	70,000	70,000	0	0
Tajikistan ©	400	400	0	0	330	330	0	0
Turkmenistan ©	3,754	3,754	0	0	0	0	0	0
Ukraine	9,458	9,458	0	0	36	36	0	0
Uzbekistan	1,909	1,909	0	0	261	261	0	0
Total: CIS	**854,901**	**854,901**	**0**	**0**	**77,798**	**77,798**	**0**	**0**
Canada ©	173,400	154,921	585	17,894	51,146	48,690	324	2,132
United States of America ©	125,707	66,944	2,140	56,623	54,864	46,491	2,567	5,806
Total: North America	**299,107**	**221,865**	**2,725**	**74,517**	**106,010**	**95,181**	**2,891**	**7,938**
Australia ©	156,877	114,568	13,627	28,683	421,590	295,774	39,890	85,926
Japan ©	24,064	9,863	0	14,201	1,082	710	0	372
New Zealand ©	6,912	5,514	0	1,398	0			
Total: Other TBFRA	**187,853**	**129,945**	**13,627**	**44,282**	**422,672**			
Grand total	**1,496,196**	**1,281,002**	**16,352**	**198,843**				

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TABLE 15

Managed forest available for wood supply by ownership categories

Country	Total	In public ownership			Owned by indigenous or tribal peoples	In private ownership			
		Total	State ownership	Owned by other public institutions		Total	Owned by individuals	Owned by forest industries	Owned by other private institutions
		(1000 ha)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Albania ©	157	157	157	0	0	0	0	0	0
Austria ©	3,352	550	460	90	0	2,802	2,315	0	487
Belgium	639	276	69	207	0	364	352	1	10
Bosnia and Herzegovina ©	712	671	671	0	0	41	41	0	0
Bulgaria	3,124	3,124	3,124	0	0	0	0	0	0
Croatia	1,446	1,215	1,213	2	0	231	231	0	0
Cyprus	43	43	43	0	0	0	0	0	0
Czech Republic	2,559	2,141	1,826	315	0	418	418	0	0
Denmark ©	440	140	118	22	0	301	200	0	100
Estonia ©	1,045	870	866	4	0	175	170	0	5
Finland	17,441	5,164	5,164	0	0	12,277	9,702	1,613	962
France ©	14,470	3,787	1,467	2,320	0	10,683	8,983	0	1,700
Germany ©	10,142	5,406	3,390	2,016	0	4,736	4,736	0	0
Greece ©	1,765	1,476	1,320	156	0	289	188	0	101
Hungary ©	1,702	1,079	1,070	9	0	623	69	0	554
Iceland ©	13	4	4	0	0	5	5	0	0
Ireland	540	374	374	0	0	166	166	0	0
Israel ©	70	69	69	0	0	1	1	0	0
Italy ©	1,117	1,110	57	1,053	0	7	7	0	0
Latvia ©	2,413	1,333	1,237	96	0	1,080	1,080	0	0
Liechtenstein ©	4.0	3.5	0.0	3.5	0	0.5	0.5	0.0	0.0
Lithuania ©	1,674	1,293	1,288	5	0	295	295	0	0
Luxembourg	10	10	5	5	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0
Netherlands ©	314	160	115	45	0	154	65	0	89
Norway ©	5,570	770	600	170	0	4,800	4,200	250	350
Poland ©	8,300	6,806	6,730	76	0	1,493	1,460	0	33
Portugal ©	428	200	25	175	0	228	28	200	0
Romania ©	5,617	5,283	5,283	0	0	334	334	0	0
Slovakia ©	1,622	933	725	208	0	689	291	0	398
Slovenia ©	1,035	310	285	25	0	725	725	0	0
Spain ©	9,431	1,931	39	1,892	0	7,501			
Sweden ©	21,236	1,904	404	1,500	0	19,332	10,916	8,416	0
Switzerland ©	1,042	686	10	676	0	356	318	0	38
The FYR of Macedonia ©	745	581	581	0	0	164	164	0	0
Turkey ©	8,635	8,620	8,620	0	0	15	14	0	1
United Kingdom ©	2,108	965	885	80	0	1,143	800	25	318
Yugoslavia ©	2,379	1,208	1,185	23	0	1,171	1,171	0	0
Total: Europe	**133,340**	**60,652**	**49,478**	**11,174**	**0**	**72,598**			
of which: EU 15	**83,434**	**23,453**	**13,892**	**9,561**	**0**	**59,982**			
Armenia	21	21	21	0	0	0	0	0	0
Azerbaijan ©	153	153	153	0	0	0	0	0	0
Belarus ©	5,745	5,745	5,745	0	0	0	0	0	0
Georgia ©	591	591	591	0	0	0	0	0	0
Kazakhstan	4,933	4,933	4,933	0	0	0	0	0	0
Kyrgyzstan ©	0	0	0	0	0	0	0	0	0
Republic of Moldova	211	211	211	0	0	0	0	0	0
Russian Federation ©	525,191	525,191	525,191	0	0	0	0	0	0
Tajikistan ©	0	0	0	0	0	0	0	0	0
Turkmenistan ©	3,650	3,650	3,650	0	0	0	0	0	0
Ukraine	5,999	5,999	5,999	0	0	0	0	0	0
Uzbekistan	0	0	0	0	0	0	0	0	0
Total: CIS	**546,494**	**546,494**	**546,494**	**0**	**0**	**0**	**0**	**0**	**0**
Canada ©	99,582	84,086	83,931	155	433	15,063	11,880	3,182	0
United States of America ©	106,497	47,734	37,159	10,575	2,140	56,623	27,494	25,377	3,752
Total: North America	**206,079**	**131,820**	**121,090**	**10,730**	**2,573**	**71,686**	**39,374**	**28,559**	**3,752**
Australia ©	16,438	9,413			4	7,020			
Japan ©	23,276	9,540	6,975	2,565	0	13,736	9,931	1,470	2,335
New Zealand ©	1,851	453	403	50	0	1,398	117	603	678
Total: Other TBFRA	**41,565**	**19,406**			**4**	**22,154**			
Grand total	**927,478**	**758,371**			**2,577**	**166,438**			

© See notes and comments in Chapter II.

TABLE 16

Managed forest (total) and forest available for wood supply by ownership categories: comparative data

Country	Managed forest (total)				Managed forest available for wood supply (FAWS)			
	Total	In public ownership	Owned by indigenous or tribal peoples	In private ownership	Total	In public ownership	Owned by indigenous or tribal peoples	In private ownership
	(Per cent of total forest)				(Per cent of total FAWS)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania	39.4	39.4	0.0	0.0	17.3	17.3	0.0	0.0
Austria	100.0	100.0	0.0	100.0	100.0	100.0	0.0	100.0
Belgium	100.0	100.0	0.0	100.0	100.0	100.0	0.0	100.0
Bosnia and Herzegovina	88.2	95.7	0.0	60.7	54.5	65.6	0.0	14.5
Bulgaria	100.0	100.0	0.0	0.0	100.0	100.0	0.0	0.0
Croatia	86.3	96.9	0.0	53.5	85.6	96.7	0.0	53.3
Cyprus	100.0	100.0	0.0	100.0	100.0	100.0	0.0	0.0
Czech Republic	100.0	100.0	0.0	100.0	100.0	100.0	0.0	100.0
Denmark	100.0	100.0	0.0	100.0	100.0	100.0	0.0	100.0
Estonia	55.8	51.6	0.0	100.0	54.1	49.5	0.0	100.0
Finland	85.0	100.0	0.0	78.9	84.4	100.0	0.0	79.2
France	100.0	100.0	0.0	100.0	100.0	100.0	0.0	100.0
Germany	100.0	100.0	0.0	100.0	100.0	100.0	0.0	100.0
Greece	59.8	65.0	0.0	42.1	57.0	61.4	0.0	41.9
Hungary	100.0	100.0	0.0	100.0	100.0	100.0	0.0	100.0
Iceland	43.3	88.9	0.0	23.8	92.9	100.0	0.0	50.0
Ireland	93.2	98.5	0.0	83.0	93.1	98.4	0.0	83.0
Israel	100.0	100.0	0.0	100.0	100.0	100.0	0.0	100.0
Italy	11.3	33.1	0.0	0.1	18.6	54.3	0.0	0.2
Latvia	100.0	100.0	0.0	100.0	100.0	100.0	0.0	100.0
Liechtenstein	100.0	100.0	0.0	100.0	100.0	100.0	0.0	100.0
Lithuania	98.0	97.5	0.0	100.0	99.3	93.0	0.0	100.0
Luxembourg	12.0	25.7	0.0	0.0	12.0	25.7	0.0	0.0
Malta	100.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Netherlands	100.0	100.0	0.0	100.0	100.0	100.0	0.0	100.0
Norway	82.1	85.7	0.0	81.5	84.3	90.3	0.0	83.4
Poland	100.0	100.0	0.0	100.0	100.0	100.0	0.0	100.0
Portugal	35.5	97.6	0.0	30.6	22.6	100.0	0.0	13.4
Romania	100.0	100.0	0.0	100.0	100.0	100.0	0.0	100.0
Slovakia	98.6	99.4	0.0	97.6	95.1	96.3	0.0	93.5
Slovenia	100.0	100.0	0.0	100.0	100.0	100.0	0.0	100.0
Spain	86.6	99.0	0.0	80.9	90.0	100.0	0.0	87.8
Sweden	100.0	100.0	0.0	100.0	100.0	100.0	0.0	100.0
Switzerland	98.3	98.0	0.0	98.9	98.3	98.0	0.0	98.9
The FYR of Macedonia	100.0	100.0	0.0	100.0	100.0	100.0	0.0	100.0
Turkey	100.0	100.0	0.0	100.0	100.0	100.0	0.0	100.0
United Kingdom	93.9	100.0	0.0	89.3	100.0	100.0	0.0	100.0
Yugoslavia	94.1	100.0	0.0	87.3	100.0	100.0	0.0	100.0
Total: Europe	**87.8**	**93.6**	**0.0**	**83.0**	**89.5**	**93.6**	**0.0**	**86.2**
of which: EU 15	**84.5**	**90.4**	**0.0**	**82.0**	**87.3**	**92.5**	**0.0**	**85.5**
Armenia	100.0	100.0	0.0	0.0	100.0	100.0	0.0	0.0
Azerbaijan	100.0	100.0	0.0	0.0	100.0	100.0	0.0	0.0
Belarus	96.3	96.3	0.0	0.0	96.3	96.3	0.0	0.0
Georgia	81.6	81.6	0.0	0.0	100.0	100.0	0.0	0.0
Kazakhstan	100.0	100.0	0.0	0.0	100.0	100.0	0.0	0.0
Kyrgyzstan	100.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Republic of Moldova	100.0	100.0	0.0	0.0	100.0	100.0	0.0	0.0
Russian Federation	100.0	100.0	0.0	0.0	100.0	100.0	0.0	0.0
Tajikistan	100.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Turkmenistan	100.0	100.0	0.0	0.0	100.0	100.0	0.0	0.0
Ukraine	100.0	100.0	0.0	0.0	100.0	100.0	0.0	0.0
Uzbekistan	100.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
Total: CIS	**99.9**	**99.9**	**0.0**	**0.0**	**100.0**	**100.0**	**0.0**	**0.0**
Canada	70.9	70.6	54.4	74.3	79.1	80.6	67.7	72.2
United States of America	57.8	92.4	68.0	39.9	53.8	89.7	68.0	39.9
Total: North America	**64.8**	**76.0**	**64.5**	**44.9**	**63.6**	**83.7**	**67.9**	**44.1**
Australia	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Japan	100.0	100.0	0.0	100.0	100.0	100.0	0.0	100.0
New Zealand	87.1	100.0	0.0	57.6	100.0	100.0	0.0	100.0
Total: Other TBFRA	**99.5**	**100.0**	**100.0**	**97.7**	**100.0**	**100.0**	**100.0**	**100.0**
Grand total	**88.9**	**94.4**	**91.6**	**64.6**	**87.4**	**96.2**	**68.0**	**61.9**

TABLE 17

Ownership and management of forest not available for wood supply

Country	Ownership of forest not available for wood supply				of which: Managed			
	Total	In public ownership	Owned by indigenous or tribal peoples	In private ownership	Total	In public ownership	Owned by indigenous or tribal peoples	In private ownership
	(1000 ha)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania	128	128	0	0	250	250		0
Austria	488	122	0	366	488	122		366
Belgium	7	3	0	3	7	3		3
Bosnia and Herzegovina	971	762	0	209	1,295	1,038		257
Bulgaria	466	466	0	0	466	466		0
Croatia	85	84	0	1	85	84		1
Cyprus	74	61	0	13	74	61		13
Czech Republic	71	71	0	0	71	71		0
Denmark	5	0	0	5	5	0		5
Estonia	84	84	0	0	80	80		0
Finland	1,208	1,168	0	40	1,168	1,168		0
France	686	178	0	508	686	178		508
Germany	598	356	0	242	598	356		242
Greece	265	199	0	66	244	215		29
Hungary	109	90	0	19	109	90		19
Iceland	16	5	0	11	0	4		0
Ireland	11	11	0	0	11	11		0
Israel	52	52	0	0	52	52		0
Italy	3,844	1,308	0	2,536	0	0		0
Latvia	471	314	0	157	471	314		157
Liechtenstein	3	3	0	0	3	3		0
Lithuania	292	237	0	55	264	295		55
Luxembourg	0	0	0	0	0	0		0
Malta	0	0	0	0	0	0		0
Netherlands	25	13	0	12	25	13		12
Norway	2,101	373	0	1,728	1,577	281		1,296
Poland	642	643	0	0	642	643		0
Portugal	1,486	48	0	1,438	773	42		731
Romania	684	678	0	7	684	678		7
Slovakia	310	155	0	155	366	184		182
Slovenia	64	20	0	44	64	20		44
Spain	3,030	2,304	0	726	2,262	2,262		0
Sweden	6,028	2,661	0	3,367	6,028	2,661		3,367
Switzerland	113	100	0	13	111	98		13
The FYR of Macedonia	161	126	0	35	161	126		35
Turkey	1,319	1,319	0	0	1,319	1,319		0
United Kingdom	361	107	0	254	211	107		104
Yugoslavia	515	344	0	171	344	344		0
Total: Europe	**26,773**	**14,593**	**0**	**12,181**	**20,994**	**13,639**		**7,446**
of which: EU 15	**18,042**	**8,478**	**0**	**9,563**	**12,506**	**7,138**		**5,367**
Armenia	313	313	0	0	313	313		0
Azerbaijan	783	783	0	0	783	783		0
Belarus	1,899	1,899	0	0	1,832	1,832		0
Georgia	2,398	2,398	0	0	1,848	1,848		0
Kazakhstan	5,571	5,571	0	0	5,571	5,571		0
Kyrgyzstan	729	729	0	0	729	729		0
Republic of Moldova	113	113	0	0	113	113		0
Russian Federation	291,347	291,347	0	0	291,347	291,347		0
Tajikistan	400	400	0	0	400	400		0
Turkmenistan	104	104	0	0	104	104		0
Ukraine	3,459	3,459	0	0	3,459	3,459		0
Uzbekistan	1,909	1,909	0	0	1,909	1,909		0
Total: CIS	**309,025**	**309,025**	**0**	**0**	**308,408**	**308,408**		**0**
Canada	118,708	115,029	436	3,243	73,818	70,835	152	2,831
United States of America	19,210	19,210	0	0	19,210	19,210		
Total: North America	**137,918**	**134,239**	**436**	**3,243**	**93,028**	**90,045**		
Australia	140,439	105,155	13,623	21,663	140,439	105,155	13,623	21,663
Japan	788	323	0	465	788	323		465
New Zealand	6,089	5,061	0	1,028	5,061	5,061		0
Total: Other TBFRA	**147,316**	**110,539**	**13,623**	**23,156**	**146,288**	**110,539**		**22,128**
Grand total	**621,032**	**568,396**	**14,059**	**38,580**	**568,718**	**522,631**		

TABLE 18

Areas and number of holdings of forest and other wooded land

Country	Reference period	Area of forest and other wooded land		Area of forest *		Number of holdings		Average size of holdings of forest and other wooded land	
		In public ownership	In private ownership	In public ownership	In private ownership	In public ownership	In private ownership	In public ownership	In private ownership
		(1000 ha)				(Number)		(ha)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Albania ©	1995	1,030	0	1,030	0	36	0	28,611	0
Austria ©	1995	1,502	1,790	1,502	1,790	7,286	227,307	206	8
Belgium ©	1997	289	383	279	367	877	155,110	330	2
Bosnia and Herzegovina	1995	2,125	584	1,785	491				
Bulgaria	1995	3,903		3,590	0	177	0	22,053	0
Croatia ©	1996	1,651	454	1,341	434	672		2,457	
Cyprus ©	1996	162	118	104	13	423		383	
Czech Republic ©	1996	2,212	418	2,212	418	4,566	137,260	484	3
Denmark ©	1990	153	359	140	306	616	20,005	248	18
Estonia ©	1996	1,978	184	1,841	175	180	17,000	10,989	11
Finland ©	1996	6,720	15,885	6,280	15,440				
France ©	1995-96	4,228	12,761	3,965	11,191	15,926		265	
Germany ©	1996	6,107	3,334			13,040	349,361	468	10
Greece ©	1992	5,331	1,182	2,603	318	2,190	1,265	2,434	934
Hungary ©	1996	1,169	642	1,169	667	962	74,047	1,215	9
Iceland ©	1998								
Ireland	1996	391	200	391	200	148	15,264	2,642	13
Israel ©	1997	168	1	121	1	0		0	
Italy ©	1995	3,686	7,156	3,352	6,505	2,241	815,586	1,645	9
Latvia	1997	1,678	1,317	1,647	1,237	575	117,645	2,918	11
Liechtenstein	1995	6.90	0.50	6.40	0.50	15	584	460	1
Lithuania ©	1996	1,683	367	1,628	350	134	139,000	12,560	3
Luxembourg	1997	41	47			295	13,785	140	3
Malta ©	1996	0.347	0	0.347	0	21	0	17	0
Netherlands ©	1995	173	166	173	166	2,558	28,870	68	6
Norway ©	1989	2,936	9,064	1,226	7,484	1,302	171,079	2,255	53
Poland ©	1992-96	7,448	1,493	7,448	1,493	461	843,802	16,156	2
Portugal ©	1995	267	3,200	248	3,135	1,140	409,524	234	8
Romania ©	1997	6,320	360	5,961	340				
Slovakia ©	1996	1,133	898	1,124	892	573	28,659	1,977	31
Slovenia ©	1996	347	819	330	769	253	290,000	1,372	3
Spain ©	1990	5,608	20,376	4,235	9,274	8,718	661,992	643	31
Sweden ©	1992-96	6,151	24,121	4,567	22,712	13,557	260,386	454	93
Switzerland ©	1996	878	326	736	326	3,503	257,700	251	1
The FYR of Macedonia	1995	775	213	707	199				
Turkey ©	1996	20,695	18	9,939	15	1,614	145	12,822	124
United Kingdom ©	1995	1,072	1,417	1,072	1,397	646	106,000	1,659	13
Yugoslavia ©	1995	1,982	1,498	1,552	1,342		3,627		413
Total: Europe									
of which: EU 15		**40,217**	**90,587**						
Armenia ©	1996	392	0	334	0	32	0	12,250	0
Azerbaijan ©	1988	990	0	936	0		0		0
Belarus	1994	8,936	0	7,865	0	1,971	0	4,534	0
Georgia	1995	2,988	0	2,988	0		0		0
Kazakhstan	1993	16,673	0	10,504	0		0		0
Kyrgyzstan	1988		0		0		0		0
Republic of Moldova ©	1997	355	0	324	0	1,690	0	210	0
Russian Federation ©	1993	886,538	0	816,538	0	1,811	0	489,530	0
Tajikistan	1995	730	0	400	0		0		0
Turkmenistan	1995	3,754	0	3,754	0		0		0
Ukraine	1996	9,494	0	9,458	0	10,515	0	903	0
Uzbekistan ©	1988		0		0	60	0		0
Total: CIS			**0**		**0**		**0**		**0**
Canada ©	1994	388,927	27,206	219,399	24,096		425,000		64
United States of America ©	1994	127,120	171,015	72,425	144,908	64	9,938,000	1,986,250	17
Total: North America		**516,047**	**198,221**	**291,824**	**169,004**		**10,363,000**		**19**
Australia ©	1990-94		114,609	13,351	28,683				
Japan ©	1990	10,573	14,573	9,863	14,201	3,467	2,859,492	3,050	5
New Zealand ©	1996	5,514	2,426	5,514	2,426				
Total: Other TBFRA			**131,608**	**28,728**	**45,310**				
Grand total									

© See notes and comments in Chapter II.

* Area corresponding to the data on number and size of holdings may not coincide with figures elsewhere.

TABLE 19

Area of holdings of forest and other wooded land in public ownership by size classes

Country	Reference period	Size classes in hectares							
		< 10	11 - 20	21 - 50	51 - 100	101- 500	501 - 10000	10001 - 100000	> 100000
		(1000 ha)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Albania ©	1995						42	988	
Austria ©	1995	9.0	11.0	29.0	36.0	72.0	0	1,345	0
Belgium ©	1997	1.2	1.0	1.9	4.5	36.1	244	0	0
Bosnia and Herzegovina	1995								
Bulgaria	1995						238	3,665	
Croatia ©	1996					10.0	1,631	10	
Cyprus ©	1996	0.6	0.8	2.1	3.5	12.7	58	84	0
Czech Republic ©	1996	6.0	6.0	17.0	21.0	77.0	134	1,951	0
Denmark ©	1990	15.4	0.8	1.7	3.0	13.0	134	0	0
Estonia ©	1996			1.0	1.0	1.0	466	1,509	
Finland ©	1996								
France ©	1995-96	7.0	20.2	92.0	188.9	1,272.6	2,437	210	
Germany ©	1996		88.9		254.7	412.0		5,352	
Greece ©	1992			2.0	2.0	5,408.0			
Hungary ©	1996	1.3	1.2	3.5	5.0	25.2	931	202	0
Iceland ©	1998								
Ireland	1996			1.0	2.0	2.0	386	0	0
Israel ©	1997	0.0	0.0	0.0	0.0				0
Italy ©	1995	9.0	9.0	21.0	35.0	3,612.0	0	0	0
Latvia	1997	0.1	0.2	1.3	24.2	99.5	80	1,473	
Liechtenstein	1995	0.0	0.0	0.0	0.15	4.10	2.7	0	0
Lithuania ©	1996	0.3	0.3	0.8	1.8	1.7	31	1,647	0
Luxembourg	1997	0.3	0.2	0.6	1.4	25.3	14	0	0
Malta ©	1996	0.16	0.04	0.15	0.0	0.0	0	0	0
Netherlands ©	1995	5.0	6.0	12.0	14.0	48.0	88	0	0
Norway ©	1989	0.0	1.0	6.0	12.0	94.0	1,105	1,053	665
Poland ©	1992-96				0.1		473	6,812	163
Portugal ©	1995	0.0	4.0	24.0	6.0	5.0	228	0	0
Romania ©	1997		5,283.3						
Slovakia ©	1996	1.0	3.0	5.0	6.0	29.0	182	169	738
Slovenia ©	1996	0.0	0.0	0.0	0.2	15.0	332	0	0
Spain ©	1990								
Sweden ©	1992-96	18.0	25.0	101.0	137.0	645.0	1,140	1,521	2,564
Switzerland ©	1996	3.0	5.0	22.0	43.0	311.0	210	274	10
The FYR of Macedonia	1995								0
Turkey ©	1996					5.0	4,396	16,035	259
United Kingdom ©	1995	0.0	2.0	4.0	9.0	25.0	164	868	0
Yugoslavia ©	1995	0.0	0.0	0.0	8.5	17.3	58	1,898	0
Total: Europe									
of which: EU 15									
Armenia ©	1996	0.0	0.0	0.0	0.0	0.0	73	319	0
Azerbaijan ©	1988	0.0							
Belarus	1994	0.0	0.0	0.0	2,530.6	4,405.2	256	1,109	635
Georgia	1995	0.0	0.0	0.0	0.0				
Kazakhstan	1993	0.0	0.0	0.0					16,673
Kyrgyzstan	1988								
Republic of Moldova ©	1997	2.6	3.0	11.2	13.5	39.3	30	255	0
Russian Federation ©	1993	0.0	0.0	0.0	0.0	0.0			
Tajikistan	1995	0.0	0.0	0.0	0.0				
Turkmenistan	1995	0.0	0.0	0.0					
Ukraine	1996	6.0	8.0	35.0	81.0	1,159.0	1,505	6,556	144
Uzbekistan ©	1988	0.0	0.0	0.0					
Total: CIS									
Canada ©	1994								
United States of America ©	1994						56	2,111	124,953
Total: North America									
Australia ©	1990-94								
Japan ©	1990	3.0	3.0	13.0	25.0	245.0	10,301		
New Zealand ©	1996								
Total: Other TBFRA									
Grand total									

© See notes and comments in Chapter II.

TABLE 20

Area of holdings of forest and other wooded land in private ownership by size classes

Country	Reference period	Size classes in hectares								
		< 3	3 - 5	6 - 10	11 - 20	21 - 50	51 - 100	101- 500	501 - 10000	> 10000
		(1000 ha)								
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Albania ©	1995	0.0	0.0	0.0						
Austria ©	1995	0.0	87.0	110.0	214.0	516.0	263.0	189	0	411
Belgium ©	1997	84.3	26.4	35.4	43.6	50.6	51.8	69	21	0
Bosnia and Herzegovina	1995									
Bulgaria	1995									
Croatia ©	1996	454.0								
Cyprus ©	1996									
Czech Republic ©	1996	125.0	36.0	36.0	17.0	23.0	13.0	99	57	12
Denmark ©	1990	27.3	23.2	40.8	30.3	41.5	23.0	77	102	0
Estonia ©	1996	8.0	13.0	32.0	59.0	57.0	14.0		1	
Finland ©	1996		532.0		2,717.0	3,580.0	2,515.0	1,659	376	
France ©	1995-96									
Germany ©	1996					1,764.9	404.3	287.3	197	680
Greece ©	1992			3.0	3.0	7.0	8.0	51.0	351	
Hungary ©	1996									
Iceland ©	1998									
Ireland	1996	6.0	12.0	30.0	60.0	61.0	15.0	10.0	6	0
Israel ©	1997	0.0	0.7	0.0	0.0	0.0	0.0	0.3	0	0
Italy ©	1995	365.0	340.0	626.0	735.0	959.0	666.0	3,465.0	0	0
Latvia	1997	48.0	117.0	227.0	376.0	437.0	100.0	12.0		
Liechtenstein	1995	0.4	0.0	0.0	0.0	0.0	0.0	0.1	0	0
Lithuania ©	1996	83.2	133.2	69.5	53.2	24.4	3.5	0.0	0	0
Luxembourg	1997	6.2	7.8	7.8	7.5	8.2	3.3	4.3	2	0
Malta ©	1996									
Netherlands ©	1995	38.0	13.0	6.0	11.0	20.0	15.0	40.0	23	0
Norway ©	1989	34.0	71.0	168.0	378.0	1,137.0	1,419.0	3,425.0	2,015	417
Poland ©	1992-96	823.0	262.0	234.0	110.0	65.0				
Portugal ©	1995	396.0	245.0	110.0	197.0	256.0	225.0	953.0	818	0
Romania ©	1997									
Slovakia ©	1996	81.0	76.0	60.0	50.0	65.0	60.0	258.0	72	176
Slovenia ©	1996	246.0	114.0	182.0	152.0	92.0	33.0	0.0	0	0
Spain ©	1990									
Sweden ©	1992-96	32.0	109.0	259.0	665.0	2,132.0	2,825.0	6,133.0	3,811	8,155
Switzerland ©	1996									
The FYR of Macedonia	1995									0
Turkey ©	1996					1.0	1.0	4.0	12	
United Kingdom ©	1995	83.0	61.0	104.0	119.0	198.0	188.0	364.0	300	0
Yugoslavia ©	1995	1,498.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Total: Europe										
of which: EU 15										
Armenia ©	1996	0	0	0	0	0	0	0	0	0
Azerbaijan ©	1988	0	0	0	0	0	0	0	0	0
Belarus	1994	0	0	0	0	0	0	0	0	0
Georgia	1995	0	0	0	0	0	0	0	0	0
Kazakhstan	1993	0	0	0	0	0	0	0	0	0
Kyrgyzstan	1988	0	0	0	0	0	0	0	0	0
Republic of Moldova ©	1997	0	0	0	0	0	0	0	0	0
Russian Federation ©	1993	0	0	0	0	0	0	0	0	0
Tajikistan	1995	0	0	0	0	0	0	0	0	0
Turkmenistan	1995	0	0	0	0	0	0	0	0	0
Ukraine	1996	0	0	0	0	0	0	0	0	0
Uzbekistan ©	1988	0	0	0	0	0	0	0	0	0
Total: CIS		0	0	0	0	0	0	0	0	0
Canada ©	1994									
United States of America ©	1994	5,884.0	3,920.0	9,224.0	12,866.0	27,309.0	16,877.0	26,663	17,445	50,827
Total: North America										
Australia ©	1990-94									
Japan ©	1990		3,238.0	1,508.0	1,634.0	1,880.0	1,086.0	2,001	2,814	
New Zealand ©	1996									
Total: Other TBFRA										
Grand total										

© See notes and comments in Chapter II.

TABLE 21

Area of holdings of forest in public ownership by size classes

Country	Reference period	Size classes in hectares							
		< 10	11 - 20	21 - 50	51 - 100	101- 500	501 - 10000	10001 - 100000	> 100000
		(1000 ha)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Albania ©	1995						42	988	
Austria ©	1995	9.0	11.0	29.0	36.0	72	0	1,345	0
Belgium ©	1997	1.2	1.0	1.9	4.4	35	236	0	0
Bosnia and Herzegovina	1995								
Bulgaria	1995	0.0	0.0	0.0	0.0	0	219	3,371	0
Croatia ©	1996					10	1,321	10	
Cyprus ©	1996								0
Czech Republic ©	1996	6.0	6.0	17.0	21.0	77	134	1,951	0
Denmark ©	1990	0.4	0.8	1.7	3.0	13	121	0	0
Estonia ©	1996			1.0	1.0	1	450	1,388	
Finland ©	1996								
France ©	1995-96	7.0	19.5	89.4	185.3	1,236	2,235	193	
Germany ©	1996								
Greece ©	1992								
Hungary ©	1996	1.3	1.2	3.5	5.0	25	931	202	0
Iceland ©	1998								
Ireland	1996			1.0	2.0	2	386	0	0
Israel ©	1997	0.0	0.0	0.0	0.0				0
Italy ©	1995	8.0	8.0	20.0	32.0	3,284	0	0	0
Latvia	1997	0.0	0.2	1.1	22.9	89	79	1,455	
Liechtenstein	1995	0.0	0.0	0.0	0.2	4	2	0	0
Lithuania ©	1996	0.2	0.2	0.5	1.4	1	29	1,594	0
Luxembourg	1997								
Malta ©	1996								
Netherlands ©	1995	5.0	6.0	12.0	14.0	48	88	0	0
Norway ©	1989	0.0	1.0	5.0	11.0	81	505	436	187
Poland ©	1992-96				0.1		473	6,812	163
Portugal ©	1995	0.0	4.0	12.0	4.0	5	223	0	0
Romania ©	1997		5,283.3						
Slovakia ©	1996	1.0	2.0	4.0	4.0	26	177	171	739
Slovenia ©	1996	0.0	0.0	0.0	0.2	15	315	0	0
Spain ©	1990								
Sweden ©	1992-96	17.0	23.0	91.0	124.0	579	971	1,089	1,673
Switzerland ©	1996	3.0	5.0	21.0	39.0	267	171	222	8
The FYR of Macedonia	1995								0
Turkey ©	1996					2	2,375	7,464	98
United Kingdom ©	1995	0.0	2.0	4.0	9.0	25	164	868	0
Yugoslavia ©	1995	0.0	0.0	0.0					0
Total: Europe									
of which: EU 15									
Armenia ©	1996	0.0	0.0	0.0	0.0	0	51	283	0
Azerbaijan ©	1988	0.0							
Belarus	1994	0.0	0.0	0.0	2,486.0	3,674	227	929	550
Georgia	1995	0.0	0.0	0.0	0.0				
Kazakhstan	1993	0.0	0.0	0.0					10,504
Kyrgyzstan	1988								
Republic of Moldova ©	1997	0.0	0.0	6.0	10.8	27	25	255	0
Russian Federation ©	1993	0.0	0.0	0.0	0.0	0			
Tajikistan	1995	0.0	0.0	0.0	0.0				
Turkmenistan	1995	0.0	0.0	0.0					
Ukraine	1996	6.0	7.0	31.0	79.0	1,150	1,497	6,544	144
Uzbekistan ©	1988	0.0	0.0	0.0					
Total: CIS									
Canada ©	1994								
United States of America ©	1994						32	1,203	71,191
Total: North America									
Australia ©	1990-94	4.0	4.0	17.0	28.0	284	4,116	7,419	1,479
Japan ©	1990								
New Zealand ©	1996								
Total: Other TBFRA									
Grand total									

© See notes and comments in Chapter II.

TABLE 22

Area of holdings of forest in private ownership by size classes

Country	Reference period	Size classes in hectares								
		< 3	3 - 5	6 - 10	11 - 20	21 - 50	51 - 100	101- 500	501 - 10000	> 10000
		(1000 ha)								
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Albania ©	1995									
Austria ©	1995	0.0	87.0	110.0	214.0	516	263	189	0	411
Belgium ©	1997	80.8	25.3	33.9	41.8	48	50	67	20	0
Bosnia and Herzegovina	1995									
Bulgaria	1995									
Croatia ©	1996	434.0								
Cyprus ©	1996									
Czech Republic ©	1996	125.0	36.0	36.0	17.0	23	13	99	57	12
Denmark ©	1990	7.3	3.2	21.8	25.3	31	23	77	102	0
Estonia ©	1996	8.0	12.0	30.0	56.0	54	14		1	
Finland ©	1996									
France ©	1995-96									
Germany ©	1996									
Greece ©	1992									
Hungary ©	1996									
Iceland ©	1998									
Ireland	1996	6.0	12.0	30.0	60.0	61	15	10	6	0
Israel ©	1997	0.0	0.7	0.0	0.0	0	0	0	0	0
Italy ©	1995	332.0	309.0	569.0	668.0	872	605	3,150	0	0
Latvia	1997	45.0	110.0	213.0	354.0	410	94	11		
Liechtenstein	1995		0.0	0.0	0.0	0	0		0	0
Lithuania ©	1996	79.0	127.8	65.1	50.7	24	3	0	0	0
Luxembourg	1997									
Malta ©	1996	0.0	0.0	0.0	0.0	0	0	0	0	0
Netherlands ©	1995	38.0	13.0	6.0	11.0	20	15	40	23	0
Norway ©	1989	28.0	63.0	149.0	334.0	992	1,205	2,771	1,618	324
Poland ©	1992-96	823.0	262.0	234.0	110.0	65				
Portugal ©	1995	376.0	239.0	105.0	197.0	256	225	953	784	0
Romania ©	1997									
Slovakia ©	1996	76.0	75.0	60.0	50.0	65	60	258	72	176
Slovenia ©	1996	231.0	107.0	171.0	143.0	86	31	0	0	0
Spain ©	1990	251.0	366.0	369.0	412.0	610	677	3,053	8,167	
Sweden ©	1992-96	32.0	106.0	251.0	639.0	2,043	2,689	5,738	3,565	7,649
Switzerland ©	1996									
The FYR of Macedonia	1995									0
Turkey ©	1996					1	1	3	10	
United Kingdom ©	1995	73.0	51.0	104.0	119.0	198	188	364	300	0
Yugoslavia ©	1995	1,342.0	0.0	0.0	0.0	0	0	0	0	0
Total: Europe										
of which: EU 15										
Armenia ©	1996	0	0	0	0	0	0	0	0	0
Azerbaijan ©	1988	0	0	0	0	0	0	0	0	0
Belarus	1994	0	0	0	0	0	0	0	0	0
Georgia	1995	0	0	0	0	0	0	0	0	0
Kazakhstan	1993	0	0	0	0	0	0	0	0	0
Kyrgyzstan	1988	0	0	0	0	0	0	0	0	0
Republic of Moldova ©	1997	0	0	0	0	0	0	0	0	0
Russian Federation ©	1993	0	0	0	0	0	0	0	0	0
Tajikistan	1995	0	0	0	0	0	0	0	0	0
Turkmenistan	1995	0	0	0	0	0	0	0	0	0
Ukraine	1996	0	0	0	0	0	0	0	0	0
Uzbekistan ©	1988	0	0	0	0	0	0	0	0	0
Total: CIS		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Canada ©	1994									
United States of America ©	1994	4,986.0	3,321.0	7,815.0	10,901.0	23,139	14,300	22,592	14,781	43,072
Total: North America										
Australia ©	1990-94									
Japan ©	1990									
New Zealand ©	1996									
Total: Other TBFRA										
Grand total										

© See notes and comments in Chapter II.

TABLE 23

Number of holdings of forest and other wooded land in public ownership by size classes

Country	Reference period	Size classes in hectares							
		< 10	11 - 20	21 - 50	51 - 100	101- 500	501 - 10000	10001 - 100000	> 100000
		(Number)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Albania ©	1995						8	28	
Austria ©	1995	2353	906	1,155	736	803	0	1,333	0
Belgium ©	1997	415	75	58	64	135	130	0	0
Bosnia and Herzegovina	1995								
Bulgaria	1995	0	0	0	0	0	32	145	0
Croatia ©	1996					34	637	1	
Cyprus ©	1996	162	52	66	50	56	34	3	0
Czech Republic ©	1996	2522	511	651	388	327	65	102	0
Denmark ©	1990	374	56	53	37	60	36	0	0
Estonia ©	1996	24	18	12	10	2	50	64	
Finland ©	1996								
France ©	1995-96	1358	1,410	2,809	2,637	5,759	1,938	15	
Germany ©	1996		7,402		2,334	1,283	691		1,330
Greece ©	1992			147	83	1,960			
Hungary ©	1996	396	80	107	70	106	186	17	0
Iceland ©	1998								
Ireland	1996	9	6	8	14	8	103	0	0
Israel ©	1997	0	0	0	0	1	9	2	0
Italy ©	1995	733	194	211	154	949	0	0	0
Latvia	1997	12	15	28	256	223	8	33	
Liechtenstein	1995	0	0	0	2	11	2	0	0
Lithuania ©	1996	36	11	13	16	6	5	47	0
Luxembourg	1997	123	17	19	21	97	20	0	0
Malta ©	1996	16	2	3	0	0	0	0	0
Netherlands ©	1995	1227	422	403	195	224	87	0	0
Norway ©	1989	167	69	180	163	392	301	27	3
Poland ©	1992-96				1		60	400	
Portugal ©	1995	0	266	685	81	39	69	0	0
Romania ©	1997		400						
Slovakia ©	1996	78	100	116	58	104	104	9	4
Slovenia ©	1996	0	1	0	3	59	190	0	0
Spain ©	1990								
Sweden ©	1992-96	3600	1,600	2,810	1,740	2,780	960	60	7
Switzerland ©	1996	523	340	593	539	1,128	247	132	1
The FYR of Macedonia	1995								0
Turkey ©	1996	41		3	4	19	727	818	2
United Kingdom ©	1995	0	120	120	140	101	128	37	0
Yugoslavia ©	1995	0	0	0					0
Total: Europe									
of which: EU 15									
Armenia ©	1996	0	0	0	0	0	19	13	0
Azerbaijan ©	1988								
Belarus	1994	0	0	0	666	1,198	13	82	12
Georgia	1995	0	0	0	0				
Kazakhstan	1993	0	0	0					
Kyrgyzstan	1988								
Republic of Moldova ©	1997	730	200	320	180	212	30	18	0
Russian Federation ©	1993	0	0	0	0	0	124	760	927
Tajikistan	1995	0	0	0	0				
Turkmenistan	1995	0	0	0					
Ukraine	1996	1375	555	1,039	1,094	5,175	1,032	244	1
Uzbekistan ©	1988	0	0	0					
Total: CIS									
Canada ©	1994								
United States of America ©	1994						13	45	6
Total: North America									
Australia ©	1990-94								
Japan ©	1990	791	227	392	339	990	728		
New Zealand ©	1996								
Total: Other TBFRA									
Grand total									

© See notes and comments in Chapter II.

TABLE 24

Number of holdings of forest and other wooded land in private ownership by size classes

Country	Reference period	Size classes in hectares								
		< 3	3 - 5	6 - 10	11 - 20	21 - 50	51 - 100	101- 500	501 - 10000	> 10000
		(Number)								
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Albania ©	1995									
Austria ©	1995	0	58,115	35,649	42,542	77,869	9,565	2,442	0	1,125
Belgium ©	1997	136,799	7,007	5,214	3,258	1,647	759	420	26	0
Bosnia and Herzegovina	1995									
Bulgaria	1995									
Croatia ©	1996	500,000								
Cyprus ©	1996									
Czech Republic ©	1996	119,443	10,954	4,530	1,124	660	132	389	27	1
Denmark ©	1990	6,875	6,134	3,302	1,892	1,025	336	347	94	0
Estonia ©	1996	3,983	3,240	4,160	3,840	1,760	16		1	
Finland ©	1996		147,141		131,965	99,718	43,209	16,627	529	
France ©	1995-96									
Germany ©	1996					343,496	4,456	927	286	196
Greece ©	1992			613	139	146	77	151	139	
Hungary ©	1996									
Iceland ©	1998									
Ireland	1996	3,000	3,000	4,000	3,500	1,500	200	60	4	0
Israel ©	1997	0		0	0	0	0	1	0	0
Italy ©	1995	322,164	163,560	150,151	91,802	55,831	17,455	14,623	0	0
Latvia	1997	27,997	25,300	25,948	23,365	13,490	1,458	87		
Liechtenstein	1995	583	0	0	0	0	0	1	0	0
Lithuania ©	1996	84,473	39,715	10,236	3,832	738	6	0	0	0
Luxembourg	1997	9,304	2,467	1,118	544	278	51	22	1	0
Malta ©	1996									
Netherlands ©	1995	22,344	3,822	869	739	647	222	204	21	0
Norway ©	1989	30,498	17,505	21,295	25,398	35,538	20,592	18,362	1,866	25
Poland ©	1992-96	755,203	53,160	27,002	6,750	1,688				
Portugal ©	1995	347,277	5,866	28,730	12,705	7,473	2,989	3,737	747	0
Romania ©	1997									
Slovakia ©	1996	10,000	14,620	489	474	892	785	1,222	100	77
Slovenia ©	1996	232,870	24,070	20,880	8,990	2,700	490	0	0	0
Spain ©	1990	405,346	126,198	56,364	31,732	20,570	9,910	14,901	5,689	
Sweden ©	1992-96	21,280	27,560	32,720	42,810	62,890	39,220	32,340	1,350	216
Switzerland ©	1996									
The FYR of Macedonia	1995									0
Turkey ©	1996	9	49	18	16	18	12	16	7	
United Kingdom ©	1995	59,000	13,200	14,500	8,400	6,200	2,500	1,800	400	0
Yugoslavia ©	1995	3,627	0	0	0	0	0	0	0	0
Total: Europe										
of which: EU 15										
Armenia ©	1996	0	0	0	0	0	0	0	0	0
Azerbaijan ©	1988	0	0	0	0	0	0	0	0	0
Belarus	1994	0	0	0	0	0	0	0	0	0
Georgia	1995	0	0	0	0	0	0	0	0	0
Kazakhstan	1993	0	0	0	0	0	0	0	0	0
Kyrgyzstan	1988	0	0	0	0	0	0	0	0	0
Republic of Moldova ©	1997	0	0	0	0	0	0	0	0	0
Russian Federation ©	1993	0	0	0	0	0	0	0	0	0
Tajikistan	1995	0	0	0	0	0	0	0	0	0
Turkmenistan	1995	0	0	0	0	0	0	0	0	0
Ukraine	1996	0	0	0	0	0	0	0	0	0
Uzbekistan ©	1988	0	0	0	0	0	0	0	0	0
Total: CIS		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Canada ©	1994									
United States of America ©	1994	5,484,400	1,007,400	1,202,800	884,500	913,700	260,000	166,700	17,300	1,200
Total: North America										
Australia ©	1990-94									
Japan ©	1990			2,693,255	94,909	49,916	12,401	7,821	1,190	
New Zealand ©	1996									
Total: Other TBFRA										
Grand total										

© See notes and comments in Chapter II.

NOTES AND COMMENTS RELATING TO CHAPTER II

Main Tables	Comments

Note: For comments on this chapter please consult also the comments for Chapter I.

Albania

9-17

Enquiry Table 5: The forests for wood supply compose 87.6 per cent (or 902,000 ha) and all belong in public ownership or state ownership.

For forest total, about 39.4 per cent (or 406,100 ha) are managed, while for forests available for wood supply, 17.3 per cent (or 156,500 ha) are managed, all included in public ownership-state ownership.

The trend of managed forests area is increasing but there is a need for improvements in methodology of management plan preparation, permanent sample plots and monitoring, using modern equipment, also after changes that may occur in forest ownership.

Changes of forest ownership are in process. According to previsions the forest ownership structure would eventually be as follows:

Private: 63,000 ha or 6.1 per cent; Communal: 215,000 ha or 20.9 per cent; State: 751,960 ha or 73.0 per cent.

18-24

Enquiry Table 6: The public forests according to ownership classes are as follows:

501 to 10,000 ha: 41,600 ha or 4 per cent.

10,000 to 100,000 ha: 988,400 ha or 96 per cent.

The total number of holdings is 36, so for each district there is one Forest Service Directorate. There are 8 or 22.2 per cent of the Forest Service Directorates in the class 501 to 10,000 ha and 28 or 77.8 per cent in the class 10,000 to 100,000 ha. Each Forest Service Directorate manages the forest in the area of each district.

According to the World Bank Project on development of forestry in Albania it is foreseen to separate the policy body from the economy body so that General Directorate of Forest and Pastures inside of Ministry of Agriculture and Food would be the policy body, which would prepare the Forestry Development Policy of Albania, with financial support by the state budget, and the Forest Corporation as the economy body, which would realize the economic activity and be self-financing.

Armenia

18-24

Enquiry Table 6:"Holdings" = forest districts, which are the smallest units for decision-making in Armenian Forestry. Every Forest Enterprise consists of 3-5 forest districts, depending on the entire size of the enterprise's forest area.

Australia

9-17

Enquiry Table 5: For the purposes of this table the following assumptions have been made:

1. Definitions :

– "managed" is defined as any land under tenure.

– Aboriginal ownership is defined as Aboriginal freehold i.e. does not include Aboriginal Leasehold or Reserve.

2. Totals for forest in public, indigenous and private ownership are derived from the above sources in the following manner:

Forest, total–In public ownership: The total forest in public ownership includes public plantation, State Forest, Nature Conservation Reserves, Leasehold Land and Other Crown Land. It also includes over 1.1 million ha of unresolved tenure.

Forest, total–Owned by indigenous or tribal peoples: The total area owned by indigenous people includes Aboriginal freehold and Aboriginal plantation.

Forest, total–In private ownership: The total area in private ownership (non-aboriginal) includes native private forest and plantation.

3. For areas available for wood supply, the total and managed columns contain indicative figures only:

Forest available for wood supply–In public ownership: Public forest estate which is available for wood supply includes public plantation, net harvestable area of State Forest and over 54 per cent of commercial forest types in Leasehold Land and Other Crown Land (see also *Enquiry Table 3* comments).

Over 1 million ha of public forest available for wood supply is leasehold land. These leases are publicly owned but privately managed, mainly for the purposes of grazing. Commercial timber rights are largely unused by the state forest management agencies.

Forest available for wood supply--State ownership: Figures are available for forest owned by public institutions (851,565 ha) but not for the areas available for wood supply. The 54.47 per cent proportion is not appropriate to apply to these areas.

Forest available for wood supply--Owned by indigenous or tribal peoples: It is unknown how much of Aboriginal freehold is available for wood supply or managed; only Aboriginal plantation is included in each total (available for wood supply and managed).

Forest available for wood supply--In private ownership: The private forest estate which is available for wood supply includes private plantation and over 54 per cent of commercial forest types on Private Land.

An area of 461,300 ha of other wooded land under "other" ownership (than public, private or by indigenous peoples) has been included under public ownership.

18-24

Enquiry Table 6: The definition of “holding” used in this table is different from the FAO definition.

The area of forest in each of the nominated parcel size classes within all State Forest tenures has been provided.

The figure of 13,351 for “In public ownership” refers to State Forest holdings only.

Data source: National Forest Inventory, 1997.

Austria

9-17

Enquiry Table 5: Forest available for wood supply includes productive forests and protection forests available for wood supply. However, the area of “unproductive” protection forests cannot be taken into account. Therefore the data seemed to be out of likely range. To clarify that, see table below:

		Total area			*Total area*
1.	Forest total	3,840	3.	Forest not available for wood supply	488
	public	672		public	122
	private	3,168		private	366
2.	Forest available for wood supply	3,352	4	Other wooded land	84
	public	550		public	40
	private	2,802		private	44

“Owned by forest industries”: No forest owned by forest industries in Austria.

18-24

Enquiry Table 6: The “Survey of the Agricultural Structure 1995” of the Austrian Statistical Office covers only holdings up from a minimum size of 1 ha, irrespective of the use of the land area. The assessment of forests is without any classification.

The Austrian Forest Inventory covers 3 ownership classes (forests <200 ha, forests >200 ha and state [public] forests), but there is no assessment of the number of holdings as the Austrian Forest Inventory is a sample plot based survey. Therefore any estimate of forest and other wooded land in the various ownership categories and holding size classes is not reliable. To avoid any misinterpretation, column “forest and other wooded land” will not be filled in; the sum of (In public ownership + In private ownership = 3,292,000 ha) in column “of which: forest” corresponds to the forest area available for wood supply in table 3 “Forest and other wooded land according to availability for wood supply” and table 4 “High forest and coppice" etc. The figures of average size of holdings in Main Table 18 are of forest available for wood supply.

(Source: Austrian Forest Inventory).

Azerbaijan

9-17

Enquiry Table 5: All forests are State property and therefore managed. Data unadjusted.

18-24

Enquiry Table 6: All forests are publicly (State-) owned.

Belarus

9-17

Enquiry Table 5: Publicly-owned forests and other wooded land in Belarus are State property.

Belgium

18-24

Enquiry Table 6: Private forests: extrapolation of data between 1959 and 1970. Public forests: internal statistics.

Bosnia and Herzegovina

9-17

Enquiry Table 5: Data on ownership categories on managed other wooded land are not available.

Canada

9-17

Enquiry Table 5: Reference source for Total area (*a*), and source for Managed area (*b*):

"Forest, total": (*a*) Source: From *Enquiry Table 1* (item 1.5), Timber productive forest; (*b*) Timber productive forest (from Management type source inventories) (The source inventories for Canada's Forest Inventory are classified as to type). Management inventories are detailed, intensive forest inventories for management purposes of areas to be managed as a unit. The forest types are usually mapped in detail with estimates given for each type.

"In public ownership" on Forest, total: (*a*) Timber productive forest of ownership classes Crown–other federal (1), Crown–provincial/territorial (3), and missing value (8) with adjustment downward for land claims settlement in the Northwest Territories; (*b*) Timber productive forest (from Management type source inventories) and ownership classes 1, 3, and 8.

"Owned by indigenous or tribal people" on Forest, total: (*a*) Timber productive forest of ownership class Native (2) with adjustment upward for land claims settlements in the Northwest Territories; (*b*) Timber productive forest (from Management type source inventories) and ownership class 2.

"In private ownership" on Forest, total: Timber productive forest of ownership classes industrial private (4), non-industrial private (5), municipal (6), and unspecified private (7); (*b*) Timber productive forest (from Management type source inventories) and ownership classes 4, 5, 6, and 7.

"Forest available for wood supply": (*a*) From *Enquiry Table 3*, Accessed non-reserved timber productive forest, adjusted as described in Table 3; (*b*) Accessed non-reserved timber productive forest (from Management type source inventories), adjusted as described in *Enquiry Table 3*.

"In public ownership" on Forest available for wood supply: (a) Accessed non-reserved timber productive forest of ownership classes 1, 3, and 8, adjusted as described in *Enquiry Table 3*; (b) Accessed non-reserved timber productive forest (from Management type source inventories) and ownership classes 1, 3, and 8, adjusted as described in *Enquiry Table 3.*

"State ownership" on Forest available for wood supply: (*a*) Accessed non-reserved timber productive forest of ownership class 1, 3, and 8, adjusted as described in *Enquiry Table 3*; (*b*) Accessed non-reserved timber productive forest (from Management type source inventories) and ownership classes 1, 3, and 8, adjusted as described in *Enquiry Table 3.*

"Owned by indigenous or tribal peoples": (*a*) Accessed non-reserved timber productive forest of ownership class 2, adjusted as described in *Enquiry Table 3;* (*b*) Accessed non-reserved timber productive forest (from Management type source inventories) and ownership class 2, adjusted as described in *Enquiry Table 3.*

"In private ownership": (*a*) Accessed non-reserved timber productive forest of ownership class 4, 5, 6, and 7, adjusted as described in *Enquiry Table 3*; (*b*) Accessed non-reserved timber productive forest (from Management type source inventories) and ownership classes 4, 5, 6, and 7, adjusted as described in *Enquiry Table 3.*

"Owned by individuals" in private ownership: (*a*) Accessed non-reserved timber productive forest of ownership class 5, 6, and 7, adjusted as described in *Enquiry Table 3*; (*b*) Accessed non-reserved timber productive forest (from Management type source inventories) and ownership classes 5, 6, and 7, adjusted as described in *Enquiry Table 3.*

"Owned by forest industries" in private ownership: *(a*) Accessed non-reserved timber productive forest of ownership class 4; (*b*) Accessed non-reserved timber productive forest (from Management type source inventories) and ownership class 4.

"Owned by other private institutions" in private ownership: (a) Not available; (b) Not available.

"Other wooded land": (*a*) From *Enquiry Table 1* (item 1.6), Forest land + timber unproductive forest; (*b*) Forest land + timber unproductive forest (from Management type source inventories).

"In public ownership" on other wooded land": (*a*) Forest land + timber unproductive forest of ownership class 1, 3, and 8; (*b*) Forest land + timber unproductive forest (from Management type source inventories) and ownership classes 1, 3, and 8.

"Owned by indigenous or tribal peoples" on other wooded land": (*a*) Forest land + timber unproductive forest of ownership class 2; (*b*) Forest land + timber unproductive forest (from Management type source inventories) and ownership class 2.

"In private ownership on other wooded land": (*a*) Forest land + timber unproductive forest of ownership class 4, 5, 6, and 7; *(b*) Forest land + timber unproductive forest (from Management type source inventories) and ownership classes 4, 5, 6, and 7.

18-24

Enquiry Table 6:

Reference Source for Forest and other wooded land (*a*); and Source for Forest (*b*)

"In public ownership": (*a*) (Forest land + timber productive forest + timber unproductive forest) of ownership classes 1, 3, and 8 ("In public ownership" on forest total + "In public ownership" on other wooded land 5.15) See Table 5 for names of ownership classes; (*b*) Timber productive forest of ownership classes 1, 3, and 8 (In public ownership).

"In private ownership": (*a*) (Forest land + timber productive forest + timber unproductive forest) of ownership classes 4, 5, 6, and 7 ("In private ownership" on forest total + "In private ownership" on other wooded land); (*b*) Timber productive forest of ownership classes 4, 5, 6, and 7 (In private ownership).

Supplementary information on number and size of holdings of forest and other wooded land:

The following information, provided by the Ontario Ministry of Natural Resources, is illustrative of the situation in Canada:

As of May 1997, the number of designated management units in Ontario was 70, excluding southern Ontario. The size of management units ranges from as small as 60,000 hectares to as large as approximately 2 million hectares. These management units occur on Crown land and are primarily managed by forest industry through a sustainable forest licence (SFL). These management units occupy a land base known as the Area of Undertaking (AOU) for a Class Environmental Assessment by the Ministry of Natural Resources for Timber Management on Crown Lands in Ontario (EA-87-02). Within the AOU, two private holdings also exist and occupy less than 300,000 hectares combined. The land base north of the AOU is primarily Crown land and consists mostly of unsurveyed land; however, eight non-designated, undeveloped, management units exist and occupy approximately 7,500,000 hectares.

The designated area defined as the Southern Ontario management unit encompasses approximately ten million hectares. Private land accounts for approximately 78 per cent of the total area while Crown land makes up the balance or 22 per cent. Federal lands, which make up 2 per cent of the total area in the Southern Ontario management unit, are included in the private land figures. Within Southern Ontario, the size of private holdings range from a couple of hectares to thousands of hectares.

Croatia

18-24

Enquiry Table 6: Number of holdings of forests in private ownership unknown. Probably, it is not less than 500,000.

Cyprus

18-24

Enquiry Table 6: The total area of the forest and other wooded land was estimated at 280,000 ha (Table 1), however only the State Forest and other wooded land (161 824 ha) can be classified in area classes. The forest area cannot be estimated in each class. The private forest and other wooded land (118,176 ha) cannot be classified in area classes (figures not available). The area of the most parcels range from 1 to 20 ha. The term "holding" means a single parcel of the forest and other wooded land which constitutes a single unit.

Czech Republic

18-24

Enquiry Table 6: Size categories of ownership used in the Czech Republic differ from the TBFRA 2000. Assessment is based on the data from the Report on Forestry in the CR, Dec. 31.1996.

Estimates are based on special data processing made by the State forests company [LCR]: numbers of individuals claiming forest ownership restitution by the size in forest area claimed. Some of them claimed the same cadastral lot [parcela] as co-owners. A number of that individuals in the TBFRA-2000 classes gives a portion of forest and forest holdings from original Czech classes. 96 forest holdings [lesni sprava] exist in the state forests. In 1990, about 1000 individuals owned 1336 ha of forest.

Denmark

9-17

Enquiry Table 5: Only other wooded land consisting of plantings along roads etc. is considered as publicly owned. Most of the rest of the other wooded lands described under *Enquiry Table 1* is more or less based on public subsidies to private land-owners and are therefore considered in this table as privately owned.

18-24

Enquiry Table 6: No concrete information on ownership of other wooded land exists. It is the general opinionthat many of these areas belong to ownership with mainly agriculture. Therefore, these areas are distributed to private ownership less than 50 ha on a rough estimate. Some of these areas–especially Christmas trees and different kinds of unplanned afforestation etc.–may also occur on bigger holdings, but more or less not on public ownership. All other wooded land in the group 'plantings along major roads' etc. (13,000 ha) has been distributed into the two smallest categories of public ownership.

Estonia

9-17

Enquiry Table 5: The Land Reform started in 1993. The land owned by private owners before the second world war will be restituted or privatized. The land area owned by private owners will increase rapidly. The land area under restitution and privatization is classified as state-owned land until the land is registered in the Land Catastre and Property Book.

18-24

Enquiry Table 6: The land area under restitution and pivatization is classified as public land. The County Board is classified as the holder for land under restitution and privatization.

Finland

18-24

Enquiry Table 6: Size classes are as follows in private ownership:

The data for "3 to 5 ha" refer to data for size class "0-5 ha".

The data for "11 to 20 ha" refer to data for size class "6 - 20 ha".

The data for "501 to 10,000 ha" refer to data for size class "more than 500 ha".

Statistics do not exactly cover all private forests; no information on the area by size classes available.

France

9-17

Enquiry Table 5: Data source for "In public ownership": Office National des Forêts (ONF), 1995/1996.

Data for "In public ownership, state ownership, owned by other public institutions", "Owned by indigenous or tribal peoples", and "In private ownership" on forest available for wood supply: Breakdown of area of forest available for wood production follows the national forest inventory figures available as at 31 December 1997.

Date for "owned by other private institutions" on forest available for wood supply: "Les indicateurs de gestion durable des forêts françaises", 1995, Ministry of Agriculture and Fisheries, Countryside and Forests Directorate. These forests encompass forestry groups (including many family groupings), companies and other corporate bodies Financial institutions own a little under 2 per cent of the wooded land in France.

Known divergences from TBFRA 2000 definitions for forests belonging to other public institutions: these are forests subject to the forestry regulations but not belonging to the State and managed by the ONF. They include forests belonging to institutions enjoying charitable status, mutual benefit societies and savings banks, which TBFRA 2000 regards as private forests.

The figure in "owned by other public institutions" on forest available for wood supply, by contrast, does not include forests belonging to other public institutions not subject to the forestry regulations, which are put at around 430,000 hectares (source: SCEES/ESSES 1976-1983, Statistical survey of economic structures in forestry). These are shown under private forests.

Other wooded land in public ownership: the National Correspondent has taken half the difference between the area managed by the ONF and the area of public forest to be other wooded land in public ownership.

Managed forest: Data for "state ownership" on forest available for wood supply: data: including 1,370,000 hectares of State forest currently under development (source: ONF, 1995/1996).

Data for "owned by other public institution" on forest available for wood supply: including 1,845,000 hectares of forest belonging to other public institutions that is currently under development (source: ONF, 1995/1996).

Data for "in private ownership" on forest available for wood supply: including 3,342,000 hectares of private forest subject to a simple management scheme in force or awaiting approval (source: National Association of Regional Centres of Forest Ownership, situation as at 31 December 1996). A negligible quantity of forest in France belongs to forestry industries.

The area of other, private, managed wooded land is probably quite small. Such land generally consists of abandoned farmland.

18-24

Enquiry Table 6: Sources: All data for public ownership: ONF, 1995/1996, including national forests, military forests assigned to the ONF by the Ministry of Defence, and other forests subject to the forestry regulations (regional, departmental, communal, sectional, and those owned by public institutions). The ONF data have been made consistent with the figures in *Enquiry Table 5* "Ownership and management of forest", rows "In public ownership" and "Other wooded land".

The National Correspondent has taken half the difference between the area managed by the ONF and the area of public forest to be other public wooded land.

Private ownership: SCEES/ESSES 1976-1983, (Statistical survey of economic structures in forestry). The size categories in this survey differ from those asked about in the TBFRA-2000 questionnaire. The ESSES findings are therefore shown in the table below. The next survey is scheduled for 1999.

There exists supportive information on "private ownership" in tabular form in the reply to the enquiry, which is available at the secretariat.

Georgia

9-17

Enquiry Table 5: It is assumed that the forest area which is "undisturbed by man" is not managed.

Germany

9-17

Enquiry Table 5: Forests owned by individuals/forest industries/other private institutions: These categories are not distinguished in Germany, as private forests are by far largely owned by natural persons.

The break-up data under Private ownership on Forest available for wood supply are secretariat estimates.

18-24

Enquiry Table 6: The representation of data for the size classes are as follows:

Public ownership:

Data for “11 to 20 ha” for FOWL area and number of holdings represent also data for “1 to 50 ha”.

Data for “51 to 100 ha” for FOWL area represent data for “51 to 200 ha”.

Data for “101 to 500 ha” for FOWL area represent data for “201 to 500 ha”.

Data for “10,000 to 100,000 ha” for FOWL area represent data for “501 to >100,000 ha”.

Private ownership: Data for “21-50” for area and number of holdings represent also data for classes <3, 3-5 ha, 6-10 ha, 11-20 ha.

Private ownership: Does not cover very small forest ownership under 1 ha, which covers more than 1 million ha of forest land in total.

Greece

9-17

Enquiry Table 5: Forest and other wooded land co-owned by the State and individuals or other forms of co-ownership such as monasteries, are included under private ownership.

18-24

Enquiry Table 6: In public ownership: The data for “21-50” include all data “less than 50 ha”; and data for “101-500 ha” include all data for “more than 100 ha”.

In private ownership: The data for “6-10 h” include all data for “less than 10”; and data for “501-10000 ha” include all data for “more than 500”.

Hungary

9-17

Enquiry Table 5: The total of 277,000 ha of forest area released from public domain, where the privatisation process has yet to be finished is recorded as “owned by other private institutions”. These areas are included in the regional forest management plans, even if the real owners are absent temporarily. Forest authorities are responsible for emergency action on these areas.

Area of forest released from public domain for restitutional purposes, where the restitution process has yet to be finished is displayed as private. In fact, there are no real owners of these forests, but they are included in the forest management plans. Emergency measures to protect forest health and vitality should be initiated and financed by the forest authorities.

Please refer to comments in *Enquiry Table 1* “Total area by main classes" for the definition of “Forest" and “Other wooded land" and *Enquiry Table 3* “Forest and OWL according to availability of wood supply" for the definition of “Forest not available for wood supply".

18-24

Enquiry Table 6: “In private ownership” includes areas where privatisation has yet to be finished (277,000 ha), therefore the number of private forest holdings relates to 390,000 ha of forest area.

Iceland

9-17

Enquiry Table 5: Based on 1985 data. New data on forest ownership are not available.

The break-up data for Forest available for wood supply by ownership categories are secretariat estimates.

18-24

Enquiry Table 6: Data on size of FOWL holdings not available.

Israel

9-17

Enquiry Table 5: State ownership and owned by other public institutions on forest available for wood supply: Data can’t be filled because of no differentiation between the two.

The break-up data for Forest available for wood supply by ownership categories are secretariat estimates.

18-24

Enquiry Table 6:

1) The data have been created by estimation only.
2) Data not available for some columns above is because no natural other wooded land data available to each holding.

Italy

9-17

Enquiry Table 5: Source for "Managed": Enquiry about "State of forest management in Italy, 1985".

The break-up data for Forest available for wood supply by ownership categories are secretariat estimates.

These data on the managed areas of forests in tables 9 to 17 refer only to forest managed with specific plans. Nevertheless, all other Italian forests are submitted to general sylvicultural prescriptions (Prescrizioni di massima e di polizia forestale). These prescriptions are adopted at Provincial level and determine the practical forms of management to be applied.

The data on ownership categories on managed other wooded land are not available.

18-24

Enquiry Table 6: Class "101 to 500 ha" consists of forest holdings with area of more than 100 ha.

Japan

9-17

Enquiry Table 5: The break-up data for ownership categories for Forest available for wood supply are secretariat estimates.

18-24

Enquiry Table 6: The data size class and number of holdings for "6 to 10 ha" includes classes "3 to 5 ha" and "less than 3 ha". The data indicated for "501 to 1000 ha" includes data for all holdings of more than 500 ha.

The number and size of holdings of forest and other wooded land were collected by the Department of Statistics and Data Analysis, Ministry of Agriculture, Forestry and Fishery. This data were reported on Forestry Census.

The gap between the two figures is 3,519,000 ha. Then forest area of private ownership 14,201,000 is divided into each classes of holding size in proportion to the figure which was collected by Forest Census 1995. We modified Forest Census 1995 data to adjust data set of Forestry Statistics 1995 by proportional distribution of difference of the two data.

Forest Census data do not provide detailed figures separated into forest and other wooded land.

Kyrgyzstan

9-17

Enquiry Table 5: Source: Secretariat estimate based on the information from different literature sources, including the article "Forest biodiversity and forest genetic resources in the Kyrgyz Republic", T. S. Mussuraliev, FAO, 1997.

Latvia

9-17

Enquiry Table 5: The land reform process is not yet finished and therefore it is expected that the area of privately owned forests will increase.

Liechtenstein

9-17

Enquiry Table 5: In principle, the whole forested area in Liechtenstein is managed according to a strictly binding management plan. The objective of forest management embraces all activities intended to preserve multiple use forest ecosystems which are able to sustainably satisfy certain human needs as regards forest goods and non-material forest services on the one hand and the needs of plant and fauna species as regards conservation and amelioration of living conditions on the other. According to the multiple functions plan, the predominance of functions is as follows: protection function 40 per cent; wood production 32 per cent; nature protection 20 per cent; recreational function 8 per cent.

Lithuania

9-17

Enquiry Table 5: The forest area in private ownership has increased since the 1992 ongoing land reform.

18-24

Enquiry Table 6: Average size of a private forest is holding is 2.64 ha.

In "Public ownership"--"501 to 10,000 ha" and "10,000 to 100,000 ha" State Forest Enterprises, National parks and Nature Reserves are represented.

Data in "Public ownership"--"3 to 5" to "501 to 10,000 ha", small holdings of other public institutions.

Malta

18-24

Enquiry Table 6: The data provided under area of holdings and number of holdings for <10 in public ownership for forest and other wooded land also represent data for area of holdings for "less than 3" and "3 to 5 ha".

Netherlands

9-17

Enquiry Table 5: No data are available for the subdivision of privately owned forest into individuals and private institutions of all forest area. A tendency is occurring for individuals to establish jointly private institutions with a legal status.

Detailed information exists on "Division of 152,000 ha privately owned forest into 42 per cent individuals and 58 per cent private institutions according to the database of 'BOSSCHAP'", in tabular form in the reply to the enquiry.

All forest areas in the Netherlands have some sort of management plan so the column 'of which managed' is equal to the column 'total area'.

18-24

Enquiry Table 6: Sources: Bosschap database, 4th National Forest Area Survey.

No up to date figures are available on the number and size of holdings and total forest area. The database of Bosschap is up-to-date but covers about 250,000 ha. The data of BOSSCHAP are used to update the figures from the 4th National Forest Area Survey (1980-1983).

New Zealand

9-17

Enquiry Table 5: Data on the forest management are the estimates by the National Correspondent made to the Table of Essential Data and the secretariat estimates.

Data on ownership on other wooded land are not available.

The National Correspondent had a problem with the indigenous ownership category because some of what is in "public" ought to be shown in "indigenous". But it is not clear how much–hence what is in "public" is really ("public + indigenous"). This means that "indigenous" has to equal "0" to balance the table. This is why the National Correspondent wanted to use "not available" for "indigenous" but could not see how to consequently reduce the "public" to a realistic quantity.

The category owned by indigenous or tribal peoples is evolving as settlements to former grievances made under the Waitangi Commission are being worked through. It was not considered sufficiently meaningful to use this category during a period of intensive claim settlements, some of which may be retrospective. For this reason forest areas shown under "in public ownership" may change as land again becomes vested in Maori tribal ownership. In the case of the former State-owned plantation forests which have been sold over the last decade, these forests are now regarded as being in private ownership for management purposes even though the title to the land on which the forests is growing remains with the State. The last sales of these forests took effect after 31 March 1996 – hence the statistics in this table are at a point where the State still managed a considerable plantation forest resource. Within the context outlined above no adjustments were made to bring the parameters within the TBFRA2000 definitions. The error ranges are estimates of the likely range and are not based on statistical sample error ranges.

To give an indication of the forest area under claim by indigenous people (the New Zealand Maori) is very difficult.

Potentially, nearly all the forest on Crown land (i.e. land in public ownership) could come within various claims–i.e. 5.5 million hectares–but this is unlikely to be the outcome of the Treaty of Waitangi settlements. A more likely scenario would see–possibly over the next 30 to 60 years–the land on which the former State-owned plantation forests were established–being vested back into Maori tribal ownership. This provision exists within the Crown Forestry Licences which were the legal instruments actually sold during the disposal of the State-owned plantation forests. In total this could mean about 600,000 hectares of forest land could come within the category of item 5.9 in *Enquiry Table 5*.

The difficulty with "managed" is appreciated. "Managed" has been interpreted in the New Zealand context as being forest managed primarily for wood supply, not for conservation or protection purposes. Where wood supply is the main purpose there is no difficulty but for conservation forests (such as the forests in national parks) there are management plans for the way in which the forests will be protected, pests and weeds minimized, tracks cut, etc.

18-24

Enquiry Table 6: No comprehensive statistics in the format of this table were available. A restricted set - for plantation forests but without the ownership parameter - has been supplied in a supplementary table (see below). The source for this was Statistics New Zealand and the agricultural survey conducted by that department in 1994.

The reason for the difference is primarily because of the different time periods but also because of two different agencies compiling the statistics, with each having slightly different methodologies. The figures in the table have come from a postal agricultural survey conducted by Statistics New Zealand (the official government statistical agency). This survey was primarily intended to cover agricultural production on farms but also collected some limited details on plantations from which the distribution was derived.

Plantation forest size group	*Area (ha)*	*Number of farms with plantation forests*
– 0-9 ha	28868	9380
– 10-39 ha	66805	3759
– 40-99 ha	50656	874
– 100-499 ha	129755	622
– 500 -999 ha	117925	174
– 1000 ha and more	1093971	196
Total	**1487980**	**15005**

The data for Public ownership and Private ownership are secretariat estimates.

Norway

9-17

Enquiry Table 5: As shown in the comments on *Enquiry Table 1*, "forest, total" is estimated by adjustment of data from the NFI and additional sources. The NFI database does not contain information on ownership groups. Distributions of "forest" (national definition),"other area below the productive forest line", "wooded area above the productive forest line" by ownership groups and size of holdings are available from the Census of Agriculture and Forestry 1989 (Statistics Norway). Forest area according to FAO definition is considerably larger than forest area according to national definition. The difference between "FAO forest" and "national definition forest" is assumed to have the same distribution by ownership groups and size of holdings as "other area below the productive forest line". Other wooded land is defined partly as "other area below the productive forest line" and partly as "wooded area above the productive forest line".

It is very difficult to estimate how much of the forest and other wooded land should be regarded as "managed" or not. Even though in many cases there may be no written formal plan, the forest owner is likely to apply his own ideas and concepts when doing any harvest or silvicultural treatment. Other wooded land is in general not regarded as suitable for wood production and will not be managed in this respect. However, it is very often utilized (and managed) for hunting, fishing, recreation etc. The same may also apply to "forest not available for wood supply".

The data provided for "of which: managed" are therefore rough estimates.

18-24

Enquiry Table 6: As shown in the comments to table 1, "forest, total" is estimated by adjustment of data from the NFI and additional sources. The NFI database does not contain information on ownership groups. Distributions of "forest" (national definition), "other area below the productive forest line", "wooded area above the productive forest line" by ownership groups, and size of holdings are available from the Census of Agriculture and Forestry 1989 (Statistics Norway), according to the national definitions. The difference between "forest" (FAO) and "forest" (national definition) is distributed as "other area below the productive forest line", while "other wooded land" (FAO) is distributed partly as "other area below the productive forest line" and partly as "wooded area above the productive forest line".

It is very difficult to estimate how much of the forest and other wooded land should be regarded as "managed" or not. Even though in many cases there may be no written formal plan, the forest owner is likely to apply his own ideas and concepts when doing any harvest or silvicultural treatment. Some very rough estimates of managed area have been made for "forest available for wood supply". Other wooded land is in general not regarded as suitable for wood production and will not be managed in this respect. However, it is very often utilized (and managed) for hunting, fishing, recreation etc. The same may also apply to "forest not available for wood supply".

Poland

9-17

Enquiry Table 5: Ownership data is the average of 1992 and 1996 information.

It was assumed that all private forests are available for wood supply (in fact, there are some exceptions).

Another assumption was that all Polish forests are managed. According to the law in force, all Polish forests should be managed on the basis of management plan. In practice a small part of primarily private forests do not have such regulations, or the plans for them are outdated, but there is no information about the area of those forests (according to the experts, their total amount is negligible).

18-24

Enquiry Table 6: The ownership structure data relate to 1996, therefore forest acreage in every class have been proportionally changed for be conformable with the data presented in the previous tables.

Data were not available on the holding structure of forests owned by communes or managed by other Ministries than the Ministry of Environmental Protection, Natural Resources and Forestry. The total area of those forests is reported in the class "More than 100 ha", without the number of holders.

Within the "public forests" class–Forest Districts and National Parks are shown as holdings. Being state-owned they are individual units from the management point of view.

Polish property size classes are different from the classes proposed in *Enquiry Table 5*; therefore they were brought into conformity with the TBFRA ones.

Portugal

9-17

Enquiry Table 5: This table refers to ownership, which may differ from use, especially in the case of indigenous and tribal peoples. For forest use by indigenous and tribal peoples, see *Enquiry Table 22* "Indigenous and tribal peoples".

18-24

Enquiry Table 6: Estimates based on percentage distribution of holdings size classes, according to available official data.

Republic of Moldova

18-24

Enquiry Table 6: All forests of the country are in public ownership (clause 127 and clause 6 of the Constitution of the Forest Code).

Romania

9-17

Enquiry Table 5: The data for Public ownership and Private ownership on Forest and on Other wooded land are secretariat estimates.

18-24

Enquiry Table 6: The data for Public ownership and Private ownership are secretariat estimates.

The holding in public ownership is the administrative area managed by a Regional Forestry Officer–as a Forest District. The private ownership structure is going to be changed. For now, the total area is owned by more than 1 million individuals.

Data for "11 to 20 ha" of public ownership include data for "6 to 10 ha" also.

Russian Federation

9-17

Enquiry Table 5: Under the Forestry Code (article 19), all forests belong to the Federation (Federal ownership).

18-24

Enquiry Table 6: The number of holdings is the figure given for forestry enterprises, the smallest entities concerned with forest management. Source: "Handbook of USSR State Committee on Forestry and other ministry- and government-department-controlled enterprises managing forests (as of 1 January 1988)", USSR State Committee on Forestry, Moscow, 1989.

Slovakia

9-17

Enquiry Table 5: The sources of information for filling in this table were as follows:

Permanent Forest Inventory 1996 (PIL 1996), Lesoprojekt Zvolen.

Database of forestry:

– data of Forest Management Plan (LHP)

– register of owners and managers of forests

Report on Forestry in SR 1997 (Green Report 1997)

The category of state forests includes the state-owned forests (managed by the Ministry of Agriculture, the Ministry of Economy, the Ministry of Education, the Ministry of Defence), communal forests (municipal and urban forests) and church forests with a total area of 1,124,000 hectares.

The category of private forests includes private (forests owned by individuals), urbarial, and compossessory forests, cottier and agricultural co-operatives, totally 892,000 hectares.

Forest available for wood supply includes the commercial and special purpose forests reduced by 16,000 hectares of the subcategory U/H. The reduction was realized proportionately for state and private forests.

18-24

Enquiry Table 6: Data sources for table 6 "Number and size of holdings of forest and other wooded land" were as follows:

Database of Lesoprojekt, part Register of forest owners and managers, Green Report of Ministry of Agriculture of SR 1997, Final reports: Optimization of spacing out the forest and agricultural lands based on the ecological and economic quantifications of the production and public-beneficial forest functions and damages of anthropogenic origin, as well as logical and expert estimates.

The classification of forest area, other wooded area and forest according to size categories of ownership in state ownership, has a high accuracy (95-100 *per cent*) with regard to the possibility to identify the ownership.

In category of private ownership, the classification into the size categories is only approximate (30 *per cent*) considering the fact that 254,000 hectares of forests in the ownership of non-state bodies have not been passed yet to former owners.

Also owner numbers (numbers of managing bodies) of forests in private ownership were estimated 10,000 owners) according to the presented area of forests (254,000 hectares).

Slovenia

9-17

Enquiry Table 5: The process of denationalization is still in continuing. It is expected that the area in private ownership will increase.

18-24

Enquiry Table 6: The structure of holdings is changing (due to the process of denationalization). The share of the area in private ownership is increasing and some private owners will own more than 100 ha in future.

Spain

9-17

Enquiry Table 5: Data for the area in private ownership are not collected. The data provided is the difference between total area and public ownership.

The break-up data for Forest available for wood supply for Private ownership are the secretariat estimates.

18-24

Enquiry Table 6: The breakdown figures for private ownership include figures for public ownership.

Data shown in this table are for forest only. Data for other wooded land are not available.

Data for "501-10000 ha" represent data for "501 and above".

Sweden

9-17

Enquiry Table 5: See *Enquiry Table 1* "Total area by main classes" for the definition of "Forest" and "Other wooded land".

"Owned by indigenous or tribal people": Sweden's indigenous people "the Saami nation", more popularly named "the Lapplanders" do not own forest because they are Saami, and because of that Sweden has not specifically stated any areas in this column. However, Saami people in Sweden do own forest estates as private persons.

The column "of which: Managed": It is considered that all areas in Sweden to have either a formal or an informal management plan (as written in the definitions) and that is the reason why the areas in this column are the same as "Total area". The formal or informal plan might also mean that no treatments are allowed - which is also a management plan.

18-24

Enquiry Table 6: Source: National Board of Forestry.

Tillägg: SLU/Resgeom.

Arealfördelning "Forest and Other Wooded Land".

Fördelning på status "wood supply" och detaljerade ägargrupper. 1994 -1996. 1000 ha.

Obs Exkl del : Fridlysta områden, Mil. imp och Fjäll.

There exists supportive information on "Land type: Forest and other wooded land" in tabular form in the reply to the enquiry, which is available at the secretariat.

Switzerland

9-17

Enquiry Tables 3 and 5: Forest area available for wood supply: Generally the total forest area of Switzerland is available for wood supply if one follows the definition of TBFRA. Exceptions are protected areas which amount to 7,000 ha in Switzerland. The amount of 103,000 ha which was estimated not to be available for wood supply for economic reasons are based on expert opinions from WSL and ETHZ researchers. There is a broad consensus that from the economic point of view, it is not meaningful to harvest those stands regularly or even at all. However logging actually was, is and will be done to some extent with cable crane and helicopter in those "remote areas".

The data on ownership categories on managed other wooded land are not available.

18-24

Enquiry Table 6: Source: Statistique forestière suisse.

These data originate from Swiss Forest Statistics, and refer to 1996. The term surface or productive is the French expression to distinguish between "forest and other wooded land" and "forest".

The detailed data concerning private ownership are not available.

Tajikistan

9-17

Enquiry Table 5: Source for Public ownership on forest: Information from the TBFRA-2000 National Correspondent Mr. G. A. Avsalov, Director General of the Forest Association "Tajikles", in reply to the Table of the TBFRA Essential Data, 20.11.1998.

Source for Public ownership on other wooded land: Secretariat estimates based on different literature sources of information.

The FYR of Macedonia

9-17

Enquiry Table 5: The data for the following are secretariat estimates based on the information from different literature sources:

Forest, total; In public ownership; In private ownership; Forest available for wood supply.

Data on ownership categories on managed other wooded land are not available.

Turkey

9-17

Enquiry Table 5: Either private or public, for the management of any forest area, forest management plan is mandatory. Forest management plans are strong institutional tools empowered by the Forest Act.

18-24

Enquiry Table 6: For the term "holding" it is an independent entity or owner for private forests, and forest management planning unit for public forests.

Turkmenistan

9-17

Enquiry Table 5: Data on the ownership and management status are secretariat estimates.

United Kingdom

9-17

Enquiry Table 5: Source: FC & NIFS databases, other estimates based on grants.

Public except FC+Northern Ireland FS, estimated 150,000 ha, moved from private to public.

It is assumed that 130/150 thousand ha of other public is available for wood supply, all managed except 150 thousand ha private.

18-24

Enquiry Table 6: All estimates from analysis in October 1997.

Based on estimates for private woodland owners in 1977, extrapolated to 1995, and on latest farm census results for farm woodlands. OWL added to area but numbers of holdings not changed.

United States of America

9-17

Enquiry Table 5: General - For this table, within "public ownership", "state ownership" includes all federally owned lands and "other public institutions" includes all state, county, and municipally owned lands. "Forest industry" includes only those owners having wood processing facilities and does not include private corporations owning forest land that do not have wood processing facilities.

Area - Area of forest and other wooded land (available and unavailable for wood supply) in public ownership was obtained from the 1992 national forest inventory database. Areas for "indigenous or tribal peoples" were derived from data reported in "Private forest-land owners of the United States, 1994". The remaining forest and other wooded land area comprises "private ownership" data.

Management - Most (85-95 per cent) of publicly owned forest and other wooded land was assumed to have some form of management plan. Management proportions for all other owners were derived from data provided in "Private forest-land owners of the United States, 1994". This report indicated that, on average, 68 per cent of forest and other wooded land for "indigenous or tribal peoples" had some form of management plan as well as 89 per cent for "forest industries", 75 per cent for "other public institutions", 50 per cent for "other private institutions", and 26-50 per cent for other private land owners. Generally, management plans were deemed less likely on "other wooded land" than on "forest land".

18-24

Enquiry Table 6: Private owners – Proportions to allocate 1992 national inventory forest and other wooded land areas were derived from "Birch, Thomas W. 1994. Private Forest-land Owners of the United States, 1994. Resource Bul. NE-134: USDA Forest Service, Radnor, PA. 183p."

Public owners – Forest Service, National Park Service, Fish & Wildlife Service, Bureau of Land Management, Department of Energy, and Defence Department are 6 primary public owners along with holdings of 37 large State, County, and Municipal owners. States, countries, and municipalities are primary owners.

Data for indigenous peoples are included in the private ownership section of *Enquiry Table 6*. Estimates for numbers of owners and area of forest and other wooded land by size class are provided in the table below. Also see supplemental table attached to TBFRA *Enquiry Table 22* "Indigenous and tribal peoples", which is available in the secretariat.

There exists supportive information on "Estimate of number of owners and area of forest and OWL by size class for Indian ownership" in the reply to the enquiry, which is available in the secretariat.

Uzbekistan

18-24

Enquiry Table 6: Source: A. A. Khanazarov, Magazin "Lesnoye Khozjaistvo" ("Forestry"), No. 12, 1990, pp. 13-15.

Yugoslavia

9-17

Enquiry Table 5: "Forest available for wood supply–owned by other public institutions": The area of 23,415 ha is owned by Agricultural and Water Resources Enterprises. State owned forests are managed by State Enterprises "Serbia Sume" and "Cosa Gora Sume".

18-24

Enquiry Table 6: The average parcel in private ownership is 0.37 ha.

CHAPTER III: WOOD SUPPLY AND CARBON SEQUESTRATION: SITUATION AND CHANGES

A) GROWING STOCK, GROWTH, DRAIN AND BALANCE[1]

Overview

This chapter summarizes the volume of growing stock, annual increment of the growing stock, annual fellings, removals and natural losses, as well as changes in growing stock over time, by sub-regions. The forest balance in different regions is also considered. Each of these concepts is important when analyzing the utilization and wood production possibilities of forests, and the potential for maintaining the biodiversity of forests within given wood production scenarios.

Almost all TBFRA countries have information on growing stock, increment and fellings, so that they are in a position to assess the forest balance at the national level. Many countries have reliable data for all, or nearly all, the parameters requested by TBFRA. However, many others have one or several of the parameters requested, but not all: for instance gross but not net annual increment (or *vice versa),* or fellings on forest available for wood supply but not on total forest. Data on natural losses and harvesting losses are frequently missing, especially in those countries where forestry does not play a significant economic role. This variability of coverage leads to major problems when one attempts to present an overview at the level of the region or country group, as omission of missing data makes comparison along rows or down columns impossible. To obtain a reasonably viable overview, it is necessary to construct a coherent and comprehensive data set, without major omissions either of parameters or of countries, without however introducing too many potentially misleading estimates[2]. In Chapter IIIA, the solution chosen is as follows:

- In the main tables, as elsewhere in TBFRA, only data supplied by National Correspondents are shown. When even one country is missing, no regional total is shown. This approach also applies to national data in figures.
- For the chapter tables, a very few countries, without significant forest cover have been omitted and, for the others, when official data are missing, rough estimates have been made for the major parameters, and included in the regional totals. These are not shown at the country level. In this way, the figures in the tables are comparable by rows and columns, and present totals which are not significantly different from the true level. The names of countries omitted, or for which estimates were necessary are given after each chapter table.

Growing stock

According to the TBFRA-2000 definition, growing stock volume is the above-stump volume of living trees measured overbark[3] to the tree tops. It includes all trees with diameter over zero cm at breast height (d.b.h.) and large branches (Appendix I, item 22). Gross annual increment should also include the average annual volume of the increment of all trees with a d.b.h. greater than 0 cm, but this has not been applied by all countries (Appendix I, item 21). This decision was taken because countries use different threshold limits, based on local conditions and traditions, and no international consensus could be obtained on any single threshold, other than the minimum one of 0 cm d.b.h.

The volume of growing stock on FOWL in the TBFRA area is estimated at 201.6 billion m^3. The growing stock volume on forest alone is 188 billion m^3, of which 127.3 billion m^3 (63 per cent) coniferous and 59.3 billion m^3 (29 per cent) non-coniferous (Table 3A.1). The remaining 8 per cent is accounted for by bamboos and the inability of a few countries to provide a breakdown by species of their growing stock.

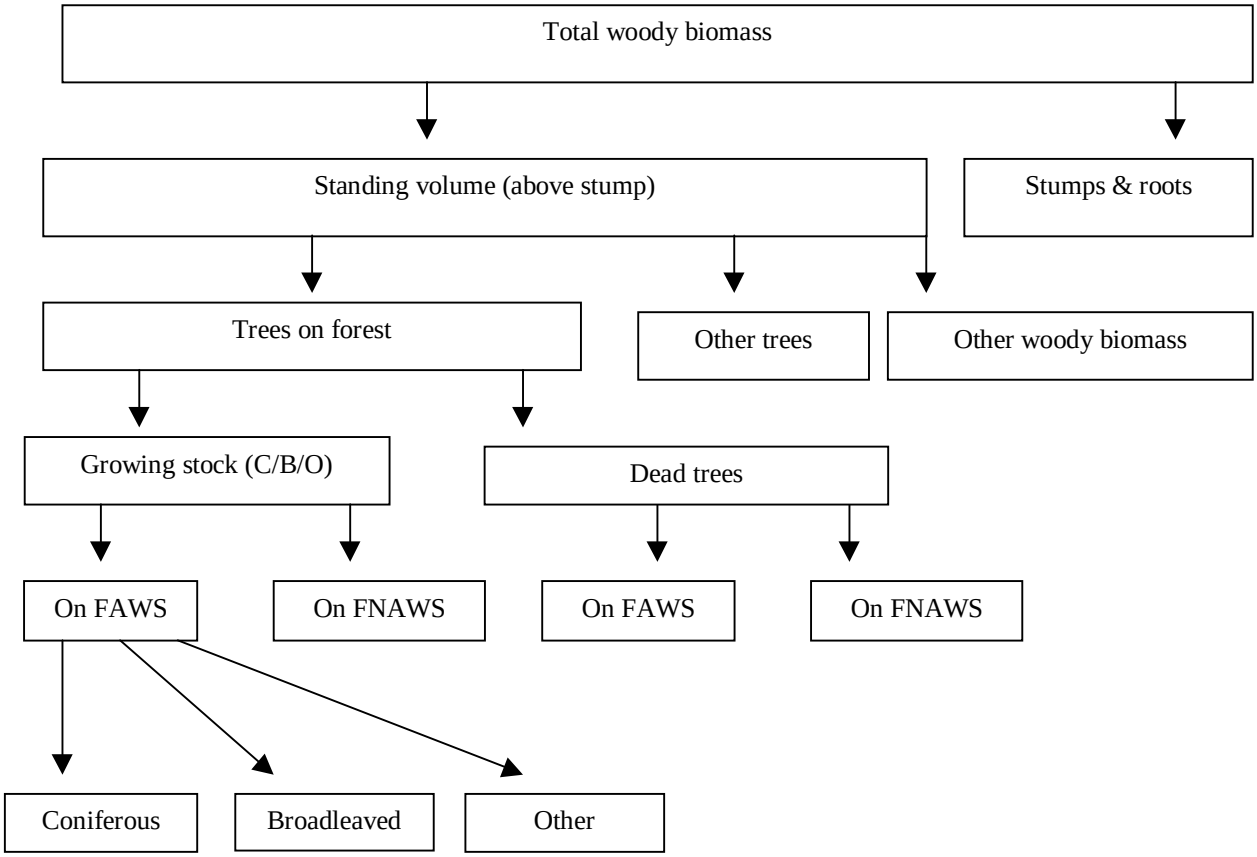
[1] This part of Chapter III was prepared by Mr. Erkki Tomppo, Mr. Kari T. Korhonen and Mr. Ville Kankaanhuhta (see Appendix V).

[2] Presentation of non-comparable data in the same table (even with footnotes) is of course, misleading in a different way.

[3] Unless stated otherwise, the volumes of growing stock, natural losses, gross and net annual increment and fellings in this chapter are expressed in cubic metres overbark (m^3 o.b.) Removals are reported in cubic metres over bark and underbark (m^3 u.b.).

DIAGRAM 3A.1

Standing volume and growing stock



Of the TBFRA region's total growing stock, rather less than half is in one sub-region, the CIS (in fact in one country, the Russian Federation), and just over a third in North America, with much smaller volumes in Europe and "Other TBFRA". Almost all growing stock (over 97 per cent) is on forest land, except in North America, where this proportion is "only" 84 per cent. However, the share of growing stock which is on "Forest available for wood supply" (FAWS) varies widely. This share is important as it is the growing stock on FAWS which may be expected to play the principal role in world wood supply. In Europe, nearly 83 per cent of growing stock is "available" in this sense, but around two thirds in CIS and North America, and less than a third in "Other TBFRA", because of Australia's large expanses of forest not available for wood supply. About two thirds of the growing stock in the TBFRA region is coniferous (about 78 per cent in CIS), but this proportion is only just over 20 per cent in "Other TBFRA", again because of Australian conditions, where non-coniferous species, notably eucalyptus, predominate.

TABLE 3A.1

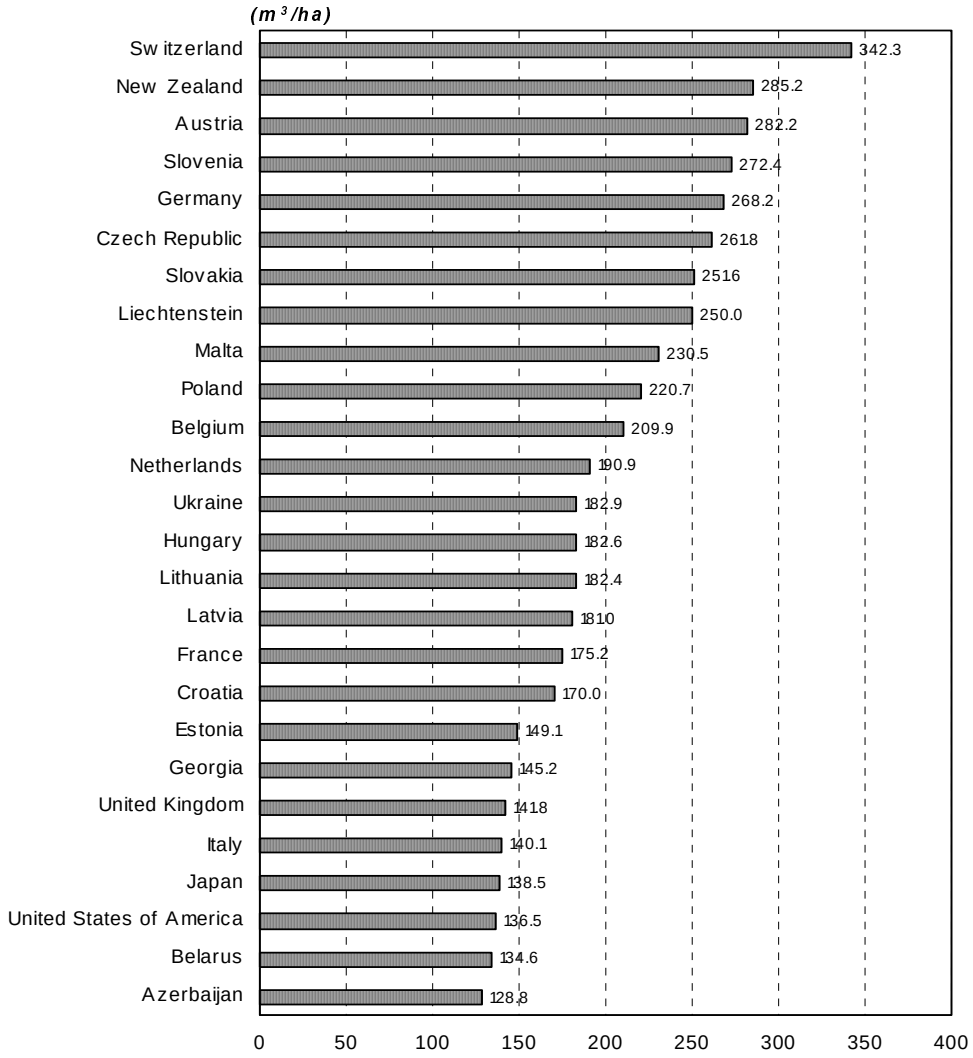
Growing stock volumes in the TBFRA area, by region

	Total growing stock (GS)	Region as per cent of TBFRA total	GS on forest	GS on forests as per cent of total GS	GS on FAWS	GS on FAWS as per cent of total GS	Coniferous GS on forest	Coniferous as per cent of total GS (on forest)
	(billion m^3 o.b.)	*(per cent)*	*(billion m^3 o.b.)*	*(per cent)*	*(billion m^3 o.b.)*	*(per cent)*	*(billion m^3 o.b.)*	*(per cent)*
Europe	25.85	12.8	25.14	97.2	21.37	82.7	15.40	61.2
CIS	91.00	45.1	89.45	98.3	63.53	69.8	69.63	77.8
North America	70.05	34.7	59.02	84.3	44.39	63.4	39.01	66.1
Other TBFRA	14.70	7.3	14.67	99.8	4.38	29.8	3.17	21.6
Grand total	201.59	100.0	188.28	93.4	133.67	66.3	127.21	67.6

Note: For Bosnia and Herzegovina, Kyrgyzstan, Luxembourg and Romania, it has been assumed that growing stock on other wooded land and trees outside the forest, for which data were not available, is negligible

FIGURE 3A.1

Mean volume of growing stock on forest and other wooded land in selected countries



The growing stock volume on forest and other wooded land (including trees outside forest) is presented, by country, in Main Table 34 and Table 3A.1. Growing stock volume varies from 87 billion m^3 in the Russian Federation and 41 billion m^3 in the USA to 80 000 m^3 in Malta. Growing stock volume exceeds 1 billion m^3 in sixteen countries. The mean growing stock volume on FOWL is presented in Figure 3A.1. The highest mean volume, 342 m^3/ha, is in Switzerland, and it exceeds 200 m^3/ha in 11 countries. The mean volume is less than 10 m^3/ha in four and less than 25 m^3/ha in nine countries.

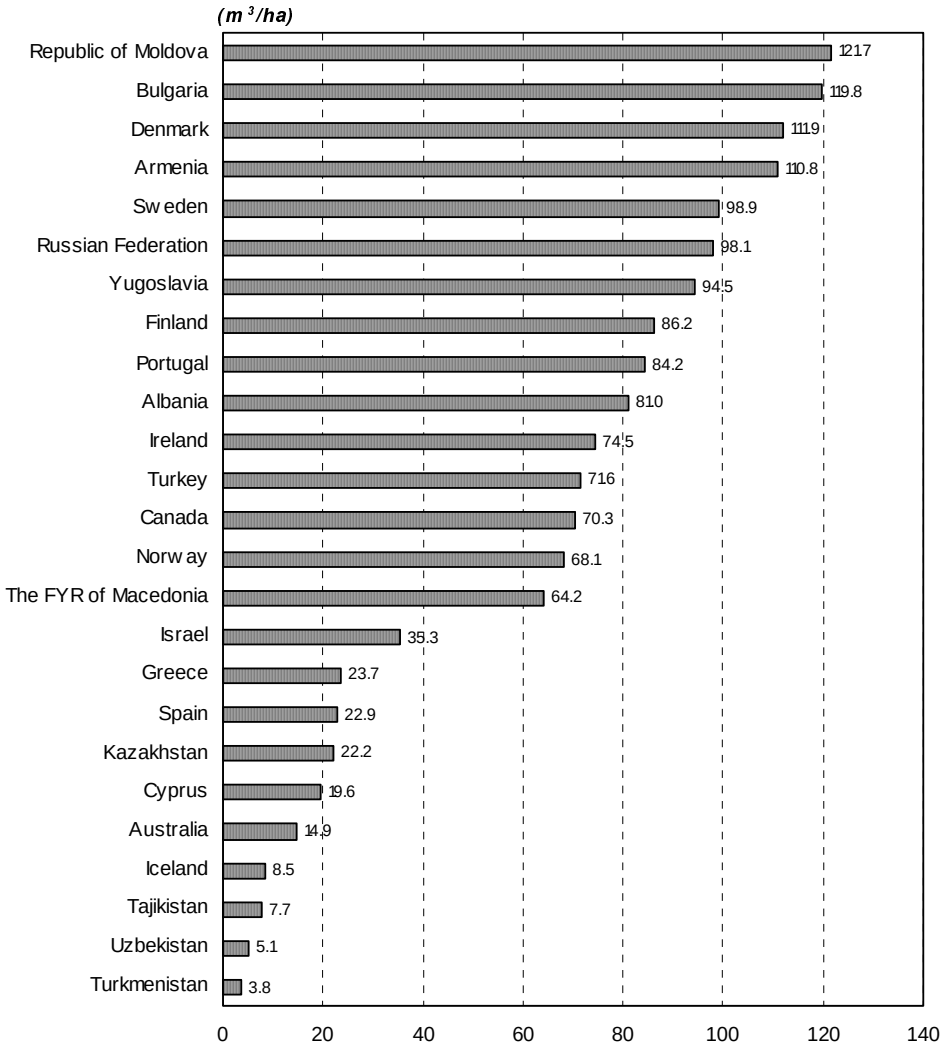
Main Tables 37 and 38 present comparable data by country, for growing stock, on forest and on FAWS, for two periods, "Reference period 1" and "Reference period 2", corresponding, in most cases, to the dates of the most recent inventory and of the previous one. From this an average rate of change in growing stock in m^3/year has been derived. In a few cases, correspondents have estimated the rate of change in growing stock, rather than estimating growing stock for previous inventories. A few countries, notably Australia, were not able to make any estimate for changes in growing stock. It is important to realize that the figure for the net change in growing stock is not the same as a growth/drain balance: the former takes into consideration other factors than increment and fellings, and in particular, changes in land cover classification. For instance growing stock on land which has moved from "forest" to other wooded land" counts as a reduction in growing stock on forest, even though the material has not been harvested or otherwise removed.

The total average annual increase in growing stock for the TBFRA area is about 640 million m^3, assuming negligible changes in non-reporting countries. The annual increase in Europe is 327 million m^3/year, and in North America 257 million m^3. The volume decreased in CIS countries by 23 million m^3/year, and by as much as 113 million m^3/year in the Russian Federation, chiefly, it appears, because of the growing stock on land which was "forest" in the early 1980s but which has become "other wooded land"[3]: this volume of growing stock appears as a reduction in the

[3] Information on changes in growing stock on other wooded land was not requested as most countries indicated they could not provide the data with an acceptable degree of accuracy.

FIGURE 3A.1 *(continued)*

Mean volume of growing stock on forest and other wooded land in selected countries



volume of growing stock on forest, although, as will be shown below, the drain on Russian forests has been well below net increment all through the period In relative terms, the annual change in growing stock on forest (as compared to the volume in "Reference period 1") was 1.39 per cent of the growing stock for Europe, and 0.44 per cent for North America. The biggest relative annual increase has happened in South & South-East Europe, (3.4 per cent per year, with Italy reporting an annual change of over 5 per cent) and the second biggest change in Central-Western & North-Western Europe, 2.5 per cent. In the CIS, the decrease in growing stock, although large in absolute terms was only 0.03 per cent per year.

The annual increases in growing stock on forest available for wood supply were lower than for total forest. The average annual increase in Europe for growing stock on FAWS was 252 million m^3, and in North America 207 million m^3. The volume decreased in CIS, by over 106 million m^3, and in Russia by nearly 170 million m^3/year, chiefly due to the transfer of forest land (including FAWS) to other land uses, notably other wooded land. The relative growth in growing stock on FAWS for the Baltic countries is 1.9 per cent, for Europe in total 1.6 per cent (EU15 1.8 per cent) and for North America 0.5 per cent.

In general, the change in growing stock by species reflects roughly the relative importance of the species in the growing stock: thus in the Nordic countries 80 per cent of the annual increase was coniferous, and in Russia, coniferous growing stock on FAWS decreased by over 200 million m^3/year, while broadleaved growing stock increased slightly. (Table 3A.2). In North America, the increase for coniferous was marginal while that for broadleaved was significant, over 190 million m^3/year.

Increment, natural losses, fellings and removals

One of the core elements of sustainable forest management – and certainly the silvicultural objective mentioned earliest and most often—is the need to maintain a proper balance between increment and felling, or, in simpler terms,

TABLE 3A.2

Change in growing stock on forest and forest available for wood supply (FAWS), by country groups (million m^3 o.b./year)

	On forest	On forest available for wood supply	Coniferous (on FAWS)	Broadleaved (on FAWS)
Nordics	61.7	52.0	41.6	10.3
Baltics	17.4	17.0	8.7	8.4
C-E Europe	46.0	36.8	21.3	15.5
C-W & N-W Europe	83.7	82.9	48.2	34.6
Iberia	14.3	8.2	4.5	3.7
S & S-E Europe	103.6	54.6	18.7	35.8
Europe	326.8	251.5	143.0	108.3
of which: EU15	219.3	164.1	95.5	68.5
CIS	-23.3	-106.3	-182.1	47.9
of which: Russian Federation	-113.4	-169.3	-206.6	37.3
North America	256.8	207.2	14.6	192.6

Note: Data on change not available for Bosnia and Herzegovina, Greece, Israel, Malta, Romania, the former Yugoslav Republic of Macedonia, Kyrgyzstan and Australia. Regional and sub-regional totals have been shown for Europe, CIS and North America, as these results are not significantly affected by these omissions, but not for "Other TBFRA" as the absence of data for Australia make regional and grand totals misleading.

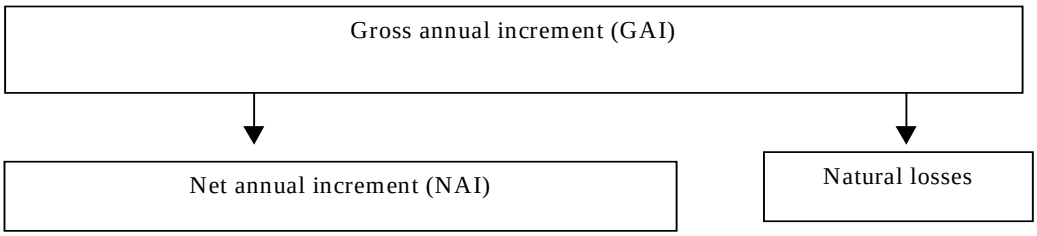
not to cut more wood than grows in the forest. To achieve this objective it is necessary to measure and monitor both sides of the equation i.e. both increment and fellings. However this process can be complex and expensive. Furthermore, natural losses, harvesting losses and bark must be properly incorporated into the balance.

This section will present the elements of this balance, mostly at the country group level. The interrelation of the various terms used is presented diagrammatically below (Diagram 3A.2).

DIAGRAM 3A.2

Annual increment

A. Gross and net increment



B. By location (for gross and net annual increment)

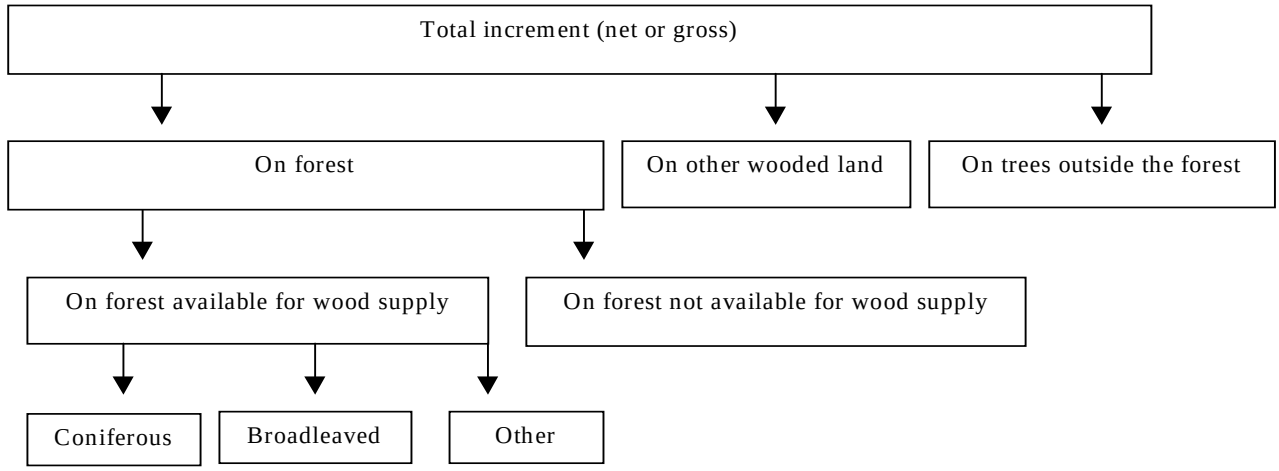


TABLE 3A.3

Gross annual increment on forest and other wooded land in the TBFRA area

	Total	On forest			On FAWS	On other wooded land
	(million m^3 o.b.)	(million m^3 o.b.)	(m^3 o.b./ha)	(per cent of growing stock)	(million m^3 o.b.)	(million m^3 o.b.)
Nordics	206.8	202.7	3.5	3.6	189.1	2.4
Baltics	40.8	38.6	5.6	3.3	33.9	1.0
C-E Europe	138.8	135.7	7.0	3.0	128.6	0.2
C-W & N-W Europe	246.7	242.8	7.7	3.6	237.6	0.5
Iberia	46.1	45.1	2.7	5.2	42.1	0.2
S & S-E Europe	163.3	153.0	3.4	2.4	133.0	4.0
Europe	842.5	818.0	4.7	3.2	764.4	8.4
of which: EU15	528.5	519.0	4.6	3.5	487.9	2.0
CIS	1888.9	1411.6	1.7	1.5	1070.4	225.4
of which: Russian Federation	1803.1	1328.1	1.6	1.6	1002.0	225.0
North America	1751.0	1396.0	4.4	3.2	1097.5	355.0
Other TBFRA	191.5	191.0	0.9	1.3	137.5	0.0
Grand Total	4673.9	3816.0	2.1	2.1	3069.8	588.8

No data for Malta, Kyrgyzstan Uzbekistan. For Bosnia and Herzegovina, Cyprus, Luxembourg, Georgia, Turkmenistan, Canada, New Zealand, data for gross annual increment on forest refer to net annual increment No data for increment on other wooded land also for Bulgaria, Croatia, Ireland, Liechtenstein, Romania, Slovakia, the FYR of Macedonia, and Australia.

Gross annual increment

The gross annual increment on forest and other wooded land amounted to over 4,670 million m^3 [4] (Main Table 42). About 40 per cent of this is in the CIS, and 37 per cent in North America, 18 per cent in Europe and 4 per cent in "Other TBFRA". In fact three countries (Canada, Russia, USA) account for 75 per cent of the increment of the region. Over 80 per cent of gross annual increment is on forest : about 3,820 million m^3, compared to at least 600 million m^3 on other wooded land. The gross annual increment is presented by countries in Figure 3A.2. The highest increment is in the Russian Federation (1,803 million m^3 and the second highest in the USA (1,309 million m^3).

The mean gross annual increment on forest in the TBFRA area is 2.1 m^3 o.b./ha. It varies by regions from 0.9 m^3o.b./ha in "Other TBFRA" and 1.7 m^3/ha in CIS to 7.7 m^3/ha in Central-Western and North-Western Europe. The mean gross annual increment in Europe is 4.7 m^3/ha with the lowest figure in Iberia, 2.7 m^3/ha. North America's and Other TBFRA's figures are 4.4 and 0.9 m^3/ha respectively. This wide variation reflects not only the natural productivity of the region, but also forest history and management objectives. Increment percentage on forest (increment as per cent of growing stock) is 2.1 per cent. It varies by regions from 1.5 per cent in "Other TBFRA" to 3.2 per cent in Europe and North America (USA). It is between 2.4 and 5.2 per cent in Europe's sub-regions (Table 3A.3).

The reported gross annual increment of coniferous trees on forest is 2,470 million m^3 (65 per cent of the increment) and broadleaved trees 1,346 million m^3. The proportion of coniferous trees in the gross annual increment is highest in the Nordic countries (80 per cent). It is 73 per cent in Central-Eastern Europe, and 70 per cent in CIS and in the EU region. The proportion of coniferous trees in the gross annual increment is lowest in South & South-East Europe (42 per cent) (Table 3A.4).

However, not all increment is available for wood supply: the gross annual increment on forest available for wood supply is 3,070 million m^3, which is 80 per cent of the increment on forest in total. The proportion in "Other TBFRA" is 72 per cent, in Europe 93 per cent, in CIS 76 per cent and in North America 91 per cent. The proportion of coniferous trees of the total increment on FAWS is 62 per cent. The highest coniferous proportion on FAWS is in "Other TBFRA" (74 per cent), in sharp contrast to the 40 per cent coniferous proportion for total forest increment. This arises because of the very sharp distinction in this region, especially in Australia and New Zealand, between species composition and management methods on forest available and not available for wood supply.

[4] In fact this is certainly an underestimate as net rather than gross increment figures were used for some major countries, including Canada, and data for increment are lacking on the millions of hectares of other wooded land in Australia.

TABLE 3A.4

Gross annual increment by species groups on forest and forest available for wood supply in the TBFRA area
(million m^3 o.b.)

	Forest			Forest available for wood supply		
	Coniferous	Broadleaved	per cent coniferous	Coniferous	Broadleaved	per cent coniferous
Nordics	162.4	40.3	80.1	152.8	36.3	80.8
Baltics	22.9	15.7	59.4	20.2	13.7	59.7
C-E Europe	98.6	37.1	72.7	93.5	35.1	72.7
C-W & N-W Europe	146.1	96.1	60.3	143.4	94.3	60.3
Iberia	26.3	18.8	58.3	25.0	17.2	59.2
S & S-E Europe	63.9	89.1	41.8	55.4	77.6	41.7
Europe	520.2	297.1	63.6	490.3	274.1	64.1
of which: EU15	344.1	174.2	66.4	328.0	159.9	67.2
CIS	1002.9	408.7	71.0	682.7	387.4	63.8
of which: Russian Federation	957.6	370.5	64.1	642.6	359.4	64.1
North America	869.4	526.7	62.3	641.3	456.2	58.4
Other TBFRA	76.6	114.4	40.1	101.2	36.3	73.6
Grand Total	2469.1	1346.6	64.7	1915.5	1154.0	62.4

No data on gross annual increment on forest for Luxembourg, Malta, Georgia, Ukraine, Uzbekistan. Estimates for Bosnia and Herzegovina, Romania, the FYR of Macedonia, Georgia, Canada and New Zealand

Natural losses

Natural losses are reported for forest, forest available for wood supply and forest not available for wood supply, as well as for coniferous and broadleaved trees separately. Most European countries have reported the figures, but not Canada, Australia, Japan and New Zealand (Main Table 44).

The volume of average annual natural losses on forest in Europe is 70 million m^3, in the CIS 375 million m^3 and in the USA 193 million m^3, respectively 8.7 per cent, 26.7 per cent and 20.2 per cent of gross annual increment (Table 3A.5). The percentage of natural losses will of course vary according to site characteristics (climate, slope, fertility etc.) and age of stand, and will tend to be proportionately higher in undisturbed forests than in those which are managed. However, it is likely that part of the wide variation in reported figures is also due to the fact that certain

TABLE 3A.5

Natural losses by species groups on forest and forest available for wood supply, by country group
(million m^3 o.b.)

	On forest			On forest available for wood supply			As per cent of gross annual increment	
	Coniferous	Broadleaved	Total	Coniferous	Broadleaved	Total	On forest	On FAWS
Nordics	7.9	2.5	10.5	7.1	2.0	9.1	5.2	4.8
Baltics	5.0	3.1	8.1	4.5	2.7	7.2	21.1	21.2
C-E Europe	14.6	5.4	20.0	14.0	5.2	19.2	14.8	14.9
C-W & N-W Europe	12.7	7.9	20.6	12.2	7.4	19.6	8.8	8.6
Iberia	0.4	0.3	0.7	0.4	0.3	0.6	1.6	1.5
S & S-E Europe	3.9	5.8	9.7	3.6	5.5	9.1	6.6	7.2
Europe	44.5	25.2	69.6	41.7	23.1	64.8	8.7	8.7
of which: EU15	20.8	10.4	31.2	19.6	9.5	29.0	6.1	6.1
CIS	281.3	90.1	374.8	186.3	85.7	274.1	26.7	25.8
of which: Russian Fed.	273.6	85.5	359.1	178.6	81.4	260.0	27.0	25.9
USA	106.0	87.0	193.0	97.0	79.0	176.0	20.2	20.2

No data for Belgium, Bosnia and Herzegovina, Ireland, Israel, Luxembourg, Malta, The FYR of Macedonia, Georgia, Kyrgyzstan, Turkmenistan, Uzbekistan, Canada, Australia, Japan and New Zealand. No breakdown by species for Ukraine (so, for CIS, coniferous plus broadleaved does not equal total).

TABLE 3A.6

Net annual increment on forest and forest available for wood supply by species groups in the TBFRA area
(million m^3 o.b.)

	Total	On forest			On forest available for wood supply		
		Coniferous	Broadleaved	Total	Coniferous	Broadleaved	Total
Nordics	195.6	154.4	37.8	192.2	145.7	34.3	180.0
Baltics	32.3	17.9	12.6	30.5	15.8	10.9	26.7
C-E Europe	118.7	84.0	31.6	115.7	79.5	29.9	109.4
C-W & N-W Europe	225.9	133.5	88.1	222.3	131.2	86.8	218.7
Iberia	45.3	25.9	18.5	44.4	24.6	16.9	41.5
S & S-E Europe	153.7	56.9	80.0	143.4	51.9	72.1	124.0
Europe	771.7	472.6	268.7	748.4	448.6	251.0	700.3
of which: EU15	496.6	323.3	163.8	487.8	308.4	150.4	459.5
CIS	1354.0	703.9	302.6	1037.5	493.2	299.6	793.1
of which: Russian Federation	1284.0	684.0	285.0	969.0	464.0	278.0	742.0
North America	1486.0	730.6	472.5	1203.0	544.3	377.2	921.5
Other TBFRA	191.5	101.3	89.7	191.0	101.2	36.3	137.5
Grand Total	3803.2	2008.3	1133.4	3179.9	1587.3	964.1	2552.4

No data for Malta, Kyrgyzstan, and Uzbekistan. Estimates for Bosnia and Herzegovina, Romania, The FYR of Macedonia. Coniferous/broadleaved breakdown estimated for Ukraine.

countries invest more than others in measuring the volume of natural losses. The share of natural losses on forest available for wood supply is very close to the proportion for forest as a whole.

Net annual increment

Practically all countries were able to provide data for net annual increment on forest, so these data may be considered the most reliable part of the "increment" side of the increment-drain equation. Net annual increment of trees on forest and other wooded land in the TBFRA region in the mid-1990s was about 3,800 million m^3 o.b. (Main Table 42). Over 70 per cent of this – 2,770 million m^3 – is in three countries, Canada, Russia and USA. However, Europe accounts for 772 million m^3 – 20 per cent of the TBFRA region total – and "Other TBFRA" for less than 200 million m^3. This latter figure is certainly an underestimate as Australia is not in a position to estimate annual increment on the millions of hectares of other wooded land on the continent (Table 3A.6).

3,180 million m^3, 84 per cent of total net annual increment, refers to forest land. About two thirds of this is coniferous and one-third broadleaved, with similar proportions in all regions, except "Other TBFRA", where broadleaved is relatively more important than elsewhere, although still less than coniferous. Only in South and South East Europe is increment of broadleaved larger than that of coniferous. In the Nordic countries, 80 per cent of increment is coniferous.

About 80 per cent of increment on forest is on forest available for wood supply (FAWS): 2,550 million m^3 o.b. There is a significant difference in the relative importance of FAWS between Europe and other regions: in Europe, 94 per cent of increment is available for wood supply while elsewhere this percentage is between 72 per cent and 77 per cent. This results from Europe's higher population density, and relative lack of undisturbed and/or remote forests, as well as the long European silvicultural tradition. In some country groups within Europe (e.g. central-western and north-western Europe) the share of increment which is available for wood supply reaches as high as 98 per cent.

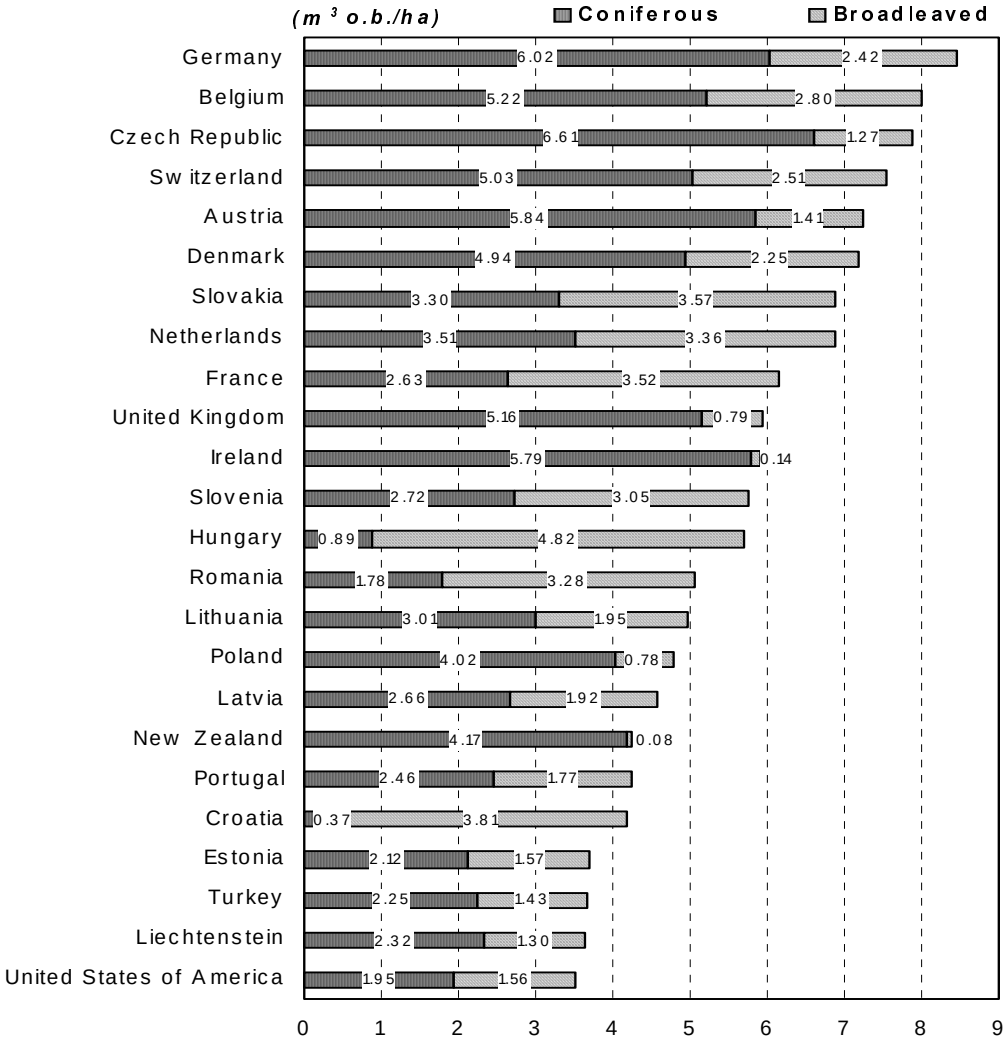
The wide variation in increment per hectare, from negligible to over 8 m^3/ha/year for forest and to nearly 14 m^3/ha/year for FAWS is demonstrated in the main tables and figures.

Fellings and removals

The data on fellings and removals have a number of inherent quality problems which are almost impossible to resolve in the short term, but must be kept in mind when using the data. TBFRA data are mostly supplied by national forest inventories and based on measurements in the forest, taken over the life cycle of the forest inventory. They are

FIGURE 3A.2

Mean net annual increment on forest by tree species groups and by countries



therefore not necessarily comparable with the annual data on removals published at the national level and in the *Timber Bulletin* and the *FAO Yearbook of Forest Products*. The latter are often estimates based on parameters which are more easily measurable on an annual basis, such as inputs of raw material to the forest industries. From time to time these estimates for annual felling are calibrated against the forest inventory data. For this reason, TBFRA data should **not** be compared to annual removals data published elsewhere, including by ECE/FAO.

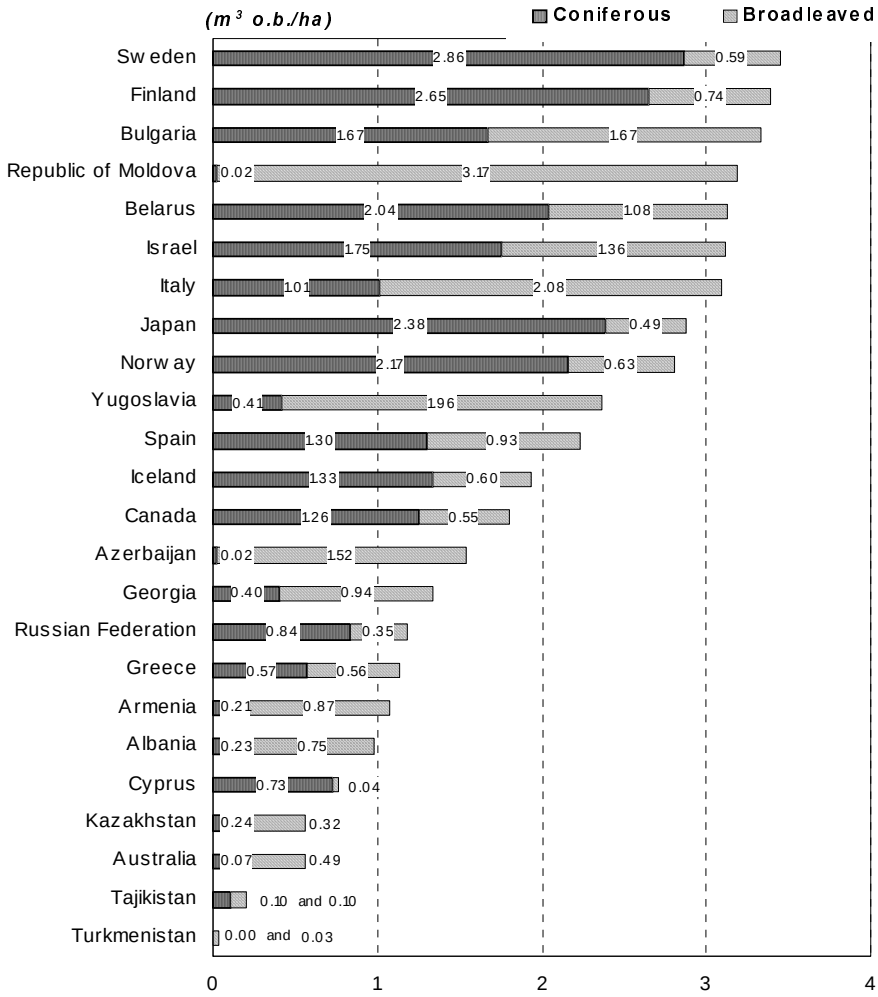
Some countries have not provided data for fellings on forest not available for wood supply (FNAWS), which should include for example tending fellings and sanitation fellings in remote or protected forest areas. Others were not able to measure or estimate fellings which did not refer to forest (i.e. on other wooded land and trees outside the forest). Although it is believed that these omissions do not significantly affect the overall picture, they should be borne in mind when using the regional totals.

Total fellings in the TBFRA region were 1,632 million m^3 in the mid-1990s (Main Table 47 and Table 3A.7). Of this, over half, 922 million m^3, was in the two countries of North America, and another 28 per cent in Europe (465 million m^3). The Russian Federation, which accounts for 30 per cent of the region's net annual increment, accounted for only 9 per cent of its fellings. The main cause of this contrast between growth and harvest in the Russian Federation was the economic, social and infrastructure problems in the Russian Federation, linked to the process of transition. Ten years ago, in the mid-1980s, Russian fellings and removals were at least three times higher than at the end of the 1990s. This dramatic decline in fellings of the world's largest forest resource has significant consequences for global wood supply and the global carbon balance.

Eighty-eight percent of total fellings, or 1,434 million m^3, was on forest and the rest on other wooded land or trees outside the forest. Removals on forest were 1,260 million m^3, implying harvest losses for the region as a whole of about 175 million m^3 (12 per cent of total fellings). Taking into account only forest land, removals were 88 per cent of

FIGURE 3A.2 (*continued*)

Mean net annual increment on forest land by tree species groups and by countries



fellings in Europe, 74 per cent in the CIS, 90 per cent in North America and 96 per cent in "Other TBFRA". Much of this variation may be explained by differences in conditions and practices between the regions. However, it may be desirable in the future to explore in more depth the issue of the relative importance of harvesting losses, and the reasons for variations between regions, during the follow-up to the TBFRA.

The volume of removals of wood, without bark, from the forest of the TBFRA region is nearly 1,220 million m^3 u.b., of which 695 million m^3 u.b. from North America, 360 million m^3 u.b. from Europe, 105 million m^3 u.b. from the CIS and 55 million m^3 u.b. from "Other TBFRA" (Main Table 48 and Table 3A.8).

Balance between increment and fellings

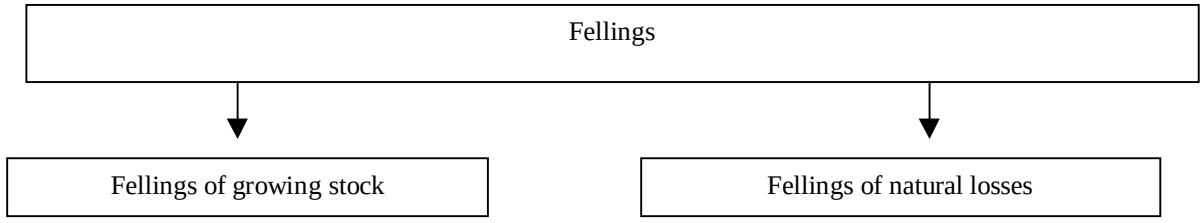
A major indicator of the long term sustainability of wood supply is the balance between net annual increment and fellings, provided of course that the two figures refer to the same area. The tables carry out this comparison for forest and for forest available for wood supply. This ratio is not the same as a calculation of allowable annual cut, as in certain circumstances it may be necessary or desirable for a certain time, to cut significantly more, or less, than the net annual increment. Nevertheless, the increment/fellings ratio is a good indicator of whether the level of wood supply is sustainable in the long term. Certainly, if it is over 100 per cent, questions should be asked to justify the level of fellings.

To make an accurate comparison, fellings of natural losses should be removed from the equation, as the dead trees which are harvested (e.g. in salvage fellings) no longer form part of the net annual increment. Thus "fellings of growing stock" (i.e. total fellings, minus fellings of natural losses) are compared to net annual increment, whenever countries are able to provide information on fellings of natural losses. In a few countries, including Belgium, Bulgaria, Czech Republic, France, Latvia, Lithuania, Poland, Slovakia Slovenia, Sweden and Turkey, fellings of natural losses account for a significant part of fellings, so this correction modifies the ratio perceptibly.

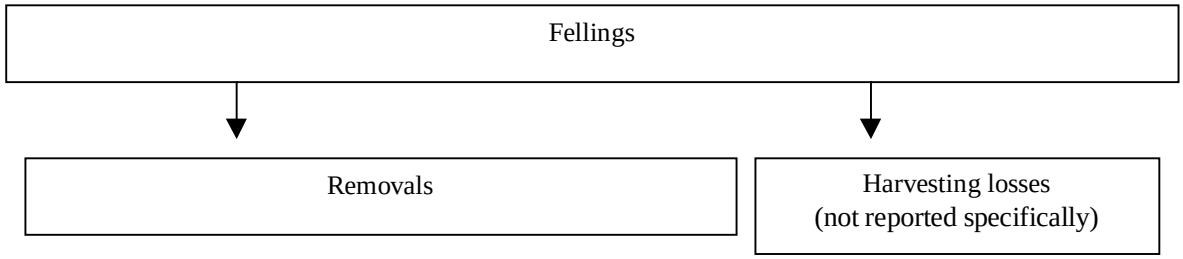
DIAGRAMME 3A.3

Fellings and removals

A. Fellings of growing stock and of natural losses



B. Removals and harvesting losses



C. Fellings/removals by location

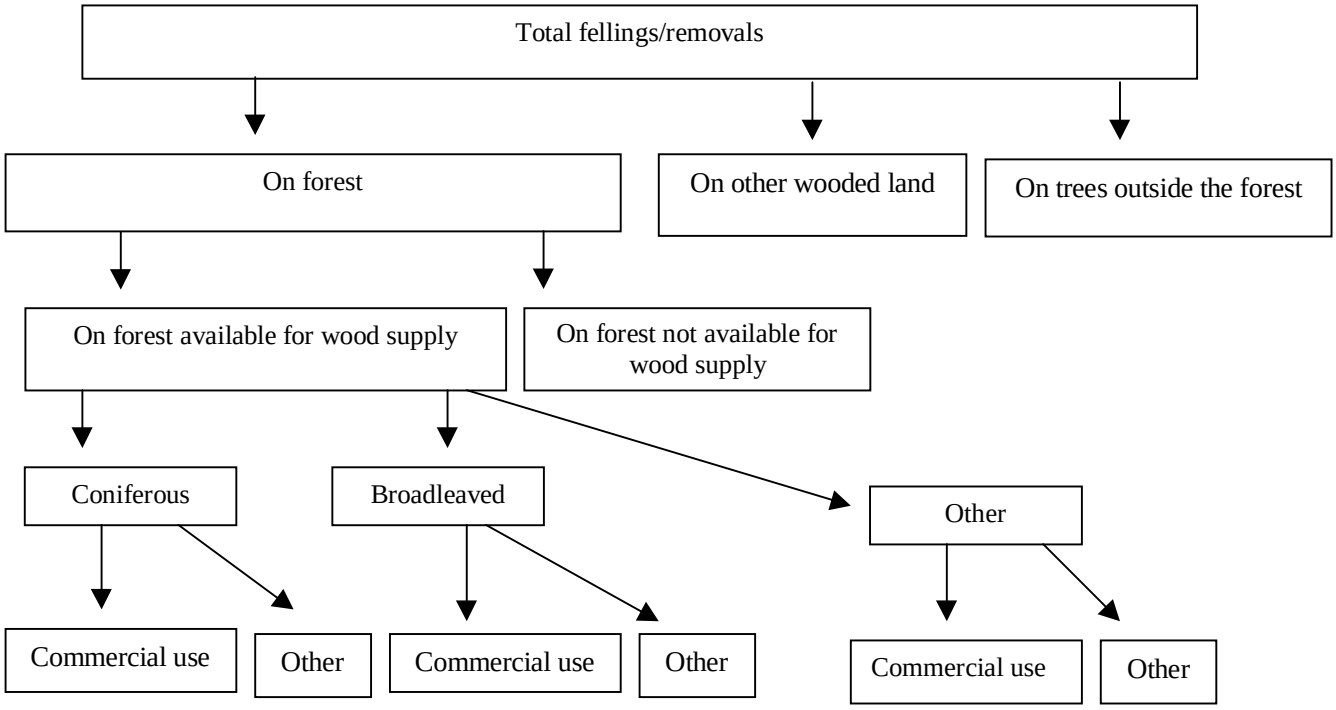


TABLE 3A.7

Fellings, by location and species groups, in the TBFRA region
(million m^3 o.b.)

	Total fellings	On forest			On forest available for wood supply		
		Total	Coniferous	Broadleaved	Total	Coniferous	Broadleaved
Nordics	133.7	132.4	111.4	21.0	132.0	111.1	21.0
Baltics	17.9	17.6	10.0	7.6	15.8	9.0	6.8
C-E Europe	82.5	81.2	60.7	20.5	79.2	59.2	20.1
C-W & N-W Europe	141.8	141.0	91.3	49.7	140.5	90.9	49.6
Iberia	27.4	24.1	13.6	10.6	22.2	12.8	9.5
S & S-E Europe	66.6	60.7	23.3	37.3	60.0	23.7	36.3
Europe	465.1	452.3	309.1	143.2	445.1	305.4	139.7
of which: EU15	311.6	304.7	218.2	86.5	301.9	216.7	85.3
CIS	174.0	173.7	118.0	55.7	146.0	100.9	45.2
of which: Russian Fed.	150.2	150.2	105.0	45.2	125.5	89.3	36.2
North America	922.1	737.1	532.9	204.23	737.1	532.9	204.2
Other TBFRA	71.3	71.3	54.0	17.3	71.3	54.0	17.3
Grand Total	1632.5	1434.4	1014.1	420.4	1399.5	993.2	406.3

TABLE 3A.8

Removals under bark, by species group and location, in the TBFRA region
(million m^3 u.b.)

	Total removals	On forest			On forest available for wood supply		
		Total	Coniferous	Broadleaved	Total	Coniferous	Broadleaved
Nordics	107.3	106.3	91.3	15.0	106.1	91.1	15.0
Baltics	14.1	13.8	8.1	5.8	12.4	7.3	5.1
C-E Europe	59.0	58.1	43.2	14.9	56.7	42.1	14.6
C-W & N-W Europe	104.4	103.9	65.6	38.3	103.5	65.3	38.2
Iberia	23.6	22.0	12.3	9.8	20.1	11.5	8.6
S & S-E Europe	55.9	51.0	19.2	31.6	50.4	19.0	31.3
Europe	360.2	351.1	238.5	112.4	345.3	235.2	109.9
of which: EU15	241.6	237.2	169.5	67.6	234.7	168.2	66.5
CIS	105.7	105.7	73.1	32.6	88.4	62.2	26.2
of which: Russian Fed.	103.8	103.8	72.5	31.3	86.6	61.6	25.0
North America	695.4	586.4	437.3	149.1	586.4	437.3	149.1
Other TBFRA	56.6	56.6	42.0	14.6	56.6	42.0	14.6
Grand Total	1217.9	1099.8	790.9	308.6	1076.7	776.7	299.7

No data for Israel, Belarus, Kyrgyzstan, Turkmenistan, Ukraine, Uzbekistan

For the TBFRA region as a whole, on forest available for wood supply, fellings of growing stock account for 52.6 per cent of net annual increment: in other words, slightly more than half of the forest growth is felled; 1,341 million m^3 o.b. are cut and 1211 million m^3 are added to the growing stock every year (Table 3A.9). There are, of course, rather wide differences between regions. In general, a larger portion of the increment is harvested in those regions with powerful forest industries. Thus in North America, the ratio is 78.6 per cent and in the Nordic countries 71.8 per cent, and in central-western and north-western Europe 62.8 per cent. In the CIS it is only 16.8 per cent while in “Other TBFRA” it is 51.8 per cent.

TABLE 3A.9

Comparison of fellings and net annual increment (NAI), on forest and forest available for wood supply, in the TBFRA region

	On forest				On forest available for wood supply			
	NAI	Fellings of growing stock	Difference	Fellings of GS as per cent of NAI	NAI	Fellings of growing stock	Difference	Fellings of GS as per cent of NAI
	(million m^3 o.b.)			(per cent)	(million m^3 o.b.)			(per cent)
Nordics	192.2	129.7	62.6	67.4	180.0	129.3	50.7	71.8
Baltics	30.5	14.5	16.0	47.6	26.7	13.5	13.2	50.4
C-E Europe	115.6	63.3	52.4	54.7	109.4	61.8	47.6	56.5
C-W & N-W Europe	222.3	137.8	84.5	62.0	218.7	137.3	81.4	62.8
Iberia	44.4	24.0	20.4	54.1	41.5	22.0	19.5	53.1
S & S-E Europe	143.4	53.4	90.0	37.2	124.0	53.0	71.0	42.7
Europe	748.4	418.6	329.8	55.9	700.3	412.8	287.4	59.0
of which: EU15	487.8	297.8	190.0	61.1	459.5	294.9	164.6	64.2
CIS	1037.5	149.2	888.3	14.4	793.1	133.2	659.9	16.8
of which: Russian Fed.	969.0	131.0	838.0	13.5	742.0	117.1	624.9	15.8
North America	1203.0	724.1	479.0	67.0	921.5	724.1	197.4	78.6
Other TBFRA	191.0	71.3	119.7	37.3	137.5	71.3	66.2	51.8
Grand Total	3179.9	1363.1	1816.8	42.9	2552.4	1341.4	1211.0	52.6

If the data are broken down by species, it is apparent that coniferous increment is used much more intensively than broadleaved: 62.5 per cent at the regional level for coniferous, 42.2 per cent for broadleaved (Table 3A.10). For Europe, the ratio for coniferous is 67.9 per cent and for broadleaved 55.9 per cent. In North America, the ratio is 97.9 per cent for coniferous, and 54.1 per cent for broadleaved. This should not be interpreted as an indication that almost all the coniferous increment on FAWS in North America is felled, because Canada is not in a position to estimate fellings of natural losses, although these may be significant The “fellings of growing stock” figure for North America is therefore overstated by a corresponding amount.

TABLE 3A.10

Comparison of fellings of growing stock and net annual increment (NAI), by species group, on forest available for wood supply, in the TBFRA region

	Coniferous				Broadleaved			
	NAI	Fellings of growing stock (GS)	Difference	Fellings of GS as per cent of NAI	NAI	Fellings of growing stock	Difference	Fellings of GS as per cent of NAI
	(million m^3 o.b.)			(per cent)	(million m^3 o.b.)			(per cent)
Nordics	145.7	111.1	34.6	76.2	34.3	21.0	13.3	61.2
Baltics	15.8	9.0	6.7	57.4	10.9	6.8	4.1	62.1
C-E Europe	79.5	59.2	20.3	74.4	29.9	20.1	9.8	67.1
C-W & N-W Europe	131.2	90.9	40.3	69.3	86.8	49.6	37.2	57.2
Iberia	24.6	12.8	11.8	52.0	16.9	9.5	7.5	55.9
S & S-E Europe	51.9	23.1	28.8	44.5	72.1	36.9	35.2	51.2
Europe	448.6	304.8	143.6	67.9	251.0	140.3	110.7	55.9
of which: EU15	308.4	216.7	91.8	70.2	150.4	85.3	65.1	56.7
CIS	493.2	100.9	392.3	20.5	299.6	45.2	254.5	15.1
of which: Russian Fed.	464.0	89.3	374.7	19.2	278.0	36.2	241.8	13.0
North America	544.3	532.9	11.4	97.9	377.2	204.2	180.0	54.1
Other TBFRA	101.2	54.0	47.2	53.4	36.3	17.3	19.0	47.6
Grand Total	1587.3	992.6	594.7	62.5	964.1	406.9	557.2	42.2

The forest "profiles" (growing stock, increment, fellings) of the four TBFRA regions are compared in Figure 3A.3, and interesting differences emerge. While the CIS has by far the largest growing stock, its net productivity in m^3/ha, is lower than elsewhere (the forest is mostly undisturbed, and in harsh climatic conditions) so increment is roughly equivalent to that of North America., while fellings, for reasons connected to the transition process, are rather low, compared to the potential. North America however has a smaller resource, in terms of growing stock, but with higher productivity and used more intensively. Europe's growing stock is much smaller than either that of CIS or North America, but it is intensively managed, giving high rates of increment per hectare, and fellings three times higher than those of the CIS, even though European growing stock is only 28 per cent of that of the CIS.

FIGURE 3A.3

Growing stock, increment and fellings as per cent of TBFRA total

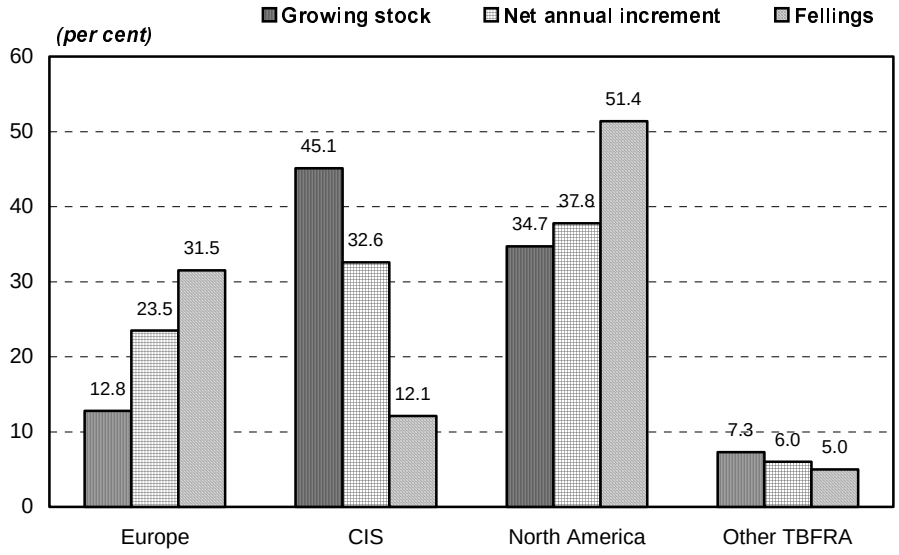


FIGURE 3A.4

Net annual increment and fellings on forest available for wood supply in selected countries

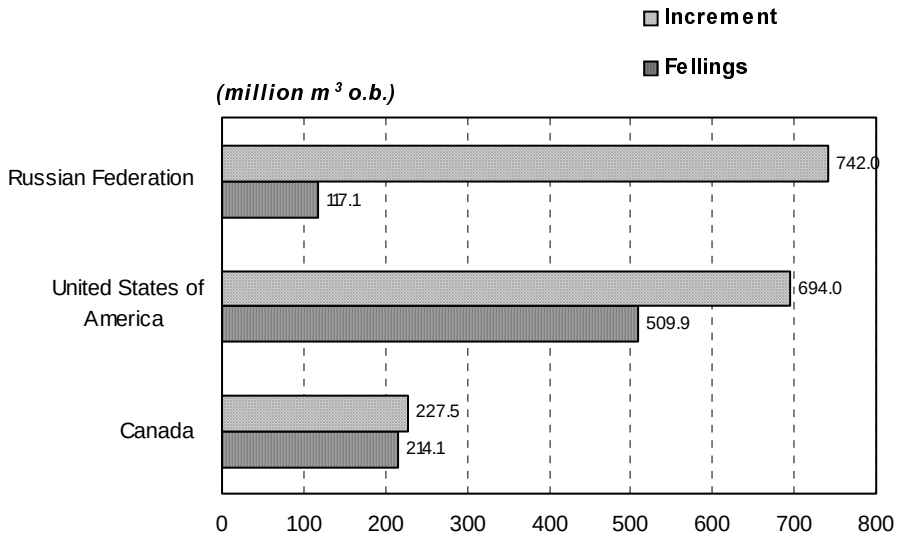


FIGURE 3A.4 *(continued)*

Net annual increment and fellings on forest available for wood supply in selected countries

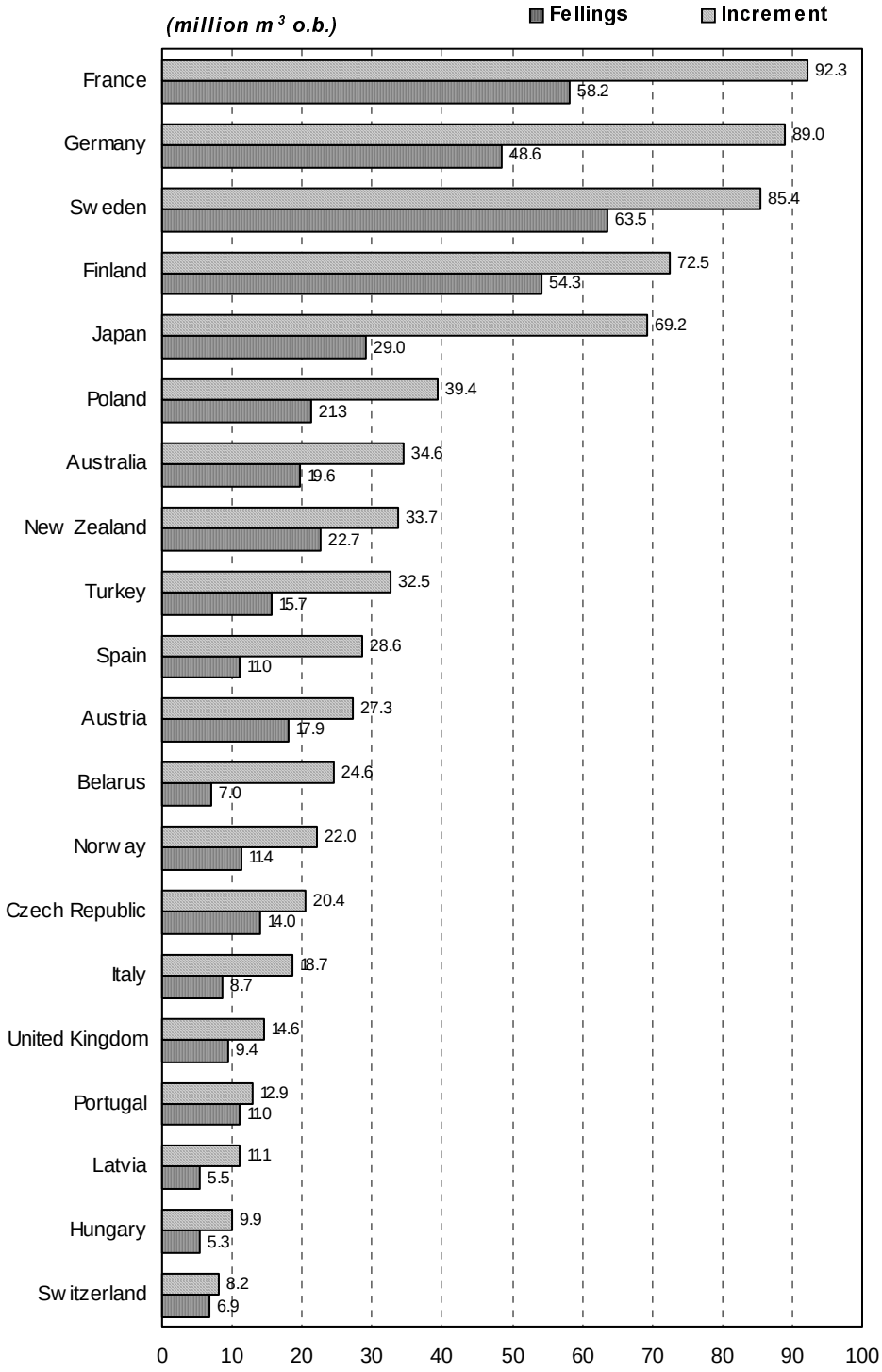
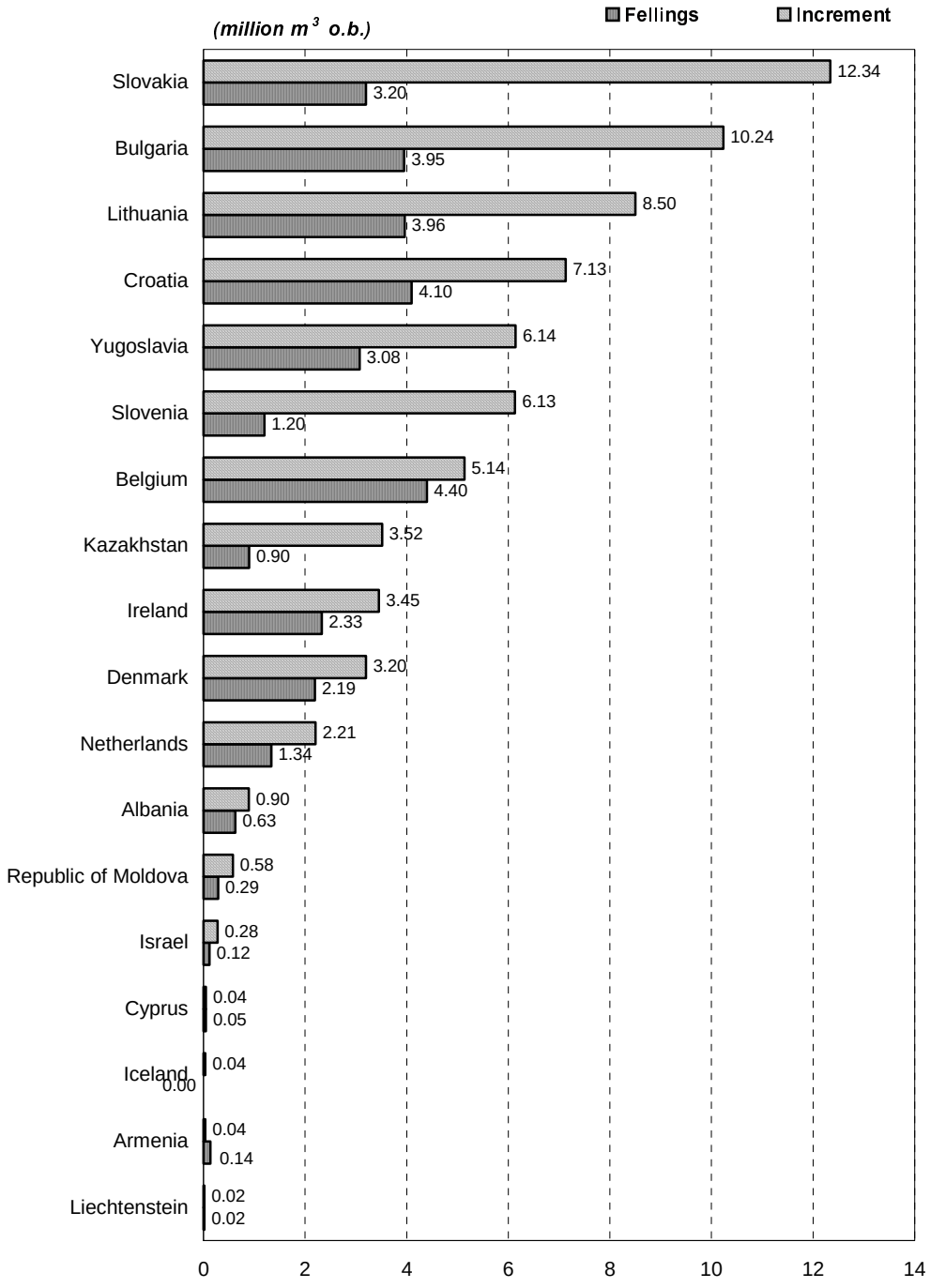


FIGURE 3A.4 *(continued)*

Net annual increment and fellings on forest available for wood supply in selected countries



Summary

1. There are just over 200 billion m^3 o.b. of growing stock in the TBFRA region—152 m^3 for each inhabitant.
2. Nearly 80 per cent of the region's growing stock is in three countries: Canada, the Russian Federation and the USA.
3. Over 90 per cent of the growing stock is on land classified as forest.
4. Two thirds of the growing stock – 134 billion m^3— is on land classified as "forest available for wood supply".
5. On average in the TBFRA region, two thirds of the growing stock is coniferous, but in the CIS the proportion is nearly 80 per cent while in the "Other TBFRA" it is just over 20 per cent.
6. On average, on forest available for wood supply, the growing stock is between 105 and 145 m^3 o.b./ha, but the national variation is very wide, from less than 50 m^3/ha in Greece, Iceland, Spain and Turkmenistan, to over 250 m^3/ha in Germany, Liechtenstein, Slovakia, Slovenia and Switzerland (all countries with a similar strong and conservative silvicultural tradition). New Zealand, with its large proportion of natural, predominantly broadleaved forests, also has a very high volume of growing stock per hectare.
7. On average, the growing stock for the region increased by 640 million m^3/year in the 1990s. The average annual increase for Europe is nearly 330 million m^3 and for North America 260 million m^3. In the CIS, growing stock on forest decreased by 23 million m^3/year, and as much as 113 million m^3/year in the Russian Federation, as forest land was transferred to other land categories (as will be seen below, fellings were well below increment, so total growing stock increased).
8. Gross annual increment (GAI) on forest and other wooded land is over 4,670 million m^3 o.b. 80 per cent of GAI is on forest where the mean annual increment is 2.1 m^3 o.b./ha or 2.1 per cent of growing stock.
9. Natural losses account for 8.7 per cent of gross annual increment in Europe, 26.7 per cent in the CIS and 20.2 per cent in the USA.
10. Net annual increment of trees on forest and other wooded land was about 3,800 million m^3 o.b. of which over 70 per cent was in three countries, Canada, the Russian Federation and the USA. 84 per cent of net increment is on forest land.
11. Net annual increment on forest available for wood supply is 2,550 million m^3 o.b.: 700 million in Europe, 793 million in the CIS and 921 million in North America.
12. Total fellings were 1,632 million m^3 o.b., of which over half in North America. The Russian Federation, which accounts for 30 per cent of the region's increment, accounted for only 9 per cent of its fellings.
13. Harvest losses accounted for about 12 per cent of total fellings.
14. Removals from the forests of the TBFRA region amounted to nearly 1,220 million m^3 of wood, under bark, of which 695 million m^3 u.b. (57 per cent) in North America.
15. About half the growth on forest available for wood supply is harvested. For the TBFRA region as a whole, fellings of growing stock were 52.6 per cent of net annual increment. In North America this ratio is 78.6 per cent, but in the CIS only 16.8 per cent.
16. The increment of coniferous trees is used more intensively: the fellings of growing stock/NAI ratio is 62.5 per cent (for the TBFRA region as a whole), and 42.2 per cent for broadleaved.

CHAPTER III: WOOD SUPPLY AND CARBON SEQUESTRATION: SITUATION AND CHANGES

B) CARBON CYCLE AND BIOMASS[1]

Introduction

– *Information in TBFRA-2000*

As a contribution to the improvement of knowledge about the role of woody biomass in the carbon cycle, it was decided to devote a special section of the TBFRA-2000 to the collection and analysis of relevant information. *Enquiry Tables 14* (Total woody biomass and the volume of growing stock), *15* (Increment) and *16* (Fellings and removals) called for statistics which would, in addition to other purposes, form the basis of calculations of the importance of woody biomass in carbon stores and balances. Countries' replies to these tables are contained in Main Tables 33 to 52 of this report. The statistics in these tables are not quoted directly in this section but are used in converted form, employing conversion factors as described below.

– *Global carbon cycle*

The increasing concentration of carbon dioxide in the atmosphere has increased interest in the research on cycling of carbon at the global level. The atmospheric CO_2 concentration has increased 30 per cent from the preindustrial level of about 280 parts per million (ppm) to the present concentration of nearly 370 ppm. During recent years the concentration has been increasing by some 1.5 ppm per year. The increase in the concentration of CO_2 in the atmosphere is predicted to reinforce the greenhouse effect of the atmosphere and consequently lead to worldwide changes in climate. This increase is caused by human activities, mainly by the combustion of fossil fuels and deforestation. Insight into the cycling of carbon is needed in order to predict the development of the concentration of CO_2 in the atmosphere and the potential climatic changes, and to combat the increase in the atmospheric CO_2 concentration by removing CO_2 from the atmosphere and binding it in other stores.

Terrestrial ecosystems play an important role in the global carbon cycle (Figure 3B.1). Terrestrial vegetation contains an amount of carbon that is comparable with the amount of carbon in the whole of the atmosphere and equal to about 40 per cent of the amount of carbon in the surface layers of oceans. The carbon store in soils is more than twice as large. The carbon store in the deep layers of oceans is an order of magnitude larger but it is in contact with the atmosphere and the other carbon stores only through the surface layers. The carbon in the terrestrial ecosystems originates from the atmosphere. Plants take up atmospheric carbon dioxide in their photosynthesis and bind it in their structures. This carbon is released back to the atmosphere with plant respiration and microbial decomposition of detritus, and in fires. These fluxes of carbon between the terrestrial ecosystems and the atmosphere are very large. Annually they are equivalent to about 8 per cent of the amount of carbon in the atmosphere, and exceed the flux released in the combustion of fossil fuels by more than tenfold. Forests have the potential to contribute significantly to the carbon cycling in the terrestrial ecosystems. They contain about 60 per cent of the vegetation carbon and about 50 per cent of the soil carbon worldwide.

– *Forest statistics in studying carbon cycling in forests*

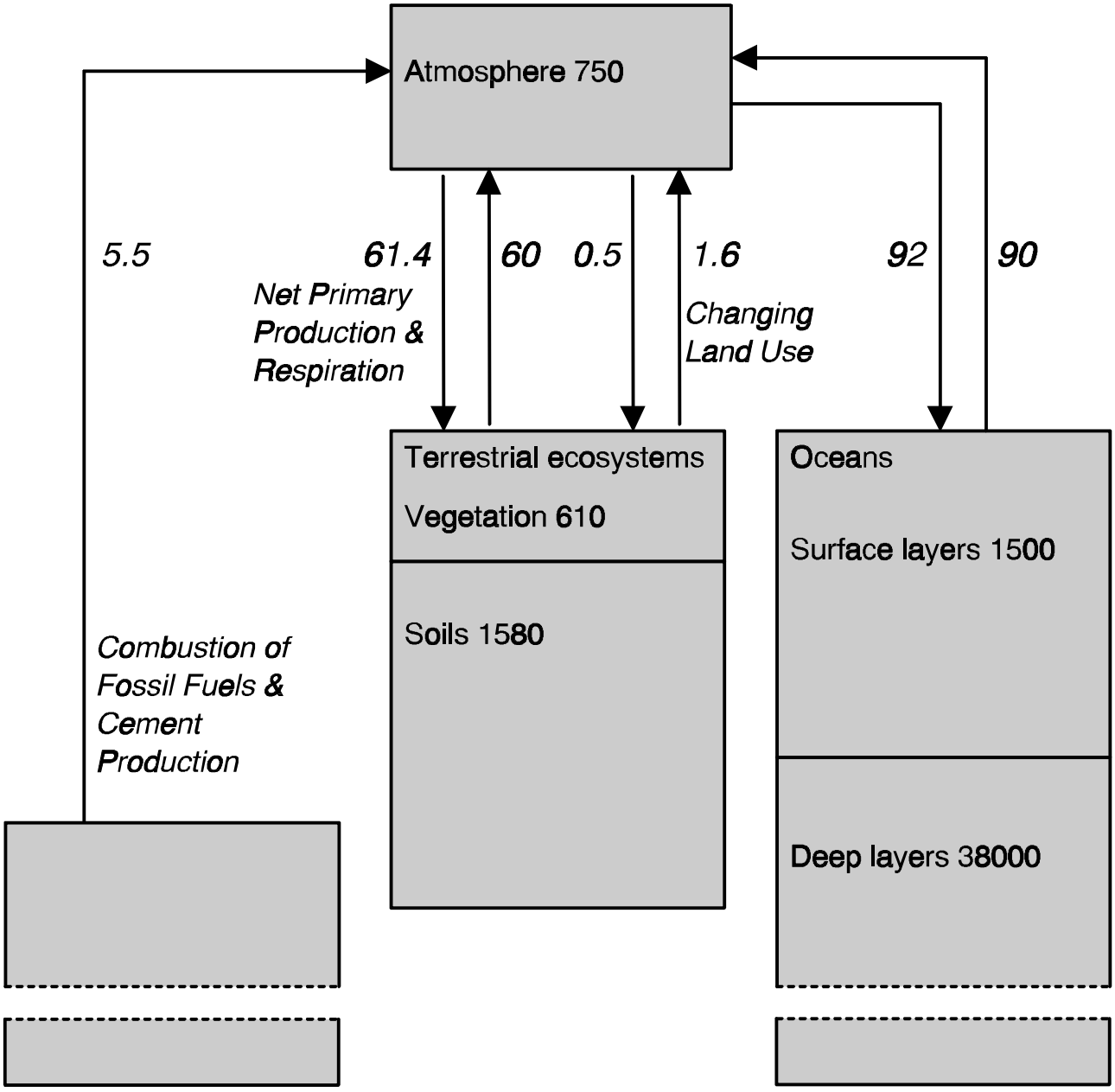
Studies of carbon cycling in a system usually involve quantifying the carbon stores of the system and their carbon balance. The carbon store means the amount of carbon in a component of the system. The carbon balance means the rate of change of a carbon store. The carbon balance can be calculated in two ways: as the difference between the fluxes of carbon into and out of a carbon store during the period in question; and as the difference in carbon stores at two points of time. If the carbon flux into a store exceeds the flux out from the store, the carbon store increases and the carbon balance of the store is positive. In the opposite case the carbon store decreases and the carbon balance of the

[1] This part of the chapter was prepared by Mr. Jari Liski and Mr. Pekka Kauppi (see Appendix V).

store is negative. Forested areas act as a carbon sink when the carbon balance is positive and as a carbon source when the balance is negative. In general, increasing biomass implies a net flux of carbon from the atmosphere to the forest and thereby a sink of atmospheric carbon. Decreasing biomass, in contrast, implies a net flux from the forest to the atmosphere and thereby a source of carbon to the atmosphere.

FIGURE 3B.1

The global carbon cycle showing the carbon stores (in Pg C, Pg = 10^{15}g) and the carbon fluxes (in Pg C/year)[2]. The sizes of the boxes demonstrate the relative sizes of the stores, except those of the deep layers of oceans and the fossil fuels and cement raw material.



Forest statistics provide a useful means to quantify the carbon stores and the carbon balances of the tree component of forest ecosystems. Some conversion of the figures in the statistics is, however, needed since the basic measure of forest statistics is the volume of stemwood of trees. To quantify the carbon store and the carbon balance of all tree biomass, stemwood volumes need first to be converted to the biomass of all tree parts and then to the carbon in this biomass. Most recent statistics also report some data on all woody biomass of trees including branches, stumps and roots in addition to stems. These data need only to be converted to carbon.

Converting stemwood volumes to biomass and carbon is one of the most critical steps in using forest statistics to quantify carbon cycling in trees. Despite this, the use of forest statistics data in studying carbon cycling in forests has

[2] Simplified from D. S. Schimel, 1995. "Terrestrial ecosystems and the carbon cycle", Global Change Biology 1: pp. 77-91.

advantages compared with other approaches, such as studies including measurements at a rather small number of sites and studies using remote sensing. Forest statistics have an extensive and comprehensive spatial and temporal coverage, and it is possible to deal with the impacts of forestry actions such as harvesting and the impacts of catastrophic landscape-scale natural events such as forest fires.

Calculating carbon cycling in forests from TBFRA-2000 data

– ***Carbon store of woody biomass***

For TBFRA-2000, countries were requested to report the dry mass of the woody parts, i.e. wood, bark, branches, twigs, stumps and roots, of all trees alive and dead as well as the dry mass of all shrubs and bushes on their forest and other wooded land. To obtain the carbon store of this woody biomass, it was assumed that 50 per cent of it was carbon and consequently the reported values were multiplied by 0.5. This conversion was considered appropriate, since the carbon concentration of biomass varies only slightly between different trees and tree parts and such conversion of biomass to carbon is common practice in carbon studies. The carbon store of above stump biomass on forest was analyzed separately from that of all biomass on forest and other wooded land so as to be able to compare the present results with the results of TBFRA-1990 where the former data were reported. However, the different definitions of forest in these two successive assessments (see Chapter I) made this comparison difficult.

Complete biomass data were available for 45 countries but missing for 10 countries. The missing biomass figures were calculated from the volume of growing stock with the help of special conversion factors also calculated from the TBFRA-2000 data. For the above stump biomass, these conversion factors were calculated separately for conifers, c_as_conif, and broadleaved trees, c_as_brleaves, on forest. For the biomass of stump and roots, c_sr, they were calculated jointly for all tree species on forest and other wooded land:

c_as_conif = above stump biomass of conifers on forest / growing stock of conifers on forest,

c_as_brleaves = above stump biomass of broad leaves on forest / growing stock of broad leaves on forest, and

c_sr = the biomass of stump and roots of all trees on forest and other wooded land / growing stock of all trees on forest and other wooded land.

The conversion factors for the above stump biomass were calculated using data on forest because on forest the data on biomass and growing stock were given by the species groups. The conversion factors for the biomass of stump and roots were calculated using data on forest and other wooded land and jointly for all trees because only such data on stump and root biomass were available in TBFRA-2000. The conversion factors were calculated for each country, except for the countries for which the needed information was missing and for those where it was incorrect and consequently resulted in conversion factors which were clearly wrong. In compiling this report, c_as values lower than 0.4 and a c_sr value as low as 0.02 were not accepted. The arithmetic means of the conversion factors of all the other countries were used for these countries. These exceptions are explained in Annex 3B.1. The missing biomass figures were calculated from the volume of growing stock by multiplying them by the conversion factors.

The conversion factors for the above stump biomass of conifers averaged 0.52 m.t./m^3, for the above stump biomass of broadleaved trees 0.66 m.t./m^3 and for the biomass of stump and roots 0.12 m.t./m^3. These values mean that for each m^3 of stem wood of conifers there was 0.52 m.t. above stump biomass, for each m^3 of stem wood of broadleaved trees there was 0.66 m.t. above stump biomass, and for each m^3 of stem wood of all trees there was 0.12 m.t. stump and root biomass.

– ***Carbon balance of woody biomass***

The carbon balance of woody biomass, i.e. the rate of change in the carbon store of woody biomass, was calculated as

net annual increment - annual fellings + annual fellings of natural losses,

after converting these figures, initially given as the volume of stem wood, to biomass and carbon. Net annual increment was used as the increment measure instead of the difference between gross annual increment and natural losses, because it was available for most countries, namely for all but three (see Annex 3B.3). Annual fellings of natural losses must be added in the difference between net annual increment and annual fellings, since they are included in annual fellings and have been subtracted from net annual increment. If they had not been added, they would have been subtracted from the balance twice. Net annual increment and annual fellings were not always reported in the countries for the same period (see Annex 3B.3). Consequently, the balance does not refer to any single year in TBFRA-2000 region but there are differences of a few years in the reference periods between the countries. The arithmetic mean of the reference years of net annual increment was 1994 and that of annual fellings 1995.

In the calculations of the carbon balance, net annual increment, annual fellings and annual fellings of natural losses given as the volume of stemwood were converted to woody biomass by multiplying them by the conversion factors (Annex 3B.1). The biomass was converted to carbon by multiplying by 0.5. On forest, this conversion was easily done both for conifers and broadleaved trees. On other wooded land, net annual increment and annual fellings were not given separately for the species groups. It was assumed that the share of conifers was the same on other wooded land as on forest. This simple assumption was considered appropriate in these calculations although the share of broadleaved trees was actually somewhat higher on other wooded land than on forest (Chapter I).

– ***Assumptions***

As described above, a few assumptions were needed to calculate the carbon store and the carbon balance of woody biomass from the TBFRA-2000 data for this analysis. Biomass was assumed to have a fixed carbon concentration equal to 50 per cent of dry mass. The conversion factors of above stump biomass calculated for forest were also applied on other wooded land. The share of conifers and broadleaved trees of net annual increment and annual fellings was assumed similar on other wooded land as on forest. In addition, various assumptions were needed to complete the calculations of countries for which the information was incomplete (see Annexes 3B.1, 3B.2 and 3B.3).

As a matter of fact, none of the figures in this chapter, despite the areas of forest and other wooded land, are taken directly from the original country enquiries. Instead they are the results of the calculations done using the original figures and utilizing the above assumptions (see Annex 3B.4 for an example). Such calculations were done so as to be able to cover the whole TBFRA-2000 region in the analysis.

Results

– ***Carbon store of woody biomass***

The carbon store of woody biomass on the forest and other wooded land in the TBFRA region at the time of the inventory is estimated at 88 Pg (Pg = 10^{15} g) (Table 3B.1). As much as 47 per cent of this total store was found in CIS countries, 35 per cent in North America, 10 per cent in Europe and 9 per cent in the other TBFRA countries (Table 3B.1, Figure 3B.2). Considering individual countries, the largest store was in the Russian Federation, 40 Pg or 45 per cent of the total store in the TBFRA region, the second largest in the USA, 19 Pg or 21 per cent of the total store, and the third largest in Canada, 12 Pg or 14 per cent of the total store (Annex 3B.2). The store in these three countries represented 80 per cent of the total store in the TBFRA region.

The woody biomass above stump on forest and other wooded land contained 72 Pg of carbon which was 82 per cent of the total store (Table 3B.1). Between the regions, this proportion varied from 77 per cent in CIS countries to 87 per cent in North America.

On forest, excluding other wooded land, the carbon store of the woody biomass above stump was 59 Pg (Table 3B.1). This is 18 per cent less than the carbon store above stump on forest and other wooded land. The area of forest was 32 per cent smaller than the area of forest and other wooded land.

Per unit land area, the carbon store of woody biomass on the forest and other wooded land averaged 35 m.t./ha (Table 3B.1). It was fairly similar in Europe, CIS countries and North America varying only from 39 to 44 m.t./ha between these regions (Table 3B.1, Figure 3.B.2). In the “Other TBFRA” countries, it was much smaller, 13 m.t./ha,

TABLE 3B.1

The carbon store of woody biomass in the TBFRA-2000 region

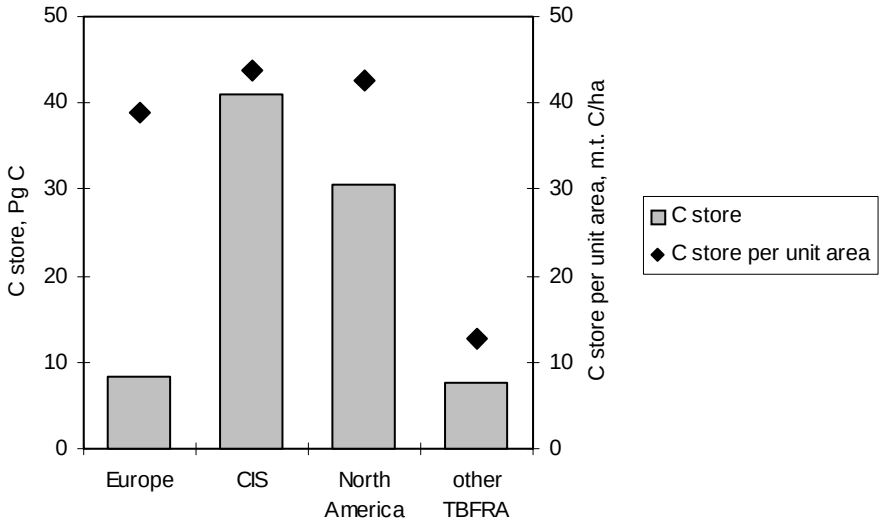
	Forest and other wooded land						Forest		
	Woody biomass	Woody biomass	Woody biomass	Above stump biomass	Stump and root biomass	Above stump biomass	Above stump biomass	Above stump biomass	Above stump biomass
	(Pg C)	(per cent of total in TBFRA region)	(m.t. C/ha)	(Pg C)	(Pg C)	(per cent of all woody biomass)	(Pg C)	(per cent of total in TBFRA region)	(m.t. C/ha)
Europe	8.4	10	39	7.0	1.3	84	6.8	12	39
of which: EU 15	5.0	6	37	4.2	0.78	84	4.1	7	36
CIS	41	47	44	32	9.5	77	24	40	28
North America	31	35	43	27	3.9	87	22	37	47
Other TBFRA	7.7	9	13	6.4	1.3	83	6.4	11	34
Total	88	100	35	72	16	82	59	100	35

which is about one third of the value in the other regions. Considering individual countries, the carbon store per unit area was highest, more than 100 m.t./ha, in four European countries, in Austria, Malta, Slovenia and Switzerland (Annex 3B.2). In the three countries containing the largest total store, the carbon store per unit area was largest in the USA, 63 m.t./ha In Russia it was 45 m.t./ha and in Canada 29 m.t./ha.

FIGURE 3B.2

The carbon store of woody biomass on forest and other wooded land in the TBFRA-2000 region

The columns show the store in Pg carbon (left axis). The dots show the store per area of forest and other wooded land in m.t. carbon/ha (right axis).



– ***Carbon balance of woody biomass***

In all 52 TBFRA countries for which data were available, net annual increment was larger than annual fellings and, consequently, the carbon store of woody biomass on the forest and other wooded land increased; the data were missing for Malta, Kyrgyzstan and Uzbekistan (Annex 3B.3). In the whole TBFRA region it increased by 0.88 Pg/year (Table 3B.2). Forests in CIS countries represented 51 per cent, North America 30 per cent, Europe 13 per cent and other TBFRA countries 7 per cent of this increase (Table 3B.2, Figure 3B.3). In individual countries, the increase rate of the carbon store was largest in the Russian Federation, 0.43 Pg/year, second largest in the USA, 0.17 Pg/year, third largest in Canada, 0.09 Pg/year, and fourth largest in Australia 0.04 Pg/year (Annex 3B.3). These four countries represented 83 per cent of the total increase, of which the Russian Federation 49 per cent, the USA 19 per cent, Canada 11 per cent, and Australia 5 per cent.

TABLE 3B.2

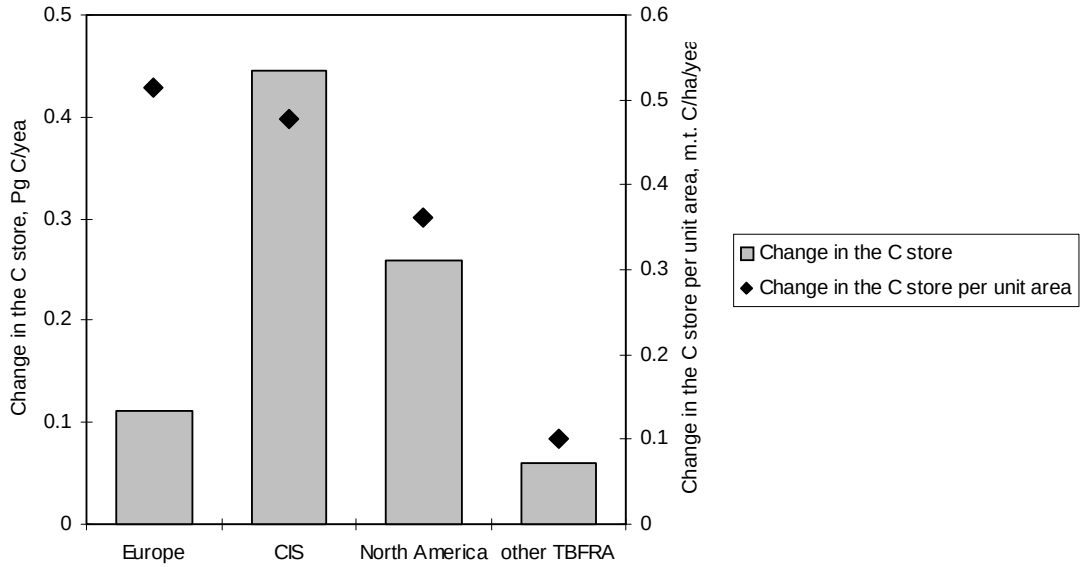
The carbon balance of woody biomass on forest and other wooded land in the TBFRA-2000 region

	Rate of increase in the carbon store of woody biomass	Rate of increase in the carbon store of woody biomass	Rate of increase in the carbon store of woody biomass	Rate of increase in the carbon store of woody biomass
	(Pg C/year)	(per cent of the total in TBFRA region)	(per cent of the present store/year)	(m.t. C/ha)
Europe	0.11	13	1.3	0.52
of which: EU 15	0.063	7	1.3	0.46
CIS	0.45	51	1.1	0.48
North America	0.26	30	0.85	0.36
Other TBFRA	0.061	7	0.79	0.10
Total	0.88	100	1.0	0.35

Figure 3B.3

The carbon balance of woody biomass on forest and other wooded land in the TBFRA-2000 region

The columns show the rate of increase in the carbon store of woody biomass in Pg carbon/year (left axis). The dots show the rate of increase per area of forest and other wooded land in m.t. carbon/ha/year (right axis).



The annual increase in the carbon store of the woody biomass on forest and other wooded land, 0.88 Pg/year, was 1.0 per cent of the present carbon store of 88 Pg (Table 3B.2). This annual increase percentage varied between the regions from 0.79 per cent in the 'other TBFRA' countries to 1.3 per cent in Europe. Among individual countries, the annual increase percentage was highest in European countries, 5.6 per cent/year in Iceland, 4.8 per cent/year in Israel, 4.0 per cent/year in Ireland and 2.4 per cent/year in Spain and Yugoslavia (Annex 3B.3). In the four countries where the increase rate was largest in absolute terms, the increase percentage was highest in the Russian Federation with 1.1 per cent/year. In the USA it was 0.89 per cent/year, in Australia 0.79 per cent/year and in Canada 0.78 per cent/year.

The rate of increase in the carbon store per unit area on forest and other wooded land averaged 0.35 m.t. carbon/ha/year (Table 3B.2). It varied between the regions from 0.10 m.t. carbon/ha/year in the "other TBFRA" countries to 0.52 m.t. carbon/ha/year in Europe (Table 3B.2, Figure 3B.3). The increase rate was larger than 1 m.t. carbon/ha/year in seven European countries, in Austria, Germany, Hungary, the Netherlands, Romania, Slovakia and Slovenia (Annex 3B.3).

Discussion

– *Carbon store of woody biomass*

The above stump biomass on forest was also analyzed in TBFRA-1990. Assuming 50 per cent carbon concentration in the biomass, the carbon store of this biomass totalled 56 Pg (Table 3B.3). The corresponding store in the present analysis was 5 per cent larger, 59 Pg. Apart from a possible increase in the store per unit area, this difference is caused by there being 17 per cent larger area of forest in the present assessment. One reason for the larger area is the difference in the definitions of forest in these assessments (see Chapter I). Earlier, forest was defined as an area with 20 per cent or more crown cover. Now the threshold of crown cover is only 10 per cent. Even though this difference makes it difficult to compare the carbon stores in these successive assessments accurately, it can be concluded that the estimates of the carbon store of the woody biomass above stump are of comparable order of magnitude.

Carbon stores in temperate and boreal forests have also been estimated before by analyzing and integrating several individual regional and national studies. Dixon et al.[3] included all above and below ground tree biomass and the biomass of non-tree vegetation in their estimate. For Europe, Canada and the USA their results are quite comparable with the present analysis, despite the differences in the analyzed areas (Table 3B.3). For Australia, however, their estimate is more than three times as large as that of the present analysis. The difference in the analyzed areas does not explain this difference in the stores since the area for which their estimate applies is even smaller than the area covered

[3] R. K. Dixon, S. Brown, R. A. Houghton, A. M. Solomon, M. C. Trexler and J. Wisniewski, 1994. "Carbon pools and flux of global forest ecosystems", Science 263: pp. 185-190.

TABLE 3B.3

The comparison of the TBFRA-2000 results on area, the carbon store of woody biomass and the carbon store per unit area with the results of TBFRA-1990 and the results of a study reviewing individual regional and national studies[4]

	Area (million ha)				Carbon store (Pg C)				Carbon store per unit area (m.t. C/ha)			
	TBFRA-2000		TBFRA-1990	Dixon et al.	TBFRA-2000		TBFRA-1990	Dixon et al.	TBFRA-2000		TBFRA-1990	Dixon et al.
	Forest and other wooded land	Forest	Forest		Woody biomass on forest and other wooded land	Above stump woody biomass on forest	Above stump woody biomass on forest		Woody biomass on forest and other wooded land	Above stump woody biomass on forest	Above stump woody biomass on forest	
Europe	215	176	149	283	8.4	6.8	5.9	9	39	32	40	32
of which: EU 15	136	113			5.0	4.1			37	30		
CIS	934	856	755	884[1]	41	24	26	74[1]	44	26	34	83[1]
North America	716	462	457	729	31	22	23	29	43	31	49	40
of which: Canada	418	245	247	436	12	11	13	12	29	24	52	28
of which: USA	298	217	210	293	19	12	9.7	17	63	39	46	58
Other TBFRA	613	189	71		7.7	6.4	2.1		13	11	29	
of which: Australia	578	157	40	396	5.4	4.5	1.2	18	9.3	7.8	30	45
Total	2478	1682	1432	2292	88	59	56	130	35	24	39	57

[1] Refers to the Russian Federation, which covers 95 per cent of the forest area in CIS countries according to TBFRA-2000.

in the present analysis. Consequently, their estimate for the carbon store per unit area in Australia is nearly five times as large as that in the present analysis. For the carbon store in the Russian Federation their estimate is also different. It is about 1.8 times as large as the store in the CIS countries in aggregate in the present analysis. The difference in the analyzed areas does not explain this difference either, since their area is again slightly smaller than the area in the present analysis. Their estimate for the carbon store in the forest vegetation per unit area in the Russian Federation, 83 m.t./ha, remains 1.9 times as high as in the present analysis, in which it was 44 m.t./ha. Dixon et al.[4] explained the high carbon store per unit area in the Russian Federation compared with the other regions by the large amount of dead standing trees in Russian forests. This difference in the results for the Russian Federation is very important considering the carbon store of woody biomass in the temperate and boreal forests as a whole since, even according to the present analysis, the forests in the CIS countries contained as much as 47 per cent of the carbon store in the forests of the TBFRA region (Table 3B.1).

In conclusion, bearing in mind the differences in the analyzed areas and what was included in the carbon stores, the present results of the carbon store of the woody biomass in temperate and boreal forests are comparable with the results by Dixon et al. for Europe and North America but considerably smaller for Australia and the CIS countries.

The size of the carbon store of the woody biomass on the forest and other wooded land in TBFRA-2000 region, 88 Pg, can be illustrated by comparing it with some other carbon stores (Figure 3B.4). It is 14 per cent of the carbon store of global vegetation and 6 per cent compared with the store in soils worldwide. It is equivalent to 12 per cent of the amount of carbon in the atmosphere at present. The soils of temperate and boreal forests have been estimated to contain more than two times as much carbon, 182 Pg, as the woody biomass in the present analysis. The estimates for these soils, however, vary considerably, with values as high as 555 Pg depending particularly on how peatlands are dealt with.

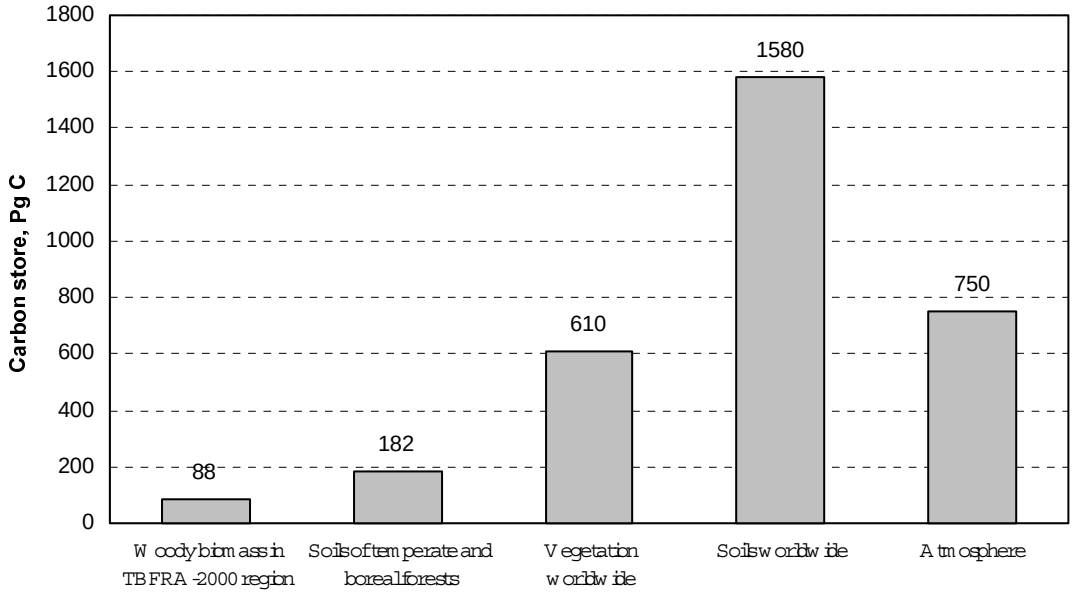
– ***Carbon balance of woody biomass***

The carbon store of the woody biomass on the forest and other wooded land in TBFRA-2000 region was calculated to increase by 0.88 Pg/year in the present analysis. This includes the biomass of woody vegetation only. Dixon et al. included also other vegetation, soils, litter and wood products in their analysis of the carbon balance of the mid and high latitude forests between 25 and 75 degree latitudes. Their mean estimate for the rate of increase was 0.74 Pg/year with a range of uncertainty from 0.57 to 0.95 Pg/year. The rate of increase in the present analysis is 19 per cent larger

[4] R. K. Dixon, S. Brown, R. A. Houghton, A. M. Solomon, M. C. Trexler and J. Wisniewski, 1994. "Carbon pools and flux of global forest ecosystems", Science 263: pp. 185-190.

FIGURE 3B.4

The carbon store of woody biomass in the TBFRA-2000 region compared with some other carbon stores[5]



than their mean estimate. In the individual regions and countries, the increase rates of the carbon store of the present analysis generally fit within the ranges Dixon et al. gave for their estimates (Table 3B.4). The larger overall mean estimate in the present analysis was a result of the estimates generally being closer to the upper than the lower limit of their range.

TABLE 3B.4

The comparison of the TBFRA-2000 results on the carbon balance of woody biomass with the results of a study reviewing individual regional and national studies[6]

	Rate of increase in the carbon store	
	TBFRA-2000	Dixon et al.
	(Pg C/year)	(Pg C/year)
Europe	0.11	0.09 to 0.12
Russia	0.43	0.30 to 0.50
North America	0.26	0.18 to 0.33
of which: Canada	0.09	0.08
of which: USA	0.17	0.10 to 0.25
Australia	0.04	trace
Total	0.84[1]	0.57 to 0.95

[1] The rate of increase does not total 0.88 Pg C/year, because Japan, New Zealand and CIS countries other than the Russian Federation are excluded from this comparison.

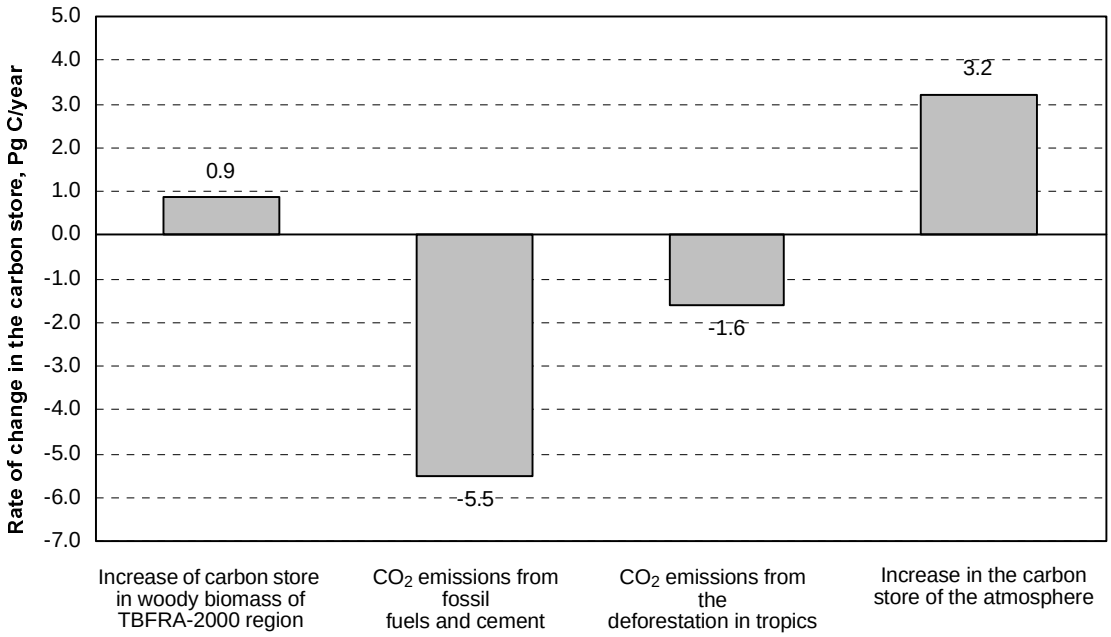
The importance of the increase in the carbon store of woody biomass in the TBFRA-2000 region can be illustrated by comparing the increase rate with changes in some other carbon stores and carbon fluxes (Figure 3B.5). The rate of total increase, 0.88 Pg/year, is about 16 per cent compared with the global anthropogenic CO_2 emissions originating from the combustion of fossil fuels and cement production, 55 per cent compared with the CO_2 emissions result-

[5] W. M. Post, W. R. Emanuel, P. J. Zinke and A. G. Stangenberger, 1982. "Soil carbon pools and world life zones", Nature 334: pp. 55-58. D. S. Schimel, 1995. "Terrestrial ecosystems and the carbon cycle", Global Change Biology 1: pp. 77-91.

[6] R. K. Dixon, S. Brown, R. A. Houghton, A. M. Solomon, M. C. Trexler and J. Wisniewski, 1994. "Carbon pools and flux of global forest ecosystems", Science 263: pp. 185-190.

FIGURE 3B.5

The rate of increase in the carbon store of woody biomass in the TBFRA-2000 region compared with CO_2 emissions worldwide and the rate of increase in the carbon store of the atmosphere[7]



ing from deforestation in the tropics and 28 per cent compared with the present rate of increase in the amount of CO_2 in the atmosphere. In other words, without this increase in the carbon store of the woody biomass of the temperate and boreal forests the amount and concentration of CO_2 in the atmosphere would be increasing 28 per cent more than they are.

The comparison between the rate of increase in the carbon store of the woody biomass and the anthropogenic CO_2 emissions can also be done specifically for the TBFRA-2000 region. CO_2 emissions from this region were about 4.0 Pg carbon/year (Table 3B.5). The increase in the carbon store of the woody biomass was the equivalent of 22 per cent of these emissions. This percentage varied by the analyzed region from 7 per cent in the EU countries and 10 per cent in the whole of Europe to a percentage as high as 48 per cent in the CIS countries.

TABLE 3B.5

The comparison of the carbon balance of woody biomass with anthropogenic CO_2 emissions in the TBFRA-2000 region[8]

	Anthropogenic CO_2 emissions	Increase in the carbon store of woody biomass	Increase in the carbon store of woody biomass
	(Pg C/year)	(Pg C/year)	(per cent of the CO_2 emissions)
Europe	1.09 [1]	0.11	10
Of which: EU	0.88	0.063	7
CIS	0.92	0.45	48
North America	1.55	0.26	17
Other TBFRA	0.42	0.061	15
Total	3.98	0.88	22

[1] 28 countries, 10 missing.

[7] D. S. Schimel, 1995. "Terrestrial ecosystems and the carbon cycle", Global Change Biology 1: pp. 77-91.

[8] United Nations Framework Convention on Climate Change, 1997. "Tables of inventories of anthropogenic emissions and removals for 1990-1995 and projections up to 2020", FCCC/SBI/1997/19/Add.1.

Intergovernmental Panel on Climate Change, 1995. "Climate Change 1995: Impacts, Adaptations, and Mitigation, Summary for Policymakers", Contribution of Working Group II to the Second Assessment Report.

In calculating these results of the carbon balance of woody biomass in TBFRA-2000 region, the original values of stemwood volume in the data needed to be converted to biomass and carbon. Particularly the conversion to biomass is considered as a serious source of uncertainty. To approximate this uncertainty, we recalculated the carbon balance using the arithmetic means of the conversion factors for all countries instead of the country-specific factors. The recalculated rate of increase in the carbon store was 11 per cent slower, 0.78 Pg/year, than the rate calculated using the country-specific factors, 0.88 Pg/year.

Summary

The carbon budget of woody biomass in the TBFRA-2000 region is summarized in Figure 3B.6 which shows that:

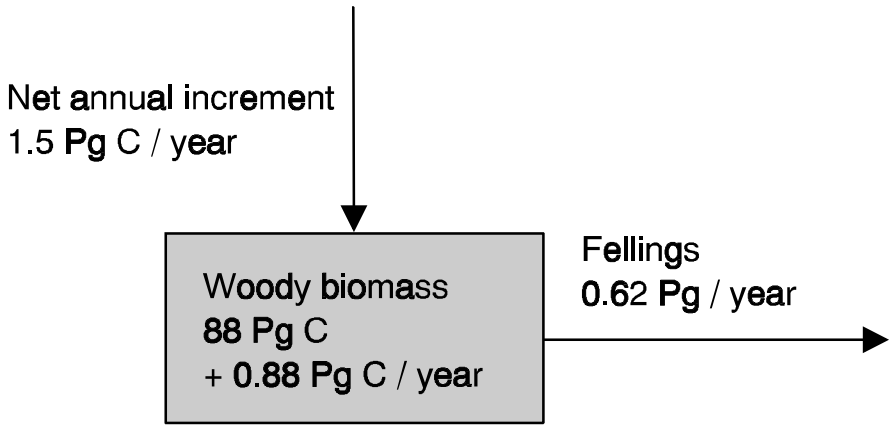
– The carbon store of woody biomass in the TBFRA-2000 region totalled 88 Pg. This is 14 per cent of the estimated amount of carbon stored in vegetation worldwide;

– The annual increment of trees exceeded fellings and natural losses. Consequently, the carbon store of woody biomass increased in all of the countries analyzed. In the whole of the TBFRA-2000 region the rate of this increase was 0.88 Pg per year. The carbon sink of these forests is the equivalent of 16 per cent of the global CO_2 emissions from the combustion of fossil fuels and cement production.

FIGURE 3B.6

The carbon budget of woody biomass in the TBFRA-2000 region.

The box illustrates the carbon store of woody biomass and the arrows the carbon fluxes into and out of the store. Fellings represent the difference between annual fellings (0.64 Pg carbon) and annual fellings of natural losses (0.025 Pg carbon).



ANNEX 3B.1

Conversion factors

Country	Above stump woody biomass (c_as) of conifers	Above stump woody biomass (c_as) of br leaves	Stump and root biomass (c_sr) of all tree species	Notes
	(m.t. biomass/ m^3 stem wood)	(m.t. biomass/m^3 stem wood)	(m.t. biomass/ m^3 stem wood)	
Albania	0.60	0.75	0.11	
Austria	0.85	1.01	0.17	
Belgium	0.39	0.52	0.09	
Bosnia and Herzegovina	0.52	0.66	0.12	means of other values
Bulgaria	0.45	0.67	0.12	
Croatia	0.40	0.55	0.10	
Cyprus	0.50	0.50	0.12	c_sr mean of other values
Czech Republic	0.45	0.64	0.12	
Denmark	0.40	0.55	0.17	
Estonia	0.51	0.60	0.08	
Finland	0.53	0.64	0.10	
France	0.40	0.53	0.07	
Germany	0.50	0.50	0.14	
Greece	0.46	0.68	0.11	
Hungary	0.50	0.67	0.13	
Iceland	0.54	0.65	0.13	
Ireland	0.52	0.66	0.07	c_as mean of other values, 0.33 and 0.33 reported
Israel	0.52	0.66	0.12	means of other values
Italy	0.42	0.56	0.12	c_sr mean of other values, 0.02 reported
Latvia	0.48	0.62	0.12	
Liechtenstein	0.40	0.67	0.11	
Lithuania	0.48	0.63	0.09	
Luxembourg	0.52	0.66	0.12	means of other values
Malta	0.52	0.66	0.19	c_as mean of other values
Netherlands	0.61	0.74	0.23	
Norway	0.51	0.69	0.09	
Poland	0.41	0.58	0.07	
Portugal	0.52	0.55	0.24	c_as of conifers mean of other values, 0.27 reported
Romania	0.47	0.65	0.12	c_sr mean of other values
Slovakia	0.46	0.65	0.08	
Slovenia	0.51	0.74	0.09	
Spain	0.51	0.61	0.08	
Sweden	0.58	0.67	0.11	
Switzerland	0.41	0.68	0.17	
The FYR of Macedonia	0.52	0.66	0.12	means of other values
Turkey	0.50	0.64	0.09	
United Kingdom	0.43	0.83	0.12	
Yugoslavia	0.52	0.66	0.12	means of other values, 0.05 and 0.24 reported for c_as
Mean of Europe	0.50	0.65	0.12	
Mean of EU 15	0.51	0.65	0.13	
Armenia	0.52	0.51	0.09	
Azerbaijan	0.75	0.77	0.14	
Belarus	0.49	0.62	0.11	
Georgia	0.60	0.70	0.10	

ANNEX 3B.1 *(continued)*

Country	Above stump woody biomass (c_as) of conifers	Above stump woody biomass (c_as) of br leaves	Stump and root biomass (c_sr) of all tree species	Notes
	(m.t. biomass/ m^3 stem wood)	(m.t. biomass/m^3 stem wood)	(m.t. biomass/ m^3 stem wood)	
Kazakhstan	0.47	0.55	0.08	
Kyrgyzstan	0.52	0.66	0.12	means of other values
Republic of Moldova	0.50	0.50	0.08	
Russian Federation	0.54	0.51	0.21	
Tajikistan	0.54	0.89	0.14	
Turkmenistan	0.60	0.70	0.15	
Ukraine	0.52	0.66	0.12	means of other values
Uzbekistan	0.52	0.66	0.12	means of other values
Mean of CIS	0.55	0.64	0.12	
Canada	0.68	0.71	0.12	
United States of America	0.68	0.93	0.10	
Mean of North America	0.68	0.82	0.11	
Australia	0.60	1.05	0.21	
Japan	0.52	0.78	0.12	
New Zealand	0.66	0.68	0.17	
Mean of Other TBFRA	0.69	0.78	0.16	
Grand mean	0.52	0.66	0.12	

ANNEX 3B.2

The carbon store of woody biomass (Tg = 10^{12} g)

Country	Forest and other wooded land							Forest		
	Ref. period for biomass	Woody biomass	Above stump biomass	Stump and root biomass	Ref. period for area	Area	Woody biomass	Above stump biomass	Area	Above stump biomass
		(Tg C)	(Tg C)	(Tg C)		(1000 ha)	(m.t. C/ha)	(Tg C)	(1000 ha)	(m.t. C/ha)
Albania	1995	34.37	29.88	4.49	1995	1030	33.4	29.88	1030	29.0
Austria	1992-96	580.36	483.63	96.73	1992-96	3924	147.9	479.05	3840	124.8
Belgium	1997	39.17	32.76	6.41	1997	672	58.3	32.76	646	50.7
Bosnia and Herzegovina	1995	89.26	73.93	15.33	1995	2710	32.9	73.93	2276	32.5
Bulgaria	1995	162.75	135.63	27.13	1995	3903	41.7	135.62	3590	37.8
Croatia	1996	115.28	97.38	17.89	1996	2105	54.8	94.66	1775	53.3
Cyprus	1980-90	1.71	1.38	0.34	1996	280	6.1	1.25	117	10.7
Czech Republic	1995	209.11	166.41	42.70	1995	2630	79.5	164.30	2630	62.5
Denmark	1990	19.58	14.58	5.00	1990	538	36.4	12.83	445	28.8
Estonia	1996	101.25	88.18	13.07	1996	2162	46.8	85.75	2016	42.5
Finland	1991-96	647.02	552.25	94.77	1991-96	22768	28.4	543.40	21883	24.8
France	1997	838.55	733.50	105.05	1997	16989	49.4	700.55	15156	46.2
Germany	1987	920.00	720.00	200.00	1987	10740	85.7	720.00	10740	67.0
Greece	1992	52.04	43.36	8.67	1992	6513	8.0	42.23	3359	12.6
Hungary	1996	128.19	106.83	21.37	1996	1811	70.8	101.68	1811	56.1
Iceland	1998	0.42	0.35	0.07	1998	130	3.2	0.25	30	8.3
Ireland	1996	8.70	7.25	1.45	1996	591	14.7	7.25	591	12.3
Israel	1997	2.10	1.74	0.37	1997	170	12.4	1.74	122	14.2
Italy	1995	409.28	390.91	18.37	1995	10842	37.7	365.75	9857	37.1
Latvia	1997	177.60	145.64	31.95	1997	2995	59.3	134.34	2884	46.6
Liechtenstein	1995	0.51	0.41	0.10	1995	7	68.9	0.41	7	59.4
Lithuania	1996	118.31	101.12	17.19	1996	2050	57.7	97.70	1978	49.4
Luxembourg	1985-97	6.53	5.28	1.25	1994-97	89	73.7	5.28	86	61.6
Malta	1996	0.06	0.05	0.01	1996	0.3	162.8	0.02	0	61.7
Netherlands	1991-95	29.29	22.00	7.29	1992-96	339	86.4	18.18	339	53.6
Norway	1994-96	265.61	227.18	38.43	1994-96	12000	22.1	212.34	8710	24.4
Poland	1992-96	506.47	439.36	67.11	1992-96	8942	56.6	420.69	8942	47.0
Portugal	1995	96.04	61.41	34.63	1995	3467	27.7	55.17	3383	16.3
Romania	1984	470.78	388.66	82.12	1995-97	6680	70.5	391.49	6301	62.1
Slovakia	1996	167.02	145.60	21.41	1996	2031	82.2	142.75	2016	70.8
Slovenia	1996	117.46	103.48	13.98	1996	1166	100.7	97.67	1099	88.9
Spain	1990	186.69	163.33	23.36	1990	25984	7.2	163.27	13509	12.1
Sweden	1992-96	1045.96	888.34	157.63	1992-96	30259	34.6	864.97	27264	31.7
Switzerland	1993-95	140.14	103.98	36.16	1993-95	1234	113.6	96.88	1173	82.6
The FYR of Macedonia	1995	20.32	16.44	3.88	1995	988	20.6	16.44	906	18.1
Turkey	1996	471.58	403.39	68.18	1996	20713	22.8	367.01	9954	36.9
United Kingdom	1995	132.00	110.00	22.00	1995	2489	53.0	94.00	2469	38.1
Yugoslavia	1995	54.63	34.51	20.13	1995	3480	15.7	33.39	2894	11.5
Total: Europe		**8366.11**	**7040.12**	**1325.99**	**0.00**	**215422**	**38.8**	**6804.86**	**175829**	**38.7**
of which: EU 15		**5011.20**	**4228.61**	**782.59**	**0.00**	**136204**	**36.8**	**4104.69**	**113567**	**36.1**
Armenia	1996	13.32	11.32	2.00	1996	392	34.0	10.95	334	32.8
Azerbaijan	1988	57.92	49.29	8.63	1988	990	58.5	49.29	936	52.7
Belarus	1994	380.01	316.47	63.54	1994-97	8936	42.5	315.86	7865	40.2

ANNEX 3B.2 *(continued)*

Country	Forest and other wooded land							Forest		
	Ref. period for biomass	Woody biomass	Above stump biomass	Stump and root biomass	Ref. period for area	Area	Woody biomass	Above stump biomass	Area	Above stump biomass
		(Tg C)	(Tg C)	(Tg C)		(1000 ha)	(m.t. C/ha)	(Tg C)	(1000 ha)	(m.t. C/ha)
Georgia	1995	167.20	145.39	21.81	1995	2988	55.9	145.39	2988	48.7
Kazakhstan	1993	106.32	92.45	13.87	1993	16673	6.4	92.45	10504	8.8
Kyrgyzstan	1988	7.88	6.47	1.41	1995	797	9.9	6.47	729	8.9
Republic of Moldova	1997	12.42	10.80	1.62	1997	355	35.0	10.40	324	32.1
Russian Federation	1993	39631.38	30385.50	9245.88	1993	886538	44.7	22741.00	816538	27.9
Tajikistan	1995	2.34	1.95	0.39	1995	730	3.2	1.95	400	4.9
Turkmenistan	1995	6.06	5.00	1.06	1995	3754	1.6	4.79	3754	1.3
Ukraine	1996	545.87	439.59	106.28	1996	9494	57.5	439.59	9458	46.5
Uzbekistan	1988	4.20	3.52	0.68	1988	2170	1.9	3.49	1909	1.8
Total: CIS		**40934.90**	**31467.75**	**9467.15**	**0.00**	**933817**	**43.8**	**23821.63**	**855739**	**27.8**
Canada	1994	11891.06	10120.05	1771.01	1994	417584	28.5	10120.05	244571	41.4
United States of America	1992	18627.00	16524.00	2103.00	1992	298135	62.5	11746.00	217333	54.0
Total: North America		**30518.06**	**26644.05**	**3874.01**	**0.00**	**715719**	**42.6**	**21866.05**	**461904**	**47.3**
Australia	1994	5384.01	4486.68	897.34	1990-94	578467	9.3	4486.68	156877	28.6
Japan	1995	1276.58	1063.82	212.76	1995	25146	50.8	1063.44	24064	44.2
New Zealand	1996	1088.13	871.13	217.00	1996	9040	120.4	862.50	7940	108.6
Total: Other TBFRA		**7748.72**	**6421.62**	**1327.10**	**0.00**	**612653**	**12.6**	**6412.61**	**188881**	**34.0**
Grand Total		**87567.79**	**71573.54**	**15994.25**	**0.00**	**2477611**	**35.3**	**58905.16**	**1682353**	**35.0**

Notes for Annex 3B.2

Country	Notes
Bosnia and Herzegovina	Growing stock on forest converted to carbon by species groups
Cyprus	Growing stock of forest and other wooded land converted to carbon by species groups
Israel	Growing stock on forest converted to carbon by species groups
Luxembourg	Total growing stock on forest converted to carbon using the conversion factors of conifers
Malta	Total growing stock on forest converted to carbon using the conversion factors of conifers
Romania	Growing stock on forest converted to carbon by species groups
The FYR of Macedonia	Total growing stock on forest converted to carbon using the conversion factors of conifers
Yugoslavia	Biomass of stump and roots calculated from growing stock
Kyrgyzstan	Growing stock on forest converted to carbon by species groups
Ukraine	Total growing stock on forest converted to carbon using the conversion factors of conifers
Uzbekistan	Growing stock on forest and other wooded land converted to carbon by species groups

ANNEX 3B.3

The carbon balance of woody biomass on forest and other wooded land

Country	Ref. period for net annual increment	Net annual increment	Net annual increment	Ref. period for annual fellings	Annual fellings	Annual fellings	Annual fellings of natural losses	Rate of change in the C store of woody biomass	Rate of change in the C store of woody biomass	Rate of change in the C store of woody biomass
		(Tg C/year)	(m.t. C/ha/ year		(Tg C/ year)	(m.t. C/ha/ year)	(Tg C/yr)	(Tg C/yr)	(per cent of the present store/yr)	(m.t. C/ha/ yr)
Albania	1995	0.41	0.40	1995	0.31	0.30	0.02	0.12	0.36	0.12
Austria	1992-96	14.85	3.79	1992-96	10.54	2.69	0.84	5.15	0.89	1.31
Belgium	1982 -97	1.36	2.03	1986-95	1.14	1.70	0.00	0.22	0.57	0.33
Bosnia and Herzegovina	1995	1.76	0.65	1995	0.38	0.14	0.00	1.37	1.54	0.51
Bulgaria	1995	4.05	1.04	1995	1.71	0.44	0.32	2.65	1.63	0.68
Croatia	1986-96	2.40	1.14	1986-96	1.44	0.69	0.16	1.12	0.97	0.53
Cyprus	1980-90	0.03	0.11	1986-95	0.02	0.07	0.00	0.01	0.73	0.04
Czech Republic	1995	6.30	2.40	1995	4.83	1.84	0.65	2.13	1.02	0.81
Denmark	1990	1.06	1.96	1996	0.75	1.40	0.00	0.30	1.56	0.57
Estonia	1996	2.42	1.12	1996	1.19	0.55	0.00	1.23	1.21	0.57
Finland	1991-96	24.24	1.06	1991-96	17.60	0.77	0.00	6.64	1.03	0.29
France	1997	25.43	1.50	1996	16.04	0.94	0.54	9.92	1.18	0.58
Germany	1995	29.54	2.75	1996	15.52	1.45	0.00	14.02	1.52	1.31
Greece	1992	1.32	0.20	1992	0.89	0.14	0.15	0.59	1.12	0.09
Hungary	1996	4.20	2.32	1996	2.50	1.38	0.21	1.91	1.49	1.06
Iceland	1998	0.02	0.18	1996	0.00	0.00	0.00	0.02	5.64	0.18
Ireland	1996	1.03	1.74	1996	0.68	1.16	0.00	0.35	3.97	0.58
Israel	1997	0.14	0.84	1997	0.04	0.24	0.00	0.10	4.83	0.60
Italy	1995	10.25	0.95	1995	3.30	0.30	0.00	6.95	1.70	0.64
Latvia	1996	4.73	1.58	1996	2.69	0.90	0.48	2.52	1.42	0.84
Liechtenstein	1995	0.01	1.03	1995	0.00	0.63	0.00	0.00	0.59	0.40
Lithuania	1996	3.24	1.58	1992-96	1.80	0.88	0.53	1.96	1.66	0.96
Luxembourg	1985-97	0.21	2.41	1992-94	0.13	1.45	0.00	0.09	1.31	0.96
Malta										
Netherlands	1991-95	1.31	3.87	1991-95	0.95	2.79	0.04	0.40	1.38	1.19
Norway	1994-96	8.13	0.68	1994-96	3.63	0.30	0.06	4.56	1.72	0.38
Poland	1992 -96	11.37	1.27	1992-96	8.35	0.93	2.47	5.49	1.08	0.61
Portugal	1995	5.84	1.68	1995	4.43	1.28	0.04	1.45	1.51	0.42
Romania	1984	11.30	1.69	1993-97	4.80	0.72	0.85	7.35	1.56	1.10
Slovakia	1996	4.45	2.19	1996	2.29	1.13	1.27	3.43	2.06	1.69
Slovenia	1996	2.30	1.97	1996	0.78	0.67	0.37	1.89	1.61	1.62
Spain	1990	9.49	0.37	1994	5.00	0.19	0.00	4.49	2.40	0.17
Sweden	1992-96	33.57	1.11	1992-96	23.63	0.78	0.91	10.85	1.04	0.36
Switzerland	1985-95	3.06	2.48	1985-95	2.44	1.97	0.08	0.71	0.50	0.57
The FYR of Macedonia	1995	0.32	0.33	1995	0.32	0.32	0.00	0.00	0.02	0.00
Turkey	1996	14.54	0.70	1996	7.23	0.35	0.61	7.93	1.68	0.38
United Kingdom	1995	4.64	1.86	1995	2.87	1.15	0.03	1.79	1.36	0.72
Yugoslavia	1995	2.61	0.75	1991-95	1.32	0.38	0.03	1.32	2.41	0.38
Total: Europe		**251.96**	**1.17**		**151.56**	**0.70**	**10.64**	**111.03**	**1.33**	**0.52**
of which: EU 15		**164.15**	**1.21**		**103.47**	**0.76**	**2.54**	**63.21**	**1.26**	**0.46**
Armenia	1996	0.13	0.32	1996	0.06	0.16	0.00	0.07	0.50	0.17
Azerbaijan	1988	0.65	0.66	1988	0.03	0.03	0.02	0.64	1.11	0.65

ANNEX 3B.3 *(continued)*

Country	Ref. period for net annual increment	Net annual increment	Net annual increment	Ref. period for annual fellings	Annual fellings	Annual fellings	Annual fellings of natural losses	Rate of change in the C store of woody biomass	Rate of change in the C store of woody biomass	Rate of change in the C store of woody biomass
		(Tg C/year)	(m.t. C/ha/ year		(Tg C/ year)	(m.t. C/ha/ year)	(Tg C/yr)	(Tg C/yr)	(percent of the present store/yr)	(m.t. C/ha/yr)
Belarus	1994	7.87	0.88	1996	3.04	0.34	0.82	5.65	1.49	0.63
Georgia	1995	1.54	0.52	1995	0.18	0.06	0.00	1.37	0.82	0.46
Kazakhstan	1993	1.81	0.11	1993	0.41	0.02	0.15	1.54	1.45	0.09
Kyrgyzstan										
Republic of Moldova	1997	0.31	0.89	1997	0.14	0.39	0.06	0.23	1.87	0.65
Russian Federation	1993	477.49	0.54	1995	55.84	0.06	7.14	428.79	1.08	0.48
Tajikistan	1995	0.04	0.05	1995	0.01	0.01	0.00	0.03	1.42	0.05
Turkmenistan	1995	0.05	0.01	1995	0.00	0.00	0.00	0.05	0.79	0.01
Ukraine	1996	10.44	1.10	1996	3.72	0.39	0.64	7.36	1.35	0.78
Uzbekistan										
Total: CIS		**500.33**	**0.54**		**63.43**	**0.07**	**8.83**	**445.74**	**1.09**	**0.48**
Canada	1994	178.97	0.43	1995	86.23	0.21	0.00	92.74	0.78	0.22
United States of America	1987 - 92	466.89	1.57	1992	306.09	1.03	5.65	166.46	0.89	0.56
Total: North America		**645.86**	**0.90**		**392.32**	**0.55**	**5.65**	**259.19**	**0.85**	**0.36**
Australia	1994	52.97	0.09	1994	10.34	0.02	0.00	42.62	0.79	0.07
Japan	1990 - 95	23.77	0.95	1995	10.09	0.40	0.00	13.67	1.07	0.54
New Zealand	1996	14.17	1.57	1996	9.42	1.04	0.00	4.75	0.44	0.53
Total: Other TBFRA		**90.90**	**0.15**		**29.85**	**0.05**	**0.00**	**61.05**	**0.79**	**0.10**
Grand Total		**1489.05**	**0.60**		**637.16**	**0.26**	**25.12**	**877.01**	**1.00**	**0.35**

Notes for Annex 3B.3

Country	Notes for net annual increment	Notes for annual fellings
Bosnia and Herzegovina	Total net annual increment on forest converted to carbon using the conversion factors of conifers	Total annual fellings on forest converted to carbon using the conversion factors of conifers
Estonia		Total annual fellings on forest converted to carbon using the conversion factors of conifers
Greece		Annual fellings not reported, annual removals used
Luxembourg	Total net annual increment on forest converted to carbon using the conversion factors of conifers	Annual fellings not reported, annual removals used
The FYR of Macedonia	Total net annual increment on forest converted to carbon using the conversion factors of conifers	Total annual fellings on forest converted to carbon using the conversion factors of conifers
Georgia		Total annual fellings on forest converted to carbon using the conversion factors of conifers
Turkmenistan		Total annual fellings on forest converted to carbon using the conversion factors of conifers
Ukraine	Total net annual increment on fowl converted to carbon using the conversion factors of conifers	Total annual fellings on forest converted to carbon using the conversion factors of conifers
Canada		Annual fellings not reported, annual removals used
Australia		Annual fellings on forest available for wood supply

ANNEX 3B.4

Example showing how the figures in Annexes 3B.1, 3B.2 and 3B.3 for Austria were calculated from the data reported by the country

– Data reported by the country

Main Table 40: Total woody biomass, column Total woody biomass, 1160710 (1000 m.t.)
Main Table 40: Total woody biomass, column Total above-stump biomass, 967258 (1000 m.t.)
Main Table 40: Total woody biomass, column Above-stump biomass of trees on forest, 958093 (1000 m.t.)
Main Table 40: Total woody biomass, column Stumps and roots, 193452 (1000 m.t.)
Main Table 34: Growing stock, column Total, 1107307 (1000 m^3)

Main Table 45: Net annual increment on forest by species groups, column Forest coniferous, 22426 (1000 m^3)
Main Table 45: Net annual increment of forest by species groups, column Forest broadleaved, 5411 (1000 m^3)
Main Table 42: Gross and net annual increment, General data, column Net annual increment Other wooded land, 200 (1000 m^3)
Main Table 42: Gross and net annual increment, General data, column Net annual increment Trees outside forest, 100 (1000 m^3)

Main Table 48: Annual fellings overbark on forest by species groups, Total forest, Coniferous total, 16432 (1000 m^3)
Main Table 48: Annual fellings overbark on forest by species groups, Total forest, Broadleaved total, 3389 (1000 m^3)
Main Table 47: Annual fellings overbark, Other wooded land, 150 (1000 m^3)
Main Table 47: Annual fellings overbark, Trees outside forest, 70 (1000 m^3)
Main Table 48: Annual fellings overbark on forest by species groups, Fellings of natural losses on forest available for wood supply, 1596 (1000 m^3)

– Calculated figures

Annex 3B.1. Conversion factors

Stump and root biomass (c_sr) of all tree species, m.t. biomass/m^3 stemwood
= 0.17 = 193452 / 1107307

Annex 3B.2. The carbon store of woody biomass

Forest and other wooded land
Woody biomass, Tg C
= 580.36 = 0.5 x 1160710 / 1000
Above stump biomass, Tg C
= 483.63 = 0.5 x 967258 / 1000
Stump and root biomass, Tg C
= 96.73 = 0.5 x 193452 / 1000
Forest
Above stump biomass, Tg C
= 479.05 = 0.5 x 958093 / 1000

Annex 3B.3. The carbon balance of woody biomass on forest and other wooded land

Net annual increment, Tg C / year
= 14.85 = 0.5 x {0.85 x [22426 + 22426 / (22426 + 5411) x (200 + 100)] + 1.01 x [5411 + 5411 / (22426 + 5411) x (200 + 100)] + 0.17 x [22426 + 5411 + 200 + 100]} / 1000
Annual fellings, Tg C / year
= 10.54 = 0.5 x {0.85 x [16432 + 16432 / (16432 + 3389) x (150 + 70)] + 1.01 x [3389 + 3389 / (16432 + 3389) x (150 + 70)] + 0.17 x [16432 + 3389 + 150 + 70]} / 1000
Annual fellings of natural losses, Tg C / year
= 0.84 = 0.5 x {0.85 x 16432 / (16432 + 3389) x 1596 + 1.01 x 3389 / (16432 + 3389) x 1596 + 0.17 x 1596)}

TABLE 25

Uneven-aged and even-aged high forest available for wood supply: total of all species

Country	Reference period	Total	Uneven-aged	Even-aged				Unknown age
				Total	40 years or less	41 - 80 years	over 80 years	
		(1000 ha)						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	1991	403	0	403	128 ①	88	187	0
Austria ©	1992-96	3,354	78	3,276	1,550	798	928	0
Belgium ©	1997	556	31	351	220	115	17	174
Bosnia and Herzegovina								
Bulgaria	1995	1,868	0	1,868	1,079	412	378	0
Croatia	1996	1,198	317	881	329	357	195	0
Cyprus	1996	43	43	0	0	0	0	0
Czech Republic	1995	2,555	0	2,555	832	898	825	0
Denmark ©	1990	438	30	408	188	110	50	0
Estonia	1996	1,932	16	1,916	810	896	211	0
Finland ©	1991-96	20,675	77	18,789	7171	6,215	5,404	1,808
France ©	1997	7,648	676	6,487	2586 ①	1,839	2,062	485
Germany ©	1987	10,142	1,500	8,642	3168 ②	2,871	2,603	0
Greece ©	1992							
Hungary ©	1996	1,201	37	1,164	778	274	112	0
Iceland	1998	14	1	13	10 ①	3	0	
Ireland	1996	580	0	580	475	44	11	50
Israel	1997	40	0	67	59	8	0	1
Italy	1995	2,616	1,099	1,517	972 ②	291	254 ④	
Latvia	1997	2,413	142	2,271	742	1,085	444	0
Liechtenstein ©	1995	4	2	2				
Lithuania ©	1996	1,686	36	1,650	624	852	174	0
Luxembourg	1994	73		73	19 ②	15	39	
Malta ©	1996							
Netherlands ©	1992-96	308	0	257	104	118	35	51
Norway ©	1994-96	6,609	1,621	4,850	2,222	975	1,653	138
Poland ©	1992-96	8,300		8,300	3,710	3,212	1,378	
Portugal ©	1995	1,201	547	654	485	169	0 ④	0
Romania ©	1984	1,590						
Slovakia ©	1996	1,647	239	1,408	477	680	251	0
Slovenia ©	1996	925	530	395	49	133	213	0
Spain								
Sweden ©	1992-96	21,236	3,794	17,442	9,219	4,155	4,068	0
Switzerland	1993-95	980	157	823	156	162	506	0
The FYR of Macedonia								
Turkey ©	1996	6,911	233	6,524				154
United Kingdom ©	1995	2,088	0	2,088	1,405	463	220	0
Yugoslavia ©	1995	1,172	622	549	201	218	127	0
Total: Europe								
of which: EU 15								
Armenia	1996	21	21	0				
Azerbaijan	1988	153	132	20	30	55	77	1
Belarus ©	1994	5,071	439	4,632	2,739	2,075	257	0
Georgia								
Kazakhstan	1993	10,504	0	10,504	4,490	5,196	818	0
Kyrgyzstan								
Republic of Moldova	1997	55	0	55	28	22	5	
Russian Federation ©	1993	516,391	0	516,391	127,003	109,748	279,640	0
Tajikistan								
Turkmenistan	1995							
Ukraine	1996	4,608	0	4,608	1,778	2,288	542	0
Uzbekistan	1995							
Total: CIS					**136,068**	**119,384**	**281,339**	
Canada ©	1994	125,863	662	102,033	18,739	41,682	41,611	23,168
United States of America ©	1992	198,123	44,509	153,614	72,265	49,514	31,835	0
Total: North America		**323,986**	**45,171**	**255,647**	**91,004**	**91,196**	**73,446**	**23,168**
Australia ©	1994	16,397	3,665	4,343	1,340 ①	528 ④	2,475 ④	8,389
Japan ©	1995	24,062	57	23,649	12,694	7,088	3,867	356
New Zealand ©	1996	1,851	291	1,560	1,544	16	0	0
Total: Other TBFRA		**42,310**	**4,013**	**29,552**	**15,578**	**7,632**	**6,342**	**8,745**
Grand total								

© See notes and comments in Chapter III.
① Without "Under regeneration".
② Without "Under regeneration" and "10 years or less".
④ Data are not available for all age-classes within this group.

TABLE 26

Uneven-aged and even-aged high forest available for wood supply: predominantly coniferous

Country	Reference period	Total	Uneven-aged	Even-aged				Unknown age
				Total	40 years or less	41 - 80 years	over 80 years	
		(1000 ha)						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	1991	157	0	157	88	29	40 ④	0
Austria ©	1992-96	2,519	0	2,519	1,128	616	775	0
Belgium ©	1997	269	0	266	160	95	10	4
Bosnia and Herzegovina								
Bulgaria	1995	677	0	677	464	120	93	0
Croatia	1996	149	72	77	53	18	6	0
Cyprus	1996	43	43	0	0	0	0	0
Czech Republic	1995	786	0	786	286	250	250	0
Denmark ©	1990	168	6	162	87	52	16	0
Estonia	1996	746	9	737	253	351	133	0
Finland ©	1991-96	16,810	63	14,958	5,297	4,869	4,792	1,789
France ©	1997	3,985	259	3,480	1,978 ①	930	572	246
Germany ©	1987	5,852						
Greece ©	1992							
Hungary ©	1996	209	5	204	178	25	1	0
Iceland	1998	8	0	8	8 ①	0	0	
Ireland	1996	491	0	491	452	33	1	5
Israel	1997	40	0	39	34	5	0	1
Italy	1995	1,277	520	757	417 ②	170	170 ④	
Latvia	1997	907	43	864	313	313	238	0
Liechtenstein ©	1995	2	1	1				
Lithuania ©	1996	752	12	740	247	362	131	0
Luxembourg	1994			24	12 ②	10	2	
Malta ©	1996							
Netherlands ©	1992-96	134	0	129	46	70	13	5
Norway ©	1994-96	4,103	906	3,105	1,231	521	1,353	92
Poland ©	1992-96	5,528		5,528	2,471	2,139	918	
Portugal ©	1995	849	195	654	485	169	0 ④	0
Romania ©	1984	3,657						
Slovakia ©	1996	443	98	345	114	172	59	0
Slovenia ©	1996	277	134	143	13	39	91	0
Spain								
Sweden ©	1992-96	17,439	2,831	14,608	7,642	3,164	3,802	0
Switzerland	1993-95	580	106	473	75	67	331	0
The FYR of Macedonia								
Turkey ©	1996	5,588	233	5,232				123
United Kingdom ©	1995	1,454	0	1,454	1,173	255	26	0
Yugoslavia ©	1995	187	152	135	115	2	19	0
Total: Europe								
of which: EU 15								
Armenia	1996	0	0	0				
Azerbaijan	1988	0	0	0	0	0	0	0
Belarus ©	1994	2,309	277	2,032	956	1,262	91	0
Georgia								
Kazakhstan	1993	1,742	0	1,742	432	492	818	0
Kyrgyzstan								
Republic of Moldova	1997	4	0	4	4	0	0	0
Russian Federation ©	1993	263,360	0	263,360	46,472	41,972	176,916	0
Tajikistan								
Turkmenistan	1995							
Ukraine	1996	1,875	0	1,875	710	992	173	0
Uzbekistan	1995							
Total: CIS								
Canada ©	1994	70,220	300	56,541	8,846	17,744	29,951	13,379
United States of America ©	1992	84,323	8,928	75,395	36,279	17,745	21,371	0
Total: North America		**154,543**	**9,228**	**131,936**	**45,125**	**35,489**	**51,322**	**13,379**
Australia ©	1994	1,108	225	865	770 ①	95 ④		18
Japan ©	1995	11,963	54	11,809	8,767	2,515	527	100
New Zealand ©	1996	1,517	0	1,517	1,503	14	0	0
Total: Other TBFRA		**14,588**	**279**	**14,191**	**11,040**	**2,624**		**118**
Grand total								

© See notes and comments in Chapter III.
① Without "Under regeneration".
② Without "Under regeneration" and "10 years or less".
④ Data are not available for all age-classes within this group.

TABLE 27

Uneven-aged and even-aged high forest available for wood supply: predominantly broadleaved

Country	Reference period	Total	Uneven-aged	Even-aged				Unknown age
				Total	40 years or less	41 - 80 years	over 80 years	
		(1000 ha)						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	1991	246	0	246	40 ①	59	147	0
Austria ©	1992-96	835	78	757	422	182	153	0
Belgium ©	1997	233	12	72	54	12	6	149
Bosnia and Herzegovina								
Bulgaria	1995	862	0	862	389	234	239	0
Croatia	1996	907	103	804	276	339	189	0
Cyprus	1996	0	0	0	0	0	0	0
Czech Republic	1995	336	0	336	92	143	101	0
Denmark ©	1990	111	12	99	55	35	16	0
Estonia	1996	401	3	398	218	175	6	0
Finland ©	1991-96	1,324	0	1,093	614	404	74	231
France ©	1997	2,982	263	2,522	477 ①	743	1,302	197
Germany ©	1987	2,515						
Greece ©	1992							
Hungary ©	1996	900	27	873	547	221	105	0
Iceland	1998	5	1	4	1 ①	3	0	
Ireland	1996	79	0	79	23	11	10	35
Israel	1997	0	0	0	0	0	0	0
Italy	1995	1,028	544	484	316 ②	100	68 ④	
Latvia	1997	458	17	441	195	223	23	0
Liechtenstein ©	1995	1	0	1				
Lithuania ©	1996	594	12	582	256	312	14	0
Luxembourg	1994			49	7 ②	5	37	
Malta ©	1996							
Netherlands ©	1992-96	128	0	90	49	28	13	38
Norway ©	1994-96	1,085	312	749	334	285	130	24
Poland ©	1992-96	1,278		1,278	570	495	212	
Portugal ©	1995	85	85	0	0	0	0	0
Romania ©	1984	0	0	0	0	0	0	0
Slovakia ©	1996	828	97	731	180	401	150	0
Slovenia ©	1996	348	184	164	24	63	77	0
Spain								
Sweden ©	1992-96	880	121	759	426	288	45	0
Switzerland	1993-95	192	20	172	50	47	75	0
The FYR of Macedonia								
Turkey ©	1996	1,323		1,292				31
United Kingdom ©	1995	498	0	498	151	174	173	0
Yugoslavia ©	1995	831	416	414	86	217	111	0
Total: Europe								
of which: EU 15								
Armenia	1996	21	21	0				
Azerbaijan	1988	153	132	20	30	55	77	1
Belarus ©	1994	1,330	39	1,292	975	268	87	0
Georgia								
Kazakhstan	1993	1,320	0	1,320	887	433	0	0
Kyrgyzstan								
Republic of Moldova	1997	51	0	51	24	22	5	0
Russian Federation ©	1993	41,311	0	41,311	19,295	14,667	7,349	0
Tajikistan								
Turkmenistan	1995							
Ukraine	1996	2,111	0	2,111	743	1,058	310	0
Uzbekistan	1995							
Total: CIS								
Canada ©	1994	27,273	142	21,667	4,422	12,364	4,881	5,464
United States of America ©	1992	89,463	25,015	64,448	28,265	26,549	9,634	0
Total: North America		**116,736**	**25,157**	**86,115**	**32,687**	**38,913**	**14,515**	**5,464**
Australia ©	1994	6,918	3,440	3,478	570 ①	433 ④	2,475 ④	13
Japan ©	1995	10,158	2	10,052	3,756	3,944	2,352	104
New Zealand ©	1996	128	85	43	41	2	0	0
Total: Other TBFRA		**17,204**	**3,527**	**13,573**	**4,367**	**4,379**	**4,827**	**117**
Grand total								

© See notes and comments in Chapter III.
① Without "Under regeneration".
② Without "Under regeneration" and "10 years or less".
④ Data are not available for all age-classes within this group.

TABLE 28

Uneven-aged and even-aged high forest available for wood supply: mixed

Country	Reference period	Total	Uneven-aged	Even-aged				Unknown age
				Total	40 years or less	41 - 80 years	over 80 years	
		(1000 ha)						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	1991	0	0	0	0	0	0	0
Austria ©	1992-96	0	0	0	0	0	0	0
Belgium ©	1997	54	20	13	6	8	0	21
Bosnia and Herzegovina								
Bulgaria	1995	329	0	329	226	58	46	0
Croatia	1996	142	142	0	0	0	0	0
Cyprus	1996	0	0	0	0	0	0	0
Czech Republic	1995	1,433	0	1,433	454	505	474	0
Denmark ©	1990	159	12	147	55	24	15	0
Estonia	1996	785	4	781	339	370	72	0
Finland ©	1991-96	2,541	14	2,434	956	939	538	94
France ©	1997	681	154	485	131 ①	166	188	42
Germany ©	1987	1,775						
Greece ©	1992							
Hungary ©	1996	92	5	87	53	28	6	0
Iceland	1998	1	0	1	1 ①	0	0	
Ireland	1996	10	0	10	0	0	0	10
Israel	1997	0	0	0	0	0	0	0
Italy	1995	311	35	276	239	21	16	
Latvia	1997	1,048	82	966	234	549	183	0
Liechtenstein ©	1995	2	1	1				
Lithuania ©	1996	340	12	328	121	178	29	0
Luxembourg	1994							
Malta ©	1996							
Netherlands ©	1992-96	46	0	38	9	20	9	8
Norway ©	1994-96	1,421	403	996	657	169	170	22
Poland ©	1992-96	1,494	0	1,494	667	578	247	
Portugal ©	1995	267	267	0	0	0	0	0
Romania ©	1984	5,247		5,676	2,243	1,895	1,539	
Slovakia ©	1996	376	44	332	183	107	42	0
Slovenia ©	1996	300	212	88	15	29	44	0
Spain								
Sweden ©	1992-96	2,917	842	2,075	1,151	703	221	0
Switzerland	1993-95	208	31	178	31	47	100	0
The FYR of Macedonia								
Turkey ©	1996	0	0	0	0	0	0	0
United Kingdom ©	1995	136	0	136	81	34	21	0
Yugoslavia ©	1995	154	154	0	0	0	0	0
Total: Europe								
of which: EU 15								
Armenia	1996	0	0	0				
Azerbaijan	1988	0	0	0	0	0	0	0
Belarus ©	1994	1,432	124	1,308	748	546	79	0
Georgia								
Kazakhstan	1993	7,442	0	7,442	3,171	4,271	0	0
Kyrgyzstan								
Republic of Moldova	1997	0	0	0	0	0	0	0
Russian Federation ©	1993	211,720	0	211,720	61,236	55,109	95,375	0
Tajikistan								
Turkmenistan	1995							
Ukraine	1996	622	0	622	325	238	59	0
Uzbekistan	1995							
Total: CIS								
Canada ©	1994	28,370	220	23,825	5,472	11,574	6,779	4,325
United States of America ©	1992	24,337	10,566	13,771	7,721	5,220	830	0
Total: North America		**52,707**	**10,786**	**37,596**	**13,193**	**16,794**	**7,609**	**4,325**
Australia ©	1994							
Japan ©	1995	1,788	0	1,788	171	630	987	0
New Zealand ©	1996	206	206	0	0	0	0	0
Total: Other TBFRA								
Grand total								

© See notes and comments in Chapter III.

① Without "Under regeneration".

TABLE 29

Age-class distribution of even-aged high forest available for wood supply: total of all species groups

Country	Age classes (years)								
	Under regeneration and < 10	11 - 20	21 - 40	41 - 60	61 - 80	81 - 100	101 - 120	121 - 140	> 140
	(1000 ha)								
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Albania ©	43 ①	51	34	34	54	57	45	85	0
Austria ©	555	271	724	419	379	328	226	153	221
Belgium ©	48	44	127	77	37	13	2	1	0
Bosnia and Herzegovina									
Bulgaria	289	287	504	225	187	161	108	65	44
Croatia	112	68	149	188	169	125	55	13	2
Cyprus	0	0	0	0	0	0	0	0	0
Czech Republic	265	175	392	426	472	455	249	87	34
Denmark ©	64	44	80	78	32	26	12	5	7
Estonia	155	162	493	560	336	136	44	22	9
Finland ©	1,954	1,676	3,541	3,226	2,989	2,238	1,323	718	1,125
France ©	537 ①	668	1,381	979	860	696	460	386	520
Germany ©		1,239	1,929	1,452	1,419	1,181	705	412	305
Greece ©									
Hungary ©	193	221	364	169	105	81	26	4	1
Iceland	7 ①	2	2	3	0	0	0	0	0
Ireland	198	102	175	36	8	5	2	2	2
Israel	17	13	29	7	1	0	0	0	0
Italy		640	332	162	129	102	67		85
Latvia	187	134	421	594	491	295	103	33	13
Liechtenstein ©									
Lithuania ©	102	119	403	504	348	142	25	5	2
Luxembourg		14	5	9	6	7	9	13	10
Malta ©									
Netherlands ©	26	19	59	72	46	23	7	2	3
Norway ©	798	591	833	528	447	565	541	421	126
Poland ©	913	639	2,158	1,776	1,436	913	314	151	0
Portugal ©	134	64	287	144	25	0			
Romania ©									
Slovakia ©	148	118	211	349	331	202	39	7	3
Slovenia ©	19	12	18	43	90	100	61	33	19
Spain									
Sweden ©	3,000	2,468	3,751	2,057	2,098	1,593	1,362	778	335
Switzerland	23	39	93	63	99	146	122	88	150
The FYR of Macedonia									
Turkey ©									
United Kingdom ©	368	341	696	331	132	79	53	41	47
Yugoslavia ©	77	64	60	170	48	35	89	4	0
Total: Europe									
of which: EU 15									
Armenia									
Azerbaijan	13	5	12	30	25	25	22	20	10
Belarus ©	347	532	1,861	1,534	541	178	19	23	36
Georgia									
Kazakhstan	1,260	978	2,252	3,684	1,512	311	364	48	95
Kyrgyzstan									
Republic of Moldova	4	8	16	14	8	2	1	1	1
Russian Federation ©	31,051	32,688	63,264	56,696	53,052	48,745	37,755	55,324	137,816
Tajikistan									
Turkmenistan									
Ukraine	380	294	1,104	1,371	917	369	117	27	29
Uzbekistan									
Total: CIS									
Canada ©	4,327	3,239	11,173	22,559	19,123	14,637	10,239	6,116	10,619
United States of America ©	23,145	20,687	28,433	28,427	21,087	14,583	8,958	4,959	3,335
Total: North America	**27,472**	**23,926**	**39,606**	**50,986**	**40,210**	**29,220**	**19,197**	**11,075**	**13,954**
Australia ©	419 ①	921		528			1,219		1,256
Japan ©	1,066	2,036	9,592	4,789	2,299	3,867	0	0	0
New Zealand ©	677	554	313	7	9	0	0	0	0
Total: Other TBFRA	**2,162**	**3,511**		**5,324**			**1,219**		**1,256**
Grand total									

© See notes and comments in Chapter III.
① Without "Under regeneration".

TABLE 30

Age-class distribution of even-aged high forest available for wood supply: predominantly coniferous

Country	Age classes (years)								
	Under regeneration and < 10	11 - 20	21 - 40	41 - 60	61 - 80	81 - 100	101 - 120	121 - 140	> 140
	(1000 ha)								
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Albania ©	31	43	14	13	15		40		
Austria ©	385	185	558	321	295	264	186	129	196
Belgium ©	40	24	97	65	30	9	1	0	0
Bosnia and Herzegovina									
Bulgaria	141	139	184	52	68	53	26	8	6
Croatia	13	11	29	12	6	5	1	0	0
Cyprus	0	0	0	0	0	0	0	0	0
Czech Republic	103	66	117	118	132	138	78	26	8
Denmark ©	25	32	30	37	15	10	4	1	2
Estonia	54	61	138	180	172	83	29	15	6
Finland ©	1,370	1,289	2,638	2,396	2,473	1,923	1,187	649	1,033
France ©	383 ①	530	1,065	597	333	221	123	85	143
Germany ©									
Greece ©									
Hungary ©	25	56	97	19	6	1	0	0	0
Iceland	6 ①	1	1	0	0	0	0	0	0
Ireland	180	100	172	29	4	1	0	0	0
Israel	11	7	17	4	1	0	0	0	0
Italy		245	172	97	73	56	48		66
Latvia	110	65	138	140	173	140	63	25	10
Liechtenstein ©									
Lithuania ©	59	43	145	180	181	105	21	4	2
Luxembourg		10	3	7	3	2	1	0	0
Malta ©									
Netherlands ©	8	8	30	43	27	11	2	0	0
Norway ©	466	239	526	307	214	389	457	392	115
Poland ©	608	426	1,437	1,183	956	608	209	101	0
Portugal ©	134	64	287	144	25	0			
Romania ©									
Slovakia ©	34	26	54	82	90	49	8	1	1
Slovenia ©	2	2	9	17	22	44	26	13	8
Spain									
Sweden ©	2,727	2,085	2,830	1,461	1,703	1,450	1,287	743	322
Switzerland	11	20	44	26	41	71	72	58	130
The FYR of Macedonia									
Turkey ©									
United Kingdom ©	278	302	593	206	49	11	6	5	4
Yugoslavia ©	49	37	29	2	0	9	10	0	0
Total: Europe									
of which: EU 15									
Armenia									
Azerbaijan	0	0	0	0	0	0	0	0	0
Belarus ©	101	161	694	916	346	83	4	4	0
Georgia									
Kazakhstan	0	162	270	183	309	311	364	48	95
Kyrgyzstan									
Republic of Moldova	0	3	0	0	0	0	0	0	0
Russian Federation ©	12,836	13,671	19,965	19,915	22,057	20,860	23,255	30,755	102,046
Tajikistan									
Turkmenistan									
Ukraine	165	80	465	567	425	140	28	4	1
Uzbekistan									
Total: CIS									
Canada ©	2,392	1,646	4,808	9,219	8,525	7,860	7,547	4,636	9,908
United States of America ©	13,573	11,944	10,762	9,034	8,711	7,230	6,888	3,932	3,321
Total: North America	**15,965**	**13,590**	**15,570**	**18,253**	**17,236**	**15,090**	**14,435**	**8,568**	**13,229**
Australia ©	235 ①	535		95					
Japan ©	797	1,608	6,363	1,764	751	527	0	0	0
New Zealand ©	651	542	310	6	8	0	0	0	0
Total: Other TBFRA	**1,683**	**2,685**		**1,865**					
Grand total									

© See notes and comments in Chapter III.

① Without "Under regeneration".

TABLE 31

Age-class distribution of even-aged high forest available for wood supply: predominantly broadleaved

Country	Age classes (years)									
	Under regeneration and < 10		11 - 20	21 - 40	41 - 60	61 - 80	81 - 100	101 - 120	121 - 140	> 140
	(1000 ha)									
(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Albania ©	11	①	8	21	21	39	43	33	71	0
Austria ©	170		86	166	98	84	64	40	24	25
Belgium ©	8		19	27	8	4	4	1	1	0
Bosnia and Herzegovina										
Bulgaria	80		80	230	147	86	82	70	53	35
Croatia	99		57	120	176	163	120	54	13	2
Cyprus	0		0	0	0	0	0	0	0	0
Czech Republic	20		16	56	84	59	40	30	17	14
Denmark ©	23		12	21	28	7	8	4	3	3
Estonia	31		31	156	140	34	4	1	0	0
Finland ©	124		99	391	285	119	58	11	3	2
France ©	139	①	109	229	298	445	408	290	267	337
Germany ©										
Greece ©										
Hungary ©	162		153	232	132	89	75	25	4	1
Iceland	0	①	0	1	3	0	0	0	0	0
Ireland	18		2	3	7	4	4	2	2	2
Israel	0		0	0	0	0	0	0	0	0
Italy			196	120	55	45	40	15		13
Latvia	48		30	117	148	75	20	1	1	1
Liechtenstein ©										
Lithuania ©	21		38	198	235	77.2	11.8	1.5	0.4	0.4
Luxembourg			5	3	2	3	5	9	13	10
Malta ©										
Netherlands ©	13		10	26	18	10	7	3	1	2
Norway ©	134		101	99	123	162	110	15	3	2
Poland ©	140		98	332	274	221	141	48	23	0
Portugal ©	0		0	0	0	0	0	0	0	0
Romania ©	0		0	0	0	0	0	0	0	0
Slovakia ©	39		39	102	212	189	119	25	5	1
Slovenia ©	9		9	6	16	47	43	17	12	5
Spain										
Sweden ©	92		85	249	202	86	27	13	4	1
Switzerland	7		12	31	22	25	34	21	12	8
The FYR of Macedonia										
Turkey ©										
United Kingdom ©	68		20	63	102	72	60	42	32	39
Yugoslavia ©	28		27	31	169	48	26	79	4	3
Total: Europe										
of which: EU 15										
Armenia										
Azerbaijan	13		5	12	30	25	25	22	20	10
Belarus ©	130		195	650	150	118	36	9	13	30
Georgia										
Kazakhstan	221		264	402	361	72	0	0	0	0
Kyrgyzstan										
Republic of Moldova	4		5	16	14	8	2	1	1	1
Russian Federation ©	5410		6,295	7,590	7,412	7,255	5,949	600	500	300
Tajikistan										
Turkmenistan										
Ukraine	160		133	450	647	411	189	77	19	25
Uzbekistan										
Total: CIS										
Canada ©	675		631	3,116	7,145	5,219	3,073	1,020	544	244
United States of America ©	7275		6,701	14,289	15,825	10,724	6,553	2,050	1,017	14
Total: North America	**7,950**		**7,332**	**17,405**	**22,970**	**15,943**	**9,626**	**3,070**	**1,561**	**258**
Australia ©	184	①	386		433			1,219		1,256
Japan ©	264		413	3,079	2,850	1,094	2,352	0	0	0
New Zealand ©	26		12	3	1	1	0	0	0	0
Total: Other TBFRA	**474**		**811**		**3,284**			**1,219**		**1,256**
Grand total										

© See notes and comments in Chapter III.
① Without "Under regeneration".

TABLE 32

Age-class distribution of even-aged high forest available for wood supply: mixed

Country	Age classes (years)								
	Under regeneration and < 10	11 - 20	21 - 40	41 - 60	61 - 80	81 - 100	101 - 120	121 - 140	> 140
	(1000 ha)								
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Albania ©	0	0	0	0	0	0	0	0	0
Austria ©	0	0	0	0	0	0	0	0	0
Belgium ©	1	2	3	4	4	0	0	0	0
Bosnia and Herzegovina									
Bulgaria	68	67	90	25	33	26	13	4	3
Croatia	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0
Czech Republic	142	93	219	224	281	277	141	44	12
Denmark ©	16	19	21	14	10	8	4	1	2
Estonia	69	70	200	241	130	49	14	7	3
Finland ©	156	289	511	542	397	257	125	66	90
France ©	15 ①	29	87	84	82	67	47	34	40
Germany ©									
Greece ©									
Hungary ©	6	12	35	18	10	5	1	0	0
Iceland	1 ①	1	0	0	0	0	0	0	0
Ireland	0	0	0	0	0	0	0	0	0
Israel	0	0	0	0	0	0	0	0	0
Italy		199	40	10	11	6	4		6
Latvia	29	39	166	306	243	135	39	7	2
Liechtenstein ©									
Lithuania ©	22	39	60	89	90	26	3	1	0
Luxembourg									
Malta ©									
Netherlands ©	5	1	3	11	9	5	2	1	1
Norway ©	198	251	208	98	71	66	69	26	9
Poland ©	164	115	388	320	258	164	56	27	0
Portugal ©	0	0	0	0	0	0	0	0	0
Romania ©		1,196	1,047	1,035	860	604	935		
Slovakia ©	75	53	55	55	52	34	6	1	1
Slovenia ©	5	4	6	9	20	11	18	8	7
Spain									
Sweden ©	181	298	672	394	309	116	62	31	12
Switzerland	5	7	19	15	32	41	30	17	12
The FYR of Macedonia									
Turkey ©	0	0	0	0	0	0	0	0	0
United Kingdom ©	22	19	40	23	11	8	5	4	4
Yugoslavia ©	0	0	0	0	0	0	0	0	0
Total: Europe									
of which: EU 15									
Armenia									
Azerbaijan	0	0	0	0	0	0	0	0	0
Belarus ©	115	116	517	468	77	59	7	7	7
Georgia									
Kazakhstan	1,039	552	1,580	3,140	1,131	0	0	0	0
Kyrgyzstan									
Republic of Moldova	0	0	0	0	0	0	0	0	0
Russian Federation ©	12,805	12,722	35,709	29,369	25,740	21,936	13,900	24,069	35,470
Tajikistan									
Turkmenistan									
Ukraine	55	81	189	157	81	40	12	4	3
Uzbekistan									
Total: CIS									
Canada ©	1,261	962	3,249	6,195	5,379	3,704	1,672	936	467
United States of America ©	2,297	2,042	3,382	3,568	1,652	800	20	10	0
Total: North America	**3,558**	**3,004**	**6,631**	**9,763**	**7,031**	**4,504**	**1,692**	**946**	**467**
Australia ©									
Japan ©	6	15	150	175	455	987	0	0	0
New Zealand ©	0	0	0	0	0	0	0	0	0
Total: Other TBFRA									
Grand total									

© See notes and comments in chapter III.
① Without "under regeneration".

TABLE 33

Standing volume of trees (growing stock and dead trees)

Country	Reference period	Total	On forest			On other wooded land and trees outside forest
			Total	Available for wood supply	Not available for wood supply	
		(1000 m3 o.b.)				
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Albania ©	1995	83,945	83,945	74,101	9,882	0 ①
Austria ©	1992 - 96	1,130,307	1,120,307	1,055,307	65,000	10,000 ①
Belgium	1997	141,033 ①	141,033 ①	139,835 ①	1,198 ①	
Bosnia and Herzegovina	1995		250,360 ①	125,180 ①	125,180 ①	
Bulgaria ©	1995	467,389 ①	468,583	402,199	66,384	44 ①
Croatia ©	1996	359,769	358,269	339,388	18,881	1,500 ①
Cyprus	1980 - 90	5,500 ①	5,000 ①	3,075		500 ①
Czech Republic ©	1995	705,571	700,891	684,942	15,956	4,680 ①
Denmark ©	1990	61,500	55,850	54,500	1,350	5,000 ①
Estonia	1996	326,812	318,972	311,390	7,582	7,840 ①
Finland	1991 - 96	2,002,000	1,978,000	1,898,000	79,000	23,000 ①
France ©	1997	2,994,920	2,909,649	2,853,176	56,473	85,271 ①
Germany	1987	2,880,000 ①	2,880,000 ①	2,820,000 ①	60,000 ①	0 ①
Greece ©	1992	156,924	154,168	141,990	12,178	0 ①
Hungary ©	1996	339,792	323,792	303,864	19,928	16,000 ①
Iceland ©	1998	1,100	800	370	430	300 ①
Ireland	1996	44,000 ①	44,000 ①	43,000 ①	1,000 ①	
Israel	1997	6,000 ①	6,000 ①	4,200 ①	1,800 ①	0 ①
Italy	1995	1,518,592 ①	1,428,742 ①	876,744 ①	551,998 ①	89,850 ①
Latvia	1997	542,000 ①	514,048	419,082	94,966	40,000 ①
Liechtenstein	1995	1,757	1,757	1,406	351	
Lithuania	1996	382,837	371,537	321,885	49,652	11,300 ①
Luxembourg	1985-97		20,517	20,517	0	
Malta	1996	80 ①	80 ①	0	80 ①	
Netherlands ©	1991-95	66,015	55,515	53,352	2,163	10,500 ①
Norway ©	1994-96	859,433	809,464	701,793	107,671	45,840 ①
Poland ©	1992-96	1,998,335	1,932,823	1,794,066	138,758	65,512 ①
Portugal ©	1995	306,364	289,370	189,192	100,178	16,246 ①
Romania	1984		1,341,465 ①			
Slovakia ©	1996	511,586	511,586	445,925	65,661	
Slovenia ©	1996	324,412	316,970	298,341	11,395	7,035 ①
Spain ©	1990	606,290	605,993	496,551	109,441	297 ①
Sweden ©	1992-96	3,071,172	3,001,457	2,621,601	379,857	69,715
Switzerland ©	1993-95	435,516	407,916	363,836	44,080	27,600 ①
The FYR of Macedonia	1995	63,420 ①	63,420 ①			
Turkey ©	1996	1,483,863 ①	1,362,141	1,187,309 ①	162,014 ①	134,540 ①
United Kingdom ©	1995	354,000	318,000	293,500	24,500	36,000 ①
Yugoslavia ©	1995	328,759 ①	419,859	375,730	42,321	8,702
Total: Europe			**25,572,279**			
of which: EU 15			**15,002,601**	**13,557,265**	**1,444,336**	
Armenia	1996	44,990	44,290	4,060	40,230	700 ①
Azerbaijan	1988	130,499	130,499	26,624	103,803	0
Belarus	1994	1,220,620	1,219,510	983,859	235,651	1,110 ①
Georgia	1995	434,000 ①	434,000 ①	86,800 ①	347,200 ①	0 ①
Kazakhstan	1993	369,810 ①	369,810 ①	369,810 ①	21,890 ①	0 ①
Kyrgyzstan	1988		23,000 ①	0	23,000 ①	
Republic of Moldova	1997	43,410	41,810	26,040	15,770	1,600 ①
Russian Federation ©	1993	91,650,252	88,650,252	63,115,156	25,535,096	1,650,000
Tajikistan	1995	5,620 ①	5,620 ①	0	5,620 ①	0 ①
Turkmenistan	1995	14,100 ①	14,100 ①	13,705 ①	395 ①	0 ①
Ukraine	1996	1,744,360	1,704,212	1,114,570	589,642	40,108 ①
Uzbekistan	1988	11,100 ①	11,000 ①	0	11,000 ①	100 ①
Total: CIS			**92,648,103**	**65,740,624**	**26,929,297**	
Canada	1994	29,364,059 ①	29,364,059 ①	17,354,560 ①	12,009,499 ①	0 ①
United States of America ©	1992	41,469,000	30,230,000	27,558,000	2,672,000	11,026,000 ①
Total: North America		**70,833,059**	**59,594,059**	**44,912,560**	**14,681,499**	**11,026,000**
Australia	1994	8,635,115 ①	8,635,115 ①	644,683 ①	7,990,432 ①	
Japan	1995	3,483,234 ①	3,482,138 ①	3,368,076 ①	114,062 ①	1,096 ①
New Zealand	1996	2,578,530 ①	2,553,000 ①	369,659 ①	2,183,341 ①	25,530 ①
Total: Other TBFRA		**14,696,879**	**14,670,253**	**4,382,418**	**10,287,835**	
Grand total			**192,484,694**			

© See notes and comments in Chapter III.
① Only growing stock.

TABLE 34

Growing stock

Country	Reference period	Total	On forest			On other wooded land and trees outside forest
			Total	Available for wood supply	Not available for wood supply	
			($1000\ m^3$ o.b.)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Albania ©	1995	83,455	83,455	73,634	9,821	0
Austria ©	1992-96	1,107,307	1,097,307 ①	1,037,307 ①	60,000	10,000
Belgium ©	1997	141,033	141,033	139,835	1,198	
Bosnia and Herzegovina ©	1995		250,360	125,180	125,180	
Bulgaria ©	1995	467,389	467,345	401,141	66,204	44
Croatia ©	1996	357,802	356,302 ①	337,700 ①	18,602	1,500
Cyprus ©	1980-90	5,500	5,000	3,055		500
Czech Republic ©	1995	688,486	683,806 ①	668,242 ①	15,571	4,680
Denmark ©	1990	60,200	55,200	53,950	1,250	5,000
Estonia	1996	322,377	314,537	307,120	7,417	7,840
Finland	1991-96	1,963,000	1,940,000	1,867,000	72,000	23,000
France ©	1997	2,977,048	2,891,777 ①	2,835,655 ①	56,122	85,271
Germany ©	1987	2,880,000	2,880,000	2,820,000	60,000	0
Greece ©	1992	154,544	151,788	139,800	11,988	0
Hungary ©	1996	330,667	314,667	295,301 ①	19,366	16,000
Iceland ©	1998	1,100	800	370	430	300
Ireland ©	1996	44,000	44,000	43,000	1,000	
Israel	1997	6,000	6,000	4,200	1,800	0
Italy	1995	1,518,592	1,428,742 ①	876,744 ①	551,998	89,850
Latvia	1997	542,000	502,000	409,260	92,740	40,000
Liechtenstein	1995	1,750	1,750	1,400	350	
Lithuania	1996	373,937	362,637	314,355	48,282	11,300
Luxembourg	1985-97		20,377	20,377	0	
Malta	1996	80	80	0	80	
Netherlands ©	1991-95	64,709	54,209 ①	52,088 ①	2,121	10,500
Norway ©	1994-96	817,288	771,448 ①	671,412 ①	100,036	45,840
Poland ©	1992-96	1,973,531	1,908,019 ①	1,771,042 ①	136,977	65,512
Portugal ©	1995	292,006	275,760 ①	188,020 ①	87,740	16,246
Romania ©	1984		1,341,465			
Slovakia ©	1996	510,948	510,948 ①	445,547 ①	65,401	
Slovenia ©	1996	317,612	310,577 ①	292,491 ①	10,852	7,035
Spain ©	1990	594,408	594,111	486,815	107,296	297
Sweden ©	1992-96	2,993,640	2,928,117 ①	2,566,532 ①	361,586	65,523
Switzerland ©	1993 95	422,453	394,853	353,212	41,641	27,600
The FYR of Macedonia ©	1995	63,420	63,420			
Turkey ©	1996	1,483,863	1,349,323	1,187,309	162,014	134,540
United Kingdom ©	1995	353,000	317,000 ①	293,000 ①	24,000	36,000
Yugoslavia ©	1995	328,759	322,313	288,456	33,857	6,446
Total: Europe			**25,140,446**			
of which: EU 15			**14,819,421**	**13,420,123**	**1,398,299**	
Armenia	1996	43,440	42,740 ①	3,900 ①	38,840	700
Azerbaijan	1988	127,440	127,440	26,000	101,440	0
Belarus	1994	1,202,420	1,201,310 ①	969,459 ①	231,851	1,110
Georgia ©	1995	434,000	434,000	86,800	347,200	0
Kazakhstan	1993	369,810	369,810	369,810	21,890	0
Kyrgyzstan	1988		23,000	0	23,000	
Republic of Moldova	1997	43,200	41,600	25,900	15,700	1,600
Russian Federation ©	1993	86,986,752	85,486,752 ①	60,922,156 ①	24,564,596	1,500,000
Tajikistan ©	1995	5,620	5,620	0	5,620	0
Turkmenistan ©	1995	14,100	14,100	13,705	395	0
Ukraine	1996	1,736,020	1,695,912 ①	1,110,470	585,442	40,108
Uzbekistan ©	1988	11,100	11,000	0	11,000	100
Total: CIS			**89,453,284**	**63,528,200**	**25,946,974**	
Canada ©	1994	29,364,059	29,364,059	17,354,560	12,009,499	0
United States of America ©	1992	40,682,000	29,656,000	27,035,000	2,621,000	11,026,000
Total: North America		**70,046,059**	**59,020,059**	**44,389,560**	**14,630,499**	**11,026,000**
Australia ©	1994	8,635,115	8,635,115 ①	644,683 ①	7,990,432	
Japan ©	1995	3,483,234	3,482,138	3,368,076	114,062	1,096
New Zealand ©	1996	2,578,530	2,553,000	369,659 ①	2,183,341	25,530
Total: Other TBFRA		**14,696,879**	**14,670,253**	**4,382,418**	**10,287,835**	
Grand total			**188,284,042**			

© See notes and comments in Chapter III.

① Adjustment to achieve conformity with TBFRA definitions arrived at by the National Correspondent.

TABLE 35

Growing stock on forest by species groups

Country	On forest		On forest available for wood supply		On forest not available for wood supply	
	Coniferous	Broadleaved	Coniferous	Broadleaved	Coniferous	Broadleaved
	(1000 m^3 o.b.)					
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Albania ©	18,897	64,558	16,155	57,479	2,742	7,079
Austria ©	909,309	187,998	849,309	187,998	60,000	0
Belgium ©	64,515	76,518	64,335	75,500	180	1,018
Bosnia and Herzegovina ©	126,000	124,360	70,000	55,180	56,000	69,180
Bulgaria ©	193,531	273,814	162,617	238,524	30,914	35,290
Croatia ©	51,044	305,258	46,416	291,284	4,628	13,974
Cyprus ©	4,800	200	3,055	0	1,745	200
Czech Republic ©	573,886	109,920	560,729	107,513	13,157	2,407
Denmark ©	31,300	23,900	31,300	22,650	0	1,250
Estonia	199,102	115,435	194,413	112,707	4,689	2,728
Finland	1,589,000	351,000	1,529,000	338,000	60,000	13,000
France ©	1,035,385	1,856,392	1,015,083	1,820,572	20,302	35,820
Germany ©	1,970,000	910,000	1,940,000	880,000	30,000	30,000
Greece ©	85,022	66,766	78,300	61,500	6,722	5,266
Hungary ©	46,937	267,730	44,916	250,385	2,021	17,345
Iceland ©	230	570	210	160	20	410
Ireland ©	40,000	4,000	39,500	3,500	500	500
Israel	3,500	2,500	2,400	1,800	1,100	700
Italy	469,206	959,536	287,927	588,817	181,279	370,719
Latvia	303,964	198,036	242,205	167,055	61,759	30,981
Liechtenstein	1,300	450	1,000	400	300	50
Lithuania	220,355	142,282	186,470	127,885	33,885	14,397
Luxembourg						
Malta	72	8	0	0	72	8
Netherlands ©	29,654	24,555	28,594	23,494	1,060	1,061
Norway ©	595,688	175,760	533,923	137,489	61,765	38,271
Poland ©	1,511,729	396,290	1,403,202	367,841	108,527	28,449
Portugal ©	147,782	127,978	140,871	47,149	6,911	80,829
Romania ©	525,735	815,730				
Slovakia ©	240,798	270,150	213,576	231,971	27,222	38,179
Slovenia ©	154,667	155,910	145,660	146,831	9,007	9,079
Spain ©	363,323	230,788	284,882	201,933	78,441	28,855
Sweden ©	2,466,262	461,855	2,188,639	377,893	277,623	83,962
Switzerland ©	281,584	113,269	246,331	106,881	35,253	6,388
The FYR of Macedonia ©		0				
Turkey ©	890,773	458,550	776,132	411,177	114,641	47,373
United Kingdom ©	190,000	127,000	188,000	105,000	2,000	22,000
Yugoslavia ©	61,053	261,260	54,742	233,714	6,311	27,546
Total: Europe						
of which: EU 15						
Armenia	790	41,950	0	3,900	790	38,050
Azerbaijan	350	127,090	310	25,690	40	101,400
Belarus	844,624	356,686	681,615	287,844	163,009	68,842
Georgia ©	130,200	303,800	26,000	60,800	104,200	243,000
Kazakhstan	241,930	127,880	230,040	117,880	11,890	10,000
Kyrgyzstan	16,000	7,000	0	0	16,000	7,000
Republic of Moldova	300	41,300	150	25,750	150	15,550
Russian Federation ©	68,389,402	17,097,350	44,641,235	16,280,920	23,748,167	816,429
Tajikistan ©	3,140	2,480	0	0	3,140	2,480
Turkmenistan ©	840	13,260	817	12,888	23	372
Ukraine						
Uzbekistan ©	2,200	8,800	0	0	2,200	8,800
Total: CIS						
Canada ©	22,695,058	6,669,001	12,772,573	4,581,987	9,922,485	2,087,014
United States of America ©	16,316,000	13,340,000	14,874,000	12,161,000	1,442,000	1,179,000
Total: North America	**39,011,058**	**20,009,001**	**27,646,573**	**16,742,987**	**11,364,485**	**3,266,014**
Australia ©	207,807	8,427,308	129,676	515,007	78,131	7,912,301
Japan ©	2,310,230	1,171,908				
New Zealand ©	653,000	1,900,000	363,310	6,349	289,690	1,893,651
Total: Other TBFRA	**3,171,037**	**11,499,216**				
Grand total						

© See notes and comments in Chapter III.

TABLE 36

Growing stock on forest available for wood supply: comparative data

Country	Growing stock per hectare on FAWS	Share of species groups in total growing stock on FAWS		Share of growing stock on FAWS in total growing stock on forest, by species groups		
		Coniferous	Broadleaved	Total	Coniferous	Broadleaved
	(m^3 overbark/ha)			(per cent)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Albania	81.6	21.9	78.1	88.2	85.5	89.0
Austria	309.5	81.9	18.1	94.5	93.4	100.0
Belgium	218.8	46.0	54.0	99.2	99.7	98.7
Bosnia and Herzegovina	95.9	55.9	44.1	50.0	55.6	44.4
Bulgaria	128.4	40.5	59.5	85.8	84.0	87.1
Croatia	199.8	13.7	86.3	94.8	90.9	95.4
Cyprus	70.7	100.0	0.0	61.1	63.6	0.0
Czech Republic	261.1	83.9	16.1	97.7	97.7	97.8
Denmark	122.5	58.0	42.0	97.7	100.0	94.8
Estonia	159.0	63.3	36.7	97.6	97.6	97.6
Finland	90.3	81.9	18.1	96.2	96.2	96.3
France	196.0	35.8	64.2	98.1	98.0	98.1
Germany	278.1	68.8	31.2	97.9	98.5	96.7
Greece	45.2	56.0	44.0	92.1	92.1	92.1
Hungary	173.5	15.2	84.8	93.8	95.7	93.5
Iceland	26.4	56.8	43.2	46.3	91.3	28.1
Ireland	74.1	91.9	8.1	97.7	98.8	87.5
Israel	60.0	57.1	42.9	70.0	68.6	72.0
Italy	145.8	32.8	67.2	61.4	61.4	61.4
Latvia	169.6	59.2	40.8	81.5	79.7	84.4
Liechtenstein	350.0	71.4	28.6	80.0	76.9	88.9
Lithuania	186.5	59.3	40.7	86.7	84.6	89.9
Luxembourg	237.5			100.0		
Malta				0.0	0.0	0.0
Netherlands	165.9	54.9	45.1	96.1	96.4	95.7
Norway	101.6	79.5	20.5	87.0	89.6	78.2
Poland	213.4	79.2	20.8	92.8	92.8	92.8
Portugal	99.1	74.9	25.1	68.2	95.3	36.8
Romania						
Slovakia	261.2	47.9	52.1	87.2	88.7	85.9
Slovenia	282.6	49.8	50.2	94.2	94.2	94.2
Spain	46.5	58.5	41.5	81.9	78.4	87.5
Sweden	120.9	85.3	14.7	87.7	88.7	81.8
Switzerland	333.2	69.7	30.3	89.5	87.5	94.4
The FYR of Macedonia						
Turkey	137.5	65.4	34.6	88.0	87.1	89.7
United Kingdom	139.0	64.2	35.8	92.4	98.9	82.7
Yugoslavia	121.3	19.0	81.0	89.5	89.7	89.5
Total: Europe						
of which: EU 15	**140.5**			**90.6**		
Armenia	185.7	0.0	100.0	9.1	0.0	9.3
Azerbaijan	170.0	1.2	98.8	20.4	88.6	20.2
Belarus	162.5	70.3	29.7	80.7	80.7	80.7
Georgia	147.0	30.0	70.0	20.0	20.0	20.0
Kazakhstan	75.0	62.2	31.9	100.0	95.1	92.2
Kyrgyzstan				0.0	0.0	0.0
Republic of Moldova	122.8	0.6	99.4	62.3	50.0	62.3
Russian Federation	116.0	73.3	26.7	71.3	65.3	95.2
Tajikistan				0.0	0.0	0.0
Turkmenistan	3.8	6.0	94.0	97.2	97.3	97.2
Ukraine	185.1			65.5		
Uzbekistan				0.0	0.0	0.0
Total: CIS				**71.0**		
Canada	137.9	73.6	26.4	59.1	56.3	68.7
United States of America	136.5	55.0	45.0	91.2	91.2	91.2
Total: North America	**137.0**	**62.3**	**37.7**	**75.2**	**70.9**	**83.7**
Australia	39.2	20.1	79.9	7.5	62.4	6.1
Japan	144.7			96.7		
New Zealand	199.7	98.3	1.7	14.5	55.6	0.3
Total: Other TBFRA	**105.4**			**29.9**		
Grand total						

TABLE 37

Changes over time in growing stock on forest and forest available for wood supply

Country	Reference period 1	Reference period 2	On forest			On forest available for wood supply		
			Reference period 1	Reference period 2	Average annual change	Reference period 1	Reference period 2	Average annual change
			(1000 m3 overbark)		(±1000 m3 o.b./year)	(1000 m3 overbark)		(±1000 m3 o.b./year)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania	1957	1995	80,467	83,455	77	80,467	73,634	-175
Austria ©	1986-90	1992-96	1,080,121	1,097,307	2,864	1,020,121	1,037,307	2,864
Belgium ©	1982	1997	122,047	141,033	1,266	121,245	139,835	1,239
Bosnia and Herzegovina	1990	1995						
Bulgaria	1985	1995	404,800	467,345	6,255	349,747	401,141	5,139
Croatia	1986	1996	328,207	356,302	2,809	310,683	337,700	2,702
Cyprus	1981	1991			40	3,123	3,055 ②	-7
Czech Republic ©	1986	1995	639,873	683,806	4,393	622,717	668,242	4,552
Denmark ©	1980	1990	43,200	55,200	1,200	43,200	55,200 ②	1,200
Estonia	1988	1996	259,680	314,537	6,857	249,230	307,120	7,236
Finland	1980-89	1991-96	1,753,000	1,940,000	19,700	1,713,000	1,867,000	16,200
France ©	1987	1997	2,538,961	2,891,777	35,282	2,489,756	2,835,655	34,590
Germany ©	1961	1987		2,880,000	35,000		2,820,000	35,000
Greece		1992		151,788			139,800	
Hungary ©	1990	1996	288,004	314,667	4,443	274,189	295,301	3,519
Iceland	1990-1990	1998-1998	760	800	5	338	370	4
Ireland	1987	1996	25,000	42,000 ②	1,700	24,000	41,000 ②	1,700
Israel								
Italy	1985	1995	712,447	1,428,742	71,630	557,000	876,744	31,974
Latvia	1988	1997	432,000	502,000	7,000	354,240	409,260	5,502
Liechtenstein	1975	1995	1,570	1,750	9	1,260	1,400	7
Lithuania	1987	1996	326,820	362,637	3,582	271,260	314,355	4,309
Luxembourg	1985	1997	20,377	20,217 ②	160	20,377	20,217 ②	160
Malta		1996		80			0	
Netherlands ©	1988-92	1991-95	52,191	54,209	672	50,070	52,088	672
Norway	1980-86	1994-96	621,332	771,448	11,547	534,717	671,412	10,515
Poland	1987-91	1992-96	1,797,258	1,908,019	22,152	1,690,298	1,771,042	16,149
Portugal ©	1985	1995	201,021	275,760	7,474	144,153	188,020	4,386
Romania								
Slovakia ©	1988	1996	413,945	510,948	12,125	368,204	445,547	9,668
Slovenia ©	1986	1996	208,500	310,577	10,208	202,200	292,491	9,029
Spain	1970	1990	456,721	594,111	6,870	411,049	486,815	3,788
Sweden ©	1985-89	1992-96	2,715,115	2,928,117	30,429	2,389,748	2,566,532	25,255
Switzerland ©	1983-85	1993-95	361,286	395,450 ②	3,383	320,605	354,050 ②	3,311
The FYR of Macedonia ©	1990	1995		63,420			44,000	
Turkey	196-72	1973-96	1,044,602	1,349,323	12,697	1,032,352	1,187,309	6,457
United Kingdom ©	1980	1995	241,000	317,000	5,067	217,000	293,000	5,067
Yugoslavia ©	1979	1995	304,434	306,887 ②	-144	284,050	274,720 ②	-549
Total: Europe								
of which: EU 15				**14,817,261**			**13,419,213**	
Armenia	1988	1996	39,900	42,740	355	2,600	3,900	160
Azerbaijan ©	1983	1988	119,000	127,440	1,688	25,010	26,000	198
Belarus	1988	1994	891,230	1,092,550 ②	33,553	720,130	909,250 ②	31,520
Georgia ©	1990	1995	421,190	434,000	2,562	84,200	86,800	520
Kazakhstan	1988	1993	354,030	369,810	3,156	354,030	369,810	3,156
Kyrgyzstan								
Republic of Moldova	1988	1997	35,290	41,600	631	20,690	25,900	521
Russian Federation ©	1988	1993	86,053,552	85,486,752	-113,360	61,768,856	60,922,156	-169,340
Tajikistan ©	1988	1995	5,200	5,620	60	0	0	0
Turkmenistan ©	1990	1995	14,100	14,100	0	13,705	13,705	0
Ukraine	1988	1996	1,319,700	1,695,912	47,026	894,630	1,110,470	26,980
Uzbekistan ©	1988	1995	11,000	19,624 ②	1,078			
Total: CIS								
Canada ©	1980	1994	28,294,000	29,364,059	76,400	16,722,000	17,354,560	45,200
United States of America ©	1987	1992	28,754,000	29,656,000	180,400	26,225,000	27,035,000	162,000
Total: North America								
Australia ©		1994		8,635,115			644,683	
Japan	1986	1995	2,862,330	3,483,234 ②	68,989	2,862,330	3,483,234 ②	68,989
New Zealand ©	1986	1996	2,428,016	2,553,000	12,498	244,675	369,659	12,498
Total: Other TBFRA								
Grand total								

© See notes and comments in Chapter III.

② The data for "Reference period 2" in this table might be different than in ***Enquiry Table 14*** "Total woody biomass and volume of growing stock", on comparing with "Trees on Forest, total (item 14.1) and "Trees on forest available for wood supply (item 14.5A)".

TABLE 38

Changes over time in growing stock on forest available for wood supply by species groups

Country	Reference period 1	Reference period 2	Coniferous			Broadleaved		
			Reference period 1	Reference period 2	Average annual change	Reference period 1	Reference period 2	Average annual change
			(1000 m^3 overbark)		(1000 m^3 o.b./year)	(1000 m^3 overbark)		(1000 m^3 o.b./year)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania	1957	1995	10,783	16,155	138	69,684	57,479	-313
Austria	1986-90	1992-96	840,597	849,309	1,452	179,524	187,998	1,412
Belgium	1982	1997	56,335	64,335	533	64,910	75,500	706
Bosnia and Herzegovina	1990	1995						
Bulgaria	1985	1995	143,661	162,617	1,896	206,086	238,524	3,244
Croatia	1986	1996	46,910	46,416	-49	263,773	291,284	2,751
Cyprus	1981	1991	3,123	3,055	-7	0	0	0
Czech Republic	1986	1995	536,808	560,729	2,392	85,909	107,513	2,160
Denmark	1980	1990	22,800	31,400	860	20,400	23,800	340
Estonia	1988	1996	175,030	194,413	2,423	74,200	112,707	4,813
Finland	1980-89	1991-96	1,406,000	1,529,000	12,950	307,000	338,000	3,250
France	1987	1997	870,733	1,015,083	14,435	1,619,023	1,820,572	20,155
Germany	1961	1987		1,940,000	24,000		880,000	11,000
Greece		1992		78,300			61,500	
Hungary	1990	1996	39,337	44,916	930	234,852	250,385	2,589
Iceland	1990-1990	1998-1998	182	210	4	156	160	1
Ireland	1987	1996	23,500	39,500	1,600	500	1,500	100
Israel								
Italy	1985	1995	201,401	287,927	8,653	355,599	588,817	23,322
Latvia	1988	1997	209,000	242,205	3,320	145,240	167,055	2,182
Liechtenstein	1975	1995	900	1,000	5	360	400	2
Lithuania	1987	1996	156,920	186,470	2,954	114,340	127,885	1,355
Luxembourg	1985	1997						
Malta		1996			0			
Netherlands	1988-92	1991-95	28,011	28,594	195	22,059	23,494	477
Norway	1980-86	1994-96	440,470	533,923	7,189	94,247	137,489	3,326
Poland	1987-91	1992-96	1,339,487	1,403,202	12,743	350,811	367,841	3,406
Portugal	1985	1995	116,188	140,871	2,468	27,965	47,149	1,918
Romania								
Slovakia	1988	1996	183,522	213,576	3,757	184,682	231,971	5,911
Slovenia	1986	1996	105,100	145,660	4,056	97,100	146,831	4,973
Spain	1970	1990	244,490	284,882	2,020	166,559	201,933	1,768
Sweden	1985-89	1992-96	2,038,090	2,188,639	21,507	351,658	377,893	3,748
Switzerland	1983-85	1993-95	228,490	246,284	1,762	92,115	107,766	1,550
The FYR of Macedonia	1990	1995						
Turkey	1963-72	1973-96	649,726	776,132	5,267	382,626	411,177	1,190
United Kingdom	1980	1995	116,000	188,000	4,800	101,000	105,000	267
Yugoslavia	1979	1995	72,737	52,135	-1,212	211,313	222,585	663
Total: Europe								
of which: EU 15								
Armenia	1988	1996	0	0	0	2,600	3,900	160
Azerbaijan	1983	1988	340	350	2	24,670	25,990	264
Belarus	1988	1994	505,830	641,380	22,591	214,300	267,870	8,928
Georgia	1990	1995	25,300	26,100	160	58,900	60,700	360
Kazakhstan	1988	1993	221,180	230,040	1,772	115,570	117,880	462
Kyrgyzstan								
Republic of Moldova	1988	1997	120	150	3	20,570	25,750	518
Russian Federation	1988	1993	45,674,209	44,641,235	-206,595	16,094,650	16,280,920	37,255
Tajikistan	1988	1995	0	0	0	0	0	0
Turkmenistan	1990	1995	817	817	0	12,888	12,888	0
Ukraine	1988	1996						
Uzbekistan	1988	1995						
Total: CIS								
Canada	1980	1994	12,310,000	12,772,573	33,000	4,412,000	4,581,987	12,200
United States of America	1987	1992	14,966,000	14,874,000	-18,400	11,259,000	12,161,000	180,400
Total: North America								
Australia		1994		129,676			515,007	
Japan	1986	1995	1,785,839	2,310,521	58,298	1,076,491	1,172,713	10,691
New Zealand	1986	1996	240,399	363,310	12,291	4,276	6,349	207
Total: Other TBFRA								
Grand total								

TABLE 39

Volume of dead trees in standing volume

Country	Total	On forest			On other wooded land and trees outside the forest
		Total	Available for wood supply	Not available for wood supply	
	(1000 m^3 o.b.)				
(1)	(2)	(3)	(4)	(5)	(6)
Albania ©	490	490	467	61	
Austria ©	23,000	23,000	18,000	5,000	
Belgium					
Bosnia and Herzegovina					
Bulgaria ©		1,238	1,058	180	
Croatia ©	1,967	1,967	1,688	279	
Cyprus			20		
Czech Republic ©	17,085	17,085	16,700	385	
Denmark ©	1,300	650	550	100	
Estonia	4,435	4,435	4,270	165	
Finland	39,000	38,000	31,000	7,000	
France ©	17,872	17,872	17,521	351	
Germany					
Greece ©	2,380	2,380	2,190	190	
Hungary ©	9,125	9,125	8,563	562	
Iceland ©	0	0	0	0	
Ireland					
Israel					
Italy					
Latvia		12,048	9,822	2,226	
Liechtenstein	7	7	6	1	
Lithuania	8,900	8,900	7,530	1,370	
Luxembourg		140	140	0	
Malta			0		
Netherlands ©	1,306	1,306	1,264	42	
Norway ©	42,145	38,016	30,381	7,635	
Poland ©	24,804	24,804	23,024	1,781	
Portugal ©	14,358	13,610	1,172	12,438	
Romania					
Slovakia ©	638	638	378	260	
Slovenia ©	6,800	6,393	5,850	543	
Spain ©	11,882	11,882	9,736	2,145	
Sweden ©	77,532	73,340	55,069	18,271	4,192
Switzerland ©	13,063	13,063	10,624	2,439	
The FYR of Macedonia					
Turkey ©		12,818			
United Kingdom ©	1,000	1,000	500	500	
Yugoslavia ©		97,546	87,274	8,464	2,256
Total: Europe					
of which: EU 15					
Armenia	1,550	1,550	160	1,390	
Azerbaijan	3,059	3,059	624	2,363	0
Belarus	18,200	18,200	14,400	3,800	
Georgia					
Kazakhstan					
Kyrgyzstan			0		
Republic of Moldova	210	210	140	70	
Russian Federation ©	4,663,500	3,163,500	2,193,000	970,500	150,000
Tajikistan			0		
Turkmenistan					
Ukraine	8,340	8,300	4,100	4,200	
Uzbekistan			0		
Total: CIS					
Canada					
United States of America ©	787,000	574,000	523,000	51,000	
Total: North America					
Australia					
Japan					
New Zealand					
Total: Other TBFRA					
Grand total					

© See notes and comments in Chapter III.

TABLE 40

Total woody biomass

Country	Total woody biomass	Above-stump biomass					Stumps and roots
		Total		Trees on forest	Other trees	Other woody biomass	
		biomass	Share of total woody biomass				
	(1000 m.t. oven-dry)		(per cent)	(1000 m.t. oven-dry)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Albania ©	68,741	59,757	86.9	59,757	0	0	8,984
Austria ©	1,160,710	967,258 ①	83.3	958,093	8,250	915	193,452
Belgium ©	78,332	65,519	83.6	65,519			12,813
Bosnia and Herzegovina							
Bulgaria ©	325,505	271,255	83.3	271,230	25		54,250
Croatia ©	230,554	194,767 ①	84.5	189,322		5,445	35,787
Cyprus				2,500			
Czech Republic ©	418,213	332,813	79.6	328,598	1,715	2,500	85,400
Denmark ©	39,165	29,165	74.5	25,665	1,500	2,000	10,000
Estonia	202,505	176,365 ①	87.1	171,500	4,260	605	26,140
Finland	1,294,031	1,104,499	85.4	1,086,797	12,207	5,495	189,532
France ©	1,677,095	1,466,998 ①	87.5	1,401,100	31,920	33,978	210,097
Germany ©	1,840,000	1,440,000	78.3	1,440,000	0	0	400,000
Greece ©	104,072	86,727	83.3	84,455	2,272		17,345
Hungary ©	256,382	213,652	83.3	203,352	10,300		42,730
Iceland ©	830	690	83.1	495	195		140
Ireland ©	17,400	14,500	83.3	14,500			2,900
Israel							
Italy	818,566	781,819 ①	95.5	731,507	45,983	4,329	36,747
Latvia	355,193	291,285	82.0	268,685	21,400	1,200	63,908
Liechtenstein	1,020	820	80.4	820			200
Lithuania	236,610	202,230	85.5	195,400	6,050	780	34,380
Luxembourg							
Malta	113	98	87.0				15
Netherlands ©	58,573	43,997 ①	75.1	36,360	7,637	0	14,576
Norway ©	531,219	454,363 ①	85.5	424,678	29,685		76,856
Poland ©	1,012,931	878,717 ①	86.7	841,375	37,342	0	134,214
Portugal ©	192,079	122,822 ①	63.9	110,331	7,984	4,507	69,257
Romania				782,975			
Slovakia ©	334,032	291,207 ①	87.2	285,497		5,710	42,825
Slovenia ©	234,920	206,956 ①	88.1	195,342	5,234	6,380	27,964
Spain ©	373,383	326,669	87.5	326,536	163		46,714
Sweden ©	2,091,927	1,776,676	84.9	1,729,948	45,728	1,000	315,251
Switzerland ©	280,282	207,963	74.2	193,763	11,000	3,200	72,319
The FYR of Macedonia							
Turkey ©	943,152	806,786	85.5	734,018	72,768		136,366
United Kingdom ©	264,000	220,000 ①	83.3	188,000	27,000	5,000	44,000
Yugoslavia ©		69,012		66,774	1,545	693	
Total: Europe							
of which: EU 15							
Armenia	26,630	22,630 ①	85.0	21,900	330	400	4,000
Azerbaijan	115,830	98,580	85.1	98,580	0	0	17,250
Belarus	760,021	632,941 ①	83.3	631,715	566	660	127,080
Georgia ©	334,397	290,780	87.0	290,780	0		43,617
Kazakhstan	212,641	184,905	87.0	184,905			27,736
Kyrgyzstan							
Republic of Moldova	24,840	21,600	87.0	20,800	800	650	3,240
Russian Federation ©	79,262,750	60,771,000 ①	76.7	45,482,000	8,539,000	6,750,000	18,491,750
Tajikistan ©	4,680	3,900	83.3	3,900			780
Turkmenistan ©	12,115	10,000	82.5	9,588	0		2,115
Ukraine							
Uzbekistan							
Total: CIS							
Canada ©	23,782,119	20,240,101	85.1	20,240,101			3,542,018
United States of America ©	37,254,000	33,048,000	88.7	23,492,000	8,734,000	822,000	4,206,000
Total: North America	**61,036,119**	**53,288,101**	**87**	**43,732,101**			**7,748,018**
Australia ©	10,768,028	8,973,357 ①	83.3	8,973,357			1,794,671
Japan ©	2,553,167	2,127,639 ①	83.3	2,126,872	767		425,528
New Zealand ©	2,176,250	1,742,250	80.1	1,725,000	17,250		434,000
Total: Other TBFRA	**15,497,445**	**12,843,246**	**82.9**	**12,825,229**			**2,654,199**
Grand total							

© See notes and comments in Chapter III.

① Adjustment to achieve conformity with TBFRA definitions arrived at by the National Correspondent.

TABLE 41

Above-stump woody biomass of trees on forest

Country	Forest						Forest available for wood supply	Forest not available for wood supply
	Coniferous			Broadleaved				
	Biomass	Share of total	Ratio: Biomass/ Growing stock	Biomass	Share of total	Ratio: Biomass/ Growing stock		
	(1000 m.t. oven-dry)	(per cent)	(m.t. oven-dry/ m³ o.b.)	(1000 m.t. oven-dry)	(per cent)	(m.t. oven-dry/ m³ o.b.)	(1000 m.t. oven-dry)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	11,338	19.0	0.60	48,419	81.0	0.75	52,280	7,477
Austria ©	769,155	80.3	0.85	188,938	19.7	1.01	904,468	53,625
Belgium ©	25,377	38.7	0.39	40,142	61.3	0.52	64,913	606
Bosnia and Herzegovina								
Bulgaria ©	87,382	32.2	0.45	183,848	67.8	0.67	233,577	37,653
Croatia ©	20,601	10.9	0.40	168,721	89.1	0.55	179,638	9,684
Cyprus ©	2,400	96.0	0.50	100	4.0	0.50	1,457	
Czech Republic ©	258,249	78.6	0.45	70,349	21.4	0.64	321,136	7,462
Denmark ©	12,520	48.8	0.40	13,145	51.2	0.55	25,260	405
Estonia	102,100	59.5	0.51	69,400	40.5	0.60	167,400	4,100
Finland	842,761	77.5	0.53	223,882	20.6	0.64	1,042,970	43,827
France ©	411,438	29.4	0.40	989,662	70.6	0.53	1,377,809	23,291
Germany ©	985,000	68.4	0.50	455,000	31.6	0.50	1,410,000	30,000
Greece ©	38,825	46.0	0.46	45,630	54.0	0.68	77,810	6,645
Hungary ©	23,304	11.5	0.50	180,048	88.5	0.67	190,824	12,528
Iceland ©	125	25.3	0.54	370	74.7	0.65	215	280
Ireland ©	13,200	91.0	0.33	1,300	9.0	0.33	14,200	300
Israel								
Italy	198,005	27.1	0.42	533,502	72.9	0.56	448,887	282,620
Latvia	145,903	54.3	0.48	122,782	45.7	0.62	218,954	49,731
Liechtenstein	520	63.4	0.40	300	36.6	0.67	665	155
Lithuania	105,800	54.1	0.48	89,600	45.9	0.63	169,200	26,200
Luxembourg								
Malta							0	
Netherlands ©	18,215	50.1	0.61	18,145	49.9	0.74	34,933	1,427
Norway ©	302,952	71.3	0.51	121,726	28.7	0.69	365,579	59,099
Poland ©	612,553	72.8	0.41	228,822	27.2	0.58	780,972	60,402
Portugal ©	40,264	36.5	0.27	70,067	63.5	0.55	63,755	46,133
Romania ©	248,672	31.8	0.47	534,303	68.2	0.65		
Slovakia ©	109,845	38.5	0.46	175,652	61.5	0.65	248,953	36,544
Slovenia ©	79,345	40.6	0.51	115,997	59.4	0.74	183,965	11,377
Spain ©	185,294	56.7	0.51	141,242	43.3	0.61	268,881	57,664
Sweden ©	1,422,082	82.2	0.58	307,866	17.8	0.67	1,490,982	238,966
Switzerland ©	116,246	60.0	0.41	77,517	40.0	0.68	174,046	19,717
The FYR of Macedonia								
Turkey ©	442,411	60.3	0.50	291,607	39.7	0.64	646,870	87,148
United Kingdom ©	82,000	43.6	0.43	106,000	56.4	0.83	168,000	20,000
Yugoslavia ©	3,132	4.7	0.05	63,642	95.3	0.24	59,740	5,078
Total: Europe								
of which: EU 15								
Armenia	410	1.9	0.52	21,490	98.1	0.51	1,960	19,940
Azerbaijan	262	0.3	0.75	98,318	99.7	0.77	9,750	36,915
Belarus	411,555	65.1	0.49	220,160	34.9	0.62	505,770	125,945
Georgia ©	78,120	26.9	0.60	212,660	73.1	0.70	59,000	231,780
Kazakhstan	114,052	61.7	0.47	70,853	38.3	0.55	173,960	
Kyrgyzstan								
Republic of Moldova	150	0.7	0.50	20,650	99.3	0.50	12,950	7,850
Russian Federation ©	36,807,000	80.9	0.54	8,675,000	19.1	0.51	32,286,000	13,196,000
Tajikistan ©	1,700	43.6	0.54	2,200	56.4	0.89	0	3,900
Turkmenistan ©	504	5.3	0.60	9,282	96.8	0.70	9,320	268
Ukraine								
Uzbekistan							0	
Total: CIS								
Canada ©	15,490,711	76.5	0.68	4,749,390	23.5	0.71	11,969,513	8,270,588
United States of America ©	11,144,000	47.4	0.68	12,348,000	52.6	0.93	21,416,000	2,077,000
Total: North America	**26,634,711**	**50.0**	**0.68**	**17,097,390**	**32.1**	**0.85**	**33,385,513**	**10,347,588**
Australia ©	124,684	1.4	0.60	8,848,673	98.6	1.05	618,563	8,354,794
Japan ©	1,208,096	56.8	0.52	918,776	43.2	0.78	2,039,843	87,029
New Zealand ©	429,000	24.9	0.66	1,296,000	75.1	0.68	232,000	1,493,000
Total: Other TBFRA	**1,761,780**	**13.7**	**0.56**	**11,063,449**	**86.1**	**0.96**	**2,890,406**	**9,934,823**
Grand total								

© See notes and comments in Chapter III.

TABLE 42

Gross and net annual increment: general data

Country	Reference period	Gross annual increment				Net annual increment			
		Total	Forest	Other wooded land	Trees outside the forest	Total	Forest	Other wooded land	Trees outside the forest
		(1000 m^3 o.b.)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Albania ©	1995	1,363	1,363	0	0	1,004	1,004	0	0
Austria	1992-96	29,733	29,433	200	100	28,137	27,837	200	100
Belgium ©	1982-97	5,176	5,176	0		5,176	5,176	0	
Bosnia and Herzegovina ©	1995					5,480	5,480		
Bulgaria	1995	12,311	12,310		1	11,973	11,972		1
Croatia ©	1986-96	9,651	9,651		0	7,543	7,423	120	0
Cyprus ©	1980-90					100	90	10	
Czech Republic ©	1995	23,056	22,915	0	141	20,856	20,715	0	141
Denmark ©	1990	3,770	3,520	250	0	3,450	3,200	250	0
Estonia	1996	10,110	9,830	160	120	7,677	7,452	130	95
Finland ©	1991-96	75,974	74,970	282	722	74,516	73,666	150	700
France ©	1997	102,215	102,096	0	119	93,330	93,211	0	119
Germany ©	1995-2020	102,736	100,722	0	2,014	92,462	90,649	0	1,813
Greece ©	1992	4,193	4,118	75		3,882	3,813	69	
Hungary ©	1996	12,093	11,493	0	600	10,884	10,344	0	540
Iceland ©	1998	67	58	9	0	67	58	9	0
Ireland ©	1996	3,500	3,500			3,500	3,500		
Israel ©	1997	404	380	24		404	380	24	
Italy	1995	32,526	30,822	0	1,704	32,211	30,507	0	1,704
Latvia	1996	17,800	16,500	500	800	14,410	13,200	450	760
Liechtenstein	1995	28	28			25	25		
Lithuania	1996	12,844	12,260	324	260	10,263	9,808	252	203
Luxembourg	1985-97					667	667		
Malta	1996							0	
Netherlands ©	1991-95	3,158	2,538	0	620	2,917	2,328	0	589
Norway ©	1994-96	27,370	26,209	1,161	0	25,223	24,391	832	0
Poland ©	1992-96	57,984	55,879	0	2,105	44,976	42,871	0	2,105
Portugal	1995	15,926	15,005	218	703	15,195	14,312	213	670
Romania ©	1984		34,650				31,878		
Slovakia ©	1996	15,929	15,929			13,858	13,858		
Slovenia ©	1996	7,120	7,064	46	10	6,395	6,339	46	10
Spain ©	1990	30,135	30,120	15		30,108	30,092	15	
Sweden ©	1992-96	103,415	101,458	991	966	95,822	94,122	760	940
Switzerland ©	1985-95	10,107	9,831	276		9,124	8,848	276	
The FYR of Macedonia ©	1995	1,010	1,010			1,010	1,010		
Turkey	1996	46,886	38,485	3,854	4,547	45,002	36,601	3,854	4,547
United Kingdom ©	1995	15,390	14,810	5	575	15,270	14,690	5	575
Yugoslavia ©	1995	7,619	7,619	0	0	6,858	6,858	0	0
Total: Europe									
of which: EU 15						**496,643**	**487,770**		
Armenia	1996	464	400	44	20	416	360	39	17
Azerbaijan	1988	1,682	1,682	6	0	1,440	1,440	5	0
Belarus	1994	36,866	36,866	0	0	24,960	24,960	0	0
Georgia	1995					4,000	4,000	0	
Kazakhstan	1993	6,379	6,140	239	0	6,379	6,140	239	0
Kyrgyzstan									
Republic of Moldova	1997	1,206	1,140	66	0	1,095	1,035	60	0
Russian Federation ©	1993	1,803,100	1,328,100	225,000	250,000	1,284,000	969,000	150,000	165,000
Tajikistan ©	1995	90	82	8	0	90	82	8	0
Turkmenistan ©	1995					130	122	0	
Ukraine	1996	34,960	33,757	10	1,193	31,470	30,357	10	1,103
Uzbekistan	1988								
Total: CIS									
Canada ©	1994					442,030	442,030	0	
United States of America ©	1987-92	1,309,000	954,000	355,000	0	1,044,000	761,000	283,000	0
Total: North America						**1,486,030**	**1,203,030**	**283,000**	
Australia ©	1994	88,110	88,110			88,110	88,110		
Japan ©	1990-95	69,205	69,205	3		69,205	69,205	3	
New Zealand ©	1996					34,200	33,700	500	0
Total: Other TBFRA						**191,515**	**191,015**		
Grand total									

© See notes and comments in Chapter III.

TABLE 43

Gross annual increment on forest by species groups

Country	Forest		Forest available for wood supply			Forest not available for wood supply		
	Coniferous	Broadleaved	Total	Coniferous	Broadleaved	Total	Coniferous	Broadleaved
				(1000 m^3 o.b.)				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	296	1,067	1,205	255	950	158	41	117
Austria	23,703	5,730	28,933	23,203	5,730	500	500	0
Belgium ©	3,369	1,807	5,137	3,359	1,778	39	10	29
Bosnia and Herzegovina								
Bulgaria	6,232	6,078	10,523	5,235	5,288	1,787	997	790
Croatia ©	1,148	8,503	9,171	1,062	8,109	480	86	394
Cyprus ©			47	47	0			
Czech Republic ©	19,231	3,684	22,555	18,929	3,626	360	302	58
Denmark ©	2,420	1,100	3,520	2,420	1,100	0	0	0
Estonia	5,790	4,040	9,440	5,520	3,920	390	270	120
Finland ©	58,573	16,397	73,753	57,654	16,099	1,217	919	298
France ©	44,306	57,790	100,454	43,595	56,859	1,642	711	931
Germany ©	71,889	28,833	98,887	70,579	28,308	1,835	1,310	525
Greece ©	2,178	1,940	3,800	2,000	1,800	318	178	140
Hungary ©	2,019	9,474	11,028	1,960	9,068	465	59	406
Iceland ©	40	18	37	32	5	21	8	13
Ireland ©	3,420	80	3,450	3,400	50	50	20	30
Israel ©	214	166	280	160	120	100	54	46
Italy	10,074	20,748	19,028	6,213	12,815	11,794	3,861	7,933
Latvia	9,590	6,910	13,811	8,027	5,784	2,689	1,563	1,126
Liechtenstein	18	10	20	13	7	8	5	3
Lithuania	7,540	4,720	10,629	6,665	3,964	1,631	875	756
Luxembourg								
Malta								
Netherlands ©	1,304	1,234	2,409	1,240	1,169	129	64	65
Norway ©	20,067	6,142	23,662	18,630	5,032	2,547	1,437	1,110
Poland ©	45,973	9,906	51,867	42,672	9,195	4,012	3,301	711
Portugal	8,719	6,286	13,523	8,265	5,258	1,482	454	1,028
Romania ©	12,190	22,460						
Slovakia ©	7,648	8,281	14,180	6,715	7,465	1,749	933	816
Slovenia ©	3,335	3,729	6,852	3,244	3,608	212	91	121
Spain ©	17,580	12,540	28,614	16,701	11,913	1,506	879	627
Sweden ©	83,682	17,776	91,670	76,516	15,154	9,788	7,166	2,622
Switzerland ©	6,558	3,273	9,062	5,935	3,127	769	623	146
The FYR of Macedonia								
Turkey	23,639	14,846	34,177	20,752	13,425	4,308	2,887	1,421
United Kingdom ©	12,860	1,950	14,710	12,850	1,860	100	10	90
Yugoslavia ©	1,329	6,290	6,827	1,037	5,789	792	292	501
Total: Europe								
of which: EU 15								
Armenia	80	320	40	0	40	360	80	280
Azerbaijan	24	1,658	273	40	234	1,403	-16	1,425
Belarus	23,703	12,713	36,416	23,703	12,713	450	0	0
Georgia								
Kazakhstan	2,520	3,360	3,519	2,281	978	2,621	239	2,382
Kyrgyzstan								
Republic of Moldova	7	1,133	638	3	635	502	4	498
Russian Federation ©	957,600	370,500	1,002,000	642,600	359,400	326,100	315,000	11,100
Tajikistan ©	41	41	0	0	0	82	41	41
Turkmenistan								
Ukraine			23,380			10,377		
Uzbekistan								
Total: CIS								
Canada								
United States of America ©	529,000	425,000	870,000	483,000	387,000	84,000	46,000	38,000
Total: North America								
Australia ©	10,881	77,229	34,615	10,789	23,826	53,495	92	53,403
Japan ©	57,327	11,878	69,205	57,327	11,878		0	0
New Zealand								
Total: Other TBFRA								
Grand total								

© See notes and comments in Chapter III.

TABLE 44

Natural losses (annual) on forest

Country	Forest			Forest available for wood supply			Forest not available for wood supply		
	Total	Coniferous	Broadleaved	Total	Coniferous	Broadleaved	Total	Coniferous	Broadleaved
	(1000 m^3 o.b.)								
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Albania ©	359	63	296	310	59	251	49	4	45
Austria	1,596	1,277	319	1,596	1,277	319	0	0	0
Belgium									
Bosnia and Herzegovina									
Bulgaria	338	247	91	287 ①	207	79	51	39	12
Croatia ©	2,228	494	1,734	2,038	461	1,577	190	33	157
Cyprus ©				2	2	0			
Czech Republic ©	2,200	1,846	354	2,200	1,846	354	0	0	0
Denmark ©	320	220	100	320	220	100	0	0	0
Estonia	2,378	1,511	867	2,303 ①	1,455	848	75	56	19
Finland ©	1,304	1,024	280	1,283	1,008	275	21	16	5
France ©	8,885	4,373	4,512	8,155 ①	4,057	4,098	730	316	414
Germany ©	10,073	7,189	2,884	9,889	7,058	2,831	184	131	53
Greece ©	305	260	45	280	240	40	25	20	5
Hungary ©	1,149	404	745	1,103 ①	392	711	46	12	34
Iceland ©	0	0	0	0	0	0	0	0	0
Ireland									
Israel									
Italy	315	101	214	315 ①	101	214	0	0	0
Latvia	3,300	1,918	1,382	2,761	1,607	1,154	539	311	228
Liechtenstein	3	2	1	2	1	1	1	1	0
Lithuania	2,452	1,583	869	2,125	1,399	726	327	184	143
Luxembourg									
Malta									
Netherlands ©	210	115	95	204 ①	112	92	6	3	3
Norway ©	1,818	1,204	614	1,621 ①	1,118	503	197	86	111
Poland ©	13,008	10,056	2,952	12,431 ①	9,606	2,825	577	450	127
Portugal	693	396	297	623	375	248	70	21	49
Romania ©	2,772	975	1,797						
Slovakia ©	2,071	994	1,077	1,843 ①	873	970	228	121	107
Slovenia ©	725	345	380	720 ①	343	377	5	2	3
Spain ©	28	16	12	25 ①	15	10	3	1	2
Sweden ©	7,336	5,704	1,632	6,239	5,002	1,237	1,097	702	395
Switzerland ©	983	656	327	907	594	313	76	62	14
The FYR of Macedonia									
Turkey	1,884	1,243	641	1,658	1,094	564	226	149	77
United Kingdom ©	120	110	10	120 ①	110	10	0	0	0
Yugoslavia ©	762	133	629	682	103	579	80	30	50
Total: Europe									
of which: EU 15									
Armenia	40	10	30	4	0	4	36	10	26
Azerbaijan	242	6	236	36	3	33	206	3	203
Belarus	11,906	7,673	4,183	11,856	7,673	4,183	50	0	0
Georgia									
Kazakhstan	0	0	0	0	0	0	0	0	0
Kyrgyzstan									
Republic of Moldova	105	0	105	58	0	58	47	0	47
Russian Federation ©	359,100	273,600	85,500	260,000 ①	178,600	81,400	99,100	95,000	4,100
Tajikistan ©	0	0	0	0	0	0	0	0	0
Turkmenistan									
Ukraine	3,400			2,110 ①			1,290		
Uzbekistan									
Total: CIS									
Canada									
United States of America ©	193,000	106,000	87,000	176,000	97,000	79,000	17,000	9,000	8,000
Total: North America									
Australia									
Japan									
New Zealand									
Total: Other TBFRA									
Grand total									

© See notes and comments in Chapter III.

① Adjustment to achieve conformity with TBFRA definitions arrived at by the National Correspondent.

TABLE 45

Net annual increment on forest by species groups

Country	Forest		Forest available for wood supply			Forest not available for wood supply		
	Coniferous	Broadleaved	Total	Coniferous	Broadleaved	Total	Coniferous	Broadleaved
				(1000 m^3 o.b.)				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	233	771	895	196	699	109	37	72
Austria	22,426	5,411	27,337	21,926	5,411	500	500	0
Belgium ©	3,369	1,807	5,137	3,359	1,778	39	10	29
Bosnia and Herzegovina ©								
Bulgaria	5,985	5,987	10,236	5,028	5,209	1,736	958	778
Croatia ©	654	6,769	7,133	601	6,532	290	53	237
Cyprus ©	85	5	44	44	0		41	5
Czech Republic ©	17,385	3,330	20,355	17,083	3,272	360	302	58
Denmark ©	2,200	1,000	3,200	2,200	1,000	0	0	0
Estonia	4,279	3,173	7,137 ①	4,065	3,072	315	214	101
Finland ©	57,549	16,117	72,470	56,646	15,824	1,196	903	293
France ©	39,933	53,278	92,299 ①	39,538	52,761	912	395	517
Germany ©	64,700	25,949	88,998	63,521	25,477	1,651	1,179	472
Greece ©	1,918	1,895	3,520	1,760	1,760	293	158	135
Hungary ©	1,615	8,729	9,925 ①	1,568	8,357	419	47	372
Iceland ©	40	18	37	32	5	21	8	13
Ireland ©	3,420	80	3,450	3,400	50	50	20	30
Israel ©	214	166	280	160	120	100	54	46
Italy	9,973	20,534	18,713 ①	6,112	12,601	11,794	3,861	7,933
Latvia	7,672	5,528	11,050	6,420	4,630	2,150	1,252	898
Liechtenstein	16	9	18	12	6	7	4	3
Lithuania	5,957	3,851	8,504	5,266	3,238	1,304	691	613
Luxembourg			667					
Malta			0	0	0			
Netherlands ©	1,189	1,139	2,205 ①	1,128	1,077	123	61	62
Norway ©	18,863	5,528	22,041 ①	17,512	4,529	2,350	1,351	999
Poland ©	35,917	6,954	39,436 ①	33,066	6,370	3,435	2,851	584
Portugal	8,323	5,989	12,900	7,890	5,010	1,412	433	979
Romania ©	11,215	20,663						
Slovakia ©	6,654	7,204	12,337 ①	5,842	6,495	1,521	812	709
Slovenia ©	2,990	3,349	6,132 ①	2,901	3,231	207	89	118
Spain ©	17,564	12,528	28,589 ①	16,686	11,903	1,503	878	625
Sweden ©	77,978	16,144	85,431 ①	71,514	13,917	8,691	6,464	2,227
Switzerland ©	5,902	2,946	8,155	5,341	2,814	693	561	132
The FYR of Macedonia ©								
Turkey	22,395	14,206	32,519	19,658	12,861	4,082	2,737	1,345
United Kingdom ©	12,750	1,940	14,590 ①	12,740	1,850	100	10	90
Yugoslavia ©	1,196	5,662	6,145	934	5,210	713	262	452
Total: Europe								
of which: EU 15			**459,506**					
Armenia	70	290	36	0	36	324	70	254
Azerbaijan	21	1,420	234	34	200	1,201	-14	1,220
Belarus	16,030	8,530	24,560	16,030	8,530	400	0	0
Georgia	1,200	2,800	800	240	560	3,200	960	2,240
Kazakhstan	2,520	3,360	3,519	2,281	978	2,621	239	2,382
Kyrgyzstan								
Republic of Moldova	7	1,028	580	3	577	455	4	451
Russian Federation ©	684,000	285,000	742,000 ①	464,000	278,000	227,000	220,000	7,000
Tajikistan ©	41	41	0	0	0	82	41	41
Turkmenistan ©	7	115	119	7	112	3	0	3
Ukraine			21,270 ①			9,087		
Uzbekistan								
Total: CIS								
Canada ©	307,570	134,460	227,480 ①	158,280	69,200	214,550	149,290	65,260
United States of America ©	423,000	338,000	694,000	386,000	308,000	67,000	37,000	30,000
Total: North America	**730,570**	**472,460**	**921,480**	**544,280**	**377,200**	**281,550**	**186,290**	**95,260**
Australia ©	10,881	77,229	34,615	10,789	23,826	53,495	92	53,403
Japan ©	57,327	11,878	69,205 ①	57,327	11,878		0	0
New Zealand ©	33,100	600	33,700	33,100	600	0	0	0
Total: Other TBFRA	**101,308**	**89,707**	**137,520**	**101,216**	**36,304**		**92**	**53,403**
Grand total								

© See notes and comments in Chapter III.
① Adjustment to achieve conformity with TBFRA definitions arrived at by the National Correspondent.

TABLE 46

Net annual increment on forest available for wood supply: comparative data

Country	Net annual increment per hectare	Net annual increment as percent of growing stock			Species groups' share of total net annual increment	
		Total	Coniferous	Broadleaved	Coniferous	Broadleaved
	(m^3 o.b./ha)	(per cent)				
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Albania	0.99	1.2	1.2	1.2	21.9	78.1
Austria	8.16	2.6	2.6	2.9	80.2	19.8
Belgium	8.04	3.7	5.2	2.4	65.4	34.6
Bosnia and Herzegovina						
Bulgaria	3.28	2.6	3.1	2.2	49.1	50.9
Croatia	4.22	2.1	1.3	2.2	8.4	91.6
Cyprus	1.03	1.5	1.5		100.0	0.0
Czech Republic	7.95	3.0	3.0	3.0	83.9	16.1
Denmark	7.27	5.9	7.0	4.4	68.8	31.3
Estonia	3.69	2.3	2.1	2.7	57.0	43.0
Finland	3.51	3.9	3.7	4.7	78.2	21.8
France	6.38	3.3	3.9	2.9	42.8	57.2
Germany	8.78	3.2	3.3	2.9	71.4	28.6
Greece	1.14	2.5	2.2	2.9	50.0	50.0
Hungary	5.83	3.4	3.5	3.3	15.8	84.2
Iceland	2.64	10.0	15.2	3.1	86.5	13.5
Ireland	5.95	8.0	8.6	1.4	98.6	1.4
Israel	4.00	6.7	6.7	6.7	57.1	42.9
Italy	3.11	2.1	2.1	2.1	32.7	67.3
Latvia	4.58	2.7	2.7	2.8	58.1	41.9
Liechtenstein	4.50	1.3	1.2	1.5	66.7	33.3
Lithuania	5.04	2.7	2.8	2.5	61.9	38.1
Luxembourg	7.78	3.3				
Malta						
Netherlands	7.02	4.2	3.9	4.6	51.2	48.8
Norway	3.33	3.3	3.3	3.3	79.5	20.5
Poland	4.75	2.2	2.4	1.7	83.8	16.2
Portugal	6.80	6.9	5.6	10.6	61.2	38.8
Romania						
Slovakia	7.23	2.8	2.7	2.8	47.4	52.6
Slovenia	5.92	2.1	2.0	2.2	47.3	52.7
Spain	2.73	5.9	5.9	5.9	58.4	41.6
Sweden	4.02	3.3	3.3	3.7	83.7	16.3
Switzerland	7.69	2.3	2.2	2.6	65.5	34.5
The FYR of Macedonia						
Turkey	3.77	2.7	2.5	3.1	60.5	39.5
United Kingdom	6.92	5.0	6.8	1.8	87.3	12.7
Yugoslavia	2.58	2.1	1.7	2.2	15.2	84.8
Total: Europe						
of which: EU 15	**4.81**	**3.4**				
Armenia	1.71	0.9		0.9	0.0	100.0
Azerbaijan	1.53	0.9	11.0	0.8	14.5	85.5
Belarus	4.12	2.5	2.4	3.0	65.3	34.7
Georgia	1.35	0.9	0.9	0.9	30.0	70.0
Kazakhstan	0.71	1.0	1.0	0.8	64.8	27.8
Kyrgyzstan						
Republic of Moldova	2.75	2.2	2.0	2.2	0.5	99.5
Russian Federation	1.41	1.2	1.0	1.7	62.5	37.5
Tajikistan						
Turkmenistan	0.03	0.9	0.9	0.9	6.0	94.0
Ukraine	3.55	1.9				
Uzbekistan						
Total: CIS						
Canada	1.81	1.3	1.2	1.5	69.6	30.4
United States of America	3.50	2.6	2.6	2.5	55.6	44.4
Total: North America	**2.84**	**2.1**	**2.0**	**2.3**	**59.1**	**40.9**
Australia	2.11	5.4	8.3	4.6	31.2	68.8
Japan	2.97	2.1			82.8	17.2
New Zealand	18.21	9.1	9.1	9.5	98.2	1.8
Total: Other TBFRA	**3.31**	**3.1**			**73.6**	**26.4**
Grand total						

TABLE 47

Annual fellings overbark

Country	Reference period	Total fellings	Forest				Other wooded land	Trees outside forest
			Total	Forest available for wood supply		Forest not available for wood supply	Total	Total
				Total	For commercial use			
		(1000 m3 o.b.)						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	1995	740	740	677	432	63	0	0
Austria	1992-96	20,041	19,821	19,521	16,511	300	150	70
Belgium ©	1986-95	4,400	4,400	4,400	4,400	0	0	
Bosnia and Herzegovina ©	1995		1,200	1,200				
Bulgaria	1995	4,852	4,852	4,852	3,327	0	0	0
Croatia	1986-96	4,600	4,600	4,600	4,400	0	0	0
Cyprus ©	1986-95	60	50	50	50		10	
Czech Republic ©	1995	16,355 ①	16,345	16,200	16,200	145	0	10
Denmark ©	1996	2,444	2,194	2,194		0	250	0
Estonia	1996		4,028	4,028				
Finland ©	1991-96	54,300	54,300	54,300	47,700	0	0	0
France ©	1996	60,174 ①	60,174	60,174	47,403	0		
Germany ©	1996	48,584 ①	48,584	48,584			0	
Greece	1992							
Hungary ©	1996	6,449	6,049	5,880	5,406	170	0	400
Iceland	1996	0	0	0		0	0	0
Ireland ©	1996	2,330	2,330	2,330	2,330	0	0	
Israel	1997	120	120	120	120	0	0	0
Italy	1995	10,101 ①	8,746	8,746	8,746	0	0	1,355
Latvia ©	1996	8,150	8,010	6,570	5,070	1,440	60	80
Liechtenstein	1995	16	16	16	15	0	0	0
Lithuania	1992-96	5,750	5,570	5,240	3,380	330	130	50
Luxembourg	1992-94					0		
Malta	1996		0	0				
Netherlands ©	1991-95	2,150 ①	1,561	1,438	1,394	123	0	589
Norway ©	1994-96	11,632 ①	11,632	11,632	10,625	0	0	0
Poland ©	1992-96	32,212 ①	31,617	30,532	29,282	1,085		595
Portugal ©	1995	11,500	11,500	11,200	11,000	300		
Romania ©	1993-97		13,600					
Slovakia ©	1996	7,400 ①	7,400	7,100	6,900	300		
Slovenia ©	1996	2,300 ①	2,300	2,300		0	0	0
Spain ©	1994	15,863	12,639	11,028		1,611		3,224
Sweden ©	1992-96	67,766 ①	66,510	66,115	61,488	395	528	728
Switzerland ©	1985-95	7,451	7,451	7,076	6,085	375	0	
The FYR of Macedonia ©	1995	999	999	999				
Turkey	1996	22,150	17,606	17,380	17,380	226	0	4,544
United Kingdom ©	1995	9,500 ①	9,500	9,500	9,400	0	0	0
Yugoslavia ©	1991-95	3,476	3,454	3,082	3,082	372	0	22
Total: Europe								
of which: EU 15								
Armenia	1996	210	200	150	90	50	5	5
Azerbaijan ©	1988	60	60	0	0	0	0	0
Belarus	1996	9,550	9,550	9,450	1,490	100	0	0
Georgia ©	1995	500	500	500		0	0	0
Kazakhstan	1993	1,400	1,400	1,400		0	0	0
Kyrgyzstan								
Republic of Moldova ©	1997	483	483	483		0	0	0
Russian Federation ©	1995	150,200	150,200	125,500	90,500	24,700	0	0
Tajikistan ©	1995	10	10	0	0	10	0	0
Turkmenistan ©	1995	10	10	10		0	0	0
Ukraine	1996	11,600	11,300	8,500		2,800	0	300
Uzbekistan	1995							
Total: CIS								
Canada	1995							
United States of America ©	1992	708,000	523,000	523,000	452,000	0	185,000	0
Total: North America								
Australia	1994			19,560	19,560			
Japan	1995	29,000	29,000	29,000	29,000	0		
New Zealand ©	1996	22,730	22,730	22,730	22,730	0	0	0
Total: Other TBFRA				**71,290**	**71,290**			
Grand total								

© See notes and comments in Chapter III.

① Adjustment to achieve conformity with TBFRA definitions arrived at by the National Correspondent.

TABLE 48

Annual fellings overbark on forest by species groups

Country	Total forest			Forest available for wood supply				
				Coniferous		Broadleaved		Fellings of natural losses on forest available for wood supply
	Coniferous Total	Broadleaved Total	Fellings of natural losses	Total	For commercial use	Total	For commercial use	
	(1000 m^3 o.b.)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	84	656	52	80	80	597	352	51
Austria	16,432	3,389	1,596	16,132	14,265	3,389	2,246	1,596
Belgium ©	3,150	1,250		3,150	3,150	1,250	1,250	
Bosnia and Herzegovina								
Bulgaria	1,772	3,080	900	1,772	1,373	3,080	1,953	900
Croatia	700	3,900	500	700	700	3,900	3,700	500
Cyprus ©	50	0		50	50	0	0	
Czech Republic ©	14,940	1,405	2,200	14,810	14,810	1,390	1,390	2,200
Denmark ©	1,468	726	0	1,468		726		0
Estonia								
Finland ©	43,500	10,800	0	43,500	40,500	10,800	7,200	0
France ©	31,180	28,994	2,013	31,180	28,013	28,994	19,390	2,013
Germany ©	37,179	11,405		37,179		11,405		
Greece			401					
Hungary ©	799	5,250	552	777	633	5,103	4,773	537
Iceland	0	0	0	0		0		0
Ireland ©	2,295	35		2,295	2,295	35	35	
Israel	90	30		90	90	30	30	
Italy	1,824	6,922		1,824	1,824	6,922	6,922	
Latvia ©	4,470	3,540	1,440	3,610	2,970	2,960	2,100	1,100
Liechtenstein	12	4		12	11	4	4	
Lithuania	3,510	2,060	1,680	3,410	2,390	1,830	990	1,280
Luxembourg								
Malta	0			0				0
Netherlands ©	1,012	549	91	950	929	488	465	100
Norway ©	10,291	1,341	183	10,291	9,880	1,341	745	183
Poland ©	24,061	7,556	9,521	23,235	22,302	7,297	6,980	9,194
Portugal ©	6,200	5,300	100	6,200	6,000	5,000	5,000	200
Romania ©	5,000	8,600	2,400					
Slovakia ©	4,500	2,900	4,100	4,200	4,100	2,900	2,800	3,900
Slovenia ©	1,500	800	1,100	1,500		800		1,100
Spain ©	7,385	5,254		6,577		4,451		
Sweden ©	57,628	8,882	2,600	57,277	53,268	8,838	8,220	2,588
Switzerland ©	5,442	2,009	246	5,121	4,404	1,955	1,681	226
The FYR of Macedonia								
Turkey	9,992	7,614	1,884	9,843	9,843	7,537	7,537	1,658
United Kingdom ©	8,300	1,200	100	8,300	8,300	1,200	1,100	100
Yugoslavia ©	605	2,849	76	508	508	2,574	2,574	5
Total: Europe								
of which: EU 15								
Armenia	20	180	15	10	10	140	80	15
Azerbaijan ©	0	60	40	0	0	0	0	0
Belarus	6,500	3,050	2,580	6,500	650	3,050	840	2,510
Georgia								
Kazakhstan	600	800	500	600		800		500
Kyrgyzstan								
Republic of Moldova ©	3	480	196	3		480		196
Russian Federation ©	105,000	45,200	19,200	89,300	68,800	36,200	21,700	8,400
Tajikistan ©	0	10		0	0	0	0	
Turkmenistan								
Ukraine			2,000					1,200
Uzbekistan								
Total: CIS								
Canada								
United States of America ©	353,000	170,000	13,075	353,000	318,000	170,000	134,000	13,075
Total: North America								
Australia ©				8,703	8,703	10,857	10,857	
Japan	23,000	6,000		23,000	23,000	6,000	6,000	
New Zealand ©	22,320	410		22,320	22,320	410	410	
Total: Other TBFRA				**54,023**	**54,023**	**17,267**	**17,267**	
Grand total								

© See notes and comments in Chapter III.

TABLE 49

Annual removals overbark on forest

Country	Forest, total			Forest available for wood supply		
	Total	Coniferous	Broadleaved	Total	Coniferous	Broadleaved
	(1000 m^3 o.b.)					
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Albania ©	692	82	610	629	78	551
Austria	17,171	14,558	2,613	16,921	14,308	2,613
Belgium ©	4,400	3,150	1,250	4,400	3,150	1,250
Bosnia and Herzegovina						
Bulgaria	3,887	1,263	2,627	3,887	1,263	2,024
Croatia	4,300	700	3,600	4,300	700	3,600
Cyprus ©	48	48	0	48	48	0
Czech Republic ©	13,140	12,033	1,107	13,022	11,926	1,096
Denmark ©	2,194	1,468	726	2,194	1,468	726
Estonia						
Finland ©	49,500	40,800	8,700	49,500	40,800	8,700
France ©	47,611	22,910	24,701	47,611	22,910	24,701
Germany ©	38,867	29,743	9,124	38,867	29,743	9,124
Greece	2,408	625	1,783	2,408	625	1,783
Hungary ©	5,375	615	4,760	5,174	597	4,577
Iceland	0	0	0	0	0	0
Ireland ©	2,330	2,295	35	2,330	2,295	35
Israel						
Italy	8,381	1,682	6,699	8,381	1,682	6,699
Latvia ©	6,710	4,030	2,680	5,480	3,250	2,230
Liechtenstein	14	10	4	14	10	4
Lithuania	4,740	2,970	1,770	4,450	2,900	1,550
Luxembourg	360	180	180	360	180	180
Malta				0	0	
Netherlands ©	1,219	836	383	1,219	836	383
Norway ©	10,880	9,673	1,207	10,880	9,673	1,207
Poland ©	26,212	19,566	6,646	25,313	18,895	6,418
Portugal ©	11,400	6,100	5,300	11,000	6,100	4,900
Romania ©	13,600	5,000	8,600			
Slovakia ©	5,600	3,500	2,100	5,400	3,300	2,100
Slovenia ©	2,300	1,500	800	2,300	1,500	800
Spain						
Sweden ©	61,593	53,824	7,769	61,266	53,526	7,740
Switzerland ©	6,408	4,680	1,728	6,086	4,405	1,681
The FYR of Macedonia						
Turkey	16,436	9,606	6,830	16,210	9,457	6,753
United Kingdom ©	8,200	7,300	900	8,200	7,300	900
Yugoslavia ©	3,058	513	2,545	2,755	455	2,300
Total: Europe						
of which: EU 15						
Armenia	150	15	135	113	8	105
Azerbaijan ©	60	0	60	0	0	0
Belarus	9,550	6,500	3,050	9,450	6,400	3,050
Georgia						
Kazakhstan	1,400	600	800	1,400	600	800
Kyrgyzstan						
Republic of Moldova ©	353	3	350	353	3	350
Russian Federation ©	116,200					
Tajikistan						
Turkmenistan						
Ukraine						
Uzbekistan						
Total: CIS						
Canada ©	214,128	179,900	34,228	214,128	179,900	34,228
United States of America ©	452,000	318,000	134,000	452,000	318,000	134,000
Total: North America	**666,128**	**497,900**	**168,228**	**666,128**	**497,900**	**168,228**
Australia ©				19,560	8,703	10,857
Japan						
New Zealand ©	19,770	19,410	360	19,410	19,050	360
Total: Other TBFRA						
Grand total						

©See notes and comments in Chapter III.

TABLE 50

Annual removals underbark, total

Country	Total removals	Forest				Other wooded land	Trees outside forest
		Total	Forest available for wood supply		Forest not available for wood supply		
			Total	For commercial use			
		(1000 m^3 o.b.)					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Albania ©	623	623	566	387	57	0	0
Austria	13,886	13,736	13,536	11,506	200	100	50
Belgium ©	3,800	3,800	3,800	3,800	0	0	
Bosnia and Herzegovina							
Bulgaria	3,338	3,338	3,338		0	0	0
Croatia	3,700	3,700	3,700		0	0	0
Cyprus ©	51	41	41	41		10	
Czech Republic ©	12,375	12,365	12,255	12,255	110	0	10
Denmark ©	2,394	2,154	2,154		0	240	0
Estonia							
Finland ©	42,500	42,500	42,500	37,600	0	0	0
France ©	40,639 ①	40,639	40,639	29,461	0		
Germany ©	37,016	37,016	37,016			0	
Greece	2,007	2,007	2,007				
Hungary ©	5,159	4,839	4,704	4,335	135	0	320
Iceland	0	0	0		0	0	0
Ireland ©	2,097	2,097	2,097	2,097	0	0	
Israel					0	0	0
Italy	9,258 ①	7,973	7,973	7,973	0	0	1,285
Latvia ©	6,000	5,910	4,780	3,760	1,130	20	70
Liechtenstein	12	12	12		0	0	0
Lithuania	4,370	4,220	3,960	2,570	260	100	50
Luxembourg	330	330	330		0		
Malta		0	0				
Netherlands ©	1,407	1,064	994	964	70	0	343
Norway ©	9,340 ①	9,340	9,340	8,562	0	0	0
Poland ©	22,430 ①	22,027	21,271	20,272	756		403
Portugal ©	9,400	9,400	9,100	8,900	300		
Romania ©		12,104					
Slovakia ©	5,100 ①	5,100	4,900	4,900	200		
Slovenia ©	2,000 ①	2,000	2,000		0	0	0
Spain ©	14,185	12,631	11,022		1,609	1,554	
Sweden ©	55,420 ①	54,507	54,217	50,422	290	336	577
Switzerland ©	5,446	5,446	5,172	5,172	274	0	
The FYR of Macedonia ©	1,100	1,100	1,100				
Turkey	17,823	14,239	14,044	14,044	195	0	3,584
United Kingdom ©	7,300	7,300	7,300	7,200	0	0	0
Yugoslavia ©	2,758	2,741	2,470	2,466	270	0	18
Total: Europe							
of which: EU 15	**241,639**	**237,154**	**234,685**				
Armenia	143	135	102	61	33	4	4
Azerbaijan ©	60	60	0	0	0	0	0
Belarus							
Georgia ©	60	60	60		0	0	0
Kazakhstan	1,400	1,400	1,400	0	0	0	0
Kyrgyzstan							
Republic of Moldova ©	275	275	275		0	0	0
Russian Federation ©	103,800	103,800	86,600			0	
Tajikistan ©	1	1	0	0	0	0	0
Turkmenistan					0	0	0
Ukraine						0	
Uzbekistan							
Total: CIS							
Canada ©	188,433	188,433	188,433		0	0	
United States of America ©	507,000	398,000	398,000	349,000	0	109,000	0
Total: North America	**695,433**	**586,433**	**586,433**		**0**	**109,000**	
Australia ©			16,626				
Japan	23,000	23,000	23,000	23,000	0		
New Zealand ©	16,930	16,930	16,930	16,930	0	0	0
Total: Other TBFRA			**56,556**				
Grand total							

© See notes and comments in Chapter III.
① Adjustment to achieve conformity with TBFRA definitions arrived at by the National Correspondent.

TABLE 51

Annual removals underbark on forest by species groups

Country	Total forest		Forest available for wood supply			
	Coniferous	Broadleaved	Coniferous		Broadleaved	
	Total	Total	Total	For commercial use	Total	For commercial use
	(1000 m^3 o.b.)					
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Albania ©	74	549	70	70	496	317
Austria	11,646	2,090	11,446	10,121	2,090	1,385
Belgium ©	2,710	1,090	2,710	2,710	1,090	1,090
Bosnia and Herzegovina						
Bulgaria	1,063	2,275	1,063		2,275	
Croatia	600	3,100	600		3,100	
Cyprus ©	41	0	41	41	0	0
Czech Republic ©	11,308	1,057	11,209	11,209	1,046	1,046
Denmark ©	1,438	716	1,438		716	
Estonia						
Finland ©	35,100	7,400	35,100	32,600	7,400	5,000
France ©	18,637	22,002	18,637	16,103	22,002	13,358
Germany ©	28,327	8,689	28,327		8,689	
Greece	521	1,486	521		1,486	
Hungary ©	559	4,280	543	443	4,161	3,892
Iceland	0	0	0		0	
Ireland ©	2,065	32	2,065	2,065	32	32
Israel						
Italy	1,505	6,468	1,505	1,505	6,468	6,468
Latvia ©	3,530	2,380	2,850	2,380	1,930	1,380
Liechtenstein	9	3	9		3	
Lithuania	2,660	1,560	2,610	1,830	1,350	740
Luxembourg	170	160	170		160	
Malta	0		0			
Netherlands ©	705	359	669	654	325	310
Norway ©	8,339	1,001	8,339	8,006	1,001	556
Poland ©	16,442	5,585	15,878	15,132	5,393	5,140
Portugal ©	4,900	4,500	4,900	4,700	4,200	4,200
Romania ©	4,450	7,654				
Slovakia ©	3,200	1,900	3,000	3,000	1,900	1,900
Slovenia ©	1,300	700	1,300		700	
Spain ©	7,381	5,250	6,573		4,449	
Sweden ©	47,903	6,604	47,639	44,304	6,579	6,118
Switzerland ©	3,978	1,468	3,743	3,743	1,429	1,429
The FYR of Macedonia ©						
Turkey	8,141	6,098	8,014	8,014	6,030	6,030
United Kingdom ©	6,500	800	6,500	6,500	800	700
Yugoslavia ©	451	2,290	400	397	2,070	2,069
Total: Europe						
of which: EU 15	**169,508**	**67,646**	**168,200**		**66,486**	
Armenia	13	122	7	7	95	54
Azerbaijan ©	0	60	0	0	0	0
Belarus						
Georgia ©						
Kazakhstan	600	800	600	0	800	0
Kyrgyzstan						
Republic of Moldova ©	3	272	3		272	
Russian Federation ©	72,500	31,300	61,600		25,000	
Tajikistan ©	0	1	0	0	0	0
Turkmenistan						
Ukraine						
Uzbekistan						
Total: CIS						
Canada ©	158,311	30,122	158,311		30,122	
United States of America ©	279,000	119,000	279,000	265,000	119,000	84,000
Total: North America	**437,311**	**149,122**	**437,311**		**149,122**	
Australia ©			7,397		9,228	
Japan	18,000	5,000	18,000	18,000	5,000	5,000
New Zealand ©	16,590	340	16,590	16,590	340	340
Total: Other TBFRA			**41,987**		**14,568**	
Grand total						

© See notes and comments in Chapter III.

TABLE 52

Fellings and removals on forest available for wood supply: comparative data

Country	Fellings per hectare	Fellings as percent of net annual increment			Removals as percent of fellings	Bark percentage on removals	
		Total	Coniferous	Broadleaved		Coniferous	Broadleaved
	(m^3 o.b./ha)	(per cent)			(per cent)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Albania ©	0.75	75.6	40.8	85.4	92.9	10.3	10
Austria	5.82	71.4	73.6	62.6	86.7	20.0	20
Belgium ©	6.88	85.7	93.8	70.3	100.0	14.0	12.8
Bosnia and Herzegovina	0.92						
Bulgaria	1.55	47.4	35.2	59.1	80.1	15.8	
Croatia	2.72	64.5	116.5	59.7	93.5	14.3	13.9
Cyprus ©	1.16	112.6	112.6		96.0	14.2	
Czech Republic ©	6.33	79.6	86.7	42.5	80.4	6.0	4.6
Denmark ©	4.98	68.6	66.7	72.6	100.0	2.0	1.4
Estonia	2.08	56.4					
Finland ©	2.63	74.9	76.8	68.3	91.2	14.0	14.9
France ©	4.16	65.2	78.9	55.0	79.1	18.7	10.9
Germany ©	4.79	54.6	58.5	44.8	80.0	4.8	4.8
Greece						16.6	16.7
Hungary ©	3.45	59.2	49.6	61.1	88.0	9.0	9.1
Iceland	0.01	0.5	0.1	3.4	95.0	33.3	12.5
Ireland ©	4.02	67.5	67.5	70.0	100.0	10.0	8.6
Israel	1.71	42.9	56.3	25.0			
Italy	1.45	46.7	29.8	54.9	95.8	10.5	3.4
Latvia ©	2.72	59.5	56.2	63.9	83.4	12.3	13.5
Liechtenstein	4.00	88.9	100.0	66.7	87.5	10.0	25
Lithuania	3.11	61.6	64.8	56.5	84.9	10.0	12.9
Luxembourg						5.6	11.1
Malta							
Netherlands ©	4.58	65.2	84.2	45.3	84.8	20.0	15.1
Norway ©	1.76	52.8	58.8	29.6	93.5	13.8	17.1
Poland ©	3.68	77.4	70.3	114.6	82.9	16.0	16
Portugal ©	5.90	86.8	78.6	99.8	98.2	19.7	14.3
Romania ©							
Slovakia ©	4.16	57.6	71.9	44.6	76.1	9.1	9.5
Slovenia ©	2.22	37.5	51.7	24.8	100.0	13.3	12.5
Spain ©	1.05	38.6	39.4	37.4			
Sweden ©	3.11	77.4	80.1	63.5	92.7	11.0	15
Switzerland ©	6.68	86.8	95.9	69.5	86.0	15.0	15
The FYR of Macedonia ©	1.34						
Turkey	2.01	53.4	50.1	58.6	93.3	15.3	10.7
United Kingdom ©	4.51	65.1	65.1	64.9	86.3	11.0	11.1
Yugoslavia ©	1.30	50.2	54.4	49.4	89.4	12.1	10
Total: Europe							
of which: EU 15							
Armenia	7.14	416.7		388.9	75.3	12.5	9.5
Azerbaijan ©	0.00	0.0	0.0	0.0			
Belarus	1.58	38.5	40.5	35.8	100.0		
Georgia ©	0.85	62.5					
Kazakhstan	0.28	39.8	26.3	81.8	100.0	0.0	0
Kyrgyzstan							
Republic of Moldova ©	2.29	83.3	100.0	83.2	73.1	0.0	22.3
Russian Federation ©	0.24	16.9	19.2	13.0			
Tajikistan ©							
Turkmenistan	0.00	8.4					
Ukraine	1.42	40.0					
Uzbekistan							
Total: CIS							
Canada ©						12.0	12
United States of America ©	2.64	75.4	91.5	55.2	86.4	12.3	11.2
Total: North America							
Australia ©	1.19	56.5	80.7	45.6	100.0	15.0	15
Japan	1.25	41.9	40.1	50.5			
New Zealand ©	12.28	67.4	67.4	68.3	85.4	12.9	5.6
Total: Other TBFRA	**1.72**	**51.8**	**53.4**	**47.6**			
Grand total							

© See notes and comments in Chapter III.

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NOTES AND COMMENTS RELATING TO CHAPTER III

Main Tables	Comments

Albania

25-32

Enquiry Table 13: The data of 40, 000 ha for coniferous for even-age class "101 to 120 years" represent data for all even-age classes over 80 years. The high forests are going on to normalization of age classes; this is clear from the figures for coniferous, broadleaved groups and for total too.

33-36, 39-41

Enquiry Table 14: In comparison with figures for 1957 the trends for total and coniferous (respectively 80,467,000 m^3 in 1957 to 83,455,000 m^3 in 1995 and 10,783,000 m^3 in 1957 to 18,897,000 m^3 in 1995) and, for broadleaved (69,684,000 m^3 in 1957 to 64,558,000 m^3 in 1995) while for the years 1990 for total and broadleaved, respectively, decreased to 1992 and thereafter, increased to 1995 or 82,138,000 m^3 in 1990 to 81,142,000 m^3 in 1992 and to 83,455,000 m^3 in 1995; decreased to year 1992 and thereafter increased to year 1995 or 64,297,000 m^3 at year 1990 to 62,971,000 m^3 at year 1992 and to 64,558,000 m^3 in 1995); they increased for coniferous (17,841,000 m^3 in 1990 to 18,997,000 m^3 in 1995).

The volume of dead trees is approximately 0.6 per cent (or 489,700 m^3) of the total growing stock and mainly on forest available for wood supply (National Correspondent's estimation based on the figures of *Enquiry Table 20*).

Woody biomass is not estimated in Albania, but the National Correspondent has calculated the average specific gravity of wood oven-dry in temperature 105°C considering the part of each species in total growing stock (The specific gravity for each species the National Correspondent has received by a Italian Study-Fogii, Q-II peso del legnami-Arboricoltura da legno Pioppicoltura N.8. Agosto, 1973, p.192. Wood specific gravity-Arboricoltura de legno, Pioppicoltura N.8. Agosto, 1973, p.192).

The stump and the root biomass was calculated considering two Italian studies, one on "Net primary productivity of poplar stands" (A. Rossi Marcelli, G. Duranti & G. Giulimondi—"Net primary productivity of poplar stands"—Pubb. del Centr. di Sperim. Agr. e Forest, Vol. XIII-Fasc.3, Roma 1960); according to that, the stump and root biomass compose about 12.9 per cent of the total woody biomass, and another one, on "Dry matter production and nutrient contents of a 4-year Pinus radiata plantations" (Giulimondi, G & Dutanti, G. "Dry matter production and nutrient contents of 4-year *Pinus radiata* plantations"—Pubb. del Centr. di Sperim Agr. e. Forest Vol. XII-Fasc 1, Roma 1975); according to the dry matter of stump compose about 11.3 per cent (excluding the roots). The National Correspondent has used the rounded average figure of about 15 per cent.

42-46

Enquiry Table 15: Total natural losses compose about 26.3 per cent (or 359,000 m^3 of the gross annual increment, and the net annual increment about 73.7 per cent (or 1,004,000 m^3). The most natural losses and net annual increment are in the broadleaved forests, respectively about 82.5 per cent and 76.8 per cent. Also the most natural losses and the net annual increment are on forests available for wood supply respectively, about 86.4 per cent and 89.1 per cent.

In natural losses the National Correspondent has included also the removals by harvests and thinnings. In this way the net annual increment would be the increment remain in forests.

47-52

Enquiry Table 16: The most quantities of wood felled and removed have been in broadleaved forests (respectively 88.6 per cent and 88.2 per cent).

The figures of annual removals (u.b.) are National Correspondent's estimation, reducing annual overbark removals with 10 per cent. The fellings of natural losses compose about 7 per cent of total annual fellings; annual removals comprise about 93.5 per cent (o.b.) and 84.2 per cent (u.b.) of the annual fellings (the fellings of natural losses are for coniferous 32.1 per cent and broadleaved 3.8 per cent and annual removals 97.6 per cent and 93 per cent (o.b.) and 88 per cent and 83.7 per cent respectively).

In the annual fellings and removals, the National Correspondent has included the volume of wood felled and removed by illegal cuttings.

In the fellings of natural losses the National Correspondent has included the volume of wood removed by illegal cuttings which over the years 1991-1995 have been very high; from 1993 year to now they are falling. The following are the figures for wood volume for some years of this period that belong to the wood volume removed by illegal cuttings: 1991= 746,000 m^3, 1992=846,000 m^3; 1993=382,000 m^3; 1994=379,000 m^3 and so on.

Australia

25-32

Enquiry Table 13: Data in this table are based on the Montreal Report (table 1.1b), and NPI Report (page 10). More details can be found in these sources.

For Australia, the age-class classification for "Even-aged" is as follows and is different from the TBFRA-2000 classification:

Data presented under "11 to 20 years" represent for "11 to 30 years".
Data presented under "41 to 60 years" represent for "31 to 100 years".
Data presented under "101 to 120 years" represent for "100 to 200 years".
Data for "over 140 years" represent the age-class category of "over 200 years".
Uneven-aged--Predominantly broadleaved: Based on SOFR 1998, page 33, except cypress pine and other forests.

The figure of 16,397 for "Total" is from *Enquiry Table 4* "High forest and coppice", first row "Forest available for wood supply". We do not have disaggregated data by age class to fully tally to it. Where these data exist, they have been included in the table, hence the age classes do not total the total figure for forest available for wood supply.

Age classes have been modified to be the same as those used by SOFR, 1998

Uneven-age is a sum of the two (mixed) age and the three or more age categories used by the Montreal Report. Other forests have been categorised as "Mixed" for the purposes of this report (as they are a mix of *Callitris* and other eucalypts).

Data Source: SOFR 1998, page 33. National Plantation Inventory, 1997, page 10.

33-36, 39-41

Enquiry Table 14: "Growing stock of Trees on forest, total"— "Coniferous": based on volume stock 139 m^3/ha and area of 883,980 ha—softwood plantations NPI report, page 10. Includes callitris forests volume based on weighted stocking volume of 98 m^3/ha and area of 866,667 ha.

Growing stock of Trees on forest, total—Broadleaved: Based on back calculation from biomass to standing volume by dividing by 1.05.

Woody biomass—Coniferous: Based on product of conversion factor of 0.6 and values in column A.

Woody biomass—Broadleaved: Based on NGGI conversion factors (using forest structure) from area (ha SOFR, p. 32) to biomass. Callitris not included.

Closed forest area x 226; Open forest area x 80; Woodland area x 42

Growing stock of Trees on forest available for wood supply—Coniferous: Based on softwood plantations and callitris. The Callitris is from table 2.1.b Montreal. Using NGGI conversion to biomass (structure) from area only.

Growing stock of Trees on forest available for wood supply—Broadleaved: Based on hardwood plantations and native forest volumes from Montreal table 2.1.b.

Wood biomass of trees on forest available for wood supply—Coniferous: Based on product of conversion factor of 0.6 and values in column A.

Wood biomass of trees on forest available for wood supply—Broadleaved: Based on product of conversion factor of 1.05 and values in column A.

Growing stock of Trees on forest not available for wood supply": Difference between the figure for "Growing Stock" of "Trees on forest, total" and "Growing stock" of "Other trees (on other wooded land and trees outside the forest".

Total woody biomass:

Average conversion factor of area to biomass = 57

Average conversion factor of area to volume = 54

Woody biomass of stumps and roots: = 0.2 (pine and eucalypt)

The volume stocking levels were derived from the biomass figures. This was done with the following assumptions:

Green density of wood = 1000 kg/m^3

Expansion factor to take account of leaves and branches = 1.75

Mass = density x volume x expansion factor (i.e. volume = mass/(density x expansion factor)

To convert the volume to biomass, the constant 0.6 for coniferous and 1.05 for broadleaved was multiplied by the volume (ref. IPCC Guidelines for National Greenhouse Gas Inventories, Workbook 5.6, 1996)

Data Source: Australia's First Approximation Report for the Montreal Process, 1997. National Plantation Inventory, 1997

Stumps and Roots biomass: Greenhouse Challenge Vegetation Sinks Workbook July 1998.

root-to-shoot ration = 0.2 (pine and eucalypt).

37, 38

Enquiry Table 17: Data only available for reference period 1994.

42-46

Enquiry Table 15:

Gross annual increment, on forest, total -- Coniferous: Uses FAWS coniferous + FNAWS coniferous. Based on softwood plantations (NPI 97) and callitris (SOFR). MAIs area 12 and 2.1 respectively. Within native forests, revised using MAI figure of 2.1 for growing component of Forests (70 per cent of forest) and MAI of 0.25 for growing woodlands (40 per cent of woodlands) Source: Mellissa Wood & Rod Keenan Sept 1999.

Gross annual increment, on forest, total—Broadleaved: Uses FAWS broadleaved + FNAWS broadleaved based on hardwood plantations (NPI 97) and native forest area (SOFR). MAIs area 12 and 2.1 respectively. Within native forests, revised using MAI figure of 2.1 for growing component of Forests (70 per cent of forest) and MAI of 0.25 for growing woodlands (40 per cent of woodlands) Source: Mellissa Wood & Rod Keenan Sept 1999.

Gross annual increment on forest available for wood supply—coniferous: Based on callitris and softwood plantations and MAI of 2.1 and 12 respectively. Callitris area is based on SOFR p 32. Within native forests, revised using MAI figure of 2.1 for growing component of Forests (70 per cent of forest) and MAI of 0.25 for growing woodlands (40 per cent of woodlands) Source: Mellissa Wood & Rod Keenan Sept 1999.

Gross annual increment on forest available for wood supply—Broadleaved: Based on hardwood plantations and native forests available for harvest and MAI of 12 and 2.1 respectively. Native forest area is based on SOFR p 32. Within native forests, revised using MAI figure of 2.1 for growing component of Forests (70 per cent of forest) and MAI of 0.25 for growing woodlands (40 per cent of woodlands) Source: Mellissa Wood & Rod Keenan Sept 1999.

Gross annual increment on forest not available for wood supply: Revised using MAI figure of 2.1 for growing Forests (70 per cent of forest) and MAI of 0.25 for growing woodlands (40 per cent of woodlands) Source: Mellissa Wood & Rod Keenan Sept 1999.

Total gross annual increment: Revised using MAI figure of 2.1 for growing Forests (70 per cent of forest) and MAI of 0.25 for growing woodlands (40 per cent of woodlands) Source: Mellissa Wood & Rod Keenan Sept 1999.

There are no data on natural losses. The Net (harvestable) Annual Increment assume there are no losses.

The MAIs used were sources from the last FAO report and are as follows:

Forest Type	*MAI m3/ha/year*		
Plantations	12		
Native forest for wood supply	2.1	for growing portion	assumes 70 per cent growing in forest and 40 per cent growing in woodland
	0.25	for non-growing portion	Assumes 70 per cent growing in forest and 40 per cent growing in woodland

Data Source: Australia's First Approximation Report for the Montreal Process, 1997. National Plantation Inventory, 1997.

Total increment in item15.12 is the sum of increment for wood available for wood supply and wood not available for wood supply. This does not sum to the value in item 15.1 as values items 15.1 to 15.8 were derived from different sources.

47-52

Enquiry Table 16: There are no data available on natural losses, therefore figures assume no loss through natural losses. Assumption that bark volume approximates 15 per cent of over bark wood volume. Based on Hamilton & Chikumbo (1997). Modelling upper stem bark thickness for Eucalypts. In: International Congress on Modelling and Simulation. Edited by McDonald, A.D. and McAleer, M. Hobart, Tasmania. Vol. (4): 1611-1616.

Removals from areas outside the forest available for wood supply are unknown. However, a National project is under way to quantify the biomass being cleared.

Austria

25-32

Enquiry Table 13:

The definitions of the Austrian Forest Inventory are as follows:

Forest area "under regeneration" (285,000 ha) is an area where regeneration (reforestation) is being practised at the time of the field assessment. "Under regeneration" areas include felling areas as well as areas where (natural) regeneration was started by silvicultural measurements, e.g. femel system, strip system, etc.

The age-class "10 years or less" (270,000 ha) covers already afforested areas. The afforestation (regeneration) was done by means of seeding (see also *Enquiry Tables 11 and 12),* planting (see also *Enquiry Tables 11* and *12*), natural regeneration enhanced by planting (see also *Enquiry Table 11*) and natural regeneration.

33-36, 39-41

Enquiry Table 14: Standing volume of trees on forest available for wood supply evaluated by the Austrian Forest Inventory x 1.05 = standing volume of trees on forest available for wood supply.

37, 38

Enquiry Table 17: Reference period "1" is adapted to "0 cm" d.b.h.

Azerbaijan

37, 38

Enquiry Table 17: As no primary felling takes place in Azerbaijan's forests for economic and environmental reasons, the timber stock rose between the two base periods because of the small volume harvested.

47-52

Enquiry Table 16: Total fellings per year are small: not more than 60,000 m^3 annually.

Belarus

25-32

Enquiry Table 13: The areas "under regeneration" are included in the "10 years or less" group.

Belgium

25-32

Enquiry Table 13: For Norway spruce (*Picea abies*) in the Walloon Region (80 per cent of coniferous in this region), the distribution is as follows:

Items 13.1 to 13.14: (in ha 1000) 170.839; 0; 169.184; 11.167; 21.783; 15.114; 52.282; 41.770; 21.605; 4.970; 0.493; 0; 0; 1.655.

33-36, 39-41

Enquiry Table 14: Volume measured to minimum diameter at breast height and top diameter of 7 cm (22 cm circumference).

Growing stock on other trees and other wooded land could be estimated as zero on the assumption that the definition for this value excludes poplar linear plantations.

37, 38

Enquiry Table 17: Measured to minimum diameter at breast height and top diameter of 7 cm (22 cm circumference).

Concerning the reference period, data related to the Walloon Region have been extrapolated to the whole country.

42-46

Enquiry Table 15: Volume measured to minimum diameter at breast height and top diameter of 7 cm (22 cm circumference).

Increments calculated in Walloon Region on the basis of tables of production for broadleaved and by difference in inventories for coniferous and extrapolated to the country as a whole.

47-52

Enquiry Table 16: Volume measured to minimum diameter at breast height and top diameter of 7 cm (22 cm circumference).

Volumes annually cut in public forests have been extrapolated to the total forests proportionately to the respective coniferous and broadleaved areas.

Bosnia and Herzegovina

33-36, 39-41

Enquiry Table 14: All data are secretariat estimates based on information from different literature sources.

42-46

Enquiry Table 15: The data are secretariat estimates based on information from different literature sources.

47-52

Enquiry Table 16: The data are secretariat estimates based on information from different literature sources.

Bulgaria

33-36, 39-41

Enquiry Table 14: not "oven-dry"

Canada

25-32

Enquiry Table 13: Data are not available from Canada's Forest Inventory (CanFI) for lines "10 years or less" and "11 to 20 years" separately, only for age class 20 years or less. The breakdown is as follows:

Predominantly coniferous:3908 (x 1000 ha)

Predominantly broadleaved: 1179 (x 1000 ha)

Mixed: 1929 (x 1000 ha)

These values were divided by two to derive the values entered in "10 years or less" and "11 to 20 years".

There exists supportive information on the details on sources of data in the reply to the enquiry, which is available at the secretariat.

In CanFI, age class is the total age of the forest to the year of information (not updated to 1991). Twenty-year age classes are used. When there was an offset in the starting year of the age class, best fit was used. For example, 6 to 25 years would be treated as age class 1 (1 to 20 years).

Even-aged	
0	0 years
1	1 to 20 years
3	21 to 40 years
5	41 to 60 years
7	61 to 80 years
9	81 to 100; or 81 and greater years
11	101 to 120; or 101 and greater years
13	121 to 140; or 121 and greater years
15	141 to 160; 141 to 250; or 141 and greater years
20	161 years and greater; or 251 and greater years
- 5	Uneven-aged
- 8	Missing value
- 9	Not applicable (record is not stocked forest land)

All values have been adjusted to "forest available for wood supply" values in *Enquiry Table 3*. The information on the area distribution in CanFI that is unclassified as to forest types exists in the reply to the TBFRA enquiry which is available at the secretariat.

33-36, 39-41

Enquiry Table 14: Ref. Source for Growing Stock (*a*); and Source for Woody Biomass (b)

"Trees on forest, total": (*a*) Total volume of all species + 12.25 per cent of same (to get overbark volume); (*b*) Total biomass of all species.

"Coniferous" on forest, total: (*a*) Total volume of coniferous species + 12.25 per cent of same (to get overbark); (*b*) Total biomass of coniferous species.

"Broadleaved" on forest: (*a*) Total volume of broadleaved species + 12.25 per cent of same (to get overbark); (*b*) Total biomass of broadleaved species.

"Other (bamboos, palms, etc.)": (*a*) Not applicable; (b) Not applicable.

"Trees on forest available for wood supply": (*a*) The total volume of all species on accessed nonreserved timber productive forest + 12.25 per cent of same (to get overbark volume) was adjusted to conform to *Enquiry Table 3* "Forest available for wood supply"; (*b*) Calculated as 14.1 (total biomass) * 14.5 (volume on forest available for wood supply)/14.1 (total volume).

"Coniferous" on Trees on forest available for wood supply: (*a*) The total volume of coniferous species on accessed nonreserved timber productive forest + 12.25 per cent of same (to get overbark volume) was adjusted to conform to *Enquiry Table 3* "Forest available for wood supply".

"Broadleaved" on Trees on forest available for wood supply: (*a*) The total volume of broadleaved species on accessed non-reserved timber productive forest + 12.25 per cent of same (to get overbark volume) was adjusted to conform to *Enquiry Table 3* "Forest available for wood supply".

"Other bamboos, palms etc.": (*a*) Not applicable.

"Trees on forest not available for wood supply": (*a*) Trees on forest, total—trees on forest available for wood supply; (*b*) Calculated as 14.1 (biomass)—14.5 (biomass).

"Other trees (on other wooded land and trees outside the forest": (*a*) Not available; (*b*) Not available.

"Other woody biomass": (*a*) Not available; (*b*) Not available.

"Total above-stump volume and woody biomass": Same as "Trees on forest, total", since there is no volume data in CanFI for other wooded land; (*b*) Same as 14.1 since it is not possible to compute biomass for other wooded land.

"Stumps and roots" of other woody biomass; (*b*) Not available.

37, 38

Enquiry Table 17: The 1997 edition of the annual report to Parliament on the state of Canada's forests included the index items shown in the "Commercial Forest Volume (1980-1994)" . This supportive information exists in tabular form in the reply to the enquiry, which is available at the secretariat.

42-46

Enquiry Table 15: Estimated Mean Annual Increment to Rotation Age on Productive and Available Forest Land in Canada*

(Cubic metres per hectare)

Region and Sub-region	*Average growth*
Atlantic Provinces	1.7
Quebec/Ontario	1.7
CANADA EAST	1.7
Prairie Provinces	1.8
British Columbia	1.9
Northern Territories	0.6
CANADA WEST	1.8
CANADA	1.8

* Mean annual growth attainable on natural stands of average stocking.

Source: UN-ECE/FAO. 1996. North American Timber Trends Study. Geneva Timber and Forest Study Papers, No.9. United Nations. New York and Geneva.

It should be noted that there are substantial regional variations within Canada. The average for western Canada as a whole is 1.8 m^3/(ha/yr) and it is 1.9 m^3/(ha/yr) in British Columbia. There are many sites on the west coast on which the mean annual increment can be several times this value under intensive management regimes.

The figures presented should be considered as net mean annual increment.

Timber growth is an often used measure of productivity and performance of timber resources. Net annual growth is annual growth, less the volume lost through mortality. In other words, it is the net effect of natural gains and losses to timber volumes. Although net growth is sometimes used as an indication of timber available for harvest, in the specific context of North American resources, this can often be misleading. In instances where there is a heavy preponderance of old growth timber, growth rates may be low although there are significant volumes of timber available for harvest. As the old growth inventory is depleted, growth rates can be expected to increase as younger, more vigorous forest stands replace the present mature and over-mature stands.

According to recent estimates for the period 1980 to 1994 (The State of Canada's Forests 1996-1997), gross volume accruals to the growing stock are approximately 382 million cubic metres per annum. Estimated losses due to fire, insects and disease over the same period are 151 million cubic metres per annum. This implies a net long run potential sustainable harvest level of 231 million cubic metres per annum. While this is a useful first approximation, a number of qualifications should be borne in mind. This estimate is based on both the current age class distribution of the forest and the current level of forest management in Canada. As harvesting proceeds and the older forest is replaced by younger and more vigorous stands, non-harvest losses can be expected to decline. Increased protection and silviculture expenditures may reduce non-harvest losses while increasing growth rates. However, policy constraints are changing both the availability of land for timber harvesting as well as the obtainable yields from those lands.

47-52

Enquiry Table 16: The underbark volume of removals may include some volumes of measured overbark. Consequently, the figures for underbark and overbark measure shown in the table may be overstated.

Croatia

33-36, 39-41

Enquiry Table 14: The data on growing stock on other wooded land are rough estimates by the National Correspondent.

42-46

Enquiry Table 15: Natural losses category includes also the damages caused by war operations and illegal cuttings during the war.

The data on net annual increment on other wooded land are rough estimates by the National Correspondent.

Cyprus

33-36, 39-41

Enquiry Table 14: The given growing stock includes only stem wood of living trees having d.b.h. >12 cm.

Woody biomass of trees on forest available for wood supply: estimate made by the secretariat.

42-46

Enquiry Table 15: Increment of measurable trees (d.b.h. >12 cm).

47-52

Enquiry Table 16: Annual removals are estimated by the secretariat.

Czech Republic

33-36, 39-41

Enquiry Table 14: Growing stock is registered in m^3 under bark, minimum diameter 7 cm.

Underbark to overbark coefficients used: conifers average = 1.064; broadleaved average = 1.048; Dead trees assessment: Survey 1991—total 14,854 thousand m^3 u.b. Average u.b. to o.b. coefficient = 1.0616.

d.b.h. "0" coefficients are based on tables by Parez, Lesnictvi 36, 1990. Medium coefficients: N. spruce—1.0674; pine—1.0800; conifers—1.0699; beech—1.1690; oak—1.1404; broadleaved—1.1604; all species—1.08348.

Biomass coefficients: conifers—0.45 ton per m^3; broadleaved—0.64 ton per m^3; average—0.4785 ton per m^3; other woody biomass [bushes in forest]—1 ton per 1,000 ha of forest.

Other trees: Trees on river banks [survey 1976]—2,096 thousands of m^3 o.b. Other land without arable land = 1,940 thousands of ha. 1 m^3 per ha.

Stumps and roots: According to the research made by Vyskot, the above ground biomass and underground biomass ratio is 1,227 : 314 = 0.2559.

Growing stock range: assessment methods accuracy is ± 5 per cent.

Woody biomass range: average of coefficients from other sources [consultation] = 0.7235.

37, 38

Enquiry Table 17: Source: FMP 1986, 1995.

42-46

Enquiry Table 15: Natural losses are the annual average of 1987-1996.

47-52

Enquiry Table 16: Fellings of natural losses are annual average of 1987-1996.

Denmark

25-32

Enquiry Table 13: Though no statistics exist on age-class distributions in the three groups of forests: broadleaved, conifers and mixed forests, this table has been compiled based on the Danish forest statistics: Danmarks Statistik og Skov- og Naturstyrelsen: Skove og Plantager 1990.

Background is *Enquiry Table 3* of the TBFRA.

The age-class distribution of conifer forests more or less follows the age-class distribution of *Picea abies*, of broadleaved more or less *Fagus silvatica*, and the mixed group an interpolation of these.

The accuracy is probably not less than +- 25 per cent.

The line 'under regeneration' is as an estimate chosen as one tenth of the age-class 10 years or less.

The 5,086 ha not available for wood-supply are distributed on an equal level at the 3 oldest age classes.

33-36, 39-41

Enquiry Table 14: The following conversions factors are used in accordance with the ECE study: "Forest Resources of the ECE Region (Europe, the USSR, North America", July 1985:

Coniferous wood to biomass	1 m^3 = 0.4 ton
Broadleaved wood to biomass	1 m^3=0.55 ton
Wood not available for wood supply	1 m^3 =0.3 ton

The Forestry Institute, The Royal Veterinarian and Agriculture University, have been helpful in discussing this table.

37, 38

Enquiry Table 17: The forest statistics for 1976 and 1990 are very difficult to compare due to very different methods used in those two statistics. Therefore the average annual increment in the period 1980 to 1990 minus the average annual cut in the same period has been used to calculate 'back' from 1990 to 1980 which figures then are compared with the (not very good) 1976-figures.

In 1981, a most severe storm occurred in Denmark. The losses was 6—8 million cubic metres.

These losses should be included in the above figures. It will raise the average annual change to about 1,800,000 m^3 in total, to 1,260,000 m^3 in conifers and to 540,000 m^3 in broadleaved.

42-46

Enquiry Table 15: Natural losses is an adjustment on not used branches, stumps, dead trees, etc. of about 10 per cent of the measured increment. No scientific knowledge is available on this item, and the percentage is probably too high.

47-52

Enquiry Table 16: Fellings of natural losses are very rare in Denmark, see below:

Conversion from o.b. to u.b. is done by calculating with standard-figures on 4 per cent for conifers and 2 per cent for broadleaved in accordance with information from the Royal veterinarian and Agricultural University, Department of Forestry, Copenhagen.

By forest law it is not permitted to leave cut wood on the forest ground—all cuttings shall be removed within a short time.

Finland

25-32

Enquiry Table 13: The totals "18789 for "Even-aged" and "545" for "Under regeneration" differ from the actual total because the totals include temporarily open areas as it is impossible to define species groups of regeneration.

42-46

Enquiry Table 15: Estimates of natural losses are based on 20-year old studies, not on recent inventories.

47-52

Enquiry Table 16: For fellings and removals, data can not be divided into the forest and other wooded land volumes. A small part for both comes from other wooded land.

France

25-32

Enquiry Table 13: There exists supportive information on "Age-class distribution of high forest (broadleaved) available for wood supply" and "Age-class distribution of high forest (conifers) available for wood supply" in tabular form in the reply to the enquiry, which is available at the secretariat.

33-36, 39-41

Enquiry Table 14: The base data used (national forest inventory volumes) are stem volumes, 7 cm cut, with a sampling diameter of 7.5 cm at stem height 1.30 m. A coefficient of 40 per cent* for the volume of large branches has been added for broadleaved trees, and one of 30 per cent* for conifers. The volume for stems from 0 cm diameter upwards has been estimated by extrapolation (see chart "Standing volume by diameter class").

The volume and biomass of trees in forest not available for wood supply have been estimated at 2 per cent of the volume and biomass of trees in forest available for wood supply, poplar plantations excluded.

Volume was converted into biomass using the coefficients below*:

	Volume	*Biomass*
Wood (from NFI volume)		
Conifers	0.86	0.4
Broadleaved	0.87	0.55
Bark (from NFI volume)		
Conifers	0.14	0.35
Broadleaved	0.13	0.35
Large branches and stems < 7.5 cm in diameter		
Conifers	0.3	0.4
Broadleaved	0.4	0.55
Stumps and roots		
Conifers	0.2	0.4
Broadleaved	0.2	0.5

No account has been taken of the volume of large branches, roots, stems less than 7.5 cm in diameter and bark on dead trees.

The volume of trees outside forests has been estimated from inventories of poplar lines, hedgerow trees and scattered trees. These data are sometimes old and incomplete.

Data for "Other woody biomass": woody biomass (shrubs and bushes) in forests and on other wooded land is estimated by the National Correspondent at 2 tons per hectare.

Likely range: 95 per cent confidence-level estimate of standing material. No account has been taken of the wide margin of uncertainty associated with the adjustments.

* Coefficients taken from the document "Forest resources in the ECE region (Europe, USSR, North America), United Nations, 1986.

There exists supportive information on "Standing volume by diameter class" in graphic form in the reply to the enquiry, which is available at the secretariat.

37, 38

Enquiry Table 17: Source: national forest inventory, data available as at 31 December 1987 (period 1973-1986) and 31 December 1997 (period 1980-1996).

The adjustment method used for the 1987 data is the same as indicated in *Enquiry Table 14*. As the inventory methods have not changed, comparability between the two periods may be regarded as good.

42-46

Enquiry Table 15: The base data are running net annual increases in stem volume, 7 cm cut for woodland and running average annual increments in stem volume, 7 cm cut for poplar plantations and avenues. These increments are measured on stems over 7.5 cm in diameter. The volume for stems from 0 cm diameter upwards has been estimated by extrapolation (see chart "Standing volume by diameter class"). On the other hand, the increment on pollarded trees has not been added for want of reliable bases for an estimate.

Natural losses in forests available for wood supply have been estimated from observations for the national forest inventory of volumes of dead wood and windblow less than five years old. Natural losses in forests not available for wood supply have been estimated at 80 per cent of increment there. The volume of natural losses has been adjusted in the same way as the volumes of felled timber shown in *Enquiry Table 16*. The increment on poplar lines is the only information available for estimating the increment outside forests. Increment on scattered trees and hedgerows containing trees is not measured in the national forest inventory.

Likely range: 95 per cent confidence-level estimate of increment.

There exists supportive information on "Net annual increment by diameter-class" in graphic form in the reply to the enquiry, which is available at the secretariat.

47-52

Enquiry Table 16: The annual sector survey of forestry operators and sawmills gives volumes after extraction, underbark in the case of conifers, overbark for broadleaved trees and Maritime pine. Estimates of underbark and overbark volume have been made with the bark coefficients suggested by SCEES. It has been assumed that annual removals correspond to stem volumes, 7 cm cut, for conifers. For broadleaved species, annual removals have been estimated at stem volumes, 7 cm. cut, plus half the volume of the branches. To arrive at annual fellings, operating losses have been estimated at 10 per cent of the volume declared in the annual sector survey. To that has been added the volume of the branches, estimated at 30 per cent* of the volume of felled stems for conifers and 40 per cent*/2, or 20 per cent, for broadleaved species.

For the data on "Annual fellings, Total" for "other" and "other" for broadleaved on forest available for wood supply: corresponding to non-commercial firewood, it has been assumed that the volumes concerned come from both stems and branches.

Lastly, it has been assumed that the volume of stems ranging between 0 and 7.5 cm in diameter felled in the course of forestry operations or firewood collection is negligible.

Data for Fellings of natural losses for Coniferous and Broadleaved on forest available for wood supply: these are probably underestimates, as exceptional windblow has not been taken into account.

A very small proportion of the fellings and removals shown in *Enquiry Table 16* as coming from forests come, in fact, from other wooded land and from trees outside the forest. It is not possible to indicate what proportion.

*/Coefficients taken from the document "Forest resources in the ECE region (Europe, USSR, North America), United Nations, 1986.

Georgia

33-36, 39-41

Enquiry Table 14: Secretariat estimates; conversion factors (coefficients) for woody biomass, as derived from GS, are assumed: above-stump, total 0.68; coniferous 0.60; broadleaved 0.70; below-stump 0.15

37, 38

Enquiry Table 17: The share of coniferous growing stock is assumed to be 30 per cent of total growing stock.

47-52

Enquiry Table 16: Data are provided by the State Department of Forest Management of Georgia in its reply to the concise enquiry for SOFO-97 (23.08.1996).

Germany

25-32

Enquiry Table 13: Data for "11-20 years, (total)" also includes data for the age-class "1-20 years".

"Uneven-aged": Estimate, includes selection forests, composite forests, advanced growth areas, underplanting, bilayer stands and femel stands.

33-36, 39-41

Enquiry Table 14: "Coniferous" and "Broadleaved" on forest, total: Total estimated on the basis that half of growing stock on forest not available for wood supply is coniferous and half broadleaved.

Woody biomass column: Conversion factor to biomass 0.5

37, 38

Enquiry Table 17: Reference period 1: Unavailable due to the different data situation in the Federal Republic of Germany and the former GDR.

"Average annual change" in growing stock on forest available for wood supply: rough estimate.

42-46

Enquiry Table 15: Conversion factor between wood with a upper diameter of 7 centimetres and the whole tree wood is 1.15 (+15 per cent).

Data for "Natural losses" are estimates on a level of 10 per cent by the National Correspondent.

47-52

Enquiry Table 16:

1) Conversion factor of annual removals under bark to annual fellings.
2) Conversion factor under bark to over bark 5 per cent.

total = 1.25 (+15 per cent solid volume to lumber stands + 10 per cent X-wood)

total annual fellings = annual removals overbark * 1.25

Greece

25-32

Enquiry Table 13: No data exist on age-class distribution. The principal reason is that all fellings are on a selective cutting system, and many of the forests are uneven-aged.

33-36, 39-41

Enquiry Table 14: The figures for trees on forest available and not available for wood supply are estimated on the basis of the proportional areas of total forest. Volume is measured to a minimum diameter breast height (d.b.h) of 5 cms.

Annual fellings and removals on other wooded land are included in those on forest. Information regarding the quantity of wood production is this case is not available.

42-46

Enquiry Table 15: Net annual increment is measured to a minimum diameter breast height (d.b.h.) of 5 cms.

Hungary

25-32

Enquiry Table 13: Please refer to comments in *Enquiry Table 1* "Total area by main classes" for the definition of "Forest" and "Other wooded land" and Enquiry Table 3 "Forest and OWL according to availability of wood supply" for the definition of "Forest not available for wood supply".

33-36, 39-41

Enquiry Table 14: Data on dead trees were calculated with the help of forest health monitoring results. Biomass values, as well as data on "Other trees (on OWL and trees outside the forest)" and "Other woody biomass--stumps and roots" are estimates. National growing stock definition matches with that of TBFRA 2000.

"Standing volume": Includes small branches and twigs, in case of conifers even foliage.

Please refer to comments in *Enquiry Table 1* "Total area by main classes" for the definition of "Forest" and Other Wooded land".

37, 38

Enquiry Table 17: Data were re-computed for 1990 from inventory raw data. Data for "Growing stock on forest, total" include small branches and twigs and in case of conifers even foliage.

42-46

Enquiry Table 15: Data on "On trees outside the forest" are estimates.

Please refer to comments in *Enquiry Table 1* "Total area by main classes" for the definition of "Forest" and "Other wooded land" and *Enquiry Table 3* Forest and OWL according to availability of wood supply" for the definition of "Forest not available for wood supply".

47-52

Enquiry Table 16: Fellings of natural losses = sanitary fellings in the national statistics. Underbark values were calculated with the help of conversion factors. Adjustment was not needed in the requested fields. The likely range is an estimate, not calculated.

Please refer to comments in *Enquiry Table 1* "Total area by main classes" for the definition of "Forest" and "Other wooded land" and *Enquiry Table 3* "Forest and OWL according to availability of wood supply" for the definition of "Forest not available for wood supply".

Iceland

33-36, 39-41

Enquiry Table 14: It is important to note that all data on standing volume and biomass in this table are provisional estimates, pending a new assessment in connection with work to improve information on carbon sequestration. This information is expected within two years, i.e. during 2000.

42-46

Enquiry Table 15: All data on increment are provisional estimates, pending a new assessment in connection with work to improve information on carbon sequestration. This information is expected within two years, i.e. during 2000.

Ireland

33-36, 39-41

Enquiry Table 14: Volume measurement to a top diameter of 7 cm.

Ratio used for calculating the volume of "Stump and roots biomass" is 0.20.

42-46

Enquiry Table 15: Measurement to top diameter of 7 cm.

47-52

Enquiry Table 16: Measurement to top diamater of 7 cm.

Israel

42-46

Enquiry Table 15: The data on increment are estimated.

Japan

25-32

Enquiry Table 13: The data for "81 to 100 years" include forest over 80 years.

This table is composed of "Forest available for wood supply" and "Forest not available for wood supply" because we don't have separate age-class statistics for forest available or not available for wood supply.

33-36, 39-41

Enquiry Table 14: Growing stock does not include trees for which the diameter is less than 4 cm.

42-46

Enquiry Table 15: The data for "On forest not available for wood supply, coniferous and broadleaved" is not known, although in TBFRA summary table 42, the data shown is "0" for both coniferous and broadleaved. This "0" is shown because of the automatic calculation of the data which is "Forest—Forest available for wood supply = forest not available for wood supply".

Latvia

47-52

Enquiry Table 16: Volume for "On forest not available for wood supply" comes from sanitary cuttings and thinnings.

Liechtenstein

25-32

Enquiry Table 13: Where wood production is predominant, we apply a rotation period of 140 years for low mountain forests and more than 180 years for high mountain forests.

Lithuania

25-32

Enquiry Table 13: In Lithuania, even-aged stands predominate (uneven-aged forests represent only 2 per cent of the total forest area), resulting in prevailing clear-cut areas.

Malta

25-32

Enquiry Table 13: Not applicable as all woodland is for amenity purposes and watershed management.

Netherlands

25-32

Enquiry Table 13: Source: HOSP-database.

As mentioned before for *Enquiry Table 3* "Forest and other wooded land according to availability for wood supply": a difference in definition on mixed forest exists between the HOSP-definition and the TBFRA-2000 definition: the threshold 75 per cent is in HOSP 80 per cent. No adjustments are made since the differences are considered as negligible.

There exists supportive information on "age-class distribution within species group on high forest" in tabular form in the reply to the enquiry, which is available at the secretariat.

There exists supportive information on "age-class distribution of *Pinus sylvestris*, Other coniferous, and Broadleaved" in tabular form in the reply to the enquiry, which is available at the secretariat.

33-36, 39-41

Enquiry Table 14: Sources:

1. Daamen, W.P. 1996. Velling en oogst HOSP-cyclus 2: periode 1992-1996. Daamen Schoonderwoerd & de Klein, Rapport 70.
2. HOSP-database.
3. CBS Landbouwtelling 1996.
4. Stichting Bosdata, 1996 Projekt Hout voor schone energie,
5. Daamen , W.P.,1997 Energiehout.
6. Nabuurs G.J. & G.M.J.Mohren, 1993 Carbon stocks and fluxes in Dutch forest ecosystems IBN research report 93/1. IBN-DLO Wageningen.

Deviations from TBFRA-2000 definition:

Growing stock is given for trees with minimum diameter breast height (d.b.h.) of 5.0 cm. By calculating the distribution of total standing volume over the diameter classes (cm), the standing volume of trees < 5.0 cm is extrapolated between 0-5 cm d.b.h. Broadleaved species have 60,000 m^3 (which is 0.2503 per cent of the standing volume > 5 cm d.b.h.) and coniferous species have 15,000 m^3 (which is 0.0506 per cent of the standing volume) with a d.b.h. 0-5 cm. The calculated volumes with d.b.h. >5 are corrected with these percentages.

Specifications on *Enquiry Table 14*:

Growing stock of "Trees on forest available for wood supply--Coniferous and Broadleaved": The growing stock is corrected according to the above stated percentages.

Growing stock of "Trees on forest not available for wood supply": No classification of growing stock in coniferous or broadleaved species is available on 'forest not available for wood supply'. A mean percentage ((0.2503+0.0506)/2) is used to estimate the growing stock < 5 cm d.b.h.

Growing stock of "Other trees (on OWL and trees outside the forest)": No correction for d.b.h. < 5 cm is made. Row plantations are considered to have negligible amount of growing stock < 5 cm.

"Dead trees" of "Trees on forest, total" to "Dead trees" of "Other woody biomass--Stumps and roots": No corrections are made for the volume < 5 cm d.b.h. They are considered as negligible.

The volume of standing dead trees is estimated by HOSP. The volume of lying dead trees is derived from other inventories on forest holdings (SYHI- and WOODSTOCK-inventories). About 1 per cent of the volume of standing trees is additional lying on the ground. So for example: the volume of 1,306,000 m^3 in "Dead trees" of "Trees on forest, total" comprises 764,000 m^3 derived from HOSP and 542,000 m^3 calculated as 1 per cent of the standing volume.

There exists supportive information on the estimation of "the growing stock on areas not covered by HOSP" in tabular form in the reply to the enquiry, which is available at the secretariat.

Conversion factors for stem volume to woody biomass above-stump and woody biomass of stumps and roots the above stated conversion factors are used, which are derived from several sources. For example 1 m^3 coniferous stem volume gives 0,595125 ton dry weight above stump and 0,20104875 ton dry weight stumps and roots.

General comments:

The growing stock, growth and removals survey (Houtoogststatistiek en prognose oogstbaar hout, HOSP) is a monitoring system of about 3000 permanent plots which cover about 310,000 ha of the 340,000 ha forest in the Netherlands. No monitoring plots are established on about 30,000 ha of forest land that meets the FAO/ECE definition of forest but has an other type of land use, e.g. campings, built up areas, parking places, zoological gardens. Changes in this area of 30,000 ha can not be estimated: in this enquiry the data on this area obtained in 1980-1983 are used.

In HOSP all trees with a diameter at breast height (d.b.h.) of 5.0 cm and more are monitored individually on the plots in a 5-year cycle. This gives the possibility of calculating standing volume, growth and removal. Since the threshold on diameter in this enquiry is set to 0 cm d.b.h. an estimate has been made of volume, growth and removal of trees with diameter < 5.0 cm d.b.h.

In this enquiry standing volume is defined as all standing and lying trees in the forest. HOSP only monitors the standing dead- or alive- trees, so a gap exists in the data of HOSP and the required data for this enquiry.

From other inventories (SYHI and WOODSTOCK) on forest holdings where lying trees are measured, it is estimated that about 1 per cent extra volume is from lying dead trees. In this enquiry a correction is made for this gap and the possibilities of collecting data according to the definition of standing volume of FAO/ECE are studied and possibly implemented as well in the HOSP-inventory system.

37, 38

Enquiry Table 17: Source: HOSP database 1988-1992 and 1991-1995.

42-46

Enquiry Table 15: Source: HOSP database 1991-1995

Adjustments:

The distribution of total annual increment for coniferous and broadleaved species over the diameter classes > 5 cm (cm classes) is calculated. The annual increment for trees < 5 cm d.b.h. is extrapolated from these distributions and expressed as a percentage of the total annual increment for trees > 5 cm d.b.h.

Coniferous species (1500 m^3/year d.b.h. < 5 cm on 1236310 m^3/year d.b.h. > 5 cm =) 0,1213 per cent

Broadleaved species (4000 m^3/year d.b.h. < 5 cm on 1155683 m^3/year d.b.h. > 5 cm =) 0,3461 per cent

Natural losses: It is assumed that half of the annual increment on trees < 5 cm can be considered as natural losses. The natural losses for trees >5 cm d.b.h. are adjusted with 50 per cent of the annual increment on trees < 5 cm d.b.h.

Specifications:

Gross annual increment on Coniferous "On forest available for wood supply" and "Gross annual increment" on Broadleaved "On forest available for wood supply": The percentages stated above are used to correct the annual increment of trees > 5 cm for the threshold 0 cm d.b.h.

Gross annual increment "On forest not available for wood supply": A mean percentage ((0,3461+0,1213)/2=) 0,23 per cent is used for correcting the annual increment < 5 cm on forest not available for wood supply.

Gross annual increment "On trees outside the forest": No corrections for d.b.h. < 5 cm are made. The increment of trees < 5 cm in row plantations is considered as negligible.

There exists supportive information on "Additional increment of areas not available for wood supply" in tabular form in the reply to the enquiry, which is available at the secretariat.

General comments: The growing stock, growth and removals survey (Houtoogststatistiek en prognose oogstbaar hout, HOSP) is a monitoring system of about 3000 permanent plots which covers about 310,000 ha of the 340,000 ha of forest in the Netherlands. No monitoring plots are established on about 30,000 ha of forest that meets the FAO/ECE definition of forest land but has another type of land use, e.g. campings, built up areas, parking places, zoological gardens. Changes in this area of 30,000 ha can not be estimated: in this enquiry the data on this area obtained in 1980-1983 are used.

In HOSP all trees with a diameter at breast height (d.b.h.) of 5.0 cm and more are monitored individually on the plots in a 5-year cycle. This gives the possibility of calculating standing volume, growth and removal. Since the threshold on diameter in this enquiry is set to 0 cm d.b.h., an estimate has been made of volume, growth and removal of trees with diameter < 5.0 cm d.b.h. In this enquiry standing volume is defined as all standing and lying trees in the forest. HOSP only monitors the standing dead or alive trees, so a gap exists in the data of HOSP and the required data for this enquiry.

From other inventories (SYHI and WOODSTOCK) on forest holdings where lying trees are measured, it is estimated that about 1 per cent extra volume is from lying dead trees. In this enquiry a correction is made for this gap and the possibilities of collecting data according to the definition of standing volume of FAO/ECE are studied and possibly implemented as well in the HOSP-inventory system.

47-52

Enquiry Table 16: Source: HOSP database 1991-1995.

The volume is estimated for trees with minimum diameter 5.0 cm. No effort is made to estimate the fellings and removals of trees with diameter < 5.0 cm. The volume of felling/removal of trees < 5.0 cm is considered as negligible.

Since no data are available on fellings and removals on 'forest not available for wood supply' and for 'trees outside the forest'; the fellings and removals are assumed equal to the net increment. It is assumed that the growing stock remains constant since 1989 for lack of data. A rough estimate of the increment can be done which is also the estimate for the fellings.

No data are available on the fellings of trees already lying on the ground. It is assumed that 50 per cent of the natural losses are removed afterwards.

The conversion of volume over bark to volume under bark is 20 per cent for coniferous and 25 per cent for broadleaved species.

General comments:

The growing stock, growth and removals survey (Houtoogststatistiek en prognose oogstbaar hout, HOSP) is a monitoring system of about 3000 permanent plots which cover about 310,000 ha of the 340,000 ha forest in the Netherlands. No monitoring plots are established on about 30,000 ha of forest that meets the FAO/ECE definition of forest but has an other type of land use, e.g. campings, built up areas, parking places, zoological gardens. Changes in this area of 30,000 ha can not be estimated: in this enquiry the data on this area obtained in 1980-1983 are used.

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From other inventories (SYHI and WOODSTOCK) on forest holdings where lying trees are measured, it is estimated that about 1 per cent extra volume is from lying dead trees. In this enquiry a correction is made for this gap and the possibilities of collecting data according to the definition of standing volume of FAO/ECE are studied and possibly implemented as well in the HOSP-inventory system.

New Zealand

25-32

Enquiry Table 13: Main source: A National Exotic Forest Description as at 1 April 1996. Ministry of Forestry 1997. The source for this table is Ministry of Forestry using historical records and NEFD data.

Typical rotation lengths currently used for the main plantation species are Pinus radiata 28-30 years; Douglas-fir 45-55 years; other softwoods 40-50 years; hardwoods 20-40 years. The rotation lengths vary depending on site conditions and intended use of the timber. More details can be found in the reference New Zealand Institute of Forestry Handbook (1995).

There is a specific table which gives the age-class distribution for the plantation forest estate species:

Native name	*Scientific name*
Radiata pine	*Pinus radiata*
Douglas-fir	*Pseudotsuga menziesii*
Other softwoods	
Hardwoods	

33-36, 39-41

Enquiry Table 14: Data on the Growing stock, and Biomass are estimates by the National Correspondent made to the Table of Essential Data, and should be regarded as preliminary pending completion of further research. The table on standing volume and biomass was the most difficult one in the Enquiry to complete in the New Zealand situation. The Comments box describes some of the problem areas. As New Zealand only undertakes forest measurement and inventory exercises on the plantation forests, the indigenous forests had a very restricted set of quantitative information which could be used for the table. Scientific research work is currently underway which will help to refine the woody biomass estimates but this was unavailable to use for the Enquiry.

As noted in the comment under "biomass" the information that New Zealand can provide is based on total biomass, which includes above and below ground components and in addition it includes forest litter. The estimates of biomass provided in *Enquiry Table 14* come from a paper-based study, which attempts to estimate terrestrial carbon stocks in New Zealand, (Tate et al, 1997). The purpose of this study was to understand the role of forests with carbon flows. The study did not attempt to model forest carbon from its constituent components. Instead it modelled total carbon (above ground, forest litter & below ground) by forest type. Following further discussions with one of the authors of this paper it was decided that it was not possible to reliably separate out the components into above and below ground from the work carried out. To do this would require a dedicated rework of this study specifically for the TBFRA and the re-engagement of the scientific staff involved. It was possible to break down the plantation forests into their above and below ground components and this has been done in table 14 "Total Woody biomass and the volume of growing stock".

The per hectare growing stock for tall indigenous forests would in all likelihood be higher than the planted forests since the planted forests are immature with an average age of approximately 13 years (for *Radiata* pine).

The multiplier used to convert from inside to outside bark is 1.17 for coniferous species. This includes all the spaces in the bark such as gaps, cracks, fissures and projections.

Comments:

Growing Stock: The growing stock estimates provided have been converted from inside bark to overbark using a multiplier of 1.17 for conifers and 1.11 for broadleaved species.

Up to date growing stock estimates for New Zealand's extensive indigenous forests are unavailable. Most of New Zealand's indigenous forests are now managed for conservation values and as such are not used for timber production.

Biomass : The more reliable biomass estimates provided in column (C) are for trees on forest available for wood supply for New Zealand's planted forests only. The paper which describes the methodology used is Wakelin et al, 1996 as listed in full under "source" above. The organic carbon estimates from this paper have been multiplied by 2 to convert them to oven dry biomass. The estimate has been separated into the above ground components and below ground components. The below ground component is composed of:

- stumps
- coarse and fine roots
- dead plant material including forest litter layers.

The below ground component excludes mineral soil carbon.

The biomass contained in New Zealand's indigenous forests is estimated as 1.5 billion oven-dry tonnes. This includes above and below ground components (which includes stumps, course & fine roots, all dead plant material including forest litter). Because of the methodology used this estimate is not able to be broken down into its constituent components nor is it able to be separated into forest types.

The research work which estimates organic carbon stocks contained in New Zealand forest ecosystems is in progress.

37, 38

Enquiry Table 17: Data for "Growing stock on forest available for wood supply" is for plantation forest growing stock only.

As with earlier tables, the more reliable estimates are only given for the plantation forest for which the data source was the Ministry of Forestry NEFD reports. Again, because the plantation forest is not in the "normal forest" equilibrium situation comparison of the average annual change with annual removals is not particularly valid as an indicator for New Zealand of how the wood potential is being used.

42-46

Enquiry Table 15: This table on increment is not particularly meaningful in the New Zealand situation.

The only reliable parameter which can be provided for this table is the net annual increment for the plantation forests. This is because New Zealand undertakes no inventory work on the remainder of the forest estate or on other wooded land or trees outside the forest. The source for the estimate which has been provided is the NEFD. As the forest undisturbed by man and most of the semi-natural forest are not available for wood supply in New Zealand it has previously been considered that the gross annual increment was balanced by natural losses leading to a net annual increment of zero for these forests. However this assumption is

being reviewed in the light of new work. This work will also allow estimates for the gross annual increment on other wooded land to be derived. As this work is on-going, no published results from it were able to be used for this table.

As the New Zealand plantation estate is expanding quite rapidly in area, it is not in an equilibrium situation. Hence the net annual increment statistic by itself is not particularly meaningful as it does not represent the "allowable cut" situation of the significant forest countries in Northern Europe where the changes are less dynamic.

The 0 cm d.b.h criterion is assumed to be included in the way in which the net annual increment has been calculated.

Further information related to the future wood supply from New Zealand's plantation estate is in NEFD National and Regional Wood Supply Forecasts 1996 (Ministry of Forestry, 1996).

At this stage the assumption has been made that the net annual increment in New Zealand's indigenous forests is zero. With the limited information currently available this is all that can realistically be assumed. Further work is underway but will not be completed by the deadline. It is very likely that future monitoring work will not be directed towards the traditional forestry measures such as growing stock and annual increment for the indigenous forests but will instead focus on measuring biomass, biodiversity and other measures of forest health.

The high NAI per hectare is one of the defining features of plantation forestry in New Zealand and is, of course, essential to the way in which New Zealand developed a plantation-based forest industry over the last one hundred years. What is not usually so well-appreciated, however, is the high level of scientific research that has been invested in plantation forest management and the intensive measures taken to protect the health of the plantation forest estate.

Data on the Net annual increment are estimates by the National Correspondent made to the Table of Essential Data.

47-52

Enquiry Table 16: The source for this table is Ministry of Forestry using roundwood removals data and NEFD data. The base data were the estimated roundwood removals which was converted to annual fellings by assuming that 15 per cent of the felled tree was retained in the forest. The 0 cm d.b.h. criterion is assumed to be included in the volumes.

Norway

25-32

Enquiry Table 13: The data for "Under regeneration" has been filled in to make the totals in correspondence with *Enquiry Table 3* "Forest and other wooded land according to availability for wood supply". Under "unknown age" are included forest roads and forest in Finnmark county (not comprised by the National Forest Inventory).

33-36, 39-41

Enquiry Table 14: Trees smaller than 5 cm d.b.h are not being assessed by the Norwegian National Forest Inventory. To make the results in accordance with the TBFRA-2000 definitions, Swedish data for volume distribution by diameter classes have been used to develop adjustment factors. These factors have been calculated separately for coniferous trees, broadleaved trees and for windthrown and dead trees.

Trees growing above the coniferous forest limit (included in "other wooded land") are also not assessed by the NFI. To obtain country totals, a rough area estimate of this land category has been combined with volume estimates based on an inventory in a limited area.

"Forest available for wood supply (for economic reasons)" is not included in the national statistics, as all forest areas which are not protected, used as military training grounds etc., are normally considered as available. To estimate "forest available for wood supply", the following areas have been excluded:

- areas with a minimum distance to road of more than 2 km
- areas with a minimum distance to road of 1-2 km and inclination of more than 50 per cent
- areas with a minimum distance to road of 1-2 km and inclination of more than 33 per cent and irregular terrain
- forest with a production capacity less than 1 m^3 o.b./ha/year
- other low-productive areas dominated by broadleaved trees
- forest with current utilisation of the land other than "forestry"

Estimates of biomass are calculated as shown in the report "The forest resources of the ECE region" (1985), page 127-128.

42-46

Enquiry Table 15: As trees smaller than 5 cm dbh are not being assessed, an adjustment has been carried out by using the same procedure as described in the comments to *Enquiry Table 14*. The same comments as mentioned above regarding "forest available for wood supply" also apply to *Enquiry Table 15*.

Natural losses are estimated at 6 per cent of gross annual increment for coniferous trees and 10 per cent for broadleaved trees on forest. On "other wooded land" the percentages are set at 20 and 30 respectively.

Trees outside the forest have not been assessed.

47-52

Enquiry Table 16: Annual removals underbark are taken from the official statistics of roundwood cut for sale and industrial production, while estimates from the Census of Agriculture and Forestry 1989 are given for non-commercial use. As the national statistics refer only to quantity underbark, removals overbark have been calculated by applying adjustment factors based on the standing volume over and under bark in mature forest.

Annual fellings are estimated by adding 6 per cent of total fellings for coniferous trees and 10 per cent for broadleaved trees.

The volume of non-decayed windthrown and dead trees in mature forest has been calculated, and the percentage of this volume in relation to the total standing volume in the same development class has been estimated. This percentage (for coniferous and broadleaved trees) has been used to estimate fellings of natural losses from the total annual fellings.

"Fellings of natural losses": e.g., trees damaged by insects, pollution, fires, storms, avalanches.

Poland

25-32

Enquiry Table 13: Stands older than 140 years are included in the class 121-140 years.

There exists supportive information in tabular form on "Area structure of Polish forests in 1996, by main species groups (without forest related areas)" in the reply to the enquiry, which is available at the secretariat.

33-36, 39-41

Enquiry Table 14: In this table information of varying reliability is inserted. The data on growing stock in the State forests are measured in a detailed way; in the private forests this feature is measured too, but with a lower accuracy. The base of adjustments was the average of 1992 and 1996 data.

The most important adjustment was connected with the change of the measurement system. The Polish system adopts 7 cm o.b. or 5 cm u.b. as a minimum diameter, and only wood above this dimension was reported. The adjustment was done in the following way:

– for the group of dominating tree species (Pine, Spruce, Beech, Alder and Birch) the mean quality class was calculated,

– with the use of official yield tables for mentioned species, the share of the volume of wood below 7 cm in diameter was assigned (for every age class),

– on the base of real volume (above 7 cm) of each age class and tree species, the real volume below 7 cm diameter was calculated,

– finally, the coefficients for coniferous and broadleaved species were derived,

– to obtain the total volume, the volume of growing stock (above 7 cm) of coniferous wood should be multiplied by 1,26, while the volume of broadleaved—by 1,17.

The volume of Dead trees was assessed on the basis of results of the forest health state inventory (conducted in 1991). Dead trees were about 1,3 per cent of growing stock volume. The volume of "Other trees" (14,10) was assessed by experts.

Woody biomass is calculated by multiplying standing volume by fixed coefficients: 0,40 m.t./ m^3 for coniferous and 0,57 m.t./ m^3 for broadleaved.

Due to the lack of information, correspondents decided not to assess other woody biomass, assuming that its volume was taken in the volume of growing stock below the 7-cm threshold.

Other woody biomass (stumps and roots) relation to the growing stock was assessed as 20 to 80.

The proportions between forest available and not available for wood supply were taken from the proportions of the areas in these categories (*Enquiry Table 3*).

42-46

Enquiry Table 15: Unfortunately, increment-related information is not measured in our inventory system (beside the volume of fellings of natural losses). For that reason the gross annual increment was calculated with the use of growing stock data and growth tables (for the volume above 7 cm diameter) and increased by relevant coefficients for growing stocks (the same as in *Enquiry Table 14*) to obtain the volume of the increment above 0 cm in diameter.

The volume of natural losses is the sum of fellings of natural losses (above 0 cm) and the volume of natural losses left in the forest (expert's assessment). Natural losses in Polish forests in the 1992-96 period, estimated to average 13.0 million m^3 o.b. a year accounted for an appreciable part (23 per cent) of gross annual increment. This was due to the unsatisfactory health condition of our forests (extremely high degree of defoliation, insect and disease epidemics, forest fires, etc.). Natural losses occurred in every age class.

The division into forest available and non-available for wood supply was done proportionally to the areas covered by these categories.

47-52

Enquiry Table 16: The source data for this table was the volume of removals, measured under bark, from the years 1992-1996. In the State Forests removals are registered in a detailed way, in division above and below 5-cm u.b. In the private forests they are recorded more roughly; removals below the 5-cm threshold are not shown and should be estimated by experts.

Removals on forest available for wood supply are the difference between removals, total and removals on forest not available for wood supply.

Removals on forest not available for wood supply consist of two parts: removals from National Parks and other removals, where intensity of cuttings (per 1 ha) was assessed two times less than on the relevant area of forest available for wood supply. It was assumed that the volume of bark amounts to 20 per cent of total volume, over bark.

Annual fellings were calculated otherwise, the entrance data were the volume of removals above 5-cm u.b. (for the years 1992-1996), enlarged by the volume of bark (*1,19) and harvesting losses (*1,05). The total volume of fellings (above 0-cm o.b. diameter) was calculated with the use of the same coefficients that were applied for the growing stock and increment.

In fact the volume of cuttings that were not predicted for commercial use consists of two parts: one of them, made by farmers, is outside official statistics. The second group is the fuelled for employees of the State Forests enterprise (this could be exchanged for money). The total volume of non-commercial cuttings is not known and was estimated by experts.

Fellings of natural losses are registered in the State Forests enterprise only, for the other forests that figure was enlarged proportionally to the volume of removals. In the 1992-96 period the salvage of natural losses from Polish forests averaged 9.5 million m^3 o.b. a year, equivalent to 73 per cent of total natural losses (the remainder being left in the forest) and to as much as 30 per cent of total fellings.

Comparing average annual fellings with net annual increment gives a distorted indication of 'forest balance' because of the high proportion of recovered natural losses in total fellings. The figures of 67 per cent for the ratio of fellings to NAI for coniferous species and 109 per cent for broadleaved are misleadingly high. By adding unrecovered natural losses to total fellings (which include fellings of natural losses = salvage fellings) and comparing that sum to gross annual increment, more realistic figures of 58 per cent for coniferous and 83 per cent for broadleaved are obtained, which are consistent with the data in *Enquiry Table 17* showing that growing stock of both coniferous and broadleaved species has been expanding."

Portugal

25-32

Enquiry Table 13: The data for "61 to 81 years" correspond to data for "61 years or more".

33-36, 39-41

Enquiry Table 14: Growing stock: National Forest Inventory data are determined by sampling. Concerning the growing stock, the practice is to calculate the stem volume including tops of trees of which d.b.h. is more than 5 cm. As we are currently in an Inventory updating phase and just collecting field data, the base for our estimate was the data of the inventory (1992) of the two main Portuguese wood supply species (*Pinus pinaster* and *Eucalyptus globulus*).

– Trees with a d.b.h. more than 5 cm: the values mentioned above, were extrapolated to the new data areas.

– Trees with a d.b.h. less than 5 cm: were collected in sub-sampling plots (1 cluster with 5 plots of 10 m^2), the tree number and height, on bases of which was assessed the mean volume concerning the observed height to a mean d.b.h. of 2.5 cm, using the formula:

$=S1m \,.\, Ni \,.\, Vi$

where:

m = number of age classes

S = sub-stratum area

Ni = number of trees per hectare

Vi = tree mean average volume

and

$Vi = h \times g \times f$

where:

h = tree mean height

g = basal area, considering a mean diameter of 2.5 cm

f = form factor (=0.6)

To obtain the volume (trees with a minimum diameter of 0 cm) of stems, a coefficient was applied to calculate final volume including branches, that was 1.24 to coniferous and 1.2 to broadleaved. Standing volume: dead trees =5 per cent of growing stock both to coniferous and broadleaved.

Woody biomass: To calculate these values, available factors conversion were used and applied to standing volume values.

Stem+branches+bark: k=0.26 to coniferous and k=0.522 to broadleaved;

Stumps+roots: k=0.12 to coniferous and k=0.34 to broadleaved.

Woody biomass of shrubs and bushes: estimated using as mean production in forest area, 1.3 ton/ha.

37, 38

Enquiry Table 17: Concerning the 1985 data, the values were recalculated to bring them into accordance with TBFRA2000, and used the same values as those used now to calculate the volume of all trees with diameter over 0 cm (0.7 per cent over growing stock of the trees with diameter > 5 cm to coniferous and 3.7 per cent to broadleaved).

47-52

Enquiry Table 16: Concerning removals, the data were estimated on the basis of mill consumption and roundwood exports.

The data for fellings and removals on other wooded land were estimated by the National Correspondent on the basis of mill consumption and roundwood exports, which is almost exclusively pine and eucalyptus wood; otherwise estimates point to a very small and insignificant value.

Republic of Moldova

47-52

Enquiry Table 16: Overbark removals estimated at 73 per cent of fellings. Underbark removals estimated at 78 per cent of overbark removals.

The figures for annual removals are the secretariat's estimates based on the analysis of the national data.

Romania

25-32

Enquiry Table 13: The available breakdown by age-classes is from the latest forest inventory (1984) and it refers to all forests.

Figures for "11 to 20 years" include figures for "10 years or less".

Figures for "101 to 120 years" include figures for "121 to 140 years" and "Over 140 years".

The total figure for high mixed forest is smaller than the sum of the areas in different age classes because the age classes include the mixed forest not available for wood supply. The total refers only to high mixed forest available for wood supply.

33-36, 39-41

Enquiry Table 14: Estimates for "Woody biomass" are made by the secretariat.

42-46

Enquiry Table 15: Estimates for "Natural losses" and "Net annual increment" are made by the secretariat.

47-52

Enquiry Table 16: Figures from column "Fellings of natural losses" are sanitary cuttings, calculated as average from statistical reports for 5 years reference period. The estimated volume of 8.0 million m^3 (mostly coniferous)—fellings caused by strong wind storms in 1995-1996, of which removals were 5.8 million m^3 (as of the end of 1997) is not included.

Estimates for "Annual removals, underbark" are made by the secretariat.

Russian Federation

25-32

Enquiry Table 13: The areas "Under regeneration" are the areas cut over the previous three years.

The distribution of high forest available for wood supply is given for forest available for exploitation and forest reserves managed by the forestry authorities. The areas themselves were assessed on the basis of data on stands by species and age classes, allowance being made for the lower age limit on cutting.

Cutting age varies by species group within the following limits:

conifers: 81-161 years;

high forest hardwoods: 81-161 years;

coppice hardwoods: 61-101 years;

soft hardwoods: 41-81 years.

For mixed stands, the average (conditional) cutting age is taken as 100 years.

33-36, 39-41

Enquiry Table 14:

(*a*) Volume of dead conifers has been taken as a ten-year aggregate of average annual losses; volume of dead hardwoods has been taken as a five-year aggregate of average annual losses (see *Enquiry Table 15*) based on growth tables and sources in the literature (Zagreev et al., 1992; Zagreev and Sinitsyn, 1992; Bazilevich, 1993);

(*b*) Woody biomass calculated by multiplying total (growing and dead) volume by the conventional average timber density (0.45 t/cu. m.) and adding branch mass: 10 per cent for broadleaved, 15 per cent for conifers;

(*c*) Other woody biomass (saplings, small trees, bushes) taken to be 3 per cent of the volume of woody biomass;

(*d*) Other biomass (stumps and roots) taken to be 25 per cent;

(*e*) During the evaluation process, volumes of growing stock were revised downwards by 10 to 30 per cent (Alekseev et al., 1994; Filipchuk, 1995), so the likely range has been taken to be a systematic error of +25 per cent.

37, 38

Enquiry Table 17:

1. The insignificant decline in overall growing stock is the result of a change in total forest area over the review period, some forest land having been reassigned to create nature reserves or for construction areas.

2. The decline in coniferous growing stock in forest available for wood supply is the result of primary felling and fires. It is also a consequence of the substitution (succession) of coniferous for broadleaved, which is directly confirmed by the increase in broadleaved stocks.

42-46

Enquiry Table 15:

(*a*) Net annual increment was arrived at by dividing volume of growing stock by the average age of the stand (A), multiplied by a corrective coefficient (K) to take account of the lag between average stand age and the actual age (restoration, succession) in a forest ecosystem. For calculation purposes K was taken to be 1.1 for stands less than 50 years old, 1.2 for stands aged between 50 and 100 years and 1.3 for stands more than 100 years old.. Incorporating the corrective coefficient, (A*K) roughly = 100 years for conifers; (A*K) roughly = 60 years for broadleaved stands. The average value of (A*K) for all Russian forests is 78 years.

(*b*) The proportion of annual losses was taken to be 40 per cent of net annual increment for coniferous and 30 per cent for broadleaved (from averaged data in growth tables for larch and birch).

47-52

Enquiry Table 16: "Fellings of natural losses" are trees damaged by insects, pollution, fires, storms and avalanches.

For "Annual removals, overbark" (on forest, total), 88,700 thousand m^3 is given as a substitute (alternative) figure. For "Annual removals, underbark" (on forest, total), 79,200 thousand m^3 is given as a substitute (alternative) figure.

1. Annual fellings have been taken to be the actual stumpage volume of standing timber felled in 1995. The figures are official data from the Russian Federal Forestry Service, which keeps the records on forests managed by itself, the Central Hunting and Nature Reserve Administration and the Ministry of High and Specialized Secondary Education, and on national nature parks (excluding Ministry of Defence and Ministry of Agriculture and Food Volumes). The ratio of conifers to broadleaved in the annual felling figures is defined by reference to their relative proportions in primary fellings.

2. By convention, forest available for wood supply (row 16.5 in *Enquiry Table 16*) includes forests in groups II and III, which account for the bulk of the exploitable forests and fellings. Forest not available for wood supply (row 16.15) includes forests in group I, which generally serve a conservation function and are therefore subject to special management regulations (restrictions on the species felled and felling methods and extent). Group II and III forests also contain certain quantities of timber that are difficult to exploit for a variety of reasons, but no separate figures are kept on the extent of the felling within them.

3. Commercial fellings in forests available for wood supply (rows 16.5 and 16.10) are calculated with reference to the proportion of commercial timber in primary fellings (77 per cent of conifers, 60 per cent of broadleaved).

4. Annual removals (1995) is taken to be the total volume of timber extracted (by the range of enterprises considered by the Russian Federal State Committee on Statistics). The definition "Removals for commercial use" covers removals of industrial timber (shown in brackets). There are no figures indicating removals from forests under different management systems or from different categories of land, nor on removals by species group.

Slovakia

25-32

Enquiry Table 13: All data were calculated from the database JPRL (unit of area stand arrangement of forests) of Lesoprojekt in connection to tab. 4.2. The stands predominantly coniferous, predominantly broadleaved and mixed were selected based on a defined approach as given in the text to the *Enquiry Table 3* (Predominantly coniferous, broadleaved, bamboos, palms, etc., mixed on "Forest, total"; and Predominantly coniferous, broadleaved, bamboos, palms, etc., mixed on "Forest available for wood supply"). The data in the database of Lesoprojekt were given within stand area. They were converted to forest land.

The figures for "Under regeneration" include figures for even-aged stands in regeneration, and clearings and areas of annual fellings.

33-36, 39-41

Enquiry Table 14: The growing stock of living trees (column A) was calculated from the data of Permanent Forest Inventory (PIL) 1996. A calculation of the proportion of growing stock in the forests of the Ministry of Defence was done according to forest categories and age classes as well as according to the data from Lesoprojekt Zvolen to 1 January 1996 provided for the needs of deriving prospective allowable cuts in the Slovak Republic. The category—trees in forests utilizable for growing stock 14.5—comprised also the category of commercial forests and the category of special purpose forests. Into the category—trees in forests unutilizable for growing stock—protection forests were included.

A conversion of the volume of large wood-dimension underbark to the required volume tree overbark was made by means of the coefficients derived from yield tables of main tree species (Final Report 1990). An overall categorization was made with regard to the percentage of required forest categories from the data of Lesoprojekt Zvolen and from forest management plans valid on 1 January 1996.

Standing volume of dead trees was determined from the data of Lesoprojekt Zvolen which were obtained within the monitoring of forest health condition to 31 December 1996. The data presented by Lesoprojekt were converted to the required volume unit of tree overbark.

The calculation of growing stock (living and dead trees) to woody biomass was made by means of the coefficients of wood density (dry matter) in kg. m^3 according to the percentage of the growing stock of individual tree species in total growing stock from Permanent Forest Inventory (PIL) 1996.

Woody biomass of shrubs and bushes at an amount of 2 per cent of woody biomass is given as a quantified estimate.

Under-stump woody biomass (roots and stumps) was determined as a qualified estimate after studying literary sources, at an amount of 15 per cent of above-stump woody biomass.

Specifications of known deviations from TBFRA-2000 definitions:

With determining the standing volume a pre-set minimal diameter of 0 cm (of breast-height diameter) was not fulfilled as Slovakia's current forest management practices are based, in determining growing stock, on callipering of stands from minimal registration diameter of 8 cm.

37, 38

Enquiry Table 17: (SLHP) Total growing stock for the reference period "1" was calculated from the data of Total Forest Management Plan 1998 related to 31 December 1998. The conversion of the volume of large-dimension wood underbark at stump to volume overbark was made by the coefficients of conversion of volume units derived from yield tables of main tree species Halaj et al. (1990). The data on total growing stock for the period "2" were taken from the *Enquiry Table 14*. Mean annual changes were derived from the differences of reference periods divided by the number giving the duration of reference period (8 years).

42-46

Enquiry Table 15: Total current increment of large-dimension wood underbark according to forest categories was taken from the data of Lesoprojekt Zvolen for the Report on Forestry 1997 and for the needs of calculation of prospective allowable cuts in SR and, and was finally calculated for the whole of Slovakia by means of the coefficient of the proportion of the growing stock in the forests of the Ministry of Defence of SR to total growing stock of the forests in Slovakia.

A conversion to volume unit of total current increment—tree overbark—was made through derived coefficients by means of the volume unit tree overbark and large wood underbark from the data of yield tables by Halaj et al. 1990 (Final Report). This calculation was made according to forest categories and tree species.

Natural losses on the increment were determined by means of natural decrease of trees with other incidental fellings taken from the Lesoprojekt Zvolen data, recorded within the monitoring of forest health condition to 31 December 1996. Total natural losses on the increment of 13 per cent are due to injurious agents (7 per cent) and incidental fellings (6 per cent).

47-52

Enquiry Table 16: The data on annual fellings were taken from the data of Permanent Forest Inventory (PIL) 1996 in the volume of large-dimension wood underbark. The data were converted to volume overbark by means of the coefficients of the relation of volume units, derived from yield tables of main tree species (Halaj et al. 1990). This volume of felling was increased by 3 per cent representing the volume of fellings of timber remaining in the stands after cleanings. A conversion to other required items was performed through given data on fellings in particular forest categories. The data on fellings from natural losses were calculated from the data on incidental fellings according to Permanent Forest Inventory (PIL) 1996 through their conversion to volume unit tree overbark in required classification.

Annual removals—meaning timber deliveries for the year 1996—were taken from the data of the Report on Forestry 1997. They were converted to overbark volume with 10 per cent additional charge for bark. The division into the required detail was calculated through the percentage of the proportion of forest categories in total timber felling in 1996.

Slovenia

25-32

Enquiry Table 13: Expert assessment based on the data from the forest management plans and "NFI" 1996.

33-36, 39-41

Enquiry Table 14: The volume of dead trees is estimated as:

"Dead trees" of "Trees on forest available for wood supply": 2 per cent of "Standing volume--Growing stock" of "Trees on forest available for wood supply";

"Dead trees" of "Trees on forest not available for wood supply": 5 per cent of Standing volume--Growing stock" of "Trees on forest not available for wood supply";

"Dead trees" of "Total above-stump volume and woody biomass" is an expert estimate based on "Dead trees" of "Trees on forest available for wood supply" and "Dead trees" of "Trees on forest not available for wood supply".

The methodology used for woody biomass is the methodology of secretariat estimation (1985).

The estimates 2 per cent and 5 per cent are based on the National Forest Inventory data, especially on the data of Forest Decline Survey.

The standing volume and increment do not include trees below d.b.h. < 10 cm. However the regression adjustment (least square method) performed for d.b.h. (classes 0-10; 10.1-20; ... over 110 cm) and corresponding volumes showed that the maximum of 1.5 per cent of the volume can be expected in the class of 0-10 cm, which is within the sampling error for the standing volume (± 3.8 per cent).

37, 38

Enquiry Table 17: A comparison between growing stocks of two reference periods is practically impossible due to differences in data collection method.

Methodology: 1986: non sampling method (combination of sampling and visual assessments); and 1996: sampling methodology (double stage sampling in tracts).

42-46

Enquiry Table 15: Gross annual increment is based on the data of the "NFI" 1996. Natural losses are estimated to be 10 per cent of gross annual increment (expert assessment), based on the "NFI", especially on the data of Forest Decline Survey.

47-52

Enquiry Table 16: Expert assessment is based on the data from the forest management plans.

Spain

33-36, 39-41

Enquiry Table 14: The figure for "Dead Trees" is estimated at 2 per cent of growing stock.

The figure for "Woody biomass" is estimated at: coniferous = 0.5 of standing volume; broadleaved = 0.6 of standing volume.

42-46

Enquiry Table 15: The 3rd National Forest Inventory is collecting data on natural losses.

Natural losses are estimated at 2 m^3/ha (~ 6 trees).

The data for "Gross annual increment and net annual increment on other wooded land" include figures for "Gross annual increment and net annual increment on trees outside the forest".

47-52

Enquiry Table 16: The figure for "Total annual fellings on other wooded land" includes figures for "Total annual fellings on trees outside forest".

Estimate for non-recovered felling losses is 5 m^3 per 10,000 m^3 (0.0005 per cent).

Sweden

25-32

Enquiry Table 13: See *Enquiry Table 1* "Total area by main classes" for the definition of Forest" and "Other wooded land".

Even-aged is defined as: at least 80 per cent of the stem volume within the 20 m radius plot should be within a 20 year interval.

Uneven-aged: less than 80 per cent

Source: Swedish University of Agricultural Sciences/Dep. of Forest Resource Management and Geomatics. Section of Forest Survey / BSc (For) Hans Toet.

33-36, 39-41

Enquiry Table 14:

See *Enquiry Table 1* "Total area by main classes" for the definition of "Forest" and "Other wooded land".

Volume overbark above-stump excludes branches, twigs and foliage (according to FRA-2000 definitions), includes large branches (>5cm oak and beech) for wood supply which have been calculated.

Woody biomass overbark above-stump includes branches, twigs and foliage (according to FRA-2000 definitions). It also includes dead trees lying on the ground which can still be used for fibre or fuel.

37, 38

Enquiry Table 17: See *Enquiry Table 1* "Total area by main classes" for the definition of "Forest" and "Other wooded land" and *Enquiry Table 14* "Woody biomass". Reference period 1985-1989 updated according to TBFRA-2000 definitions. Source: Swedish University of Agricultural Sciences/Dep. of Forest Resource Management and Geomatics.Section of Forest Survey/BSc (For) Hans Toet.

The "Average annual change" figures have a large random error component since it is the difference between (growing stock period 2) and (growing stock period 1). The growing stock in the respective periods is a statistical estimate with a random error component included, and the difference of the two combined might add up to a large error. Because of this (the resulting figures in *Enquiry Table 7* first indicated changes in the "wrong" direction) a correction is included in the figures. The average annual change between the two periods is therefore probably in the intervals:

Growing stock on "Forest" total:	26000—32500
on "Forest available for wood supply":	21500-27000
of which coniferous:	18300-23000
of which broadleaved:	3200-4000

42-46

Enquiry Table 15: See *Enquiry Table 1* "Total area by main classes" for the definition of "Forest" and "Other wooded land" and *Enquiry Table 14* "Woody biomass".

Increment on trees which have been felled or died during the reference period has been calculated. Annual natural losses include recovered annual natural losses which have not been recorded as standing non-growing stock for inventory year(s).

47-52

Enquiry Table 16: See *Enquiry Table 1* "Total area by main classes" for the definition of "Forest" and "Other wooded land" and *Enquiry Table 14* "Woody biomass".

Fellings for trees < 50 mm stump diameter and > 0 mm diameter at breast height have been calculated.

Natural losses include recovered natural losses which have to be used as a part of total annual natural losses in *Enquiry Table 15* "Increment".

Annual removals stem volume excludes tops left on site. Oven dry = dried 48 hours at 105 °C.

There is a long-time observed difference between the National Forest Survey's felling figures (estimated from stump inventories) and the National Board of Forestry's calculated annual gross fellings (based on a combination of retrieved industry data, the National Forest Survey stump inventory, and other sources of information). Also, according to investigations by the National Forest Survey they assume that their stump inventory data are systematically under-estimated. Therefore a calibration of the National Forest Survey data has been carried out in all cells in *Enquiry Table 16*, that is all original figures are calibrated with 1.06 (6 per cent) according to Mr. Hans Toet.

Switzerland

33-36, 39-41

Enquiry Table 14: Data on "Other trees (on other wooded land and trees outside the forest)" and "Other woody biomass (shrubs and bushes) on forest and other wooded land" are raw estimates derived from national statistics on carbon balance of Switzerland.

37, 38

Enquiry Table 17: The average annual change is related to a period of 10.1 years.

Reason: The data were measured within a 3-year period on each of the two inventory occasions. The average number of vegetation periods between the two occasions was calculated to derive an exact time period to which change figures for volume etc. are related.

42-46

Enquiry Table 15: For "on other wooded land" and "on trees outside the forest", no data are available; an expert guess would lead to arbitrary data.

47-52

Enquiry Table 16: For "on other wooded land" and "on trees outside forest", no data are available; an expert guess would lead to arbitrary data.

Tajikistan

33-36, 39-41

Enquiry Table 14: Source for Above-stump volume and biomass of trees on forest, total, and Trees on forest not available for wood supply: Information from the TBFRA-2000 National Correspondent, Mr. G. A. Avsalov, Director General of the Forest Association "Tajikles", in reply to the Table of the TBFRA Essential Data, 20.11.1998.

37, 38

Enquiry Table 17: Information from the TBFRA-2000 National Correspondent, Mr. G. A. Avsalov.

42-46

Enquiry Table 15: Gross annual increment is the secretariat estimate calculated with the assumption that it is equal to about 1.5 per cent of growing stock. Source: Information on "Net annual increment" is from the TBFRA-2000 National Correspondent, Mr. G. A. Avsalov, in reply to the Table of the TBFRA Essential Data, 20.11.1998.

47-52

Enquiry Table 16: Information from the TBFRA-2000 National Correspondent, Mr. G. A. Avsalov.

The FYR of Macedonia

33-36, 39-41

Enquiry Table 14: The data are secretariat estimates based on information from different literature sources, including ETTS-V, 1996, and other UN-ECE/FAO publications.

37, 38

Enquiry Table 17: The data for "Growing stock on forest available for wood supply" are secretariat estimates based on literature sources of information.

42-46

Enquiry Table 15: The data are secretariat estimates based on information from different literature sources, including ETTS-V, 1996, and other UN-ECE/FAO publications.

47-52

Enquiry Table 16: The data are secretariat estimates based on information from different literature sources, including ETTS-V, 1996, and other UN-ECE/FAO publications.

Turkey

25-32

Enquiry Table 13: There are national data on the distribution of forest area by age classes. But those do not conform to FRA standards: Age classes involves determination of rotation ages and rotation periods by tree species. For the rotation age lesser than 70 years, the rotation period is 10, for higher it is 20 years. In addition the last rotation period also includes very old forest stands which is symbolized as +" in plans. Therefore there are many distribution figures according to various tree species and it is impossible to refine them into a single table (at least for the time being).

There exists supportive information on "Even-aged high forest available for wood supply" in the reply to the TBFRA enquiry, which is available at the secretariat.

33-36, 39-41

Enquiry Table 14: The data in this table do not include:

– areas of high forest where d.b.h. is less than 8 cm (1,458,563 ha);

– young stands where coppice sprouting or planting has been carried out recently (54,737 ha);

– bushy areas (1,107,761 ha).

8 cm diameter is the basis for all statistical calculations. The figures of standing volume and increment in our management plans reflect the volume and increment of stem above stump. To include the root and branches we used factors of 1.2 for coniferous, 1.25 for broadleaved forests and 1.45 for coppices. Also the measurement unit for coppices is the "stère" we assumed that 1 stère equals 0.75 m^3.

For the trees outside forest, the figures are estimates based on various studies and published documents.

Total volume and biomass of dead trees on forest: estimate made by the secretariat with the permission of the National Correspondent of Turkey.

Turkmenistan

33-36, 39-41

Enquiry Table 14: Source for "Trees on forest total", "Coniferous on forest", and "Other trees": Data provided by the Ministry of Natural Resources Utilization and Environmental Protection of Turkmenistan in its reply to the concise enquiry for SOFO-97 (12.08.1996).

Source for "Broadleaved on forest total", "Coniferous and Broadleaved on forest available for wood supply": Secretariat estimates based on different literature sources. Secretariat estimates; conversion factors (coefficients) for woody biomass, as derived from GS, are assumed to be: above-stump, total 0.68; coniferous 0.60; broadleaved 0.70; below-stump 0.15 of the above-stump.

37, 38

Enquiry Table 17: Data provided by the Ministry of Natural Resources Utilization and Environmental Protection of Turkmenistan in its reply to the concise enquiry for SOFO-97 (12.08.1996).

Secretariat estimates based on different literature sources.

42-46

Enquiry Table 15: Data provided by the Ministry of Natural Resources Utilization and Environmental Protection of Turkmenistan in its reply to the concise enquiry for SOFO-97 (12.08.1996).

Secretariat estimates based on different literature sources.

Net annual increment distribution between coniferous and broadleaved is calculated on the basis of growing stock.

47-52

Enquiry Table 16: Data provided by the Ministry of Natural Resources Utilization and Environmental Protection of Turkmenistan in its reply to the concise enquiry for SOFO-97 (12.08.1996).

Secretariat estimates based on different literature sources.

United Kingdom

25-32

Enquiry Table 13: Based on data from GB production forecasts and 1980 Census, rated up to totals *in Enquiry Table 3*. Age breakdown for mixed is estimated by subtraction.

33-36, 39-41

Enquiry Table 14: Source: Production forecast programs for FC and non-FC + estimates.

Dead trees, biomass shrubs + bushes, stump and roots—all are rough estimates: no data available.

Growing stock on forest: Estimated from UK area, assume growing stock 50 m^3/ha.

Growing stock on forest available for wood supply: GB + 4 per cent NI—5 per cent less open space—3 per cent stump + 6 per cent 0-7 cm + 20 per cent (broadleaved only) large branches.

Total above-stump woody biomass: Uses factors 0.43 for conifers, 0.83 broadleaved; rounded.

37, 38

Enquiry Table 17: All figures adjusted from UK definition (7 cm) minimum to 0 cm minimum.

Figures for 1980 taken from Census publication, with similar adjustment as 1995 for "not available for wood supply".

Source of figures reported for FRA 1990 not known; they look inconsistent.

For broadleaved, annual increase in growing stock over this 15-year period is less than the difference between latest (1995) figures for increment (*Enquiry Table 15*) and fellings (*Enquiry Table 16*), because losses in 1987 storm were cleared before 1995.

42-46

Enquiry Table 15: Source: GAI based on GB Production forecast for FC + private, using factors from 1980 Census, adjusted for volume definition.

Net annual increment on forest available for wood supply: GB + 4 per cent for NI—3 per cent stump + 2 per cent 0-7cm + 5 per cent less open space.

Natural losses on forest available for wood supply: rough estimates.

47-52

Enquiry Table 16: Fellings of natural losses is rough estimate for 1995, was higher after storms.

Annual fellings, total: Factors "underbark" to "overbark" smaller than used in UK statistics, to exclude stump, then adjusted for estimated volume 0-7 cm including large branches.

Annual removals, total, u.b.: Factors "underbark" to "overbark" smaller than used in UK statistics, to exclude stump, then adjusted for estimated volume 0-7 cm including large branches.

United States of America

25-32

Enquiry Table 13: Source: RPA database summary tables, unpublished.

Estimates for "Under regeneration" through "1 to 20 years" are derived. Estimates developed and prorated to align with data in *Enquiry Table 11* "egeneration and extension of forest".

33-36, 39-41

Enquiry Table 14: Growing stock volumes in the U.S. are based on top minimum diameter 10.2 cm (4.0 inches) for coniferous and broadleaved; minimum diameter at breast height (d.b.h.) 12.7 cm (5.0 inches) for coniferous and broadleaved; branches not included. Volume data are, however, gathered for all live trees down to 2.5cm (1-inch) dbh. For TBFRA-2000, all live trees are considered as growing stock, which include commercial tree species; non-commercial tree species; and sound cull trees (trees or volume declared cull due to poor form, splits, cracks, etc.). Adjusted growing stock and other volumes reported in TBFRA for the United States will always be higher than those observed in domestic publications. This is due to the more expansive TBFRA definition of growing stock, which includes live trees less than 12.5cm d.b.h. and is reported overbark. Biomass data should be roughly equivalent without adjustment.

Dead trees include only salvageable dead trees still standing; excludes dead trees lying on the ground. In addition, information is available only for these salvageable dead trees on available forest land.

Field inventories do not completely cover reserved forest (unavailable forest) or other wooded land at present. They are in progress. Volume and mass figures on unavailable forest land and other wooded land were derived from averages per acre as estimated on available forest land, and expanded by the number of hectares.

Other tree component volume and biomass—Based on summaries of several studies, it was estimated that stump and root biomass was equivalent to 20 per cent of the bole volume of trees. Shrub volume was estimated to be equivalent to 8 per cent of average bole volume based on limited data.

Trees outside the forest—Data for "Other trees on OWL" and "Trees outside the forest" only includes estimates for "other wooded land". Information for trees outside the forest is currently unavailable.

There exists supportive information on "Supplement tables converting U.S. data to international format" (in tabular form) in the reply to the enquiry, which is available at the secretariat.

IMPORTANT NOTES on reported area and volume estimates:

The reader is cautioned that there are important differences between the numbers provided in this report and those found in domestic U.S. reports. Terms used in the TBFRA such as "forest" and "growing stock" are the same as used in the U.S.A. but the meanings have subtle differences.

Forest land area—by U.S. Forest Service definition, forest land is at least 10 per cent stocked by forest trees, and at least 0.5 hectare in size. This is similar to the FAO definition, which defines forest as land with tree crown cover of more than 10 per cent and minimum size of 0.5 ha in general, the U.S. definition is considered to be compliant with the TBFRA 2000 definition for productive forest land. However, much of the land presented in this report for the U.S. as "Other wooded land" may in fact be "Forest' by the TBFRA definition. Full inventory data collection for these lands to assure compliance with the TBFRA definition is

currently underway but will not be available for 3 to 5 years. The lands reported as "Other wooded land' in this report are generally of low productivity (less than 1.4 m^3/ha/yr) and listed as "unproductive forest" or "other forest land" in U.S.A. reports. The U.S.A. response is generally consistent with the Canadian response for this land category.

Other wooded land area—"Other wooded land" in this report is primarily unproductive forest, not capable of producing 1.4 m^3 per hectare of industrial wood annually. Most of this land will probably be re-classified as forest in future TBFRA Assessments. See discussion of forest land above.

Forest Available for Wood Supply—In the context of this report 'available for wood supply' means only that the forest land is not withdrawn from timber production by law or administrative regulation. Actual availability, at any given time, will vary by ownership objectives. For instance, on public lands in the U.S.A such as National Forest System lands, availability of forest land for timber production is further restricted in the planning process by determining if it is currently 'suitable' for timber management. Suitability varies based on factors such as available markets, accessibility, aesthetic restrictions, conservation restrictions, higher value alternative uses, and many other considerations. Private industrial forests are also subject to restrictions in the corporate planning process. And, the nearly 10 million non-industrial private forest landowners have management objectives perhaps as diverse as their numbers. Thus, in general, the values reported here as 'available for wood supply' will overstate the actual area and volume available for wood supply by the cumulative restrictions of the forest planning process. For example, current plans suggest that perhaps only 1/3 of the available National Forest lands and, according to a recent private ownership study in the U.S.A., only 1/3 of privately owned forest lands have timber management as a primary objective.

Volume: In the U.S.A, while biomass is generally reported overbark, timber volumes are generally reported underbark. Most volumes requested by the TBFRA Enquiry are overbark. Volumes have been adjusted to include estimates of bark. Volumes for currently unsurveyed 'reserved' and 'unproductive' forest lands have been estimated to provide a more complete picture of U.S.A. forests. Surveys of these lands are under way.

37, 38

Enquiry Table 17: As in *Enquiry Table 14* "Total woody biomass and the volume of growing stock"—Growing stock volumes in the U.S.A. are based on top minimum diameter 10.2 cm (4.0 inches) for coniferous and broadleaved; minimum diameter at breast height (d.b.h.) 12.7 cm (5.0 inches) for coniferous and broadleaved; branches not included. Volume data are, however, gathered for all live trees down to 2.5 cm (1-inch) d.b.h. For TBFRA-2000, all live trees are considered as growing stock, which include commercial tree species; non-commercial tree species; and sound cull trees (trees or volume declared cull due to poor form, splits, cracks, etc.). Adjusted growing stock and other volumes reported in TBFRA for the United States will always be higher than those observed in domestic publications. This is due to the more expansive TBFRA definition of growing stock, which includes live trees less than 12.5 cm d.b.h. and is reported overbark.

42-46

Enquiry Table 15: Figures are not adjusted to estimate increment on cull trees or on trees below 12.5 cm d.b.h. Estimates are adjusted for overbark and include estimates for trees on unavailable forest and other wooded land based on volume estimates in *Enquiry Table 14* "Total woody biomass and the volume of growing stock". Thus the estimates of increment presented here will understate the true value. The volume represented by the missing trees is assumed to be a small proportion of the total.

There exists supportive information on "Supplement tables converting U.S. data to international format" (in tabular form) in the reply to the enquiry, which is available at the secretariat.

47-52

Enquiry Table 16: Data on annual increment and fellings are available only for land areas that the U.S. Forest Service defines as timberland (available forest land). Information for other land classes approximated by ratios to available forest land. Proportion of removals from other wooded land not separated.

Data for "On forest not available for wood supply" primarily represent lands within legal reserves within the United States (IUCN categories I & II) where harvesting is not allowed.

Data for "On other wooded land" is not a direct measure and is derived from total fellings and removals data based on logging utilization studies.

Uzbekistan

33-36, 39-41

Enquiry Table 14: The growing stock of *Halaxilon* spp. (broadleaved) constitutes about 75 per cent of the total growing stock of forest in Uzbekistan.

37, 38

Enquiry Table 17: Source for Reference period 2: Secretariat estimates based on literature sources of information, including the article "Biological diversity and genetic resources of forests in Uzbekistan", A. K. Kayimov and E.S. Alexandrovsky, FAO, 1997.

Yugoslavia

25-32

Enquiry Table 13: The categories "10 years or less", "11 to 20 years and "21 to 40 years" of "Even-aged broadleaved forest" include the area of poplar plantations.

33-36, 39-41

Enquiry Table 14: Source: Statistical Bulletin of FRJ “Sumarstvo” 1995.

37, 38

Enquiry Table 17: Source: Statistical Annual Review 1979; Statistical Annual Review 1995.

42-46

Enquiry Table 15: Source: Statistical Bulletin of FRJ “Sumarstvo” 1995.

47-52

Enquiry Table 16: Source: Statistical Bulletin of FRJ “Sumarstvo” 1995; Statistical Annual Review 1995.

CHAPTER IV: BIOLOGICAL DIVERSITY AND ENVIRONMENTAL PROTECTION[1]

Introduction

The TBFRA-2000 differs from earlier enquiries in the extent to which it has sought information on forest condition, or forest quality, rather than just on the resource itself. This change does not signify an abrupt switch in emphasis, but is part of a continuing trend to broaden the scope of the enquiry. Decisions about the type of questions, and about their formulation, are based on discussions at an experts' meeting in Kotka, Finland in 1996 and further deliberations by two working groups, including representatives from conservation organizations. The inclusion of questions relating to biological diversity, the naturalness of forests and the extent and type of regeneration reflects increasing interest in biodiversity and environmental protection. It also provided a serious challenge to correspondents, who were faced with questions that required greater interpretation than has been the case in the past, and relied upon information that may not, until recently, have been collected by governments. These difficulties are reflected by the replies. Responses to the questions in this section have been both less complete and in some cases more ambiguous than for those relating to more traditional issues such as volume of wood extracted or area under trees.

The question of data quality requires some discussion. In a number of cases, due to both misinterpretation of questions and lack of information, data quality is suspect and some of the results will be controversial. Questions of forest naturalness have only really emerged in the last few years, and interest has until recently been confined to professional ecologists and some non-governmental organizations. Whilst a few governments have developed their own criteria and built up data sets, others have responded to the TBFRA questions as best they can, using very general categorization. In other cases, such as numbers of species at risk, most data sets are partial. Finally, the TBFRA has uncovered serious disagreements with respect to interpretation of some information, particularly with regard to what constitutes a protected area; indeed the current enquiry has to some extent opened up debates about the status of protected areas within parts of its member countries.

It is, therefore, particularly important to treat the following information with care. Nonetheless, the very considerable efforts made by many correspondents to address the questions, and the quality of many of the responses, is encouraging.

It should also be noted that due to the fact that many questions reported in this chapter are new to the TBFRA, there is no time comparison. Hopefully, time comparison data will become available in the future.

Given the more experimental nature of this section, the following chapter starts by introducing the reasons for inclusion of each question, outlines some of the definitions chosen to define the issue and then summarizes and discusses the results. Although full data tables are included at the end of the section, selected information has been extracted and presented in diagrammatic form below. All figures must be treated with caution because of the absence of data from some countries; however on the whole data gaps are from countries with relatively limited forest resources on a global scale and therefore unlikely to have a major impact on global proportions.

Forest and other wooded land by categories of naturalness (Main Tables 53 and 54)

Concern has been expressed that temperate and boreal forests, although expanding in area, are decreasing in "quality". One of the commonest elements mentioned, as contributing to quality is the degree of "naturalness" or "authenticity". In ecological terms, this refers to the degree to which a forest corresponds to the original forest in terms of species composition and ecological processes. However, these terms are difficult to define in an unambiguous and measurable way; in some cases it is by now difficult to determine the composition of an "original" forest and most forests in the region are to some extent altered by human activity, often over hundreds or thousands of years. For this reason, correspondents were invited to estimate the area of "forest undisturbed by man" as an approximation of "naturalness". The terms used by TBFRA "forest undisturbed by man" has a rigorous definition, as it implies no human disturbance at all or disturbance so long ago that natural processes have been completely re-established. Forests that do

[1] This chapter was prepared by Mr. Nigel Dudley (see Appendix V).

not satisfy this rigorous definition, even if they may well appear to be "natural" and have minimal silvicultural intervention, are considered "semi-natural". However, despite the rigorous definition, some uncertainties remain, including:

- How long must a forest remain untouched after an intervention to regain its status as "undisturbed"? (This is likely to vary between forest types and with respect to the degree of intervention.)
- What is the minimum size needed for an area to be classified as an "undisturbed forest"? Do small pockets of undisturbed trees fulfil the ecological roles of undisturbed forests?
- How are inventory crews going to identify undisturbed forests on the ground, given that long-term records often do not exist and knowledge of the ecology of undisturbed forests may be limited?

According to the replies by correspondents, 55 per cent of forest in the TBFRA area can still be classified as "undisturbed by man", with 41 per cent "semi-natural" and just 4 per cent of the area covered by plantations (Figure 4.1) (Note that these figures do not include data from Greece).

FIGURE 4.1

Proportion of TBFRA region forest graded by "naturalness"

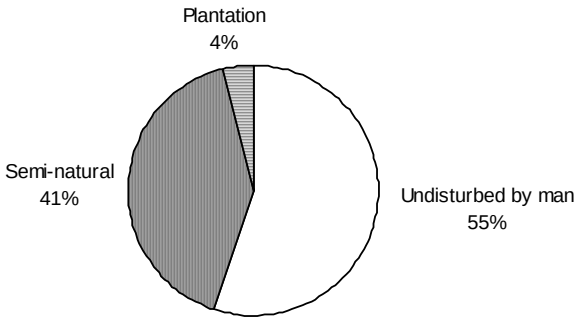
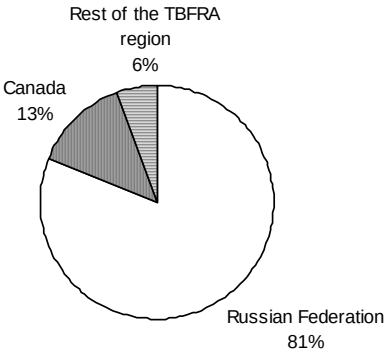


FIGURE 4.2

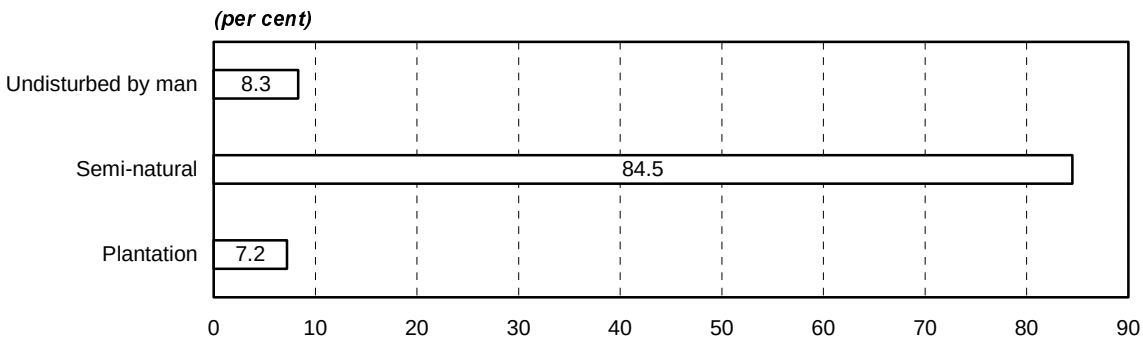
Forest in the TBFRA region undisturbed by man



The results suggest that the statistics for the TBFRA area on forest degree of naturalness are, not surprisingly, dominated by forest condition in the Russian Federation and Canada (and therefore on the accuracy of data from these two countries and on the ways in which they distinguish between "undisturbed by man" and "semi-natural") (Figure 4.2). However, if relative naturalness is analysed outside the Russian Federation and Canada, the figure for forest "undisturbed by man" drops to just 7 per cent of the total, as shown below (Figure 4.3).

FIGURE 4.3

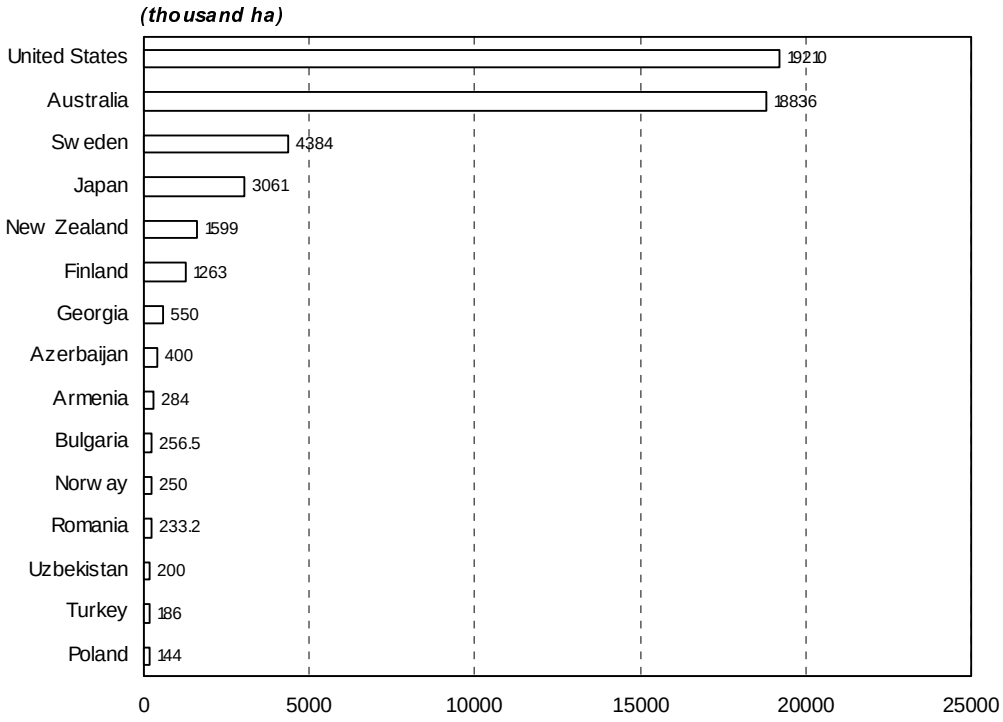
Percentage of forest graded by naturalness excluding Russian Federation and Canada



Closer examination of the data outside the two dominant forest countries shows further concentration. The bulk of the remaining forest "undisturbed by man" exists in the United States and Australia with smaller amounts in the Nordic countries, Japan and New Zealand; in the rest of Europe the proportion is usually from zero to less than one per cent. Nonetheless, in Europe as a whole, almost 9 million ha are defined as "undisturbed by man". While over half of this is in Sweden and much of the rest in Norway and Finland, many former Soviet states apparently contain important remnant areas (Figure 4.4).

FIGURE 4.4

Main forest areas undisturbed by man outside Russian Federation and Canada



Analysis of "naturalness" in "other wooded land" shows a similar concentration of the forest "undisturbed by man" with two countries dominating the statistics, although in this case Canada has recorded considerably more land than the Russian Federation (Figures 4.5 and 4.6). In general, boreal countries have the majority of other wooded land "undisturbed by man". Six of the seven countries in this category all have substantial boreal forests (in descending order: Canada, the Russian Federation, USA, Sweden, Finland and Norway) although the United States of America has substantial areas of other wooded land south of Alaska. The non-boreal country is Australia with a reported area of undisturbed other wooded land of over 23 million ha. In this category, substantially more other wooded land is recorded as "undisturbed by man" than "semi-natural".

FIGURE 4.5

Proportion of other wooded land in the TBFRA region classified by "naturalness"

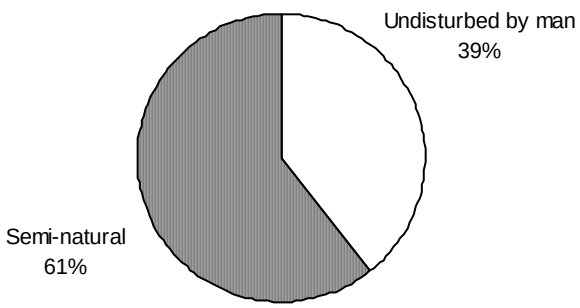
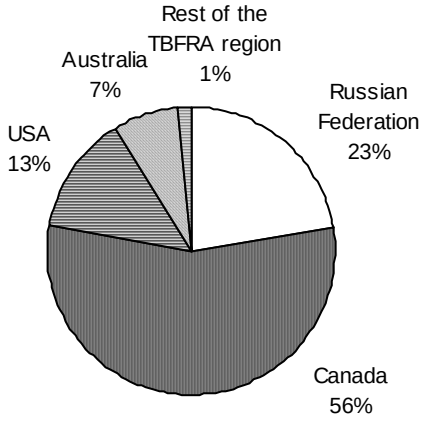


FIGURE 4.6

Proportions of other wooded land in the TBFRA region classified as undisturbed by man

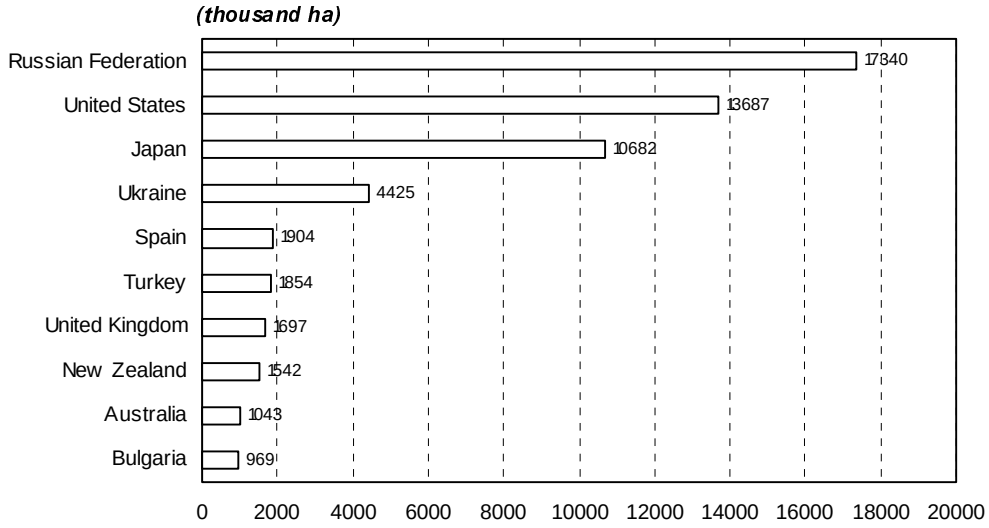


The dominance of Canada and the Russian Federation in terms of forest cover means that their estimations of "naturalness" inevitably have a major impact on total TBFRA figures and any errors would result in global distortion. Unfortunately, neither country has undertaken a comprehensive study of degree of naturalness within forests. The nearest equivalent found is the "frontier forest" study undertaken by the World Resources Institute (WRI). Comparison with WRI's figures found approximately similar proportions for Canada but less frontier forest (approximately equivalent to "forests undisturbed by man" in the Russian Federation[3].

Only 4 per cent of the total forest area in TBFRA countries is currently under plantations. 90 per cent of plantations in the area are found in just ten countries, dominated by the Russian Federation, the United States and Japan (Figure 4.7). This may reflect choices about forest management; for example Canada identified no plantations at all and defined all its managed forests as "semi-natural".

FIGURE 4.7

Area of plantations in ten countries



Tree species

One important information gap identified in the TBFRA planning discussions was a centralized set of data on presence and abundance of tree species in different countries. Such a data source would provide comparative information on biodiversity, commercial opportunities, conservation status and the broad geographical spread of species and families. Accordingly, correspondents were asked to provide information on tree species in these countries, including:

- scientific and common names of all tree species;
- an estimation of their abundance;
- an indication of whether they are native or introduced.
- Although most of the information should be fairly unambiguous, and well known in the majority of countries in the TBFRA, some questions remain open for interpretation by correspondents, including the following:
- How can correspondents be certain that a particular species has been introduced? In some cases where species have been present for many centuries it is now impossible to be certain if the species was originally native (for example this is true of the sycamore (Acer pseudoplatanus) in the UK). In other cases it remains very clear.
- What is the status of species that are native in one part of a country but have been spread into many other areas as a result of human activity? This is particularly significant in the larger countries, where species have in some cases been introduced into radically different habitats thousands of kilometres away from the original source.
- How can correspondents standardize estimations of abundance?
- How are naturalized species to be classified? (While the instructions were clear, these have not always been adhered to in replying to the enquiry.)

The full country replies are very voluminous and will be set out in a TBFRA-2000 accompanying discussion paper. They constitute probably the single largest comparison of country species lists assembled for the region and, in complete form, it will provide a unique data source.

[3] Dirk Bryant, Daniel Nielsen and Laura Tangley, "The Last Frontier Forests: Ecosystems and Economies on the Edge", World Resources Institute, Washington DC, 1997.

However, it has posed many problems for correspondents and there are relatively few countries in which data are unequivocal. Indeed in the large majority of cases the number of tree species listed in this section varied considerably from the total listed later in answer to the question summarized in Main Table 56.

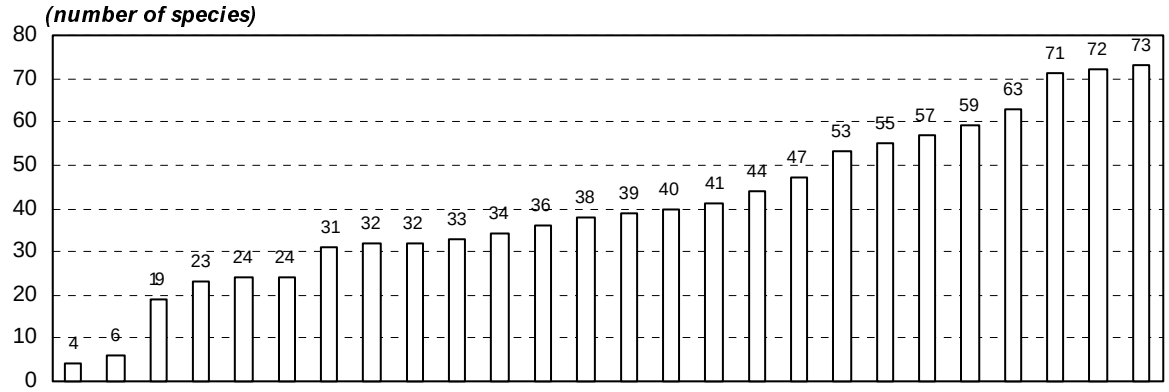
Some countries have also clearly included introduced species within their list of "natural" species and there is also some confusion about the status of naturalized species. The following summary of information is therefore necessarily selective and partial and further work is required to complete this compilation.

Any generalizations about speciation and relative biodiversity are very difficult to apply and any global patterns are heavily influenced by local anomalies. Nonetheless, some general conclusions can be drawn about numbers of tree species and levels of biodiversity.

The highest levels of biodiversity with respect to trees are found in the southern part of the Pacific Rim and Japan and the lowest levels occur in the northern boreal regions (Figure 4.9). In Europe and Central Asia (an area where small countries result in smaller sample units) tree diversity increases towards the south and the east (Figure 4.8).

FIGURE 4.8

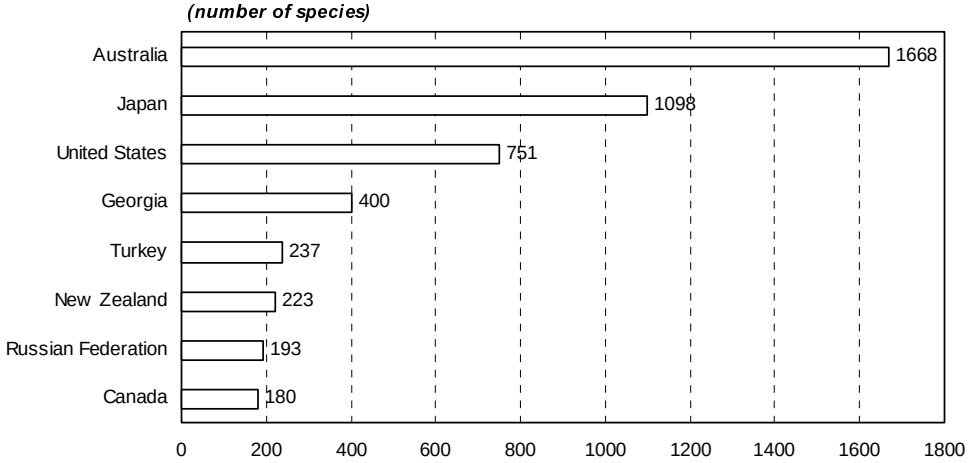
Number of native tree species in European countries



The analysis also includes itemization of threatened tree species. Currently the data are too sporadic to allow comparisons to be made – further work would allow greater analysis of trends. The unique value of the data already collected means that further work would be well rewarded.

FIGURE 4.9

Number of native tree species in "Other TBFRA" countries



Protection status: Forest and other wooded land (MainTable 55)

There is considerable interest in information relating to the amount of forest in protected areas and about the form that protection takes. Fears about a decline in natural forests have created a political momentum for an increase in forest protected areas, to protected biodiversity and also related ecological, social and cultural values. At the Fourth World Congress on National Parks and Protected Areas, in Caracas in 1992, IUCN/World Conservation Union suggested that around 10 per cent of the Earth's land surface should be in protected areas to conserve a full complement of biodiversity. This target was repeated in 1995 in a joint IUCN/WWF forest strategy. Some national governments have endorsed this figure, including for example those of Austria and Greece. The Australian government is committed to protecting 15 per cent of its pre-1750 forests and the Canadian federal and provincial governments are committed to a 12 per cent forest protection target. On the other hand a number of industry representatives have been expressing concern about the amount of forest being removed from productive use and questioning the amount of land put under protection. These issues are, in some countries, extremely emotive and there is a need for clear and accurate information on this subject. Many TBFRA countries are already collecting information for other purposes, including fulfilment of existing obligations (such as reporting to the Pan European and the Montreal Processes) and addressing national policy goals.

Correspondents were asked to collect and present information relating to forests and other wooded land in protected areas. Data were to be divided into the area under strict protection (as defined by IUCN categories I and II) and the area under more flexible forms of protection (i.e. forest and woodland in IUCN categories III-IV). Correspondents were also asked, where possible, to give an indication of trends in size and number of forest protected areas.

The definition used by TBFRA is based on that of IUCN – i.e. *an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.* This is further subdivided into six categories depending on the degree of protection and the primary management objective, ranging from strictly protected areas where even human access is severely curtailed to working landscapes where protection takes place alongside human communities continuing their everyday lives. Protected areas falling into the more general categories, particularly Categories V and VI, are a long way from the popular concept of an uninhabited landscape set aside for wildlife.

Although IUCN and its World Commission on Protected Areas (WCPA) provide a detailed guide to distinguishing between the various categories, several ambiguities remain to provide a challenge for correspondents. The following questions remain to be answered:

- Does the current definition of the IUCN categories provide clear enough guidance to allow the development of data sets that are sufficiently standardized to allow comparison between countries?
- How do correspondents measure protected areas that are partly forested? More generally, how is a "forested protected area" defined from the perspective of whether or not it constitutes a forest?
- How do correspondents measure protected areas that can be subdivided into a number of different categories?
- How "official" do protected areas need to be? Can private lands (e.g. land owned by companies or charitable trusts) be included and if so how can it be determined?
- Should judgement about protection be made solely in terms of designation or should judgements be made about the effectiveness of protection? Protected areas are sometimes degraded through encroachment, illegal logging, hunting, mining and pollution; these may appear on official statistics but not provide real protection for biodiversity or other values. Currently very few countries have data on effectiveness of protected areas and this issue was therefore not addressed in the questionnaire.

The responses to this question are to some extent the least satisfactory in this section in terms of statistics, although very interesting in light of developments in thinking about protected areas. There was considerable confusion, and a measure of disagreement, amongst correspondents about when forest should be suitable for categorization under various IUCN protected area categories. In particular, there were differences in interpretation about the use of Category V, relating to *Landscape/seascape conservation and recreation.* This is defined as: *an area of land, with coast or sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area.*

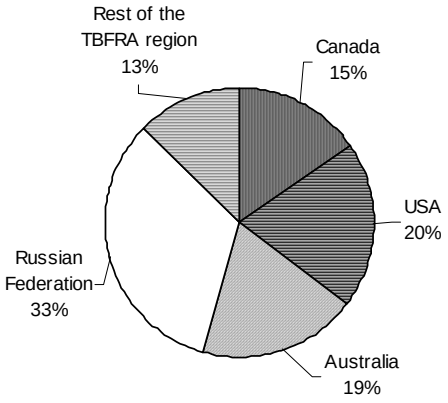
Some countries argued that most or all their forest fitted into this type of management category, and therefore listed all their forests as having protected area status. Others took a more traditional view of protection and listed only designated protected areas. Six countries listed *all* their forests in protected areas (Azerbaijan, Cyprus, Liechtenstein, Kazakhstan, Tajikistan and Yugoslavia). Several others argued that the majority of their forests corresponded to IUCN categories I to IV, including Uzbekistan (95.9 per cent), Denmark (95.5 per cent), Kyrgyzstan (86.3 per cent) and Germany (71.7 per cent).

To some extent, these discrepancies reflect changing attitudes towards protected areas. In the last twenty years, protected areas have become more flexible in terms of their aims, definition, size and approaches to management. Their role has become as much about the protection of processes—such as supply of water, prevention of erosion and

maintenance of human lifestyles—as about the protection of species. The integration of multiple functions within protected areas has resulted in changing attitudes amongst protected area managers. It has on the one hand encouraged formation of new protected areas, as a wider section of society appreciates the potential benefits, while it has also resulted in some serious challenges to traditional protected area functions in recent years. It has, for example, been suggested that clearcutting forests might be permitted within protected areas—the World Commission on Protected Areas rejected this. A number of the ambiguities could be addressed by giving greater prominence to the underlying IUCN definition, that protected areas should have biodiversity protection as their main aim. Areas that appear to correspond to one of the categories but do not meet this underlying criterion should not generally be included amongst the listed protected areas. The different interpretations of the questions in TBFRA-2000 are at least in part the result of the changing attitudes towards protected areas and some confusion about where a protected area starts and ends. However, this clearly makes comparisons between countries extremely difficult. Further work is needed in defining, or perhaps in better explaining, the categories if data can be used for international statistical analysis. Figures are less ambiguous for the more complete forms of protection, corresponding to Categories I to II (strict nature reserves, wilderness areas, national parks and natural monuments). For these categories, the TBFRA survey has provided an important overview of the status of protection within the biome. The large majority of the protected areas are found in the four major forest countries: Russia, the United States, Australia and Canada, with the remaining countries making up just 13 per cent of the total (Figure 4.10).

FIGURE 4.10

Main areas of IUCN Category I and II protected forest areas in the TBFRA region



These figures must be treated with some caution. European countries have traditionally put greater focus on the less strict protected area categories, and particularly on Category V protected landscapes, that relates closely to the west European national park model. This choice reflects in part the need to integrate conservation within a cultural and usually quite heavily populated landscape. The proportions are likely to change when the wider categories are taken into account, but this will require further analysis of the figures. Some countries, such as Denmark, are currently reassessing protected areas with respect to the IUCN categories. The proportion of forest under protection is of particular interest to many governments and NGOs. Figure 4.11 summarizes all the results not shown earlier, although some of these figures must be treated with extreme caution – they certainly do not signify strict protection.

Reported number of species (total and forest-occurring) including proportion endangered (Main Tables 56-64)

A number of scientists have expressed fears that we may be undergoing an extinction "pulse", during which a large number of species of plants and animals could disappear, largely as a result of human actions. This possibility has gained official recognition, for example through the Convention on Biological Diversity. Whilst the majority of forest-occurring species exist in the tropics, and these are also the areas where the greatest number of species are judged to be at risk or endangered, concern has also been expressed about the status of some forest-occurring species in temperate and boreal regions. Accordingly, the TBFRA invited correspondents to provide information on the number of forest-occurring plant and animal species that are judged to be endangered, thereby giving an indication of the state of biological diversity in forest and other wooded land.

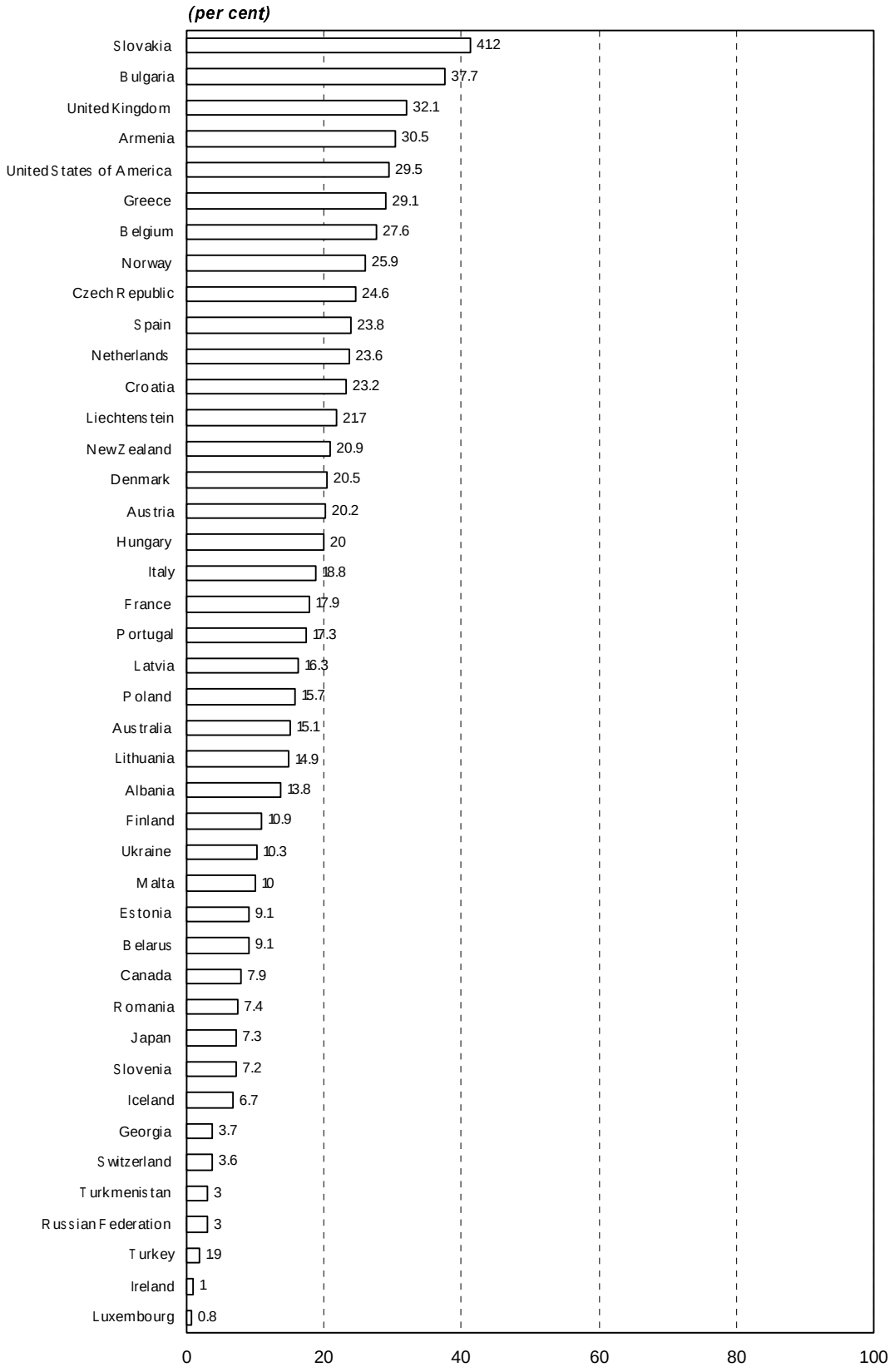
Data were sought on a range of plant and animal groups (trees, other vascular plants, ferns, mosses, lichens, mammals, birds, other vertebrates and butterflies and moths), both for the country as a whole and a subset referring specifically to forest-occurring species. In each case, questions asked for information on the following:

- total species
- of which: endangered
- endemic species
- of which: endangered

Information was also requested, as an annex to the table, on problematic introduced species.

FIGURE 4.11

Percentage of protected forest (IUCN categories I to VI) in total forest area in selected countries



Precise status categories were suggested for the term "endangered", drawing on a ranking system drawn up by IUCN's Species Survival Commission, with the opportunity of using either the pre- or post-1994 system. For countries with an existing red data book such information is relatively accessible; in other cases correspondents faced a challenging job of drawing together information from red data books referring to specific groups (such as *Threatened Plants of the World*) or drawing on judgements made by national experts.

Accuracy depends on the quality and coverage of data, on the way in which risk is assessed and on the ability to predict future trends. While some of the TBFRA countries have detailed species data (including paradoxically some of those that have undergone the most profound changes to their native wildlife), other correspondents will have only very rudimentary and fragmentary information to draw upon.

Data from the survey were extremely useful, but at this stage still very incomplete. The results nonetheless provide the most thorough survey of threats to forest species in the temperate and boreal biomes – the major 1992 survey of *Global Biodiversity* carried out by the World Conservation Monitoring Centre did not even consider non tropical forests.

Unfortunately, the number of serious gaps still remaining make it difficult to make justifiable statements about global numbers of threatened species in the various categories. In the following analysis, data are drawn from those countries providing the most detailed information. It should also be noted that assessment of risk would appear to differ between countries, with some adopting a more cautious approach (and thus listing a greater number of species as "threatened") than others. Some preliminary data are presented below (Figures 4.12 to 4.17).

FIGURE 4.12

Endangered forest-occurring mammal species

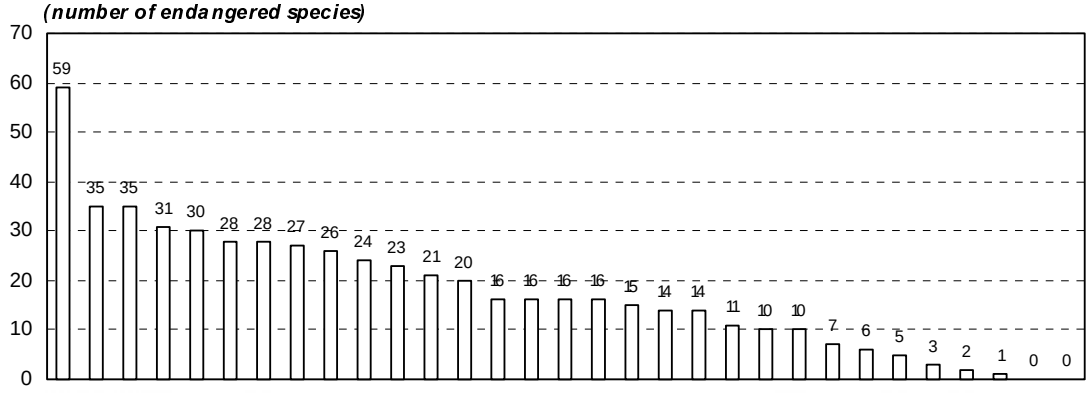


FIGURE 4.13

Endangered species of forest-occurring birds

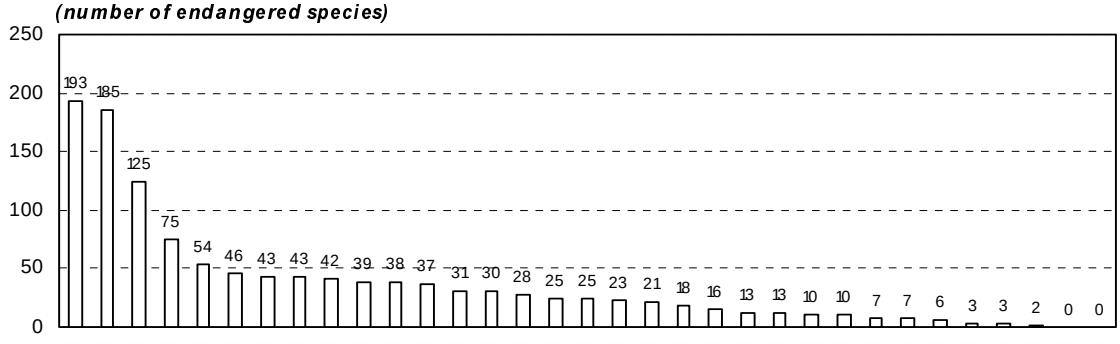


FIGURE 4.14

Other endangered forest-occurring vertebrate species (reptiles, amphibians and fish)

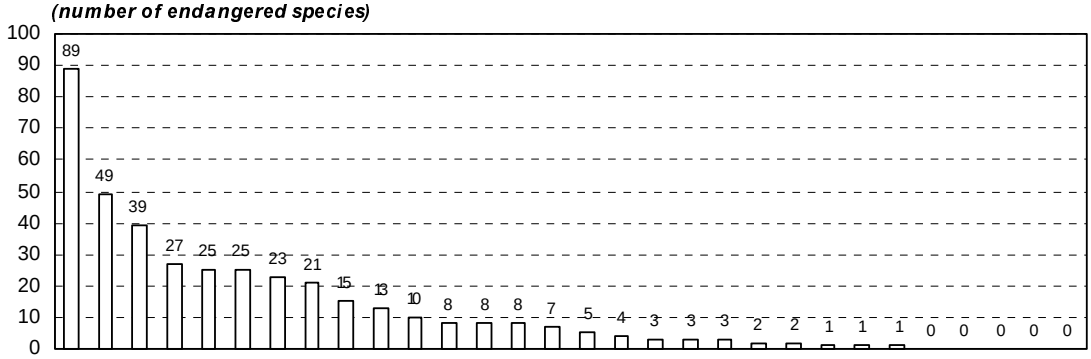


FIGURE 4.15

Endangered species of forest-dwelling butterflies and moths

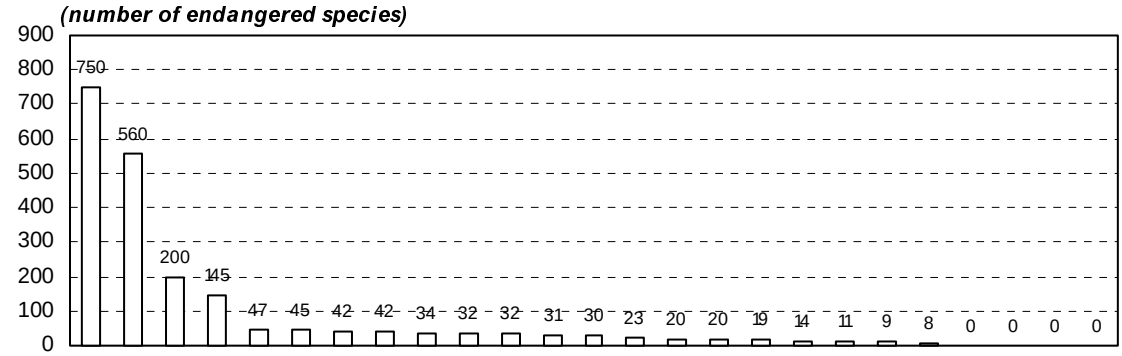


FIGURE 4.16

Endangered species of forest-occurring flowering plants

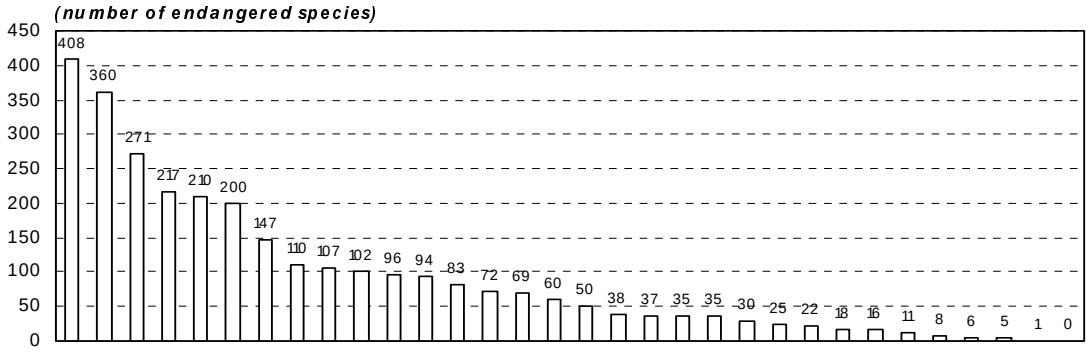
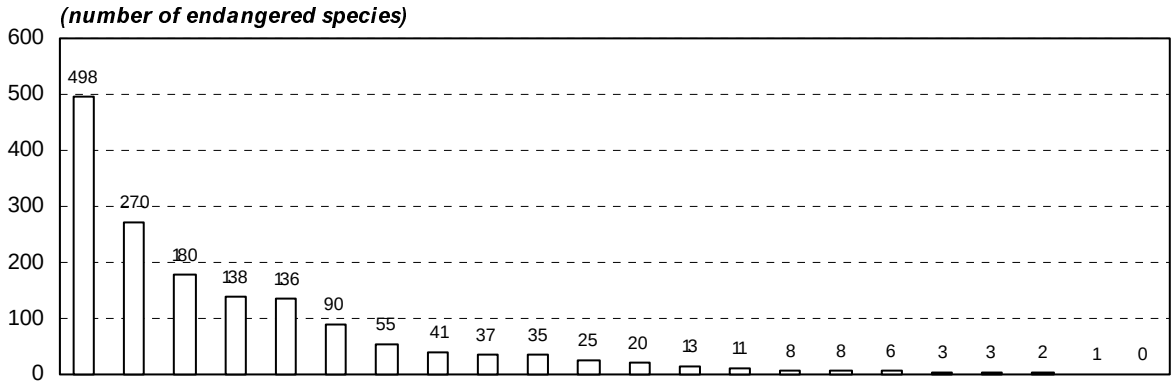


FIGURE 4.17

Number of endangered species of forest-occurring mosses



Despite the relatively incomplete nature of the data, a number of inferences can be drawn. First, there is clearly a perception that significant numbers of wild plant and animal species are endangered, despite the existence of a relatively stable forest estate. [Further analysis is needed of the links between area of natural forest and numbers of species endangered.] This includes significant numbers of endangered species in all the groups included: mammals, birds, other vertebrates, butterflies and moths, lichens, mosses, trees and other vascular plants.

Although data quality may be distorting results, larger animals (particularly mammals and birds) seem to be proportionately more endangered than smaller creatures. Some countries listed almost as many mammals as being endangered as butterflies and moths, although the diversity of the latter is far greater. It may be that the remaining area of forest that is semi-natural or undisturbed by man in many countries is sufficient to maintain populations of many small species but not large enough to maintain species requiring greater territory. (However, these figures may also reflect the fact that mammals are generally better studied and recorded than invertebrate groups.)

In the case of plants, the situation is reversed, with more lower plants (lichens and mosses) being listed as endangered than vascular plants and other trees.

There was no obvious correlation between loss of forest and threats to species. Although one forest-poor country (Israel) consistently appeared amongst those with the most endangered species in various plant and animal groups, other apparently “high risk” countries included many with large forest estates.

Amongst those recording high numbers of endangered species were Albania, Austria, the Czech Republic, Norway, Slovenia, Sweden, the United States of America and Yugoslavia.

There appears to be a slight tendency for greater threats to forest-dwelling species in western Europe than further east, although lack of data from some central and eastern European countries and Central Asian countries means that this apparent trend should be treated with caution.

There may well be differences in scoring between countries, i.e. some countries may be more willing to list a species as “endangered” than is the case elsewhere. This is an inevitable factor in what is, inevitably, a judgement that is partly subjective (and may also be influenced by political considerations).

As an adjunct to the analysis, countries were asked to list significant numbers of invasive species. Only 16 corresspondents answered this question—it was not clear whether the question had been ignored in other cases because there was no perception of problems with invasive species or because data were unavailable or time was lacking.

The results are nevertheless instructive. Invasive species are regarded as an important threat to biodiversity in New Zealand and Australia and as significant in Canada. Perceptions of threat are much lower in Europe. Although several countries (for example Belgium, Denmark, Ireland and Moldova) said that invasive tree and other species could inhibit natural regeneration, Estonia and Lithuania specifically stated that they perceived no significant problem from invasive species.

A summary table below lists the main invasive species identified.

Country	Problems with invasive species
Australia	There are 48 exotic plant species that are serious pests in native production forests, including blackberry (***Rubus vulgaris)***, gorse (***Ulex europaeaus***), lantana (***Lantana camara***), and pampas grass (***Cortaderia*** spp.) Cats, dogs, introduced deer, donkeys, horses, goats, hares, rats, mice and foxes all also represent a serious threat to forested ecosystems. Foxes are probably the most widespread exotic animal damaging these ecosystems and have severely limited ground-living mammals.
Belgium	Several invasive species are listed as preventing other tree species from regenerating, including ***Prunus serotina***, ***Rhododendron ponticum*** and ***Amelanchier lamarkii***. ***Eutamias sibiricus*** threatens populations of small songbirds and ***Psittacula krameri*** is out-competing indigenous species that have the same nesting sites.
Canada	In total, 25 exotic insect pests, 10 introduced fungi and 27 other exotic plant species are listed as problematic, along with the threats that they pose. Major invasive species include garlic mustard (***Alliaria petiolata***) which threatens the endangered wood poppy, Scotch broom (***Cytisus scoparius***) which is invading threatened Garry oak habitats in British Columbia, Tartarian honeysuckle (***Lonicera tatarica***) in Ontario.
Denmark	The sycamore (***Acer pseudoplatanus***) can sometimes inhibit natural regeneration of tree-species such as beech (***Fagus sylvatica***).
Estonia	Introduced species have not created problems for forest ecosystems.
Hungary	Three species were mentioned: the locust tree (***Robinia pseudaccacia***) is aggressive, outcompeting indigenous species; the box-elder (***Acer negundo***) is invasive and ***Asclepias syriaca*** hinders regeneration and afforestation.
Ireland	Two plant species were identified as invasives inhibiting regeneration: the rhododendron (***Rhododendron ponticum***) and the cherry laurel (***Prunus laurocerasus***). In addition, three invasive mammals cause direct damage to plantations: the sika deer (***Cervus nippon nippon***), rabbit (***Oryctolagus cuniculus***) and grey squirrel (***Neosciurus carolinensis***).
Israel	***Acacia cyanofila*** is invasive on agricultural lands and ***Hiteroteca subaxilaris*** is invasive in coastal sand areas.
Kazakhstan	One species mentioned.
Latvia	Three species are listed: Indian balsam (***Impatiens glandulifera***), small balsam (***Impatiens parviflora***) and ***Amelanchier spicata*** (rose family). Amongst the mammals, the North American mink (***Mustela vison***) is identified as an important pest.
Lithuania	Introduced species have not created problems for forest ecosystems.
Moldova	The box-elder (***Acer negundo***) is listed as a problematic invasive species.
New Zealand	116 problematic invasive plant species are listed, including 12 that are known to be affecting the dominant structure, species composition or regeneration of several high conservation sites within the country. These are: smilax (***Asparagus asparagoides*** and ***A scandens***), buddleia (***Buddleia davidii***), old-man's beard (***Clematis vitalba***), kahili ginger (***Hedychium gardnerianum***), hawkweed (***Hieracium*** spp.), Japanese honeysuckle (***Lonicera japonica***), lodgepole pine (***Pinus contorta***), wilding pine (***Pinus*** spp.), wandering willie (***Tradescantia fluminensis***) and gorse (***Ulex europaeus***). In addition, 14 problematic introduced mammals are listed, including cats, dogs, two species of rats, three species of mustelids, goats, tahr, deer, pigs and horses. The most serious pest, occupying more than 90 per cent of the country, is the possum (***Trichosurus vulpecula***).
Netherlands	(***Prunus serotina***) is invasive especially on poor sandy soils and is suppressing natural regeneration. Invasion is more or less under control through forest management. Red oak (***Quercus rubra***) is invasive in pine forests on sandy soils but does not compete with other species.
Slovenia	Fallow deer (***Cervus dama***) and mouflon (***Ovis ammon***) are causing damage in regenerating forests. Two other introduced species – the Alpine stainbock (***Capra ibex***) and the Alpine marmot (***Marmota marmota***) are not causing damage.

Annual averages of regeneration and extension of forest (Main Tables 65-68)

Throughout much of the TBFRA region, forest cover is currently expanding following past deforestation. The *type* of expansion changes from one country to another and can vary, for example, from establishment of plantations of introduced species to natural re-colonization of abandoned farmland. From both an ecological and a commercial perspective, the nature of regeneration is important. Correspondents were therefore asked to provide information on the extent of regeneration over a recent 10-year period by natural and artificial means, in order to assess types of management methods and likely changes in genetic composition.

The questionnaire was precise in distinguishing between three main ways in which forest cover can be extended, each of which has a number of management methods.

Way in which forest cover can be extended	*Explanation*
Regeneration of forest land	**Reforestation of land that has recently been forested**
– natural regeneration	Regeneration without planting through natural seeding (sometimes through preservation of seed trees)
– natural regeneration enhanced by planting	For example to change composition or to increase rate of growth or total biomass
– coppice sprouting	Regular cutting of trees and allowing them to re-grow from the base
– planting or seeding	Deliberate planting or seeding, often accompanied by suppression of natural regeneration
Extension of forest	Establishment of forest on land that has not recently been forested (afforestation) or conversion of other wooded land to forest
– Natural colonization	For example, natural regeneration on abandoned agricultural land
– Natural conversion of other wooded land to forest	For example, as a result of reduced grazing pressure
– Planting or seeding of non-forest land	For example, re-establishment on land that lost forest long in the past, reclamation of industrial sites, etc.
– Planting or seeding of other wooded land	Deliberate conversion of other wooded land to forest
Natural colonization of non-forest land to other wooded land	Development of other wooded land as a result of, for example, changes in agricultural practice or climatic variations

Correspondents were also asked to separate out data for introduced species.

Despite the detailed definitions, some ambiguity remains for correspondents, including for example:

- How are forests classified when several regeneration and extension systems are operating simultaneously?
- How long must land be free of forest cover to classify as afforestation rather than reforestation?

Figures 4.18 and 4.19 outline the main results. In general, forest and other wooded land area is continuing to be extended in the TBFRA countries, following historical deforestation. Although most of the extension is taking place in the Russian Federation and the United States, there is significant expansion in most European countries as well. (Note that these figures have been calculated by combining the extension of forest, including afforestation and the conversion of other wooded land to forest, and of other wooded land; there is the possibility that some small areas of land have been counted twice, so results should be treated with caution.)

FIGURE 4.18

Countries accounting for most of the annual average of extension of forest and other wooded land in the TBFRA region

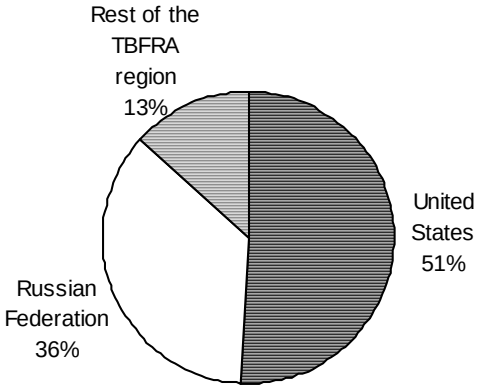
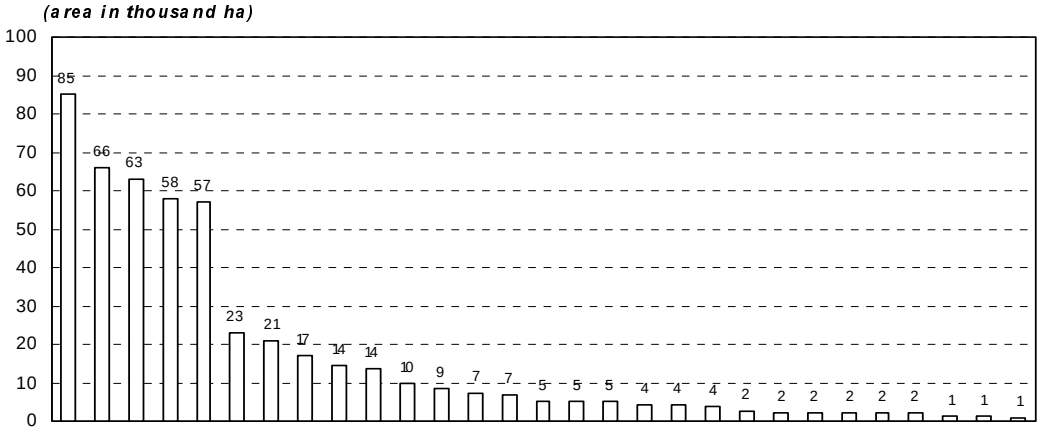


FIGURE 4.19

Countries (excepting the Russian Federation and the USA) with forests and other wooded land extension at over 1000 hectares/year



At the same time, most countries appear to be regenerating forests. Again, the main areas of regeneration are in the three major forest countries of the Russian Federation, the United States and Canada, but expansion is also taking place elsewhere as shown in Figures 4.20 and 4.21.

FIGURE 4.20

Countries accounting for most of the annual average of forest regeneration in the TBFRA region

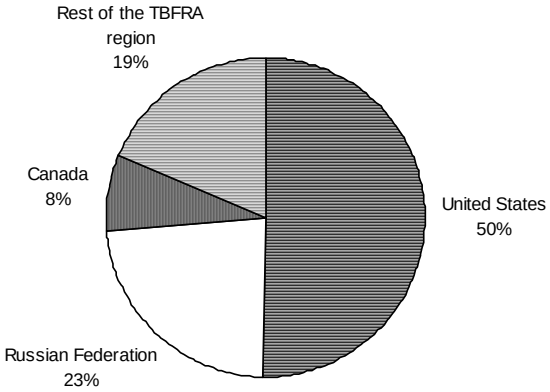
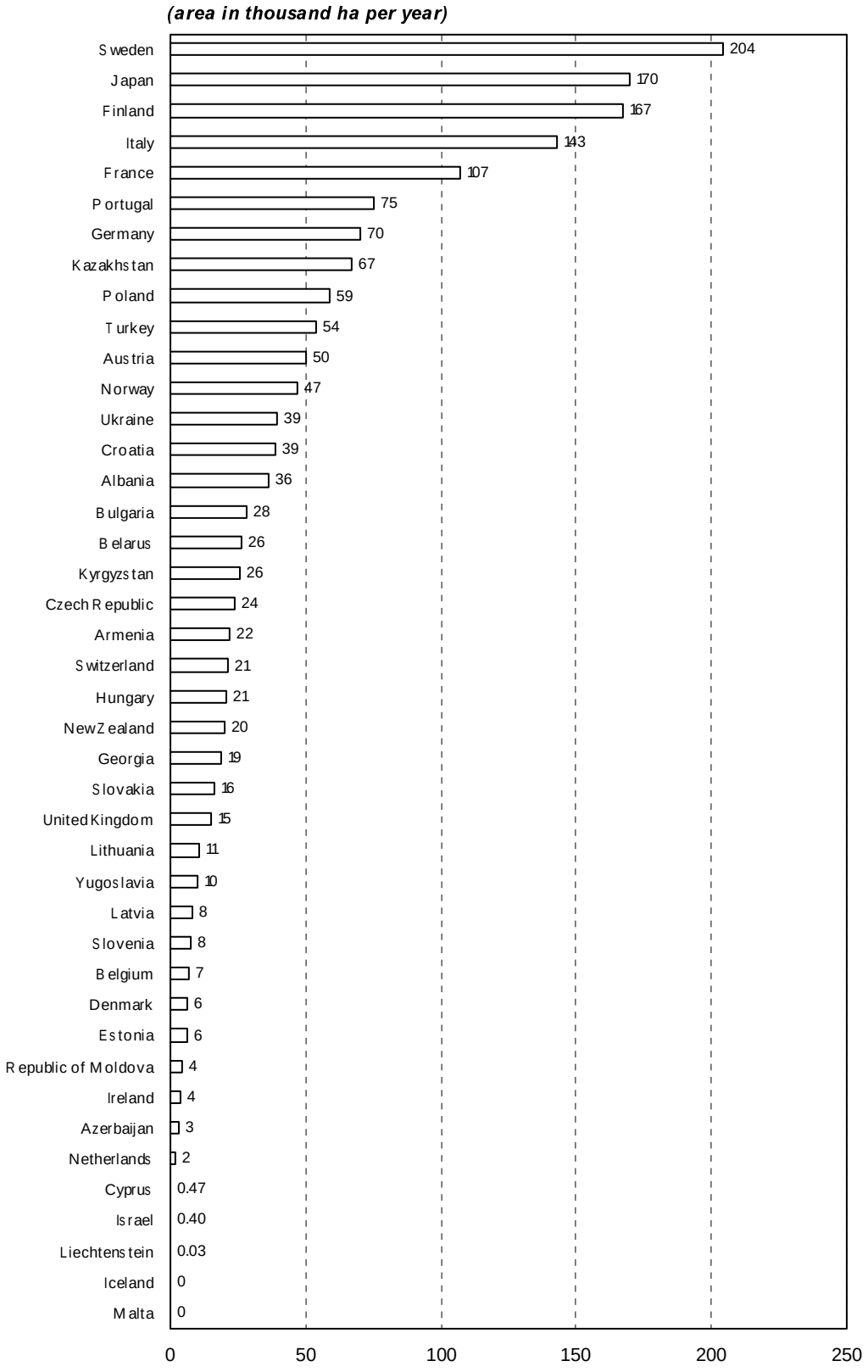


FIGURE 4.21

Forest regeneration in TBFRA countries other than USA, Russian Federation and Canada



Over one-fifth of this regeneration is with non-native species, and these are particularly important in Armenia, Denmark, France, Hungary, Moldova, New Zealand (100 per cent) Portugal, and the United Kingdom.

Finally in this section, the natural colonization of non-forested land to other woodland land was recorded. Although according to correspondents over 1.5 million hectares is recolonized every year, over 90 per cent of this is in

the Russian Federation (Figure 4.22). Other significant areas, including France, Norway and New Zealand, may reflect changing agricultural practices and abandonment of agriculture (Figure 4.23). The small amount of recolonization recorded, particularly in Europe, is significant when compared with claims made about the amount of land being removed from agriculture. From the responses to the TBFRA, it appears that most of this land is used for other purposes (including probably afforestation).

Origin of planting material used in the forest (Main Table 69)

Interest has been expressed in the provenance of planting material used in the forest although perspectives differ between interest groups. Forest managers are often interested in selecting the most efficient provenance for any particular set of environmental circumstances, to maximize productivity and minimize losses. People concerned with conservation of biological diversity, on the other hand, have expressed concern about the risk of losing local varieties and consequent loss of genetic diversity and evolutionary potential. The TBFRA sought to provide clear, factual data on the provenance of planting material, to provide information on trends in species diversity, genetic diversity and the origin of planting material used in managed forests.

Correspondents were asked to list all indigenous and introduced tree species planted over a recent ten-year period and to divide these into three categories:

- known local provenance,
- known non-local provenance,
- unknown provenance.

This question was generally poorly answered and it is clear that many correspondents were confused about what was being required. However, those that did supply information provide the beginnings of the first such survey to be attempted. Preliminary results, which must be treated with considerable caution because of the limited nature of the data, suggest that the large majority of trees being planted in the TBFRA catchment remain of local provenance. Further work, and perhaps further discussion with correspondents, is needed to verify this very preliminary conclusion.

FIGURE 4.22

Natural colonisation of non-forest land to other wooded land in the TBFRA region

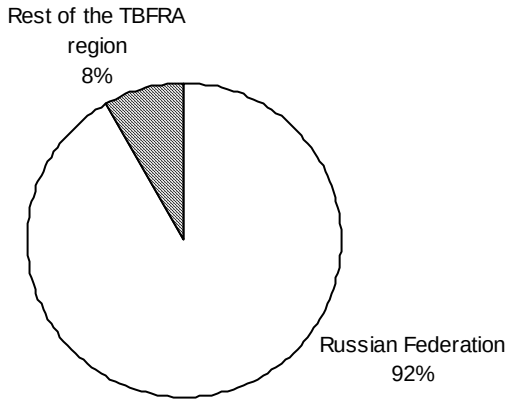


FIGURE 4.23

Natural colonization of non-forest land to other wooded land in TBFRA countries other than the Russian Federation

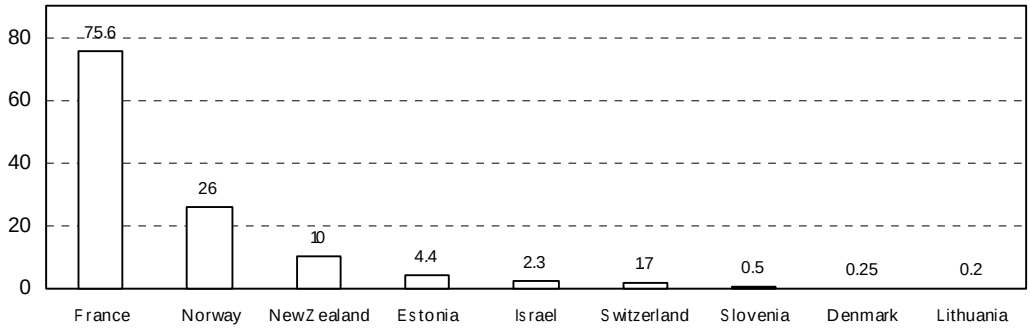


FIGURE 4.24

Major TBFRA countries with significant planting of non-local provenance

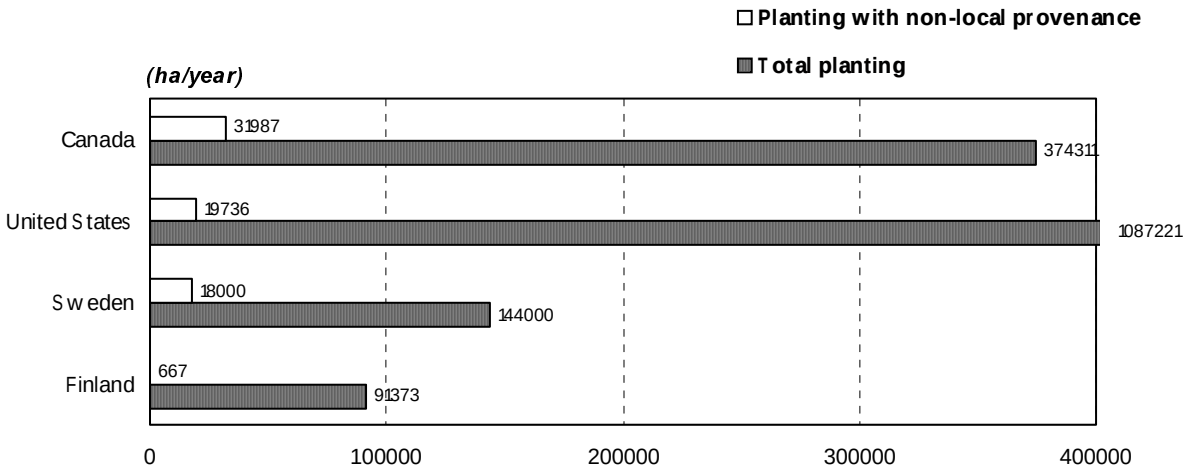


FIGURE 4.25

Proportion of non-local provenance planted in some selected countries

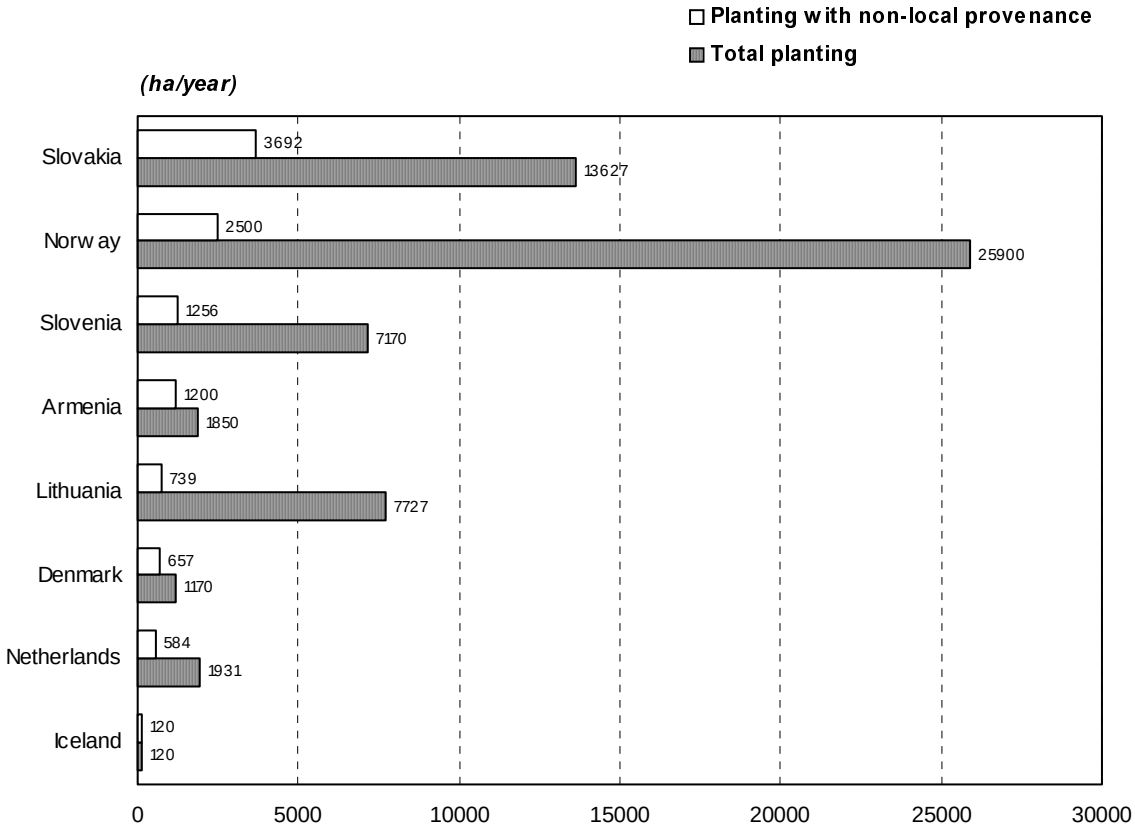


TABLE 53

Forest and other wooded land by categories of "naturalness"

Country	Reference period	Forest			Other wooded land	
		Undisturbed by man	Semi-natural	Plantations	Undisturbed by man	Semi-natural
		(1000 ha)			(1000 ha)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Albania ©	1995	84.8	843.2	102.0	0.0	0.0
Austria ©	1992-96	34.0	3,806.0	0.0	84.0	0.0
Belgium ©	1997	0.0	351.7	294.2	0.0	26.0
Bosnia and Herzegovina ©	1995	0.0	2,219.3	56.9	0.0	433.6
Bulgaria	1995	256.5	2,364.6	968.5	0.0	313.8
Croatia ©	1996	2.4	1,725.7	47.0	33.0	297.0
Cyprus	1996	0.0	90.0	27.0	0.0	163.0
Czech Republic	1995	0.0	2,630.0	0.0	0.0	0.0
Denmark ©	1990	0.4	104.2	340.7	10.0	
Estonia ©	1996	2.0	1,709.0	305.0	0.0	146.0
Finland ©	1991	1,263.0	20,620.0	0.0	408.0	477.0
France ©	1997	30.0	14,165.0	961.0	0.0	1,833.0
Germany ©	1997	0.0	10,740.0	0.0	0.0	0.0
Greece	1992			120.0	0.0	3,154.0
Hungary ©	1996	0.1	1,674.7	136.2	0.0	0.0
Iceland ©	1998	0.0	18.0	12.0	0.0	100.0
Ireland	1996	1.0	0.0	590.0	0.0	0.0
Israel ©	1997	0.0	31.0	91.0	0.0	48.0
Italy	1995	6.0	9,718.0	133.0	197.0	788.0
Latvia ©	1997	4.0	2,737.0	143.0	0.0	111.0
Liechtenstein	1995	1.5	5.1	0.3	0.3	0.2
Lithuania ©	1996	12.0	1,682.0	284.0	0.0	72.0
Luxembourg	1994	0.0			0.0	2.8
Malta ©	1996	0.0	0.0	0.3	0.0	0.0
Netherlands ©	1992-96	0.0	239.0	100.0	0.0	0.0
Norway ©	1994-96	250.0	8,160.0	300.0	329.0	2,961.0
Poland ©	1992-96	144.0	8,758.0	39.0	0.0	0.0
Portugal	1995	55.0	2,494.0	834.0	44.0	40.0
Romania ©	1990-97	233.2	5,977.4	90.6		
Slovakia ©	1996	20.0	1,981.0	15.0	0.0	15.0
Slovenia ©	1996	50.0	1,048.0	1.0	0.0	67.0
Spain	1990	5.0	11,600.0	1,904.0	3.0	12,472.0
Sweden ©	1992-96	4,384.0	22,311.0	569.0	2,854.0	141.0
Switzerland ©	1997	7.0	1,162.0	4.0	0.0	61.0
The FYR of Macedonia ©	1995	0.0	876.0	30.0	0.0	82.0
Turkey ©	1996	186.0	7,914.0	1,854.0	144.0	10,615.0
United Kingdom ©	1995	0.0	772.0	1,697.0	0.0	20.0
Yugoslavia ©	1995	3.6	2,851.4	39.4	11.7	573.8
Total: Europe						
of which: EU 15					**3,600.0**	**18,963.8**
Armenia ©	1996	284.0	37.0	13.0	41.0	17.0
Azerbaijan ©	1988	400.0	515.5	20.0	15.0	39.0
Belarus	1994-97	43.5	7,626.5	194.8	0.0	1,071.3
Georgia ©	1995	550.0	2,238.4	200.0	0.0	0.0
Kazakhstan	1993	0.0	10,499.0	5.0	0.0	6,169.0
Kyrgyzstan ©	1988	100.0	572.0	57.0	0.0	68.0
Republic of Moldova ©	1997	0.0	322.8	1.3	0.0	30.8
Russian Federation ©	1993	749,198.0	50,000.0	17,340.0	70,000.0	0.0
Tajikistan ©	1995	21.0	369.0	10.0	18.0	312.0
Turkmenistan ©	1995	0.0	3,742.0	12.4	0.0	0.0
Ukraine	1996	59.0	4,974.0	4,425.0	6.0	30.0
Uzbekistan ©	1988	200.0	1,409.0	300.0	0.0	261.0
Total: CIS		**750,855.5**	**82,305.2**	**22,578.5**	**70,080.0**	**7,998.1**
Canada ©	1994	123,947.0	120,624.0	0.0	173,013.0	0.0
United States of America ©	1992	19,210.0	184,436.0	13,687.0	41,884.0	38,918.0
Total: North America		**143,157.0**	**305,060.0**	**13,687.0**	**214,897.0**	**38,918.0**
Australia ©	1990-94	18,836.0	136,999.0	1,043.0	23,429.0	398,161.0
Japan ©	1995	3,061.0	10,321.0	10,682.0		
New Zealand ©	1996	1,599.0	4,799.0	1,542.0	0.0	1,100.0
Total: Other TBFRA		**23,496.0**	**152,119.0**	**13,267.0**		
Grand total						

© See notes and comments in Chapter IV.

TABLE 54

Forest and other wooded land by categories of "naturalness": comparative data

Country	Forest			Other wooded land	
	Undisturbed by man	Semi-natural	Plantations	Undisturbed by man	Semi-natural
	(per cent of total forest)			(per cent of total other wooded land)	
(1)	(2)	(3)	(4)	(5)	(6)
Albania	8.2	81.9	9.9		
Austria	0.9	99.1	0.0	100.0	0.0
Belgium	0.0	54.4	45.6	0.0	100.0
Bosnia and Herzegovina	0.0	97.5	2.5	0.0	100.0
Bulgaria	7.1	65.9	27.0	0.0	100.0
Croatia	0.1	97.2	2.6	10.0	90.0
Cyprus	0.0	76.9	23.1	0.0	100.0
Czech Republic	0.0	100.0	0.0		
Denmark	0.1	23.4	76.5	10.8	10.8
Estonia	0.1	84.8	15.1	0.0	100.0
Finland	5.8	94.2	0.0	46.1	53.9
France	0.2	93.5	6.3	0.0	100.0
Germany	0.0	100.0	0.0		
Greece			3.6	0.0	100.0
Hungary	0.0	92.5	7.5		
Iceland	0.0	60.0	40.0	0.0	100.0
Ireland	0.2	0.0	99.8		
Israel	0.0	25.4	74.6	0.0	100.0
Italy	0.1	98.6	1.3	20.0	80.0
Latvia	0.1	94.9	5.0	0.0	100.0
Liechtenstein	21.7	73.9	4.3	60.0	40.0
Lithuania	0.6	85.0	14.4	0.0	100.0
Luxembourg	0.0			0.0	100.0
Malta	0.0	0.0	100.0		
Netherlands	0.0	70.5	29.5		
Norway	2.9	93.7	3.4	10.0	90.0
Poland	1.6	97.9	0.4		
Portugal	1.6	73.7	24.7	52.4	47.6
Romania	3.7	94.9	1.4		
Slovakia	1.0	98.3	0.7	0.0	100.0
Slovenia	4.5	95.4	0.1	0.0	100.0
Spain	0.0	85.9	14.1	0.0	100.0
Sweden	16.1	81.8	2.1	95.3	4.7
Switzerland	0.6	99.1	0.3	0.0	100.0
The FYR of Macedonia	0.0	96.7	3.3	0.0	100.0
Turkey	1.9	79.5	18.6	1.3	98.7
United Kingdom	0.0	31.3	68.7	0.0	100.0
Yugoslavia	0.1	98.5	1.4	2.0	98.0
Total: Europe					
of which: EU 15					
Armenia	85.0	11.1	3.9	70.7	29.3
Azerbaijan	42.8	55.1	2.1	27.8	72.2
Belarus	0.6	97.0	2.5	0.0	100.0
Georgia	18.4	74.9	6.7		
Kazakhstan	0.0	100.0	0.0	0.0	100.0
Kyrgyzstan	13.7	78.5	7.8	0.0	100.0
Republic of Moldova	0.0	99.6	0.4	0.0	100.0
Russian Federation	91.8	6.1	2.1	100.0	0.0
Tajikistan	5.3	92.3	2.5	5.5	94.5
Turkmenistan	0.0	99.7	0.3		
Ukraine	0.6	52.6	46.8	16.7	83.3
Uzbekistan	10.5	73.8	15.7	0.0	100.0
Total: CIS	**87.7**	**9.6**	**2.6**		
Canada	50.7	49.3	0.0	100.0	0.0
United States of America	8.8	84.9	6.3	51.8	48.2
Total: North America	**31.0**	**66.0**	**3.0**	**84.7**	**15.3**
Australia	12.0	87.3	0.7	5.6	94.4
Japan	12.7	42.9	44.4		
New Zealand	20.1	60.4	19.4	0.0	100.0
Total: Other TBFRA	**12.4**	**80.5**	**7.0**		
Grand total					

TABLE 55

Protection status: Forest and other wooded land in IUCN protection categories I to IV and forest not available for wood supply for conservation/protection reasons

Country	Forest		Other wooded land		Percent of IUCN categories I to VI in total		Forest not available for wood supply	
	IUCN I and II	IUCN III to VI	IUCN I and II	IUCN III to VI	Forest	Other wooded land	Protected for conservation/ protection reasons	Per cent of forest
	(1000 ha)				(per cent)		(1000 ha)	(per cent)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	24	118	0	0	13.8		29	2.8
Austria	2	773	0	0	20.2	.0	488	12.7
Belgium ©	4	174	6	20	27.6	100.0	7	1.0
Bosnia and Herzegovina								
Bulgaria	290	1,064	0	0	37.7	.0	265	7.4
Croatia	65	346	0	78	23.2	23.6	85	4.8
Cyprus	1	116	0	163	100.0	100.0	11	9.0
Czech Republic	109	537	0	0	24.6		71	2.7
Denmark ©	5	86	0	11	20.5	11.3	5	1.1
Estonia ©	52	131	1	7	9.1	5.5	61	3.0
Finland	979	410	36	102	6.3	15.6	1,208	5.5
France ©	39	2,677	75	555	17.9	34.4	0	.0
Germany ©	105	7,100	0	0	67.1		83	.8
Greece ©	55	921	14	230	29.1	7.7	142	4.2
Hungary ©	62	299	0	0	20.0		68	3.8
Iceland	2	0	3	9	6.7	12.0	2	6.7
Ireland	0.5	5.7	0	0	1.2		6	1.0
Israel							10	8.2
Italy	1,105	750	110	75	18.8	18.8	1,855	18.8
Latvia	106	365	4	13	16.3	15.3	471	16.3
Liechtenstein	2	0	0	0	21.7	100.0	2	21.7
Lithuania	112	184	3	6	14.9	13.3	249	12.6
Luxembourg	0	1	0	0	.8	14.3	0	.0
Malta	0	0	0	0	10.0		0	100.0
Netherlands ©	3	77	0	0	23.6		3	.9
Norway ©	114	2,140	86	2,215	25.9	69.9	114	1.3
Poland ©	173	1,232			15.7		398	4.5
Portugal	541	44	2	0	17.3	2.4	76	2.2
Romania	397	72	0	0	7.4	.0		
Slovakia ©	373	458	1	0	41.2	7.4	310	15.4
Slovenia ©	22	56	2	3	7.2	8.1	52	4.7
Spain ©	216	2,995	0	0	23.8	.0	2,727	20.2
Sweden ©							5,180	19.0
Switzerland ©	9	33	1	2	3.6	3.6	7	.6
The FYR of Macedonia								
Turkey ©	177	9	139	5	1.9	1.3	1,319	13.3
United Kingdom ©	30	762	0	2	32.1	10.0	75	3.0
Yugoslavia ©	137	2,757	29	557	100.0	100.0	515	17.8
Armenia	35	67	22	10	30.5	55.2	102	30.5
Azerbaijan ©	72	864	15	39	100.0	100.0	633	67.6
Belarus	209	511	3	60	9.1	5.8	1,719	21.9
Georgia ©	111	0	0	0	3.7			
Kazakhstan	29	10,475	15	6,154	100.0	100.0	590	5.6
Kyrgyzstan ©	120	509	18	50	86.3	100.0	600	82.3
Republic of Moldova	44							
Russian Federation ©	23,691	1,060	0	0	3.0	.0	23,691	2.9
Tajikistan ©	21	379	18	312	100.0	100.0	360	90.0
Turkmenistan ©	14	100	0	0	3.0		104	2.8
Ukraine ©	173	800	1	1	10.3	5.6	3,445	36.4
Uzbekistan ©	330	1,500			95.9			
Canada ©	11,106	8,197	5,676	5,661	7.9	6.6	19,664	8.0
United States of America ©	13,904	50,197	4,819	46,974	29.5	64.1	19,210	8.8
Australia ©	13,758	9,896			15.1			
Japan ©	1,260	491			7.3		788	3.3
New Zealand ©	1,599	64	0	0	20.9	.0	5,573	70.2

© See notes and comments in Chapter IV.

TABLE 56

Reported number of species (total and forest-occurring), of which endangered: Trees

Country	All species				Forest-occurring species			
	Total	of which: Endangered	Endemic species		Total	of which: Endangered	Endemic species	
			Total	of which: Endangered			Total	of which: Endangered
	(Number)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	330	27	0	0	120	21	0	0
Austria ©	58	9	0	0	58	9	0	0
Belgium ©	68	11	0	0	38	3	0	0
Bosnia and Herzegovina								
Bulgaria ©	3,750	728	470		210			
Croatia ©	305	14	5					
Cyprus ©	82	1	2	1	47	1	2	1
Czech Republic ©	277	14	3	3	277	14	3	3
Denmark ©	98	7	0	0	63	7	0	0
Estonia ©	74	13			62	13		
Finland ©	33	8	0	0	33	8	0	0
France ©	136	0	0	0	104	0	0	0
Germany ©	66	0	6	0	63	0	6	0
Greece								
Hungary ©	140	6	22	1	79	4	1	1
Iceland ©	27	0	0	0	27	0	0	0
Ireland ©	130	0	0	0	85	0	0	0
Israel ©	60	17	2	0	50	10	0	0
Italy					86	1		
Latvia ©	47	2	0	0	47	2	0	0
Liechtenstein ©	39							
Lithuania ©	84	7	0	0	32	2	0	0
Luxembourg								
Malta ©	3	1	2	1	2	0	1	0
Netherlands ©	78	30	0	0	74	27	0	0
Norway ©	43	2	1	1	43	2	1	1
Poland ©	81	1	5	1	81	1	5	1
Portugal	63	5	12	5	63	5	12	5
Romania								
Slovakia ©	57	7	0	0	57	7	0	0
Slovenia ©	73	5	0	0	73	5	0	0
Spain ©	8,500	1,020	1,500	0				
Sweden ©	32	6	0	0	30	6	0	0
Switzerland ©	44	4	0	0	44	4	0	0
The FYR of Macedonia								
Turkey	287	36	32	27				
United Kingdom ©	140	1	7					
Yugoslavia ©								
Armenia	100	4			90	3		
Azerbaijan ©	110	15	1	1	80	12	1	1
Belarus	33	2	0	0	33	2	0	0
Georgia ©	400							
Kazakhstan ©	23	0	2	0	23	0	2	0
Kyrgyzstan ©								
Republic of Moldova	47	7	20		47	7	20	
Russian Federation ©	283	4			283	4		
Tajikistan								
Turkmenistan ©								
Ukraine ©	210	14		4	148	14		4
Uzbekistan								
Canada ©	180	8	0			8		
United States of America ©	833	4	216	4	833	4		4
Australia ©								
Japan	1,825	75						
New Zealand ©	400	0	223	0	400	0	223	0

© See notes and comments in Chapter IV.

TABLE 57

Reported number of species (total and forest-occurring), of which endangered: Vascular plants other than trees

Country	All species				Forest-occurring species			
	Total	of which: Endangered	Endemic species		Total	of which: Endangered	Endemic species	
			Total	of which: Endangered			Total	of which: Endangered
	(Number)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	2,920	103	30	30	1,460	38	0	0
Austria ©	2,873	1,081	59	22	1,049	271	21	11
Belgium ©	1,202	463	0	0	131	37	0	0
Bosnia and Herzegovina								
Bulgaria ©								
Croatia ©	3,566	265	255					
Cyprus ©	1,828	22	139	18	1,500	22	127	18
Czech Republic ©	2,692	771	19	19	655	83	8	8
Denmark ©	1,200	33	1	0	256	50	0	0
Estonia ©	1,363	175			240	69		
Finland ©	1,211	202	0	0	213	35	0	0
France ©	4,428	457	103	103	611	11	10	10
Germany ©	3,170	116	88	12	601	6	0	0
Greece								
Hungary ©	2,206	34	62			5		
Iceland ©	468	46	0	0		1	0	0
Ireland ©	1,100	134	1	1	130	8	0	0
Israel ©	2,721	714	148	33	1,506	408	37	15
Italy	6,190	776	322	50				
Latvia ©	1,622	336	0	0	480	94	0	0
Liechtenstein ©	1,600							
Lithuania ©	1,270	184	6	3	713	102	0	0
Luxembourg								
Malta ©	9	2	8	1	6	0	0	0
Netherlands ©	1,326	388	0	0	317	72	0	0
Norway ©	1,300	234	15	0	700	60	0	0
Poland ©	2,254	156	71	16	524			
Portugal	4,600	299	567	275	490	16	44	14
Romania								
Slovakia ©	2,434	901	156	92	1,500	360	30	30
Slovenia ©	3,027	309	66	12				
Spain ©								
Sweden ©	1,900	425	0	0	360	96	0	0
Switzerland ©	2,600	884	3	0	442	110	1	0
The FYR of Macedonia								
Turkey	8,663	2,975	3,040	19				
United Kingdom ©	1,500	198	43					
Yugoslavia ©	4,282	217	87		4,282	217	87	
Armenia	3,400	387	120	20	1,400			
Azerbaijan ©	4,500	105	0	0	380	35	0	0
Belarus	1,575	186	5	1	850	107	2	0
Georgia ©	4,500		405					
Kazakhstan ©	4,407	218	535	218	3,085	147	393	147
Kyrgyzstan ©	4,630	300	125		300			
Republic of Moldova	1,752	83	527	57	130	18	71	23
Russian Federation ©	17,000	69			12,000	30		
Tajikistan								
Turkmenistan ©	2,499							
Ukraine ©	4,500	400		150	730	200		50
Uzbekistan								
Canada ©	2,800	92	75			25		
United States of America ©	14,729	638	3,645	512		210		203
Australia ©	18,000	235			13,622			
Japan	5,262	425						
New Zealand ©	4,000	180	1,900	180				

© See notes and comments in Chapter IV.

TABLE 58

Reported number of species (total and forest-occurring), of which endangered: Ferns

Country	All species				Forest-occurring species			
	Total	of which: Endangered	Endemic species		Total	of which: Endangered	Endemic species	
			Total	of which: Endangered			Total	of which: Endangered
	(Number)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©								
Austria ©	54	22	0	0	36	11	0	0
Belgium ©	29	15	0	0	16		0	0
Bosnia and Herzegovina								
Bulgaria ©								
Croatia ©	75	10	2					
Cyprus ©	20	0	0	0	20	0	0	0
Czech Republic ©	68	22	0	0	60	15	0	0
Denmark ©	48	22	0	0	24	8	0	0
Estonia ©	42	23			23	6		
Finland ©	59	13	0	0	29	3	0	0
France ©	110	29	4	4	13	0	0	0
Germany ©	83	2	0	0	50	2	0	0
Greece								
Hungary ©	60	1			42	1		
Iceland ©	17	6	0	0		0	0	0
Ireland ©	78	11	0	0	21	3	0	0
Israel ©	25	6	0	0	21	4	0	0
Italy		27						
Latvia ©	48	22	0	0	41	17	0	0
Liechtenstein ©	35							
Lithuania ©	21	6	0	0	18	5	0	0
Luxembourg								
Malta ©	0	0	0			0	0	0
Netherlands ©	32	5	0	0	18	1	0	0
Norway ©								
Poland ©	69	12						
Portugal	114	7	26	6	34	3	13	3
Romania								
Slovakia ©	63	27	7	7	42	15	1	1
Slovenia ©	75	16	0	0	950	47		
Spain ©								
Sweden ©	50	14	0	0	40	12	0	0
Switzerland ©	84	36	0	0	29	8	0	0
The FYR of Macedonia								
Turkey	78		1					
United Kingdom ©	80	2						
Yugoslavia ©	57				57			
Armenia	30	19						
Azerbaijan ©	71	36	0	0	71	36	0	0
Belarus	24	10	0	0	20	3	0	0
Georgia ©								
Kazakhstan ©	46	3	6	3	46	3	6	3
Kyrgyzstan ©								
Republic of Moldova								
Russian Federation ©	600	2			400	0		
Tajikistan								
Turkmenistan ©								
Ukraine ©	55	11		0	34	2		0
Uzbekistan								
Canada ©	100	3				1		
United States of America ©	546	28		25		7		6
Australia ©								
Japan								
New Zealand ©	219	15	193	15	219	15	193	15

© See notes and comments in Chapter IV.

TABLE 59

Reported number of species (total and forest-occurring), of which endangered: Mosses

Country	All species				Forest-occurring species			
	Total	of which: Endangered	Endemic species		Total	Endemic species		
			Total	of which: Endangered		of which: Endangered	Total	of which: Endangered
	(Number)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©								
Austria ©	959	498	1	1	959	498	1	1
Belgium ©	502	39			97		0	0
Bosnia and Herzegovina								
Bulgaria ©								
Croatia ©	638	38	11					
Cyprus ©								
Czech Republic ©	868	187	2	2	800	180	0	0
Denmark ©	400		0	0			0	0
Estonia ©	525	50			125	25		
Finland ©	870	160	0	0		37	0	0
France ©	13,000							
Germany ©	1,121	28	0	0	300	3	0	0
Greece								
Hungary ©	589	32				20		
Iceland ©	456	44	0	0		3	0	0
Ireland ©	759	192	0	0	150		0	0
Israel ©	260							
Italy								
Latvia ©	504	203	0	0	270	41	0	0
Liechtenstein ©								
Lithuania ©	325	13	0	0	310	13	0	0
Luxembourg								
Malta ©	20	20						
Netherlands ©	547	250	0	0	203	55	0	0
Norway ©	1,100	222		0	600	90		0
Poland ©	910	131			800			
Portugal	451	211	6	5	92	11	2	1
Romania								
Slovakia ©	902	540	3	3	720	270	3	3
Slovenia ©	755	261	0	0				
Spain ©	1,012	264						
Sweden ©	1,050	241	1	0	300	138	0	0
Switzerland ©	1,030	401			390	136	0	
The FYR of Macedonia								
Turkey	234							
United Kingdom ©	1,000	100	20					
Yugoslavia ©	565	8	7		565	8	7	
Armenia	347	102			308			
Azerbaijan ©	400	35	0	0	400	35	0	0
Belarus	430	9	0	0	290	6	0	0
Georgia ©								
Kazakhstan ©	11	3	4	3	10	2	3	2
Kyrgyzstan ©								
Republic of Moldova	10		10				10	
Russian Federation ©	1,000	0			700	0		
Tajikistan								
Turkmenistan ©								
Ukraine ©	800	28		0	40	8		0
Uzbekistan								
Canada ©	965	1				1		
United States of America ©	1,320							
Australia ©								
Japan	1,800	184						
New Zealand ©	524		514					

© See notes and comments in Chapter IV.

TABLE 60

Reported number of species (total and forest-occurring), of which endangered: Lichens

Country	All species				Forest-occurring species			
	Total	of which: Endangered	Endemic species		Total	of which: Endangered	Endemic species	
			Total	of which: Endangered			Total	of which: Endangered
	(Number)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©								
Austria ©	200	200	100	100	200	200	100	100
Belgium ©	168	85	0	0			0	0
Bosnia and Herzegovina								
Bulgaria ©								
Croatia ©	900		82					
Cyprus ©								
Czech Republic ©	1,400	560	0	0	1,200	500	0	0
Denmark ©	900	634	0	0	500	218	0	0
Estonia ©	800	95			390	55		
Finland ©	1,500	132	0	0		62	0	0
France ©	5,000							
Germany ©	1,691	252	0	0			0	0
Greece								
Hungary ©	800	68	12	5	250	31		
Iceland ©	600	67	0	0	60	15	0	0
Ireland ©	1,050				190			
Israel ©	235							
Italy								
Latvia ©	500	34	0	0	350	17	0	0
Liechtenstein ©	58							
Lithuania ©	106	13	0	0	106	13	0	0
Luxembourg								
Malta ©	195		12					
Netherlands ©	694	241	0	0			0	0
Norway ©	1,800	69	10	0	1,000	50	1	1
Poland ©	1,619	460						
Portugal								
Romania								
Slovakia ©	1,468	583	2	2	1,180	480	2	2
Slovenia ©	600	88	0	0				
Spain ©	2,000							
Sweden ©	2,000	238	2	2	800	198	2	2
Switzerland ©	960				465			
The FYR of Macedonia								
Turkey								
United Kingdom ©	1,500	86						
Yugoslavia ©	516	12	174		516	12	174	
Armenia								
Azerbaijan ©	500	56	2	1	500	56	2	1
Belarus	477	14	0	0	320	12	0	0
Georgia ©								
Kazakhstan ©	10	1	3	1	7	1	2	1
Kyrgyzstan ©								
Republic of Moldova	16		16				16	
Russian Federation ©	1,000	0			700	0		
Tajikistan								
Turkmenistan ©								
Ukraine ©	1,000	27		1		12		0
Uzbekistan								
Canada ©	2,000	4				4		
United States of America ©	3,750	2		2				
Australia ©								
Japan	1,000	62						
New Zealand ©	1,300		1,300					

© See notes and comments in Chapter IV.

TABLE 61

Reported number of species (total and forest-occurring), of which endangered: Mammals

Country	All species				Forest-occurring species			
	Total	of which: Endangered	Endemic species		Total	of which: Endangered	Endemic species	
			Total	of which: Endangered			Total	of which: Endangered
	(Number)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	84	33	0	0	58	27	0	0
Austria ©	96	47	86	47	57	28	57	28
Belgium ©	57	28	0	0		6	0	0
Bosnia and Herzegovina								
Bulgaria ©	94		6					
Croatia ©	100	46	3					
Cyprus ©	25	2	1	1	21	1	1	1
Czech Republic ©	76	31	0	0	71	31	0	0
Denmark ©	48	16	0	0	25	11	0	0
Estonia ©	65	18			40	14		
Finland ©	66	16	0	0	38	7	0	0
France ©	119	46	0	0	73	21	0	0
Germany ©	86	44	1	1	20	10	0	0
Greece								
Hungary ©	83	7						
Iceland ©	6	0	0	0	0	0	0	0
Ireland ©	29	0	2	0	20	0	1	0
Israel ©	116	75	0	0	85	59	0	0
Italy	105	38						
Latvia ©	69	24	0	0	50	15	0	0
Liechtenstein ©	56							
Lithuania ©	70	18	0	0	64	16	0	0
Luxembourg								
Malta ©								
Netherlands ©	65	14	0	0	24	5	0	0
Norway ©	76	22	0	0	50	16	0	0
Poland ©	93	27	5	4	69			
Portugal	70	25	8	6	35	16	5	5
Romania								
Slovakia ©	85	23	0	0	77	23	0	0
Slovenia ©	88	45	0	0	56	26	0	0
Spain ©	118	37	12	8				
Sweden ©	69	23	0	0	43	16	0	0
Switzerland ©	57	19	0	0	20	2	0	
The FYR of Macedonia								
Turkey	132	24	2	2				
United Kingdom ©	48	0						
Yugoslavia ©	96	35			96	35		
Armenia	74	18						
Azerbaijan ©	37	7	0	0	7	3	0	0
Belarus	74	14	0	0	74	14	0	0
Georgia ©		152						
Kazakhstan ©	158	40	20	20	107	28	17	17
Kyrgyzstan ©								
Republic of Moldova	67						11	
Russian Federation ©	230	22			97	10		
Tajikistan								
Turkmenistan ©								
Ukraine ©	108	41		1	60	24		0
Uzbekistan								
Canada ©	196	53				20		
United States of America ©	418	65	101	42	334	35		25
Australia ©		30						
Japan	106	34	48	28	81	30	42	26
New Zealand ©	77	6	4	4			2	2

© See notes and comments in Chapter IV.

TABLE 62

Reported number of species (total and forest-occurring), of which endangered: Birds

Country	All species				Forest-occurring species			
	Total	of which: Endangered	Endemic species		Total	of which: Endangered	Endemic species	
			Total	of which: Endangered			Total	of which: Endangered
	(Number)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	320	104	0	0	60	43	0	0
Austria ©	250	134	0	0	113	43	0	0
Belgium ©	167	99	0	0		7	0	0
Bosnia and Herzegovina								
Bulgaria ©	383	78						
Croatia ©	232							
Cyprus ©	365	0	7	0	209	0	7	0
Czech Republic ©	396	248	0	0	287	125	0	0
Denmark ©	185	11	0	0	94	3	0	0
Estonia ©	549	73			90	38		
Finland ©	240	33	0	0	105	13	0	0
France ©	284	78	1	0	90	13	1	0
Germany ©	255	84	0	0	53	10	0	0
Greece								
Hungary ©	370	21	1	1				
Iceland ©	100	24	0	0	3	0	0	0
Ireland ©	420	29	0	0	60	7	0	0
Israel ©	511	218	0	0	345	193	0	0
Italy	230	125						
Latvia ©	320	79	0	0	102	25	0	0
Liechtenstein ©	145	30						
Lithuania ©	321	67	0	0	195	42	0	0
Luxembourg	136	64	0	0	61	21	0	0
Malta ©	360	360	8	8				
Netherlands ©	172	48	0	0	37	2	0	0
Norway ©	220	59	0	0	115	18	0	0
Poland ©	360	57			160			
Portugal	350	10	15	4	122	3	9	2
Romania								
Slovakia ©	335	63	0	0	188	31	0	0
Slovenia ©	361	121	0	0	95	46	0	0
Spain ©	368	92	4	3				
Sweden ©	245	91	0	0	110	39	0	0
Switzerland ©	205	115	0	0	83	28	0	0
The FYR of Macedonia								
Turkey	450	39						
United Kingdom ©	390	0	1					
Yugoslavia ©	382	185	260		382	185	260	
Armenia	302	66						
Azerbaijan ©	65	36	0	0	15	6	0	0
Belarus	298	75	0	0	278	75	0	0
Georgia ©								
Kazakhstan ©	485	56	56	56	178	23	27	23
Kyrgyzstan ©								
Republic of Moldova	243						36	
Russian Federation ©	557	25			302	10		
Tajikistan								
Turkmenistan ©	372							
Ukraine ©	400	67	0	0	130	30	0	0
Uzbekistan								
Canada ©	435	47				16		
United States of America ©	776	90	70	50	698	54		37
Australia ©		26						
Japan	538	49	18	14	146	25	15	11
New Zealand ©	183	55	68	55	84	37	50	37

© See notes and comments in Chapter IV.

TABLE 63

Reported number of species (total and forest-occurring), of which endangered: Other vertebrates (fish, amphibians and reptiles)

Country	All species				Forest-occurring species			
	Total	of which: Endangered	Endemic species		Total	of which: Endangered	Endemic species	
			Total	of which: Endangered			Total	of which: Endangered
	(Number)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	365	111	0	0	42	27	0	0
Austria ©	33	33	0	0	25	25	0	0
Belgium ©	65	46	0	0	0	0	0	0
Bosnia and Herzegovina								
Bulgaria ©	259	78	17					
Croatia ©	600	150						
Cyprus ©	26	3	4	1	23	1	4	1
Czech Republic ©	88	47	0	0	44	25	0	0
Denmark ©	58	22	0	0	3	2	0	0
Estonia ©	87	14			8	2		
Finland ©	104	12	0	0	1	0	0	0
France ©	73	30	2	2	24	10	0	0
Germany ©	35	25	0	0	6	3	0	0
Greece								
Hungary ©	111	5						
Iceland ©	6	0	0	0	0	0	0	0
Ireland ©	19	10	4	4	2	0	0	0
Israel ©	152	68	6	6	115	49	2	2
Italy	140	98						
Latvia ©	118	16	0	0	20	8	0	0
Liechtenstein ©	39	13						
Lithuania ©	120	22	0	0	35	5	0	0
Luxembourg								
Malta ©		3						
Netherlands ©	23	15	0	0	3	1	0	0
Norway ©	35	10	0	0	10	4	0	0
Poland ©	139	15	4	4				
Portugal	46	5	17	3	12	0	3	0
Romania								
Slovakia ©	111	40	0	0	33	23	0	0
Slovenia ©	144	107	2	2	27	21	0	0
Spain ©	149	47	48	26				
Sweden ©	161	32	0	0	62	8	0	0
Switzerland ©	89	74	0	0	8	3	0	0
The FYR of Macedonia								
Turkey	635	22	8					
United Kingdom ©	50	3						
Yugoslavia ©	180	27	56					
Armenia	76	14	3	3				
Azerbaijan ©	24	4	0	0	4	3	0	0
Belarus	81	8	0	0	81	8	0	0
Georgia ©	13							
Kazakhstan ©	211	29	29	29	57	7	7	7
Kyrgyzstan ©								
Republic of Moldova							50	
Russian Federation ©	450	4			45	1		
Tajikistan								
Turkmenistan ©	60							
Ukraine ©	238	47		0		13		0
Uzbekistan								
Canada ©	1,175	79						
United States of America ©	1,342	158		126	1,179	89		79
Australia ©		21						
Japan	343	29	86	21	114	15	85	13
New Zealand ©	1,081	50	192	50	114	39	90	39

© See notes and comments in Chapter IV.

TABLE 64

Reported number of species (total and forest-occurring), of which endangered: Butterflies and moths

Country	All species				Forest-occurring species			
	Total	of which: Endangered	Endemic species		Total	of which: Endangered	Endemic species	
			Total	of which: Endangered			Total	of which: Endangered
	(Number)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	877	43	0	0	142	42	0	0
Austria ©	4,000	800	400	400	2,800	560	280	280
Belgium ©	50	43	0	0		11	0	0
Bosnia and Herzegovina								
Bulgaria ©	20,000	2,125	470					
Croatia ©	2,505							
Cyprus ©	52	0	9	0	44	0	9	0
Czech Republic ©	3,340	400	40	30				
Denmark ©	3,940	1,224		0			0	0
Estonia ©	897	34			568	34		
Finland ©	2,390	179	0	0		47	0	0
France ©	5,120							
Germany ©	185	112	0	0	51	32	0	0
Greece								
Hungary ©	3,570	180	25	25	2,356	20		
Iceland	51		0	0	11	0	0	0
Ireland ©								
Israel ©	5,140							
Italy		12						
Latvia ©	2,396	45	0	0	1,500	19	0	0
Liechtenstein ©								
Lithuania ©	1,200	58	0	0	700	20	0	0
Luxembourg								
Malta ©								
Netherlands ©	70	45	0	0	15	14	0	0
Norway ©	2,100	540	2	0	1,000	200	0	0
Poland ©	3,200	512	10					
Portugal	151	1	17	0	74	0	3	0
Romania								
Slovakia ©	3,949							
Slovenia ©	1,402	1,170	13	12	900	750		
Spain ©								
Sweden ©	2,700	333	6	2	439	145	2	2
Switzerland ©	182	108	0	0	128	32	0	0
The FYR of Macedonia								
Turkey								
United Kingdom ©	2,500	107						
Yugoslavia ©	4,000	45			4,000	45		
Armenia								
Azerbaijan ©	7,000	40	0	0	652	30	0	0
Belarus	1,590	31	0	0	1,420	31	0	0
Georgia ©								
Kazakhstan ©	0	0	0	0	0	0	0	0
Kyrgyzstan ©								
Republic of Moldova								
Russian Federation ©	9,000	9				8		
Tajikistan								
Turkmenistan ©								
Ukraine ©	5,000	58		1	2,000	42		1
Uzbekistan								
Canada ©	4,630	3						
United States of America ©	600	18		16		9		7
Australia ©								
Japan	237	43	15	7	152	23	13	5
New Zealand ©	1,490		11					

© See notes and comments in Chapter IV.

TABLE 65

Annual averages of area of regeneration and extension of forest and natural colonization of other wooded land over ten-year period

Country	Ten-year period from - to	Regeneration of forest		Extension of forest including afforestation and reforestation of other wooded land		Natural colonization of non-forest land to OWL	
		Annual average area over 10-year period total	of which: With introduced tree species	Annual average area over 10-year period	of which: With introduced tree species	Annual average area over 10-year period	of which: With introduced tree species
		(1000 ha)					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Albania ©	1951-90	36.4	0.0	5.0	0.0	0.0	0.0
Austria ©	1986-96	50.0	0.0	2.0	0.0	0.0	0.0
Belgium	1988-97	7.0	4.9	0.1		0.0	
Bosnia and Herzegovina							
Bulgaria	1985-95	28.0	2.0				
Croatia	1986-96	39.0	0.6	2.0	0.0	0.0	0.0
Cyprus	1987-96	0.5 ①	0.0		0.0		0.0
Czech Republic ©	1986-95	24.0	1.0	1.0	0.0	0.0	0.0
Denmark ©	1990	6.4	5.2	2.2	1.3	0.3	0.2
Estonia ©	1987-96	6.1 ①		10.0		4.4	
Finland ©	1987-96	167.0	1.9	21.0	0.0		
France ©	1987-97	107.0 ①	33.0	9.5	4.5	75.6	0.0
Germany ©	1987-96	70.0	4.5	7.2	0.4	0.0	0.0
Greece	1986-95						
Hungary ©	1987-96	20.7	12.7	6.8	4.6		
Iceland ©	1987-97	0.0 ①	0.0	0.6	0.5		
Ireland	1987-96	4.0	4.0	17.0	16.0	0.0	0.0
Israel ©	1987-97	0.4	0.4	2.1	2.1	2.3	
Italy	1986-95	143.0 ①					
Latvia ©	1988-97	8.0	0.0	0.0	0.0	0.0	0.0
Liechtenstein	1975-95	0.0		0.0		0.0	
Lithuania	1987-97	10.7	0.0	1.8	0.0	0.2	0.0
Luxembourg	1987-97						
Malta	1986-96	0.0	0.0	0.0	0.0	0.0	0.0
Netherlands ©	1985-95	2.1 ①	0.4	1.2	0.2	0.0	0.0
Norway ©	1987-96	47.0	1.0	31.0	0.0	26.0	0.0
Poland ©	1987-96	59.1 ①	0.0	10.0	0.0		0.0
Portugal	1985-95	75.0	40.0	58.0	9.0	0.0	0.0
Romania							
Slovakia ©	1987-96	16.5 ①	1.5	0.3	0.0	0.0	0.0
Slovenia ©	1986-96	7.5 ①	0.0	3.6	0.0	0.5	0.0
Spain							
Sweden ©	1987-96	204.0 ①	16.0	2.0			
Switzerland ©	1985-95	21.4	0.0	6.9		1.7	
The FYR of Macedonia							
Turkey ©	1987-96	54.0		66.0	3.0		
United Kingdom ©	1986-95	14.8	11.4	22.8	15.5	0.0	0.0
Yugoslavia ©	1990-97	9.9	0.4	5.5	1.1	0.0	0.0
Armenia	1983-93	22.0	10.0	4.0	2.0	0.0	0.0
Azerbaijan	1987-97	3.0	0.0	2.0	0.0	0.0	0.0
Belarus	1988-97	26.2	0.1	0.6	0.0	0.0	0.0
Georgia ©	1985-94	19.1					
Kazakhstan	1987-97	67.0	0.0	0.0	0.0	0.0	0.0
Kyrgyzstan		26.0					
Republic of Moldova	1988-97	4.2	2.6	1.2	0.6		
Russian Federation ©	1983-93	2,026.0	0.0	0.0	0.0	1,316.0	0.0
Tajikistan							
Turkmenistan ©	1980-89						
Ukraine	1987-96	39.4	5.0	13.8	6.9	0.0	0.0
Uzbekistan	1988-95						
Canada ©	1986-97	692.9		0.0	0.0		
United States of America ©	1987-92	4,372.0	4.0	1,868.0			
Australia ©		①					
Japan	1990-94	170.0 ①		5.0			
New Zealand ©	1987-96	20.0	20.0	53.0	43.0	10.0	0.0

© See notes and comments in Chapter IV.

① Adjustment to achieve conformity with TBFRA definitions arrived at by the National Correspondent.

TABLE 66

Forest regenerated by natural regeneration, natural regeneration enhanced by planting, coppice sprouting and planting or seeding over ten-year period

Country	Natural regeneration		Natural regeneration enhanced by planting		Coppice sprouting		Planting or seeding	
	Annual average area over 10-year period	of which: With introduced tree species	Annual average area over 10-year period	of which: With introduced tree species	Annual average area over 10-year period	of which: With introduced tree species	Annual average area over 10-year period	of which: With introduced tree species
	(1000 ha)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)		(9)
Albania ©	2.2	0.0	0.0	0.0	34.2	0.0	0.0	0.0
Austria ©	38.0	0.0	5.0	0.0	0.0	0.0	7.0	0.0
Belgium	1.7	0.8			0.0	0.0	5.3	4.1
Bosnia and Herzegovina								
Bulgaria	10.5		4.7	0.5	2.8		10.0	1.6
Croatia	28.0	0.0	3.0	0.0	5.0	0.0	3.0	0.6
Cyprus	0.0 ①	0.0	0.0 ①	0.0	0.0 ①	0.0	0.5 ①	0.0
Czech Republic ©	0.0	0.0	1.0	0.0	0.0	0.0	23.0	1.0
Denmark ©	0.2	0.0	0.2	0.0	0.1	0.0	5.8	5.2
Estonia ©	1.3 ①		0.7 ①		0.0		4.1	
Finland ©	49.0	0.0		0.0	0.0	0.0	118.0	1.9
France ©	7.3 ①	0.4	0.0 ①	0.0	70.9 ①	17.0	28.8 ①	15.6
Germany ©	28.0	0.3	0.0	0.0	0.0	0.0	42.0	4.2
Greece	22.4	0.0					4.0	
Hungary ©	1.6				6.0		13.1	
Iceland ©	0.0	0.0	0.0	0.0	0.0	0.0	0.0 ①	0.0
Ireland	0.0	0.0	0.0	0.0	0.0	0.0	4.0	4.0
Israel ©			0.1	0.1	0.1	0.1	0.3	0.3
Italy	65.0 ①		3.0 ①		63.0 ①		12.0 ①	10.0
Latvia ©	2.0	0.0	0.0	0.0	0.0	0.0	6.1	0.0
Liechtenstein	0.0		0.0		0.0		0.0	
Lithuania	2.9	0.0	0.0	0.0	0.0	0.0	7.8	0.0
Luxembourg								
Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Netherlands ©	0.6 ①	0.2	0.0	0.0	0.6	0.0	0.9 ①	0.3
Norway ©	20.0	0.0	0.0	0.0	0.0	0.0	27.0	1.0
Poland ©	0.7 ①	0.0	2.8 ①	0.0	0.0	0.0	55.6	0.0
Portugal	23.0	0.0	0.0	0.0	40.0	40.0	12.0	0.0
Romania								
Slovakia ©	1.6 ①	0.0	0.2 ①	0.0	0.0	0.0	14.6 ①	1.5
Slovenia ©	5.8 ①	0.0	0.2 ①	0.0	1.0 ①	0.0	0.5 ①	0.0
Spain								
Sweden ©	38.0	0.0	4.0	0.0	2.0 ①	0.0	160.0	16.0
Switzerland ©	18.8	0.0	1.7	0.0	0.0	0.0	0.9	0.0
The FYR of Macedonia								
Turkey ©	21.0				11.0		22.0	
United Kingdom ©	0.3	0.2	0.0	0.0	0.1	0.1	14.4	11.1
Yugoslavia ©	1.3	0.0	2.0	0.0	3.8	0.1	2.8	0.3
Armenia	7.0	0.0	2.0	0.0	0.0	0.0	13.0	10.0
Azerbaijan	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Belarus	2.8	0.0	0.0	0.0	1.2	0.0	22.2	0.1
Georgia ©	16.2		2.5				0.4	
Kazakhstan	0.0	0.0	13.0	0.0	0.0	0.0	54.0	0.0
Kyrgyzstan	16.0		7.0		0.0		3.0	
Republic of Moldova	1.3	0.6	0.0	0.0	0.8	0.8	2.1	1.2
Russian Federation ©	763.0	0.0	657.0	0.0	38.0	0.0	568.0	0.0
Tajikistan								
Turkmenistan ©	0.0	0.0	0.0	0.0	0.0		3.4	
Ukraine	1.1	0.0	1.0	0.0	1.0	0.0	36.3	5.0
Uzbekistan								
Canada ©	424.4						268.5	
United States of America ©	3,260.0		0.0		0.0		1,112.0	4.0
Australia ©								
Japan	88.0 ①		22.0 ①		1.0 ①		59.0 ①	
New Zealand ©	0.0	0.0	0.0	0.0	0.0	0.0	20.0	20.0

© See notes and comments in Chapter IV.

① Adjustment to achieve conformity with TBFRA definitions arrived at by the National Correspondent.

TABLE 67

Extension of forest (afforestation and reforestation of other wooded land)

Country	Natural colonization of non-forest land to forest		Natural colonization of other wooded land to forest		Planting or seeding of non-forest land		Planting or seeding of other wooded land	
	Annual average over 10-year period	of which: With introduced tree species	Annual average over 10-year period	of which: With introduced tree species	Annual average over 10-year period	of which: With introduced tree species	Annual average over 10-year period	of which: With introduced tree species
	(1000 ha)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	0.0	0.0	0.0	0.0	5.0	0.04	0.0	0.0
Austria ©	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Belgium	0.0		0.0		0.1		0.0	
Bosnia and Herzegovina								
Bulgaria								
Croatia	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0
Cyprus		0.0		0.0		0.0		0.0
Czech Republic ©	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Denmark ©	0.2	0.2	0.1	0.0	1.9	1.1	0.0	0.0
Estonia ©	4.2		5.3		0.4		0.1	
Finland ©	4.0	0.0	8.0	0.0	9.0		0.0	0.0
France ©	0.2	0.0	0.1	0.0	8.0	3.9	1.2	0.6
Germany ©	3.0	0.0	0.0	0.0	4.2	0.3	0.0	0.0
Greece								
Hungary ©	0.5				6.3	4.6		
Iceland ©	0.0	0.0	0.0	0.0	0.6	0.5	0.0	0.0
Ireland	0.0	0.0	0.0	0.0	17.0	16.0	0.0	0.0
Israel ©	0.0	0.0	0.0	0.0	1.3	1.3	0.8	0.8
Italy								
Latvia ©	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Liechtenstein	0.0		0.0		0.0		0.0	
Lithuania	0.2	0.0	0.2	0.0	0.5	0.0	1.0	0.0
Luxembourg								
Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Netherlands ©	0.0	0.0	0.0	0.0	1.2	0.2	0.0	0.0
Norway ©	20.0	0.0	11.0	0.0	0.0	0.0	0.0	0.0
Poland ©		0.0	0.0	0.0	10.0	0.0	0.0	0.0
Portugal	0.0	0.0	29.0	0.0	28.0	9.0	1.0	0.0
Romania								
Slovakia ©	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
Slovenia ©	0.3	0.0	3.3	0.0	0.0	0.0	0.0	0.0
Spain								
Sweden ©					2.0		0.0	0.0
Switzerland ©	5.0		0.9		0.9		0.1	
The FYR of Macedonia								
Turkey ©					18.0	1.0	48.0	2.0
United Kingdom ©	0.0	0.0	0.0	0.0	22.8	15.5	0.0	0.0
Yugoslavia ©	0.0	0.0	0.0	0.0	0.4	0.0	5.2	1.1
Armenia	0.0	0.0	2.0	1.0	1.0	0.0	1.0	1.0
Azerbaijan	0.0	0.0	0.0	0.0	0.8	0.0	1.2	0.0
Belarus	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0
Georgia ©								
Kazakhstan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kyrgyzstan								
Republic of Moldova	0.0	0.0	0.0	0.0	1.2	0.6	0.0	0.0
Russian Federation ©	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tajikistan								
Turkmenistan ©								
Ukraine	0.0	0.0	0.0	0.0	13.8	6.9	0.0	0.0
Uzbekistan								
Canada ©								
United States of America ©	1,140.0		323.0		405.0		0.0	
Australia ©								
Japan	5.0							
New Zealand ©		0.0	10.0	0.0	43.0	43.0		0.0

© See notes and comments in Chapter IV..

TABLE 68

Types of regeneration and extension of forest (share of annual average area over ten-year period)

Country	Regeneration of forest				Extension of forest			
	Natural regeneration	Natural regeneration enhanced by planting	Coppice sprouting	Planting or seeding	Non-forest land to forest (Natural colonization)	Other wooded land to forest (Natural conversion)	Planting or seeding of non-forest land	Planting or seeding of other wooded land
	(per cent of total regeneration)				(per cent of total extension)			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania	6.1	0.0	93.9	0.0	0.0	0.0	100.0	0.0
Austria	76.0	10.0	0.0	14.0	50.0	0.0	50.0	0.0
Belgium	24.4		0.0	75.6	0.0	0.0	100.0	0.0
Bosnia and Herzegovina								
Bulgaria	37.5	16.8	10.0	35.7				
Croatia	71.8	7.7	12.8	7.7	0.0	0.0	100.0	0.0
Cyprus	0.0	0.0	0.0	100.0				
Czech Republic	0.0	4.2	0.0	95.8	0.0	0.0	100.0	0.0
Denmark	3.5	3.5	2.0	90.9	9.1	4.5	86.4	0.0
Estonia	21.3	11.5	0.0	67.2	42.0	53.0	4.0	1.0
Finland	29.3		0.0	70.7	19.0	38.1	42.9	0.0
France	6.8	0.0	66.3	26.9	2.1	1.1	84.2	12.6
Germany	40.0	0.0	0.0	60.0	41.7	0.0	58.3	0.0
Greece								
Hungary	7.7		29.0	63.3	7.4		92.6	
Iceland					0.0	0.0	100.0	0.0
Ireland	0.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0
Israel		25.0	12.5	62.5	0.0	0.0	61.9	38.1
Italy	45.5	2.1	44.1	8.4				
Latvia	24.6	0.0	0.0	75.4				
Liechtenstein	50.0	33.3	0.0	16.7	75.0	0.0	25.0	0.0
Lithuania	27.1	0.3	0.0	72.6	11.0	11.0	24.7	53.3
Luxembourg								
Malta					0.0	0.0	0.0	100.0
Netherlands	28.6	0.0	28.6	42.9	0.0	0.0	100.0	0.0
Norway	42.6	0.0	0.0	57.4	64.5	35.5	0.0	0.0
Poland	1.2	4.7	0.0	94.2		0.0	100.0	0.0
Portugal	30.7	0.0	53.3	16.0	0.0	50.0	48.3	1.7
Romania								
Slovakia	9.9	1.2	0.0	88.9	0.0	0.0	100.0	0.0
Slovenia	77.3	2.7	13.3	6.7	8.3	91.7	0.0	0.0
Spain								
Sweden	18.6	2.0	1.0	78.4			100.0	0.0
Switzerland	87.9	7.9	0.0	4.2	72.5	13.0	13.0	1.4
The FYR of Macedonia								
Turkey	38.9		20.4	40.7			27.3	72.7
United Kingdom	2.0	0.0	0.7	97.3	0.0	0.0	100.0	0.0
Yugoslavia	13.6	20.0	38.0	28.4	0.0	0.0	6.4	93.6
Armenia	31.8	9.1	0.0	59.1	0.0	50.0	25.0	25.0
Azerbaijan	100.0	0.0	0.0	0.0	0.0	0.0	40.0	60.0
Belarus	10.7	0.0	4.6	84.7	0.0	0.0	100.0	0.0
Georgia	84.8	13.3		1.9				
Kazakhstan	0.0	19.4	0.0	80.6				
Kyrgyzstan	69.6	30.4	0.0	13.0				
Republic of Moldova	31.0	0.0	19.0	50.0	0.0	0.0	100.0	0.0
Russian Federation	37.7	32.4	1.9	28.0				
Tajikistan								
Turkmenistan								
Ukraine	2.8	2.5	2.5	92.1	0.0	0.0	100.0	0.0
Uzbekistan								
Canada	61.2			38.8				
United States of America	74.6	0.0	0.0	25.4	61.0	17.3	21.7	0.0
Australia								
Japan	51.8	12.9	0.6	34.7	100.0			
New Zealand	0.0	0.0	0.0	100.0		18.9	81.1	

TABLE 69

Origin of planting material used in the forest

Country	Ten-year period	Indigenous species				Introduced species		
		Total	of which:			Total	of which:	
			Known local provenance	Known non-local provenance	Unknown provenance		Known non-local provenance	Unknown provenance
		(ha/year)						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania	1955-85	1,990	1,840	0	150	850	350	500
Austria	1988-97	6,835	6,835	0	0	150	150	0
Belgium ©	1988-97	693	0	0	0	3,456	0	0
Bosnia and Herzegovina								
Bulgaria	1985-95	8,440	8,440			2,150		
Croatia	1986-96	7,536	7,536			597	597	
Cyprus	1987-96	474	474	0	0			
Czech Republic ©	1989-96	30,879	30,879	0	0	0	0	
Denmark ©	1980-90	1,170	513	657		5,215	5,215	
Estonia	1987-96	4,290	4,290	0	0	4	4	0
Finland ©	1987-96	91,373	90,766	667	0	1,875	1,875	0
France	1995-96	46,859	0	0	0	24,108	0	0
Germany ©	1987-96	41,500	31,200			4,700		
Greece								
Hungary ©	1987-96	13,661				12,343		
Iceland ©	1987-97	120		120		490	490	
Ireland ©								
Israel								
Italy	1984-93	1,560	1,560	0	0	10,606	10,606	0
Latvia ©	1988-97	6,011	6,011			43		43
Liechtenstein ©	1975-95							
Lithuania	1987-97	7,727	6,786	739	202	30	4	25
Luxembourg								
Malta ©	1986-96							
Netherlands ©	1985-95	1,931	1,102	584	245	158	158	0
Norway ©	1987-96	25,900	23,400	2,500		1,100	1,100	
Poland ©	1987-96	91,711	91,711	0	0			
Portugal ©	1985-95	11,029			11,029	1,651		1,651
Romania								
Slovakia ©	1986-96	13,627	9,892	3,692	143	1,430	1,290	140
Slovenia ©	1986-96	7,170	5,119	1,256	795	100	0	100
Spain								
Sweden ©	1987-96	144,000	126,000	18,000		16,000	16,000	
Switzerland ©	1991-91				0			
The FYR of Macedonia								
Turkey	1987-96	83,878	83,878	0	0	2,586	2,586	0
United Kingdom ©	1986-95	10,534				26,646		
Yugoslavia	1985-95	5,632	5,632	0	0	566	0	0
Total: Europe								
of which: EU 15								
Armenia	1983-93	1,850	650	1,200	0	210	50	160
Azerbaijan	1987-97	7	7	0	0	23	23	0
Belarus	1988-97	22,154	22,154	0	0	38	0	6
Georgia								
Kazakhstan	1987-97	53,300	53,300	0	0			
Kyrgyzstan								
Republic of Moldova	1988-97	1,550	1,550			2,650	150	
Russian Federation	1987-96	357,945	357,945	0	0			
Tajikistan								
Turkmenistan								
Ukraine	1987-96	42,100	42,100	0	0	8,050	0	0
Uzbekistan								
Total: CIS								
Canada ©	1986-95	374,311	342,324	31,987		4,886	4,886	
United States of America ©	1987-97	1,087,221	1,067,486	19,736		3,572	3,572	
Total: North America		**1,461,531**	**1,409,810**	**51,723**		**8,458**	**8,458**	
Australia ©	1993-94	172,417				838,680		
Japan	1986-95	64,794	64,794			229	229	
New Zealand	1986-96					29,500		
Total: Other TBFRA						**868,409**		
Grand Total								

© See notes and comments in Chapter IV.

NOTES AND COMMENTS RELATING TO CHAPTER IV

Main Tables	Comments

Albania

53, 54

Enquiry Table 2: About 83.0 per cent of forest area is semi-natural forest originating from natural regeneration, conserving the main species composition, also there are about 8.2 per cent of virgin/primeval forests, mainly localised in the northern part of Albania; the plantations compose 8.8 per cent consisting mainly of indigenous species.

The trends in the area of the above classes over the last 100-200 years, particularly since 1950s, were as follows:

The forest undisturbed by man was reduced from 300,000 ha (or 22.5 per cent of forest area) in 1950 to 84,841 in 1995 (or 8.2 per cent of forest area).

The semi-natural forests were reduced from 1,328,700 ha (or 100 per cent of forest area) in 1957 to 843,160 ha in 1995 (or 83 per cent of forest area) but during the 1990s the area has begun to increase again.

The plantation area increased from nothing in the 1950s to 102,000 ha in 1995 (or 8.8 per cent of forest area). During the 1990s or transition period, reforestation was reduced.

The nature and driving forces of these structural trends and underlying circumstances were as follows:

1. Exploitation
2. Thinnings
3. Grazing
4. Fires
5. Illegal cuttings
6. Deforestation and reforestation
7. Pest and diseases
8. Pollution
9. Climate changes

Because of forest exploitation and thinnings there have been many difficulties to conserve the composition and structure of nature forest species. Construction of roads, buildings or other structures, etc., cutting and conservation or collection of fruits of certain species have favoured other species to occupy more territory.

Grazing favours livestock at the expense of other browsing species. Fire changes everything and favours growth of the most resistant species under the new more difficult conditions.

As a result of illegal cuttings, the most important species disappear and the least important species or individual tree survive. Deforestation causes the natural forest ecosystems to disappear and reforestation always replaces a different kind of ecosystem.

Pests and diseases, pollution and climate change allow those species that resist them or adjust better to the new conditions to survive.

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Enquiry Table 8: There is the increasing trend in protected areas, because the Albania is a montainous-hilly country (the average elevation above sea-level is 691.2 m) placed on the boundary of Mediterranean and central European climate zones with very rich biodiversity and landscape. These are very important resources to include in regional or European worknets of research.

56-64

Enquiry Table 10: Of the 3250 plant species that compose the flora of Albania about 10.2 per cent (or 330 species) are trees while the remaining part are other vascular plants (flowers) or 89.8 per cent (or 2920 species), from which are:

- Endangered tree species 0.8 per cent (or 27 species)
- Endangered other vascular plant species (flowers) 3.2 per cent (or 103 species)
- The rare species are about 6.1 per cent (or 199 species)

The endemic species are 0.9 per cent (or 30 species) of the total plant species.

There are Balkanic and sub-endemic species which are as follows:

- Plants 13.8 per cent (or 450 species)
- Mammals 2.5 per cent (or 2 species)
- Amphibians and reptiles 23.1 per cent (or 12 species)
- Butterflies and moths1.3 per cent (or 11 species)

The number of forest-occurring species, respectively, for trees is 3.7 per cent (or 120 species) and other vascular plants (flowers) is 44.9 per cent (or 1460 species); this last is specialist estimation. Of them there are endangered species respectively, 0.5 per cent (or 15 tree species) and 9.4 per cent (or 305 other vascular plant species (flowers)).

The ferns, mosses and lichens have not been studied.

Also, for forest occurring species there are mammals 69.0 per cent (or 58 species), birds 18.8 per cent (or 60 species), other vertebrates 7.4 per cent and 11.5 per cent (amphibians and reptiles) (or 42 species) and butterflies and moths 16.2 per cent (or 142 species) of each total.

Out of them, the endangered species are mammals 32.1 per cent (or 27 species), birds 9.7 per cent (or 31 species), other vertebrates 7.4 per cent (or 27 species) and butterflies and moths 4.8 per cent (or 42 species).

There exists supportive information on the "Endangered status categories" in tabular form in the reply to the enquiry which is available at the secretariat.

65-68

Enquiry Table 11: The high forests are treated with successive cutting systems and selective cutting systems based on natural regeneration by seed of remaining trees while the coppice forests are treated with clearing cutting system based on natural regeneration by sprouts of the remaining stumps.

From the figures provided, it is clear that the larger part of the forest area was regenerated as coppice; the annual average area during the forty-years period (1951-1990) was 34,150 ha (or 93.9 per cent of the total regenerated forest area). In the second place, there is planting of non-forest lands using introduced species about 0.8 per cent (or 40 ha annual average area) and thirdly, there is natural regeneration in high forests.

Armenia

53, 54

Enquiry Table 2: Four categories of "Especially Protected Nature Areas" are defined by law (1992): state preserves (arghelotz), national parks, state protected areas (arghelavaire) and nature monuments. These differ from internationally adopted IUCN Protection Status categories. The status of the protected areas was defined mainly in the late 1950s and the early 1970s. The protected areas cover in total about 311,600 ha. Sevan National Park, which is the only national park, counts for 151,100 ha of which 124,100 is water.

It should be noted that out of the total forested areas of the country (334,100 ha) present protected areas cover over 100,000 ha, which is a high percentage in international comparisons. The management of the protected areas is shared between the Ministry of Agriculture, Hayantar, and the Ministry of Nature Protection. Hayantar is responsible for 17 protected areas, including two major preserves (Khosrov, Dilidjan) and especially Shikaghogh.

Australia

53, 54

Enquiry Table 2: The figure of 18,836 in row "Forest undisturbed by man" is derived from the total area of forest in conservation reserves plus old growth forest in multiple use forests. Source: State of the Forest Report (1998).

Comments to the adjustment table:

Enquiry Table 2: Native Forest: forest undisturbed by man and semi-natural forest.

No areas have been recorded for items 2.2 and 2.3, as 'naturalness' is a difficult quality to quantify. Australia has developed a method of wilderness assessment that can be applied in practice, at an appropriate data scale.

Wilderness is defined in the National Forest Policy Statement (1992) as: land that, together with its plant and animal communities, is in a state that has not been substantially modified by, and is remote from, the influences of European settlement, or is capable of being restored to such a state; is of sufficient size to make its maintenance in such a state feasible; and is capable of providing opportunities for solitude and self-reliant recreation.

The National Wilderness Inventory (Australian Heritage Commission. 1995) assesses wilderness quality across Australia using four indicators:

- remoteness from settlement - distance from the nearest house or town;
- remoteness from access - distance from the nearest track or road;
- apparent naturalness - distance from the nearest permanent structures associated with modern human society (including fences, powerlines, transmission towers and the like); and
- biophysical naturalness - the extent to which an area's plant and animal communities have remained undisturbed by modern technology.

Incorporation of relevant data in the calculation of these indicators for particular environments is based on data availability. Potential wilderness quality is calculated by summing the four indicators, each of which can contribute a maximum of 5 units. Potential wilderness values range between one and twenty, e.g. urban areas have low values and pristine environments receive high values.

Data from the National Wilderness Inventory have been incorporated into the National Forest Inventory database to generate information on the wilderness status of native forests. Forest environments with a potential wilderness value (PWV) of 12 or greater, cover approximately 55 per cent of the native forest estate; with approximately 32 per cent of native forest having a PWV of less than 12 ; and approximately 13 per cent having an unknown wilderness value (State of the Forest Report (1998) Table 29).

Designation as wilderness however also depends on areas with high values of PWV existing as contiguous spatial units. For example, in some regions, the National Wilderness Inventory method has been applied to high resolution spatial data and wilderness areas have been reserved where :

- the PWV is 12 or more and
- forest patches are at least 5000 ha to 8000 ha in size.

Native Forest, trends: According to the State of the Forest Report (1998), determining the historical rate of forest cover change is a difficult task, given the pre-European forest cover can only be estimated from information available today. Current information at the national level only allows approximations to be made, but it seems likely that about 40 per cent of Australia's forests were converted to agricultural land between 1788 and 1980 (State of the Forest Report (1998) table 32).

Forests may change in character while retaining their status as forests. The estimated area of forest in which density has decreased since European settlement (1788) as a result of forest management practices is 7.5 million ha (State of the Forest Report (1998) table 34).

Information is not available at the national level for the assessment of current changes in forest cover. In 1995 the Commonwealth Government committed AUS $3.4 million to a joint project between the Commonwealth and the States and Territories to develop a national land clearance database using high-resolution satellite information. This project is now under way (State of the Forest Report (1998) and data will be available at the end of 1998.

Plantations: According to the National Plantation Inventory (1997, page 10), the area of standing plantation estate in 1997 was:

- 10,010 ha (93 per cent softwood), planted prior to 1940;
- 51,210 ha (96 per cent softwood), planted to the end of 1959;
- 531,810 ha (91 per cent softwood), planted to the end of 1979;
- 862,500 ha (90 per cent softwood), planted to the end of 1989;
- 1,042,600 ha (85 per cent softwood), planted to the end of 1994.

The plantation expansion between 1960 and 1980 was driven by Commonwealth softwood plantation loans. The softwood planting rate peaked in 1975-1979. Since then it has been declining, especially since 1990, due to commercial and tax reasons as well as competition for land. The hardwood planting rate has increased from the mid-1970s through to 1994.

The Commonwealth Vision 2020 Initiative proposes to treble the total 1997 plantation estate by the year 2020.

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Enquiry Table 8: Not all forest in Australia has IUCN value. About 15 per cent of forest has determined IUCN value. IUCN includes all National Parks, Nature Reserves and domestic water supply, where available. It also includes dedicated reserves in State forest except for Queensland.

The figure of 9,896,000 for "Forest--in IUCN categories III to VI" includes 3,605,100 ha of State Forest and Timber Reserve with IUCN value.

Differences with Australia's First Approximation Report for the Montreal Process, 1997 data is due to different data sources – Montreal from State Agencies, TBFRA-2000 data from NFI.

Data Source: National Forest Inventory, 1997 and State Government Agencies.

56-64

Enquiry Table 10: The data for "Other vascular plants" include all vascular plants, including data for "Trees".

The data for "Trees--Total species" are (468 + > 1200) which are incomplete. However, they are the best available.

Data for "Other vertebrates--endangered" are composed of 7 Amphibians, 8 Fish, and 6 Reptiles.

Data source: State of the Forest Report (1998), and after Commonwealth of Australia 1992 Endangered Species Act 1992.

Problematic introduced species: Determining the extent to which pests and diseases affect the forest is of considerable importance in assessing the state of the forests, but it is also an extremely difficult task. Currently, there are no quantitative national data on the pests and diseases that occur in Australia's forests, or of the damage they cause. Due to the climatic range across Australia very few pests and diseases are nationally distributed. Many of the pests and diseases are significant at a sub-continental scale. Foxes and blackberries (*Rubus vulgaris*) are the most widespread animal and plant pests in forests, and are responsible for limiting ground dwelling animals and displacing understorey species respectively.

Detail:

Weeds: There are 220 plant species that have been declared noxious in Australia. Most of these are exotic (not native to Australia), and almost half (46 per cent) were introduced deliberately, often as garden plants but also for agriculture. On average, one or two plants a year become recognised as weeds, often decades after their introduction into Australia or a specific region.

Exotic species that invade native forests can significantly alter forest ecosystems. In production forests and plantations they may also cause economic damage by stunting, deforming or destroying trees, often by competing with forest seedlings for nutrients and water during the establishment phase.

Nation-wide, there are 48 plants that are widespread or serious pests in native production forests and plantations. Of these, blackberry (*Rubus vulgaris*) is the most extensive and damaging, occurring in every State and Territory except the Northern

Territory. Other problem pest plants that compete with native flora in forests include gorse (*Ulex europaeus*), lantana (*Lantana camara*) and pampas grass (*Cortaderia spp*) which can all become locally dominant.

Exotic pine species can colonise native forests adjacent to pine plantations: *radiata pine* is considered widespread in Victorian native forests. Unwanted pines are a serious but limited problem in South Australian plantations and a serious and extensive problem in ACT plantations.

Mammalian pests: Like their plant kingdom counterparts, exotic animals can invade native forests, displacing native species and altering forest ecosystems, and they can cause economic damage in commercial forests and plantations. Economic damage is not limited to exotic species - some native animals are costly pests in production forests and plantations.

Feral animals may also spread disease. Pigs, for instance, are known to spread Phytophthora cinnamomi and may act as a feral 'reservoir' of potentially devastating animal diseases such as footrot. Cats, dogs, deer, donkeys, horses, goats, hares, rats, mice and foxes are all widespread in Australian forests and represent a serious threat to forest species and ecosystems. Foxes are the most widespread exotic animals adversely affecting forested ecosystems. They occur across mainland Australia and have severely limited populations of ground-dwelling mammals.

Data source: State of the Forest Report (1998).

Australia's First Approximation Report for the Montreal Process, 1997.

65-68

Enquiry Table 11:

A. Regeneration of forest (reforestation*), total for 1990-1994

(There exists supportive information on "Regeneration and extension of forest--Area of native forest under multiple-use forest tenure harvested annually, by State and Territory" in tabular form in the reply to the enquiry which is available at the secretariat.)

(Data source: State of the Forest Report (1998)).

B. Extension of forest **, including afforestation and reforestation, total (1981-1991): Annual average area: 36,000 ha.

(Data Source: Based on Plantation Establishment figures, Australian Forest Resources, Australian Bureau of Agricultural & Resource Economics 1981-1991).

C. Natural colonization of non-forest land to other wooded land: No data.

Notes:

Changes to TBFRA-2000 definitions:

* Regeneration methods:

– Natural regeneration

– Natural regeneration enhanced by planting

– Coppice sprouting

– Planting or seeding

** Extension methods:

– Planting or seeding of non-forest land

– Planting or seeding of forested land

Comments:

(1) For Part A the National Correspondents have based the response on the assumption that any forest that has been harvested will have also been regenerated. All States and Territories have a Code of Forest Practice that requires post-harvest regeneration of native forest to produce the same timber species and timber species composition as before harvest.

(2) On average, less than one per cent of the native forest area available for harvesting nationally is logged in any one year. This figure is based on data covering the years 1989/90 - 1993/94.

(3) The concept of harvested area is made complex by the variety of harvesting techniques used, which range from clearfelling to light selective logging. States utilising different techniques cannot be directly compared e.g., Queensland and NSW use selective harvesting where a large area is harvested lightly. This cannot be compared to Victoria where the area harvested is done by clearfelling which harvests almost the entire area.

(4 In many areas where selective logging takes place it is impossible to map from satellite and difficult and expensive to map from API. These technical difficulties have been identified as research priorities and are being funded in relation to implementing the Montreal Process Criteria and Indicators at regional scales.

(5) There is currently a national programme underway to map across the continent changes in landcover and forest cover using Landsat TM for the period 1990-1995. This programme is due to report at the end of 1998. Programmes are also being established to monitor national revegetation initiatives.

69

Enquiry Table 12: There exists supportive information on "common forest-dominant eucalypt and Callitris species" in tabular form in the reply to the enquiry which is available at the secretariat.

Euc. sp.—multiple use forests: For native forest in multiple use forests, there is tendency to use onsite material for regeneration and if unsuccessful to use local material.

Data source: National Plantation Inventory, 1997 and State of the Forests Report (1998).

Austria

53, 54

Enquiry Table 2: In 1997 a study on "The Hemeroby (Naturalness) of Austrian Forests", published by the Institute of Ecology—University of Vienna, in co-ordination with the Federal Ministry of Agriculture and Forestry and in close collaboration with the Austrian Forest Inventory assessed that 3 per cent of the Austrian forest and other wooded land can be considered as natural.

56-64

Enquiry Table 10: Data for Lichens are estimates.

Data provided for Mosses under "All species and Forest-occurring species"—"endemic species" and "of which endangered" are estimates.

Source: Museum of Natural History Vienna; Federal Forest Research Centre Vienna

65-68

Enquiry Table 11: The yearly forest area "under regeneration" is 57 kha +/- 6 kha (285 / 5 = 57). This figure fits with the figure "regeneration of forest" (50 kha +/- 5 kha) in *Enquiry Table 11* "Regeneration and extension of forest".

Usually the "planting and seeding" area (areas from 0,5 ha to 2 ha [2 ha is the maximum size of a felling area according to the Forest Act 1975]) as well as "natural regeneration enhanced by planting" areas (area from 0,1 ha to 0,5.ha) are afforested with 3 or more indigenous tree species (see also *Enquiry Table 12* "Species diversity and origin of planting material used in the forest"). Introduced species could be supplementary to indigenous tree species in some regeneration areas.

This small sized silvicultural management of forests produces semi-natural forests but not plantations.

Azerbaijan

53, 54

Enquiry Table 2: Initial data unadjusted for lack of sufficient material and information. Further to *Enquiry Table 2,* we would add that forest and other wooded land has long been subject to modification. According to the Azerbaijani Forestry Research and Development Planning Institute, the country's forests and woodlands have shrunk by 2.4 million hectares—almost two thirds—over the past 150 to 200 years. Before 1920 they were shrinking by 0.9-1.0 per cent of their total area every year, but after 1920 (up to 1950) the forests shrank at 0.4 per cent per year. Over the last 40 to 45 years there has been no further significant decrease in forest area, although there is a tendency for them to shrink and for forest quality to decline – i.e. density is decreasing and the average height of stands is diminishing, the proportion of valuable indigenous species is falling and that of low-value trees and bushes is rising.

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Enquiry Table 8: According to sources in the literature and national evaluation survey data, forest and other wooded land and other woodland areas have increased by roughly 80,000 hectares over the past 20 to 30 years.

56-64

Enquiry Table 10: Fourteen of 97 of the mammalian species are on the Red List.

There are 357 species and subspecies of birds, of which 36 are endangered.

Altogether 134 species of vertebrate live here; 18 are on the Red List.

Azerbaijan has many butterflies and insects - over 7,000 species. Of these, 40 are on the Red List.

Of the country's 4,500 plant species, around 400 are in need of protection. Of the 380 species of trees and shrubs growing in its forests and other woodlands, around 45 need protecting.

Belgium

53, 54

Enquiry Table 2: Plantations include blocks of clonal poplars, but not poplars planted in lines.

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Enquiry Table 8: The categories I and II have only existed since 1973 and their areas are obtained on the basis of precise parcellaires (Cadastral survey).

56-64

Enquiry Table 10:

Belgium (Flanders): The reference period for flora 1975 and for fauna 1994.

Tree species endangered: *Malus sylvestris, Pyrus pyraster,* and *Mespilus germanica.*

Lichens: only *Corticolons*.

The number of species corresponds with the species encountered in a natural state and does not include those in aa and botanical gardens.

This table also exists for Wallonia and Brussels regions of Belgium as supportive information in the reply to the enquiry which is available at the secretariat.

Problematic introduced species:

- *Prunus serotina*: preventing the other tree species from regenerating;
- *Rhododendron ponticum*: preventing the other tree species from regenerating;
- *Amelanchier lamarkii*: preventing the other tree species from regenerating;
- *Eutamias sibiricus*: is a threat for the population of small songbirds;
- *Psittacula krameri*: is out-competing indigenous species which have the same nesting places.

69

Enquiry Table 12: 1) The data are available for the Walloon region which has 80 per cent of the forest. 2) Local provenance specially used are Beech, Wild cherry, Norway spruce and Red oak.

Bosnia and Herzegovina

53, 54

Enquiry Table 2: The data for "Forest undisturbed by man", "Semi-natural forest" and "Plantations" are secretariat estimates based on the assessment of the situation in neighbouring countries.

Bulgaria

56-64

Enquiry Table 10: The figures for all species in "Trees" include other vascular plants. All figures relate to species living in natural conditions.

Canada

53, 54

Enquiry Table 2:

Source: Canada's Forest Inventory.

"Forest undisturbed by man": Non-accessed timber productive forest + reserved accessed timber productive forest + 18.8 per cent of nonreserved accessed timber productive forest to account for policy constraints on harvest (except Nova Scotia).

"Semi-natural forest": This value is not available from CanFI. The reported value was computed (Forest—Forest undisturbed by man = Semi-natural forest).

"Plantations": There is no basis for estimating this value.

"Other wooded land undisturbed by man": Forest land + timber unproductive land (CanFI land classes 2 and 3).

"Semi-natural other wooded land": There is no basis for estimating this value.

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Enquiry Table 8: Canad's Green Plan, adopted by the federal government in 1990, set the target for protected space as 12 per cent of Canada's total territory. The National Forest Strategy stated in 1992 that "all members of the forest community will work towards completing, by the year 2000, a network of protected areas representative of Canada's forests, to provide ecological benchmarks, protect areas of unique biological value and ensure wilderness experience."

The estimates reported under items 8.2 and 8.5 of *Enquiry Table 8* were calculated by proportionate attribution of "strictly protected forest land" as derived from the Canada Conservation Areas Database and the National Atlas AVHRR database, Canada, Vegetation Cover. The estimate includes IUCN category III, which is a very small area in Canada.

The estimates reported in items 8.3 and 8.6 were calculated by proportionate attribution of "other protected forest land" (IUCN categories IV, V, and VI) from the same sources.

Harvesting is restricted on IUCN category IV, V and VI lands in Canada. In 1995, about 7.6 per cent of Canada's forest land was protected by legislation, in addition to the forests protected by provincial policies and operating guidelines.

Please see below for trend information:

	Area (1000 ha)	
	1975	***1985***
Forest	244571	224571
– In IUCN categories I and II	8373	9420
– In IUCN categories III and IV	6562	8102
Other wooded land	173013	17303
– In IUNC categories I and II	3939	4345
– In IUCN categories III and IV	3344	5623

56-64

Enquiry Table 10: The information source for total species is Mosquin, T.R., Whiting, P.G., and McAllister, D.E., 1995, Canada's biodiversity, Canadian Museum of Nature, Ottawa, Ontario. Information on species at risk is from the Committee on the Status of Endangered Wildlife in Canada, 1997, Canadian species at risk, Canadian Wildlife Service, Ottawa, Ontario.

There is no means to separate forest-occurring and non-forest species in Canada. A more detailed definition of "forest occurring species" than is currently provided by TBFRA-2000 will be needed to decide, for example, which fish could be included in this category. There is also no authoritative list of endemic species in Canada. A preliminary list of endangered species that are forest-occurring is available, as reflected in the numbers provided in this *Enquiry Table 10* "Forest-occurring species at risk or endangered".

The most problematic introduced species in Canadian forests are insects pests and disease-causing fungi. There exists supportive information on the following topics (in tabular form) in the reply to the enquiry which is available at the secretariat:

Information on "Problematic introduced species of insects and fungi" which lists some that are presently causing economic losses of timber species. Invasive introduced plants are shown.

Information on "Problematic introduced plant species". Invasive introduced plants tend to have a more limited occurrence in Canadian forests, and mostly threaten the conservation of native vegetation.

Problematic introduced species: The most problematic introduced species in Canadian forests are insects pests and disease-causing fungi. There exists supportive information on the following topics (in tabular form) in the reply to the enquiry:

"Problematic introduced species of insects and fungi" which lists some that are presently causing economic losses of timber species. Invasive introduced plants are shown.

"Problematic introduced plant species": Invasive introduced plants tend to have a more limited occurrence in Canadian forests, and mostly threaten the conservation of native vegetation.

65-68

Enquiry Table 11: "Natural regeneration enhanced by planting": Much of the planting and seeding activity in Canada results in "natural regeneration enhanced by planting," but our data do not allow us to distinguish between "Natural regeneration enhanced by planting" of forest and "Planting or seeding" of forest . There exists in the reply to the enquiry in detailed form the supportive information from one province for which data are available, where "Full" planting can be equated to "Planting or seeding" and "Fill" planting can be equated to "Natural regeneration enhanced by planting." This supportive information is available at the secretariat.

"Coppice sprouting": Natural regeneration by coppice sprouting of poplar species is very common in mixedwood boreal forests, but our data do not allow us to quantify the area that could be categorized as "Coppice sprouting" rather than "Natural regeneration" or "Natural regeneration enhanced by planting."

The introduced species listed in *Enquiry Table 12* "Species diversity and origin of planting material used in the forest" are more generally used for afforestation of marginal farm land or other special purposes than for regeneration of forest land that has been recently harvested or subject to natural disturbances.

There exists supportive information on "description of the source of the data presented in this table" in the reply to the enquiry which is available at the secretariat.

69

Enquiry Table 12: The totals in *Enquiry Table 12* "Provenance" do not equal totals in *Enquiry Table 11* "Regeneration and extension of forest" which presents data on all tree planting, whereas *Enquiry Table 11* reports only on planting of harvested areas.

An impression could be gained from *Enquiry Table 12* that thousands of hectares are planted with a single species, resulting in extensive monoculture plantations. In fact, species are matched to the site and may be planted together on the same site where appropriate. An example (British Columbia) of the extent of mixed species is presented in the table (this supportive information exists in tabular form in the reply to the enquiry which is available at the secretariat).

Croatia

53, 54

Enquiry Table 2: There exists supportive information on "trends over the period 1947-1997 in the area of forest and other wooded land in the IUCN protection categories" (in tabular form) in the reply to the enquiry which is available at the secretariat.

Data on forest cover share within protected area are not available.

Data adjustment: Croatian protection categories are re-grouped according to the UN-ECE/FAO definitions.

56-64

Enquiry Table 10: "Trees": Trees (coniferous and broadleaved species) and other vascular plants - data on shares of trees or other vascular plants are not available.

"Birds": Includes breeding too.

"Other vertebrates": Estimations.

Cyprus

56-64

Enquiry Table 10: Other vertebrates: Information is given for amphibians, reptiles, snakes and fresh water fish, only.

Czech Republic

56-64

Enquiry Table 10: New ranks are shown here. Data are based on the national Red List [vol. 1,2 & 3 (in manuscript)], 1997.

Endemic species: "Trees": *Sorbus bohemica, Sorbus eximia, Sorbus sudetica*. "Other vascular plants (flowers)": *Campanula bohemica, Campanula gelida, Cerastium alsinifolium, Hieracium corconticum, Epipacticum albensis, Galium sudeticum, Pedicularis sutetica, Poa riphaea*.

Butterflies = *Lepidoptera* (Butterflies and Moths) / Butterflies only.

"Tree" species include those in special collections (arboreta and parks).

65-68

Enquiry Table 11: Introduced species [mainly *Picea pungens*] were planted in the pollution damaged areas mostly before 1990.

69

Enquiry Table 12: Main groups of tree species are recorded only. Recording system before 1989 is not compatible. *Picea pungens* [and a variety of introduced species in small areas] has been planted before 1990.

Denmark

53, 54

Enquiry Table 2: "Forest undisturbed by man": very few forests of this kind remain. The total area of 200 ha is an estimate of the areas of very few forests such as Draved Forest in South Jutland, Suserup Forest in West Zealand, Varsøe at East Jutland and a few more. The forests are protected intensively by a declaration in accordance with the nature protection act.

"Semi-natural forest": the estimate is made by The National Forest and Landscape Institute in connection with the Dobris-assessment (1995). The semi-natural forests (approximately 35,000 ha-200 ha (forest undisturbed by man)) must not have been subject to regeneration by artificial sowing or planting.

"Plantations": equivalent to the rest of the forest area. It can be mentioned that approximately 86,000 ha of this area consists of elderly stands of native tree-species of natural or foreign provenance in which no bond-structure can be seen and in which natural regeneration can be and in many cases will be undertaken.

"Other wooded land undisturbed by man" and "Semi-natural other wooded land": (please again note the remark on the check-calculation !): No statistic exists on this item – anyhow undisturbed and semi-natural other wooded land may exclusively be found in the part "shrubs along slopes etc. (see comments under E*nquiry Table 1*, shrubs, etc.: 20,000 ha) and is here estimated to be half undisturbed, half semi-natural.

Trends and driving forces in the structural trends and the underlying circumstances:

The background is that Denmark about the year 1800 was more or less deforested. Almost the whole present forest area is therefore first, second or in some cases third generation after afforestation of non- wooded land. Anyhow natural conditions in

natural tree-species (and some introduced tree-species) sets in after a few decades and these forests are regarded in the mind of most of the population as 'natural'.

Since the beginning of the last century afforestation has more or less continuously been carried out by the state or by private owners or companies subsidized by the state.

In 1989 a Parliament decision stated as a part of the Danish follow-up of the European Community common agriculture policy that the Danish forest area should be doubled within a "tree-generation" (80-100 years), that this afforestation should be undertaken by the state and private land-owners half and half, and that the afforestation should consist of equal parts of conifers and broadleaved. The latter conditions have later been altered. As a consequence state and private-subsidised schemes have been settled.

The result of these schemes up to now can be seen from *Enquiry Table 11* "Regeneration and extension of forest". The afforestation rate is considered likely to increase.

Besides the public and the public-funded private subsidized afforestation, non-public-funded private afforestation takes place. The amount of this can only be estimated very roughly but is included in the figures in *Enquiry Table 11*.

This private afforestation has besides other means been encouraged by various different alterations to the legislation on agriculture, cadastral conditions and tax-systems.

Part of this afforestation consists of unsuccessful plantings of Christmas-trees growing up.

In the 1980s another trend appeared: As a consequence of the Rio–, Helsinki- and other international agreements and national policies much more emphasis is being put on various kinds of natural forest types, natural (tree-) species, natural regeneration-systems, etc.

Regarding *Enquiry Table 2* this trend will have the consequence in few decades that the amount of forests or other wooded land undisturbed by man or semi-natural forests will increase (in 1996 the following areas have been laid out as strict nature reserves:

Private forests: 46 reserves, 1147 ha.

Public owned forests: 246 reserves, 3937 ha

Total: 292 reserves, 5086 ha.

The number of reserves and the total area of these strict-nature-reserves will increase.

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Enquiry Table 8: IUCN categories III to VI: Secretariat estimates based on comments received from the National Correspondent.

Note: The official IUCN categories for protection status have not been used in this table for Denmark.

The reason is that protection categories like "strict nature reserve","'wilderness area", "national park", "national monument" etc. are not used in Denmark.

In the scheme showed above the following description is used:

Protection category	*Area of forest, ha*	*Similar IUCN-categories*
Strict nature protection areas	5,086	I
Bird-protection areas	1,000	IV
EU-Habitat-areas	24,000	IV
Protected by nature protection law	70,000	V
Designated for forestry by forest law	330,500	VI
Not protected	19,891	other
Total	**445,391**	

This is a rough estimate. An area which would be present in a higher category will not also be present in a lower category. In this connection it is assumed that all bird-protection-areas and EU-protection-areas also are protected by the nature-protection-law, and that all areas protected by the nature protection-law also are protected by designation to forestry according to the forest law.

The data provided in January, 1998 by WCMC (World Conservation Monitoring Center, UK) through the FAO/ECE-secretariat will give the following figures:

Forests in IUCN-categories I and II:20 ha

Forests in IUCN-categories III to VI:16,000 ha

This description is not considered to be valid concerning the protection status of Danish forests. For instance the forest law settles tight obligations for the forest owners to manage the forest closely to sustainability which must be considered as a very high degree of protection.

56-64

Enquiry Table 10: Main source: "Rødliste '90. Særligt beskyttelseskrævende planter og dyr i Danmark" Miljøministeriet, Skov- og naturstyrelsen, 1991.

Source concerning especially other vascular plants: verbal communication, Peter Vind, Danish Agency for Environmental Research.

Data for Butterflies represent the number of insects and not butterflies.

There exists supportive information on “Endangered species in Denmark” in tabular form in the reply to the enquiry which is available at the secretariat.

Problematic introduced species: Endagered forest tree-species: Ulmus laevis (skærm-elm, naturalised), Ulmus carpinifolia (småbladet elm), Tilia platyphyllos (storbladet lind), Taxus baccata (taks), Sorbus terminalis (tarmvrid-røn), Sorbus hybrida (finsk røn), Salix myrcinifolia (sort pil).

65-68

Enquiry Table 11: No statistics exist on these matters for Denmark.

All the figures are estimates brought into a proper correlation with the rest of the tables. No special assumptions which have not been mentioned in the other tables have been made here.

69

Enquiry Table 12: In Denmark it is only allowed either to use material to forestry produced on the ownership—and in this situation the provenance is called and known as local—or to use material from forest-nurseries—and in this situation the provenance should be known. Provenance in the nurseries is controlled by the Plant-directorate, Ministry for Food, Agriculture and Fisheries.

Some material may not be of known provenance, but that is considered as very rare. Seed– or plant-material from existing stands in Denmark is considered as local provenance either if the stand is of local or non-local provenance.

The area-figures mentioned are based on: Danmarks Statistik og Skov– og Naturstyrelsen: Skove og Plantager 1990, age classes 0 - 10 years. The State Forests Plant Breeding Station, which is a quite large part of the producers of plant material for forestry and other wooded areas, has the opinion that the use of plant material has been rather stable since and therefore it is the assumption that the re- and afforestation picture not have changed since.

In total an annual average of 513 ha has been planted with known local provenance and 5872 ha with known non-local provenance.

Estonia

53, 54

Enquiry Table 2: The forest area increased from 929,000 ha in 1940 to 2,016,000 ha in 1996 as a result of afforestation and natural colonization on non-forest land.

The area of forest undisturbed by man includes some old forest inside wetland areas and reserves. The area of plantations includes areas of afforestation and reforestation by planting or seedling.

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Enquiry Table 8: Due to changes in legislation the number and area of protection areas will increase during the next few years.

56-64

Enquiry Table 10: The group Butterflies includes *Lepidoptera* only. *Microlepidoptera* (about 1000 species) are not included.

65-68

Enquiry Table 11: The area regenerated with introduced tree species is only some hectares per year.

Finland

53, 54

Enquiry Table 2: Re-coding of the Finnish forest definition to the TBFRA-2000 definition was carried out by using measured basal areas for the plot stands and partly by interpretation of aerial photographs. Forests with mean age of growing stock higher than 160 years in Southern Finland and higher than 200 years in Northern Finland and with no signs of human activities (cuttings, drainage etc) during the past 30 years were regarded as undisturbed forests.

56-64

Enquiry Table 10: Number of species includes only native, indigenous species and established neophytes, definitely domesticated species. Ferns is taken to mean all *Pteridophyta*, including clubmosses (*Lycopsida*) and horsetails (*Equisetum*).

The numbers for ferns sensu stricto would be: 42 (total), 13 (endangered), 23 (forest occurring), and 2 (endangered forest occurring). For butterflies, we have reported all *Lepidoptera* species including moths.

For mosses, lichens, and butterflies we can not estimate the forest occurring (dependent) species.

65-68

Enquiry Table 11: The data for “Natural conversion of other wooded land to forest” include afforestation due to drainage of peatlands.

The data for “Natural colonization of non-forest land to forest” and “Natural conversion of other wooded land to forest” are not for the same 10-year period as other information.

69

Enquiry Table 12: In recent years, planting of *Pinus contorta* has drastically decreased. Thus, the given period does not describe the current situation.

France

53, 54

Enquiry Table 2: "Forest undisturbed by man": Source: "Les indicateurs de gestion durable des forêts françaises", 1995, Ministry of Agriculture and Fisheries, Countryside and Forests Directorate.

"Plantations": Source: National forest inventory, data available as on 31 December 1997. The criteria selected for plantations are as follows:

* Afforestation and reforestation with introduced species (see *Enquiry Table 9*), less than 30 years old, in regular stands, stocked with not more than two strains, one of them covering more than 75 per cent.

* Private afforestation and reforestation of Maritime pine in the Landes de Gascogne, less than 30 years old, in regular stands, stocked with not more than two species, one of them being Maritime pine and covering more than 75 per cent.

* Poplar stands cultivated for their wood output.

Afforestation and reforestation as above but over 30 years old are not categorized as "plantations" because they are not normally intensively exploited. Moreover, an understorey tends to develop, and then they consist of more than two species.

"Semi-natural other wooded land": Apart from a narrow weather-beaten coastal strip, other wooded land undisturbed by man in France invariably tends to evolve into forest. As a result, the area of other undisturbed land in France is very small.

From a minimum area reached at the beginning of the 19th century, the area of forested land in France appears to have virtually doubled in two centuries. Semi-natural forest has long accounted for the bulk of wooded land. Since the Second World War, the area planted to trees has increased thanks to an active afforestation and reforestation policy.

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Enquiry Table 8: There are some 30 different kinds of protected status in France, but it has only been possible to use maps displaying seven of those statuses here.

Among the statuses for which no maps yet exist, mention should be made of 700 hectares of strictly protected biological reserves grouped under IUCN category I (source: National Forests Office) and 16,250 hectares of managed biological resources grouped under IUCN category IV (source: National Forests Office). These two figures have not been incorporated into *Enquiry Table 8* to avoid double counting.

Areas protected under international conventions have not been taken into account in *Enquiry Table 8*.

A comparison of *Enquiry Tables 1* "Total area by main classes" and 8 "Protection status" shows that there are 12,440,000 hectares of forests and 1,203,000 hectares of other wooded land that enjoy no protection within the meaning of IUCN.

For the past ten years or so, IUCN categories IV and V protected land has been increasing with the issuance of new orders protecting biotopes, nature reserves and regional nature parks.

There exists supportive information on "Protection" in tabular form in the reply to the enquiry which is available at the secretariat.

56-64

Enquiry Table 10: Source: National Museum of Natural History (SPN/IEGB/MNHN). For endangered species of vascular plants and ferns: Red List of endangered flora in France, vol. 1, 1995. For endangered species of mammals, birds, reptiles and anurans: Red List of endangered fauna in France, 1994.

Data for "Trees": The total number of tree species is the same as the total number of varieties shown *in Enquiry Table 9*.

Data for "Other vascular plants", "Ferns", "Mosses", "Lichens": These are "wild" species of French flora, i.e. indigenous species that have not been introduced deliberately or inadvertently by man.

Data for "Birds": Only nesting birds have been included; migratory and hibernating birds have been omitted.

Data for "Other vertebrates": Information relates to reptiles and amphibians only.

65-68

Enquiry Table 11: Source: Rows "natural regeneration" and "planting or seeding" of regeneration for forest, total: Assessment of stand growth from the national forest inventory, with figures broken down in accordance with National Forests Office data for public forests, and the document "Sustainable management indicators for French forests" [in French]...for private forests.

Row "coppice sprouting": area of coppices under 10 years old, according to the national forest inventory.

Rows "natural colonization of non-forest land to forest", "natural conversion of other wooded land to forest", "planting or seeding of non-forest land", and "planting or seeding of other wooded land": Assessment of stand growth from the national forest inventory, with figures broken down in accordance with land use survey (TERUTI) data for the period 1993-1997.

Row "natural colonization of non-forest land to other wooded land": land use survey (TERUTI) data for the period 1993-1997.

Areas of "natural regeneration enhanced by planting" are included under "natural regeneration".

Introduced species have been identified by reference to *Enquiry Table 9* "Tree species occurring on forest and other wooded land".

Given the difficulty of estimating how long natural regeneration takes, the likely ranges of error for the areas shown in *Enquiry Table 11* "Regeneration and extension of forest" are probably very broad.

Georgia

53, 54

Enquiry Table 2: Secretariat estimates.

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Enquiry Table 8: The information is from the WCMC database on protected areas.

There are 20 natural reserves in Georgia (administratively united with 14 State reserves, with a total area of 168,000 ha, or about 24 per cent of the total territory of the country. Reserves are formed on the basis of the state forest fund, and as a result they are mainly represented by forest vegetation formations (source: http://www.grida.no/prog/cee/enrin/htm...georgia/....biodiv/...htm).

56-64

Enquiry Table 10: "Trees", "Other vascular plants" and "Other vertebrates": Georgia is rich in biological diversity due to its highly varied climatic, geological, topographical and hydrological conditions. These conditions allow Gergia to support up to 4,500 species of vascular plants. Endemic plant species constitute about 9 per cent of the total flora.

Georgia has a number of unique and representative communities and ecosystems, including subalpine coniferous forests, meadows, wetlands, peat bogs and lakes; coniferous and beech forests; oak woodlands; etc. Amphibian research has been carefully updated: 4 species of Caudata and 9 species of Anura inhabit the territory of Georgia.

(Source: http://www.grida.no/prog/cee/enrin/htm...georgia/....biodiv/...htm)

"Mammals": Research on mammals has been increased during the last years. In 1982 there were 62 species listed in the Georgian Red Data Book, while in a new edition 152 species will be represented. Plans are under way for a re-introduction programme for threatened and extinct species of native mammals (source: http://www.grida.no/prog/cee/enrin/htm...georgia/ ....biodiv/...htm).

65-68

Enquiry Table 11: The information as received by the secretariat from the Ministry of Environment of Georgia, Department of Biodiversity Protection, in 1996.

Germany

53, 54

Enquiry Table 2: "Forest undisturbed by man": Forests undisturbed by man cover 83,000 ha, but on a great part human intervention is not "long enough ago" according to the definition.

"Plantations": In principle, German forests are managed in a site adapted and ecologically compatible way with long rotation periods. Planted stands, too, also become close to nature in the course of their life-cycle. Furthermore, the data situation does not allow a separate designation of plantations.

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Enquiry Table 8: "In IUCN categories I and II" of Forest: Includes total forest area in National Parks plus strictly protected forest areas under various other German protection categories.

Protected area categories corresponding with IUCN categories III-VI. From the 7,600,000 ha of forests in protected area corresponding with categories III-VI, the landscape conservation areas hold the greatest share with 3,590,730 ha covered by forests followed by nature parks with 2,695,480 ha covered by forests, both together 6,286,210 ha or 83 per cent.

All other German protection areas under forest law, hunting law or nature conservation law (with the remaining 17 per cent of protected forest area) outside the criteria for I and II correspond more or less either with IUCN categories III or IV; category VI does not exist in Germany.

Likely range: In the case of the above mentioned protection area categories, a likely range below the given figure was used only due to the fact that there is overlap between categories (different from the areas under I and II) ensuring that no figure greater than the given one was realistic.

Note: The IUCN categories I to VI cover only forest areas with a special protection status. Therefore, the sum of Forest, in IUCN categories I and II + in IUCN categories III to VI will not equal to Forest, total.

56-64

Enquiry Table 10: Number not determined: Mammals—Forest occurring species, total species, and of which: endangered.

65-68

Enquiry Table 11: The data are estimates except for "Planting or seeding of non-forest land" which are based on assessment.

69

Enquiry Table 12: Total: Vague estimation calculated from Federal Forest Assessment (1987/93) and Nursery Statistik (1992-96). Local provenance is in this case provenance from the same Region of Provenance.

Known local provenance: Very rough estimation. It is not possible to split up the difference between "Total" and "Known local provenance" to "Known not-local" and "unknown".

Acer, Fraxinus, Tilia, etc.: Mostly noble hardwoods.

Alnus, Betula, Sorbus, etc.: Other broadleaved.

Greece

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Enquiry Table 8: The data for IUCN categories I and II relate to virgin forests and National Parks. Those for categories III to VI include aesthetic forests and other specially protected areas. However, because of the special conditions in Greece, the whole of the area of forest and other wooded land is protected under 2 Articles of the Constitution and special laws. Some closely protected areas, such as mountain watersheds are not included in the data in *Enquiry Table 8.*

Hungary

53, 54

Enquiry Table 2: "Forest undisturbed by man" includes areas without known human intervention for at least one rotation period.

"Plantations" includes the total area of genetically improved poplar stands, plus area of stands where regular spacing was applied to enhance wood production.

Please refer to comments in *Enquiry Table 1* "Total area by main classes" for the definition of "Forest" and "Other wooded land".

55

Enquiry Table 8: The area in IUCN category I is expected to increase by about 4000 ha after the official designation of the forest reserves network. The areas of two newly established national parks are listed in category V, but expected to become partly category II.

Please refer to comments in *Enquiry Table 1* "Total area by main classes" for the definition of "Forest" and "Other wooded land" and *Enquiry Table 3* "Forest and OWL according to availability of wood supply" for the definition of "Forest not available for wood supply".

56-64

Enquiry Table 10: Birds are never exclusively occurring in forests.

Lichen species living on wood, bark etc. Species living on rocks etc. in forest are not included.

65-68

Enquiry Table 11: Natural regeneration and natural regeneration enhanced by planting can not be separated, therefore both are classified as natural regeneration. Tree-species distribution of the regeneration methods could be computed from the raw data only, but not within the time frame of TBFRA 2000, due to the amount of work involved. Adjustment was not needed due to matching definitions with the exception of area limit.

Please refer to comments in *Enquiry Table 1* "Total area by main classes" for the definition of "Forest" and "Other wooded land" and *Enquiry Table 3* "Forest and OWL according to availability of wood supply" for the definition of "Forest not available for wood supply".

69

Enquiry Table 12: * includes native and indigenous species as well.

Iceland

53, 54

Enquiry Table 2:

1. Trends: Forests undisturbed by man have probably not existed in Iceland since shortly after human settlement in the 9th century AD and definitely not since the 12th-13th century, when sheep farming became the major form of production. By 1900 the total area of forest and other wooded land had been reduced from an estimated 25-30 per cent of the land area at the time of settlement to about 1 per cent. The total area of semi-natural forest and other wooded land has apparently not changed much during the 20th century.

With the exception of a few very small plantings, plantation forestry did not commence in Iceland until around 1950. The level of planting was 200-500 ha per year from 1950 to 1989, increasing to 1000-1400 ha per year since 1990.

2. Driving forces: Forests were cut for fuel, charcoal and fodder, while sheep grazing prevented regeneration. Forests were already rare by the 13th century and finally exterminated as an important resource by the end of the 18th century.

The remnant birch woodlands in 1900 had somehow managed to regenerate from repeated cutting, despite sheep grazing. The semi-natural woodlands probably continued to decline slightly during the early decades of the 20th century but changes in

agriculture during the 1940s and 1950s led to a reduction and finally virtual elimination of winter grazing. However, a sharp increase in sheep numbers followed, leading to very heavy summer grazing well into the 1980s. The number of sheep in Iceland has been halved during the last 20 years and the positive effects of this on birch regeneration are becoming more obvious all the time. However, 2 surveys of all birch woodlands in Iceland, one during the early 1990s, failed to show any increase in the total area of semi-natural woodlands in Iceland despite decreased grazing pressure and no wood harvesting. It will take a longer time for the birch woodlands to reclaim a large enough area to be measurable, but if sheep numbers remain low a gradual increase in forest and other wooded land (mostly OWL) should occur.

Between 1950 and 1990, afforestation by planting was mostly carried out by volunteers in forestry societies and the Iceland Forest Service. This "experimental period" proved that trees would indeed grow in Iceland. The increase in planting since 1990 consists of 1) increased planting for land reclamation and erosion control and 2) grants for commercial afforestation on farms, both supported by the state, and 3) increased amenity planting around urban areas, mostly supported by the communities themselves and forestry societies. Increased funding by the state beginning in 1997 will bring total planting up to 2000 ha/year by the year 2000, with the greatest increase in farm afforestation (with fewer sheep, farmers now perceive that they have land that can be afforested). This increase in support is due to the national strategy of using CO_2 sequestration in new forests as part of the effort to reduce net emissions, that has recently been accepted in the Kyoto Protocol.

56-64

Enquiry Table 10: Reference: Iceland Institute of Natural History, Iceland Forest Service. Mammals--Total species (10.6): land mammals; Other vertebrates--Total species (10.8): fresh water fish. The number of species include only native species and introduced species that have become established as self-sustaining populations, not species found only in collections or only where cultivated. In addition to the 27 tree species listed in *Enquiry Table 9*, there are about a further 50 found only in gardens and arboreta.

65-68

Enquiry Table 11: The extent of natural colonization is not well known.

69

Enquiry Table 12: Fifteen other species are planted on less than 10 ha/year each.

Ireland

56-64

Enquiry Table 10: The number of tree species is estimated and excludes those in special collections; the same is true for those of other species shown in the table. The total number of tree species including those in special collections is estimated to be around 1,000.

69

Enquiry Table 12: Scots pine, Oak, Ash and Beech come under the category of "known local provenance" as well as "Known non-local provenance. The rest of the species are only "known non-local provenance".

Israel

53, 54

Enquiry Table 2: The main trend in natural forests in Israel:

1) Overgrazing and over-harvesting in natural forests areas over the decades until the end of World War I.

2) Since the 1920s and especially after the declaration of the state of Israel, there came limitations on grazing and harvesting by rules and regulations, and enforcement of these has allowed a recovery of natural forests.

56-64

Enquiry Table 10: The numbers of "forest-occurring species" were estimated as the numbers of species occurring in the Mediterranean area of the country, because of difficulty in strict differentiation between forests and non forests in this area, and the dynamic relation between them.

The number of freshwater fish (48) was included in both columns: "All species in country" and "Forest-occurring species".

This was according to the rule mentioned above - to include species occurring in the Mediterranean part of the country.

65-68

Enquiry Table 11:

1) Regeneration: Mixed local with introduced species and plantation .

2) There are no data for natural regeneration

3) Data for "Natural colonization of non-forest land to other wooded land": Estimation by the national correspondent.

Japan

53, 54

Enquiry Table 2: Natural forest of more than 100 years old is classified under forest undisturbed by man. Plantation includes bamboo forests.

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Enquiry Table 8: It is not possible to separate protected area into forest and other wood land.

Kazakhstan

56-64

Enquiry Table 10: Endangered species status categories:

Fish: EN - 7; CR - 7; VU - 1; NE - 1: total 9 species

Amphibians: CR - 1; VU - 1; NE - 1: total 3 species

Reptiles: VU - 6; NE - 4: total 4 species

Birds: EN - 15; CR- 15; VU - 18; LR - 4; NE - 4: total 56 species

Mammals: EN - 9; CR - 5; VU - 23; NE - 3: total 40 species (Source: Kazakhstan Red List, 1997)

Vascular plants, ferns, mosses, lichens: CR - 20; VU - 238; LR - 48: total 306 species (Source: Kazakhstan Red List, 1981)

Source for total number of species: "Kazakhstan" encyclopaedia, "Plants" section (Moscow, 1969). Forest-occurring species arrived at by adjustment (70-75 per cent of the total).

Kyrgyzstan

53, 54

Enquiry Table 2: Information on Forest and other wooded land undisturbed by man, Semi-natural forest and other wooded land, and Plantations: Information is the secretariat estimates based on literature sources and analysis of the situation in neighbouring countries.

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Enquiry Table 8: Source: Secretariat estimate based on literature sources of the information; All the forests and other wooded land of the country belong to the first group, i.e. all the forests and other wooded land implement the protection functions.

56-64

Enquiry Table 10: The data for "Other vascular plants" includes trees, the break down is as follows: "Trees": 130, "Other vascular plants": 4500. The information is based on literature sources, including the article "Forest biodiversity and forest genetic resources in the Kyrgyz Republic", T. S. Mussuraliev, FAO, 1997.

Latvia

53, 54

Enquiry Table 2: The forest area in 1925 was 1,845,000 ha, in 1961 was 2,063,000 ha and in 1997- 2,884,000 ha. The increasing forest area is a result of afforestation and natural conversion of other land to forest covered land. The area undisturbed by man has increased since the 1950s. It includes old forests in strict nature reserves and national parks. There are no forests specially grown as plantations in Latvia. This category has been adjusted to show artifically regenerated forest stands, where forest management is so intensive that only one tree species with regular spacing is present.

56-64

Enquiry Table 10: The data for Total number of "Forest occurring species" for butterflies are 1000-1500.

Problematic introduced species: *Impatiens glandulifera, Impatiens parviflora, Amelanchier spicata, Mustela vison.*

65-68

Enquiry Table 11: Data before the year 1991 represent only state forests (about 2/3 of all forests), but since 1991—represent all forests. The extent of natural regeneration in recent years has significantly increased due to changes in management methods. A more important role is assigned to deciduous species.

69

Enquiry Table 12: Data before the year 1991, represent only state forests (about 2/3 of all forests), but since 1991 represent all forests.

Liechtenstein

56-64

Enquiry Table 10: The whole forest area enjoys the strictest protection and conservation status; accordingly forest-living species are considered to be the least endangered ones.

69

Enquiry Table 12: The area planted with introduced species is insignificant, all planted species of known local provenance total to 0.007 ha/year.

Lithuania

53, 54

Enquiry Table 2: The forest area increased from 1,450,000 ha in 1956 to 1,978,000 ha in 1996 as the result of afforestation and regeneration of forest land and natural colonization of non-forest land. The area of plantations in this period increased from 30,000 ha to 284,000 ha. There are no forests specially grown as plantations in Lithuania. This category has been adjusted to include planted forest stands, where forest management is so intensive that only one tree species is left with regular spacing. The area of forest undisturbed by man is stable and contains old and poor pine stands on wet soils swamps as well as in strict nature reserves.

56-64

Enquiry Table 10: Source for endangered species: "Red Data Book of Lithuania, 1992, Vilnius" (Included species IUCN ranks Ex/E, E, V and R). Endangered tree species in Lithuania—*Taxus baccata* (Ex/E), *Betula nana* (E), *Myrica gale* (E), *Salix lapponum* (V), *Salix myrtilloides* (R), *Quercus petrea* (R), *Prunus spinosa* (R).

Data on "Butterflies" include only daily moth *Lepidoptera.* Besides, there are 1017 *Microlepidoptera.*

Problematic introduced species: Introduced species have not created any problems for forest ecosystems.

Malta

53, 54

Enquiry Table 2: Not applicable as woodlands are in the main for amenity purposes and watershed management.

56-64

Enquiry Table 10: Data source: Based on Red Data Book for the Maltese Islands - 1989. Environment Division, Ministry of Education.

69

Enquiry Table 12: All woodland is on a mixed species basis. In coastal area, T*amarix* is predominant while inland *Pinus halepensis* and olives are dominant.

Local provenance used for planting.

Netherlands

53, 54

Enquiry Table 2: No specific data on the management system used are available. However data on method of forestation (planted/seeded or otherwise) are available.

Out of 308,000 ha high forest about 252,000 ha is planted with a known age-class and an originally regular spacing. Up to the age-class of 40 years the regular spacing is obvious. In total 100,000 ha is planted with an age-class of less than or equal to 40 years, which is considered as 'plantation'.

Sources:

– HOSP-database.

Lit 1: Daamen, W.P. 1996. Velling en oogst HOSP-cyclus 2: period 1992-1996. Daamen Schoonderwoerd & de Klein, Rapport 70.

Lit 2: Edelenbosch N.H.,1996. Ex-post evaluatie van bosuitbreidingsbeleid in Nederland over de periode 1990-1995. IBN-DLO rapport 230, Wageningen.

Likely range: As is explained in the chapter 'Trends', attached to *Enquiry Table 2* "Forest and other wooded land according to naturalness": a great part of the forests is planted with a regular spacing and one or two species in even-aged stands with wood-production as the only purpose. A rapid change towards forests for "multiple purposes" (e.g. nature, recreation) has an impact even on these pure stands: many of them are now changed into more age-classes, more species and so on even though the original purpose of wood-production remains. The given figures for 'plantations' are maximum estimates: many of the originally planted forests have changed in the last decade. There is no possibility to estimate a sampling error.

Appendix to *Enquiry Table 2*: TRENDS

The following table gives an overview of the change in forest area and other wooded land:

	Year			
	About 1800	*About 1900*	*About 1960*	*About 1996*
Population	2,080,000	5,180,000	11,600,000	15,600,000
Forested area (ha)	100,000	250,000	260,000	339,000

Sources: Buis, J. 1985. Historia Forestis. Wageningen; CBS, 1966. De Nederlandse bosstatistiek, deel 9 Nederland, 1952-1963

In the beginning of the 19th century, most of the forest land was managed as coppice or coppice with standards. Only a few relicts of undisturbed forest remained in the Netherlands. Tree species used were mostly indigenous species.

Exotic species were mostly used as curiosities in forest parks. The forest area was part of the common marches as was also waste land. There was little or no interest in long term investments for production of merchantable timber. Short term use of the forest took place: the forest area was devastated by intensive use of the forest .

Regulations on the common marches were ended in the period 1800-1810. In the period 1810-1850 former common marches were divided and sold to institutions and/or private individuals. Large scale plantations started in the period 1850-1900 by forestation of waste land (protection forest against sand drifts, introduction of artificial fertilizers) and establishment of high forest as long term investment. Mostly *Pinus sylvestris* is used and also a substantial area is afforested with introduced exotic species as *Pseudotsuga menziesii*, *Larix* species, *Pinus nigra*-species.

In the period 1900-1950 afforestation of waste land continued. During World Wars I and II the forested area diminished. The main part of the forest is in this period was managed as high forest. An important product is logs for the mining industry. Nearly all coniferous forests are managed as plantations.

After 1950 the mining industry lost its important role: the last mine was closed around 1968 and so the market for logs was lost. Economically important is roundwood production for paper, fibreboard and sawlogs. The forest area with exotic species has remained fairly constant in the last 40 years. As a result of greater emphasize on recreational, landscape and nature aspects of the forest area the deciduous forest area has rapidly increased in the last 40 years while the coniferous 'production' forest area has remained fairly constant.

Species in high forest (coverage >60 per cent)	***2nd Nat.Survey around 1960***	***4th Nat.Survey around 1980***	***HOSP 1992-1996 around 1996***
Pinus sylvestris	101278	98213	92057
Exotic coniferous species	53066	69132	67296
Deciduous species	28983	67279	85650
Total: high forest	183327	234624	245003

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Enquiry Table 8: In the last decade strict Nature Reserves (IUCN Protection category I) has been increasing rapidly. The State Forest Service (Staatsbosbeheer) is planning about 22500 ha as nature reserve ("Bos met accent natuu") in the next decade. Also is planned several thousands of hectares forest area as nature reserve on forest land ("Bosreservaten" and "A-locaties"). No exact figures are yet available on this subject since not all areas are located and formally established. It is not known yet if management plans are already dealing with the new status of the areas.

For this table the figures known to WCMC which are provided by WWF-Netherlands and IKC-N are presented.

Sources: WCMC, WWF-Netherlands and IKC-N.

Sources: HOSP 1993-1996, Staatsbosbeheer

In the light of international developments such as the process of the Ministerial Conferences on the Protection of Forests in Europe, the Netherlands is developing operational criteria for protected forest areas. It is therefore at this time not possible to give exact numbers as to the actual area of protected forests in the Netherlands. Although all forest in the Netherlands are protected by the Forest Law, and it therefore could be argued that 100 per cent of the forests in the Netherlands are protected, this is not considered realistic by the Dutch government. The law in fact only guarantees that all forest remains forests: it is in the first place a quantitative protection. Although there is a possibility of protection of the quality of forests this is not the main purpose of the law.

An important part of forests in the Netherlands however is owned by private nature conservation organisations. These organisations are subsidized by the government and have protection as a main goal, although sometimes harvesting is practised as long as it does not obstruct the protection goal. These (about 57000 ha) forests therefore are considered as protected in the sense of the 5th category of IUCN by the Netherlands government.

Staatsbosbeheer, the State Forest Service, manages the state owned forests. Of these a certain area is protected. At this time a review is under way to establish the exact area and location of these forests. The forest area under protection by the Forest State Service of about 20000 ha must be considered an informed estimate.

56-64

Enquiry Table 10: None of the species is endemic in the Netherlands

Other vascular plants: only flowers.

Birds: only breeding birds.

Butterflies: only diurnal butterflies

Sources: Red Lists, databases on habitat of the different species of IBN-DLO, CBS

Information on this table provided by J. Thissen, IKC-N, Wageningen. The sources are the 'red lists' of the different species-groups. The main problem is to distinguish the forest-occurring species. Other sources had to be consulted in which information on the habitat was available. As can be seen: on lichens no direct source on information of the habitat is available: the table is not filled in for this species-group.

65-68

Enquiry Table 11: Very little is known for the country as a whole about these issues. The HOSP database gives some information for the forests established since 1985 on planting or regeneration and also the proportion planted or regenerated naturally. The area with "Natural generation enhanced with planting" is unknown but considered as negligible.

No information on the regeneration of coppice is available. It is assumed that in a period of 10 years all coppice is harvested once and regenerated by sprouting.

There exists supportive information on "Total area planted and natural regeneration by age-class species for 10 year period" in the reply to the enquiry which is available at the secretariat.

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Enquiry Table 12: Sources NAKB, HOSP-database.

The "Nederlandse Algemene Keuringsdienst voor Bloemisterij– en Boomkwekerijgewassen" (NAKB) does not distinguish planting material used in the forest separately. An estimate on the planted area is made on the basis of HOSP-data. The subdivision into provenance is made on the basis of data provided by the NAKB.

New Zealand

53, 54

Enquiry Table 2: The sources for the data in this table are informed estimates made by the Ministry of Forestry using historical records and other current NEFD data. The forest undisturbed by man is largely in national parks and is within the IUCN categories I and II. It is considered to closely correspond to the TBFRA-2000 definition and hence no adjustment was required. Likewise for plantations as in the New Zealand context these are always of introduced species. There are small areas planted with indigenous species but as these are not considered to meet the intensive management criteria it was considered that the semi-natural forest category more correctly described these plantings of indigenous species. The semi-natural forest parameter includes previously cut-over indigenous forest because of the strict criteria applying to forest undisturbed by man and to plantations. The error ranges are estimates of the likely ranges and are not based on statistical sample error ranges. Where the ranges are large this reflects a lack of reliable measuring in the past for the parameter. The NZLCDB work when it is completed is expected to refine these estimates considerably.

Trends in the areas in the classes are described reasonably comprehensively as qualitative information in the publications listed under General comments above. The area in plantation has been increasing as former agricultural land becomes available and a time series of this is in tables 7 and 8 of National Exotic Forest Description as at 1 April 1996, (Ministry of Forestry, 1996). For semi-natural other wooded land this area is expected to have shown an increasing trend since the structural adjustment of the New Zealand economy from the 1980's but quantitative data are not available to demonstrate this until the NZLCDB work is completed.

In terms of whether "undisturbed areas" have been altered by man in past centuries, it is really difficult to be certain. Most of the forest land that was allocated to this category is in the remote Fiordland National Park in the south-west of the South Island. Certainly European explorers such as Captain James Cook in the 1700's, sealers and whalers and some Maori would have visited the region, but there is no evidence that the forests were used for timber extraction for housing and other significant purposes. However, there are introduced mammals in the forest - does this mean then that they cannot now be regarded as "undisturbed by man" because New Zealand has so few endemic mammals (see *Enquiry Table 10*) even though the mammals were not deliberately introduced into the forest? It needs to be noted that most of this area has been in a national park for nearly all this century and that the natural forest dynamic processes are well established.

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Enquiry Table 8: The source for this table was the information supplied by the WCMC and checked to the extent possible in New Zealand. Work within the NZLCDB project will enable a more comprehensive verification of the estimates at a later date and these will subsequently be notified to the WCMC. The error ranges are estimates of the likely range and are not based on statistical sample error ranges.

Suitable forest and other land areas have been gazetted as national park lands over the last twenty years but no time series of this has been derived.

56-64

Enquiry Table 10: Sources: "The Native Trees of New Zealand", T. J. Salmon 1980 A. H. & A. W. Reed Ltd., Wellington.

"Indigenous vascular plants of New Zealand", compiled by A. P. Druce. Revised September 1993. Unpublished. "The State of New Zealand's Environment - The State of Our Biodiversity", the Ministry for the Environment 1997. NZIF 1995 Forestry Handbook. Editor - Don Hammond. The New Zealand Institute of Forestry (Inc.) 1995. "The New Zealand Biota—what do we know after 200 years?", edited by P. J. Brownsey and A. N. Baker. National Museum of New Zealand 1983. New Zealand Botanical Society: Threatened and local plant lists (1995 Revision). Cameron et al. 1995. New Zealand Botanical Society Newsletter 39: pp. 15-28 for threatened species. New Zealand Official Yearbook 1997. Statistics New Zealand 1997.

Other vascular plants: No compiled figures for other vascular plants (flowers) have been located in this format and this would require further research and contact with scientists before reliable estimates could be supplied.

Lichens: Lichens could be assumed as only endemic species.

Birds: The data for birds include both land and freshwater birds and seabirds.

Butterflies, endemic species of all species in country of butterflies/moths: 11 endemic butterflies.

The data for "mammals" include both land based and marine mammals.

"Forest occurring species"—"endemic species": The long and short-tailed bats are the only two endemic terrestrial mammals in New Zealand, both of which are endangered.

The problem with marine mammals—for example: seals, dolphins, whales - coming with the table is because the sea surrounding the country is also viewed as part of the country's ecosystem in terms of the international conventions.

The correct name should be "possum"—not "opossum". There is some confusion between writers but "opossum" should strictly be reserved for the North American animal and "possum" for the major forest pest which New Zealand has gained from Australia. Some further facts on this pest are given to show the extent of the problem: "Brushtail possums were among the earliest animals introduced into New Zealand by European settlers. They were first brought from Australia in 1837 to establish a fur industry. By 1922, 36 batches of possums had been imported, mostly from Tasmania where possums were larger and most had the black fur preferred by furriers. These possums and their descendants were liberated at more than 450 places around New Zealand by 1930. At the time, these introductions and liberations were considered entirely beneficial, but after 1900 a number of reports of possum damage to crops, orchards, and forests prompted the Government to commission investigations by two of the country's leading botanists, Professor HB Kirk and Dr L Cockayne. They both concluded that damage to New Zealand's forests was negligible. Kirk went so far as to state that "opossums (sic) may, in my opinion, with advantage be liberated in all forest districts except where the forest is fringed by orchards or has plantations of imported tree species in the neighbourhood". However, from 1921 to 1947, the Government attempted to stop any further liberation of possums, which was prohibited by the Department of Internal Affairs. Both hunting and selling skins were regulated. The regulations merely provoked a flurry of illegal liberations. During the 1940s, evidence of damage by possums to New Zealand's forests increased, and in 1947 all restrictions on possum hunting were removed and penalties for releasing them were increased. The need for action against possums on a national scale was recognised, and in 1951 a bounty of 2/6d (25c) per head was introduced for animals whose skin were not sold. During the following 11 years, more than 8 million bounties were paid, but this did little to control the increasing and expanding populations of possums. In the late 1940s the first survey of possum distribution in New Zealand showed that possums had occupied about half of New Zealand. By 1961-63 they had spread to 84 per cent of the country. Within the last five years Northland and the Coromandel Peninsula have been colonised, leaving few areas yet to be occupied. The number of possums in New Zealand has been estimated at 70 million. Because there are no predators or competitors here in New Zealand, and suitable habitats are readily available, possums occupy most habitats – all types of native and exotic forest, mountain shrublands and tussock grasslands; swamps, farmland, orchard and cropping areas; and areas in and around towns and cities. Possums tolerate habitats with a wide range of climates - from arid plans to areas with high rainfall, and from temperate coastlands to harsh alpine slopes at more than 1800m altitude in the North and South Island ranges. Today possums are considered the major animal pest in New Zealand. In farming areas, they spread bovine tuberculosis to beef and dairy cattle, and to farmed deer, damage crops and orchards, kill poplars and willows planted to control hill-country erosion and stabilise riverbanks, and eat pasture. In exotic forest plantations they kill young trees and stunt the growth of older trees by ring-barking them or breaking the uppermost branches. In conservation areas, possums cause severe damage by altering habitats important to native animals. Tree species that are palatable to both possums and native birds (e.g. rata, kamahi, and pohutukawa) become much reduced or locally extinct, and are replaced by plants that are less palatable such as tree ferns and pepperwood. As well as altering the composition of native forests and competing with native fauna, possums also prey directly on native insects and birds." Source: Landcare Research. "Tahr" are an animal introduced for hunting purposes and originally from the Himalayan region of Asia. They are similar in appearance to a cross between a long-coated goat and a deer. "Mustelid" is the generic term for stoats, ferrets and weasels and they were introduced to control yet another introduced pest, the rabbit.

Problematic introduced species: Information on the problematic introduced species and the degree of impact on the forest ecosystem:

Flora

Local name	*Scientific name*	*Degree of impact*
sycamore	*Acer pseudoplantanus*	3
monkey apple	*Acmena smithii*	2
Mexican devil	*Ageratina adenaphora*	2
mist flower	*Ageratina riparia*	3
onion weed	*Allium triquetrum*	2
elephant's ear	*Alocasia brisbanensis*	1
Madeira vine	*Anredera cordifolia*	2
moth (kapok) plant	*Araujia sericifera*	3
aristea	*Aristea ecklonii*	3
Italian lily	*Arum italicum*	1
giant reed	*Arundo donax*	2
smilax	*Asparagus asparagoides*	4
climbing asparagus	*Asparagus scandens*	4
Darwin's barberry	*Berberis darwinii*	3
barberry	*Berberis glaucocarpa*	3
buddleia	*Buddleja davidii*	4
Mysore thorn	*Caesalpinia decapetala*	1
heather	*Calluna vulgaris*	3
Australian sedge	*Carex longebrachiata*	3
climbing spindleberry	*Celastrus orbiculatus*	1

Local name	*Scientific name*	*Degree of impact*
orange cestrum	*Cestrum aurantiacum*	1
red cestrum	*Cestrum elegans*	1
bone seed	*Chrysanthemoides monilifera*	3
clematis	*Clematis flammula*	1
old man's beard	*Clematis vitalba*	4+
cathedral bells	*Cobaea scandens*	2
convolulus/ field bindweed	*Convolvulus arvensis*	2
purple pampas	*Cortaderia jubata*	3
pampas grass	*Cortaderia selloana*	4
cotoneaster	*Cotoneaster glauophyllus*	3
Khasia berry	*Cotoneaster simonisii*	2
hawthorn	*Crataegus monogyna*	3
montbretia	*Crocosmia x crocosmiiflora*	2
broom	*Cytisus scoparius*	3
mile-a-miunte	*Dipogon lignosus*	3
pyp grass	*Ehrhata villosa*	1
elaeagnus	*Elaeagnus x reflexa*	3
Spainish heath	*Erica lusitancia*	3
Mexican daisy	*Erigeron karvinskianus*	2
loquat	*Eriobotrya japonica*	1
spindleberry	*Euonymus europeaus*	2
Japanese spindleberry	*Euonymus japonicus*	2
hakea, downy	*Hakea, gibbosa*	2
hakea, willow leaved	*Hakea, saliciflora*	2
hakea, prickly	*Hakea, sericea*	2
ivy	*Hedera helix*	3
yellow ginger	*Hedychium flavescens*	3
kahili ginger	*Hedychium gardnerianum*	4
hawkweed	*Hieracium spp.*	4
hops	*Humulus lupulus*	1
tutsan	*Hypericum androsaemum*	2
blue morning glory	*Ipomoea indica*	2
stinking iris	*Iris foetidissima*	1
yellow jasmine	*Jasiminium humile*	2
jasmine	*Jasiminium polyanthum*	2
Japanese walnut	*Juglans ailantifolia*	2
heath rush	*Juncus squarrosus*	2
lantana	*Lantana camara var. aculeata*	2
Himalayan honeysuckle	*Leycesteria formosa*	3
tree privet	*Ligustrum lucidum*	2
Chinese privet	*Ligustrum sinense*	2
Japanese honeysuckle	*Lonicera japonica*	4
lotus	*Lotus pedunculatus*	3
Russell lupin	*Lupinus polyphyllus*	2
boxthorn	*Lycium ferocissimu*m	3
Cape honey flower	*Melianthus major*	2
Chinese ladder fern/tuber sword fern,	*Nephrolepis cordifolia*	2
African olive	*Olea europeae subsp. cuspidata*	2
oxylobium	*Oxylobium lanceolatum*	2
wonga wonga vine	*Pandorea pandorana*	2
brush wattle	*Paraserianthes lophantha*	2
Mercer grass	*Paspalum distichum*	3
black passionfruit	*Passiflora edulis*	1
northern banana passion fruit,	*Passiflora mixta*	2
banana passionfruit	*Passiflora mollissima*	3

Local name	*Scientific name*	*Degree of impact*
Kikuyu grass	*Pennisetum clandestinum*	3
African feather grass	*Pennisetum macrourum*	2
inkweed	*Phytolacca octandra*	2
lodgepole pine	*Pinus contorta*	4
cluster / maritime pine	*Pinus pinaster*	2
wilding pine	*Pinus spp.*	4
sweet pea bush	*Polygala myrtifolia*	3
poplar, white	*Populus alba*	2
sweet cherry / wild cherry,	*Prunus avium*	1
Douglas-fir	*Pseudotsuga menziesii*	3
dally pine	*Psoralea pinnata*	2
orange firethorn	*Pyracantha angustifoli*a	1
silver wattle	*Racosperma dealbatum*	2
Sydney golden wattle	*Racosperma longifoliu*m	3
kangaroo acacia	*Racosperma paradoxum*	2
Japanese knotweed	*Reynoutiria japonica*	2
giant knotweed	*Reynoutria sachalinensi*s	1
evergreen buckthorn	*Rhamnus alaternus*	2
sweet briar	*Rosa rubiginosa*	3
blackberry	*Rubus fruticosus agg.*	3
climbing dock	*Rumex sagittatus*	2
elder / elderberry	*Sambucus nigra*	2
African club moss	*Selaginella kraussiana*	3
Cape ivy	*Senecio angulatus*	3
German ivy	*Senecio mikanioides*	3
buttercup brush	*Senna septemtrionalis*	1
potato vine	*Solanum jasminoides*	2
apple of Sodom	*Solanum linnaeanum*	2
woolly nightshade	*Solanum mauritianum*	3
rowan	*Sorbus aucuparia*	3
nassella tussock	*Stipa trichotoma*	2
brush cherry	*Syzgium australe*	2
Montpellier broom	*Teline monspessulana*	2
wandering willie	*Tradescantia fluminensis*	4
nasturtium	*Tropaeolum majus*	1
Chilean flame creeper	*Tropaeolum speciosum*	3
gorse	*Ulex europaeus*	4
blueberry	*Vaccinium corymbosa*	1
periwinkle	*Vinca major*	3
watsonia	*Watsonia bulbillifera*	2
arum lily	*Zantedeschia aethiopica*	2

Degree of impact in the country (Adapted from Owen, 1997):

4. Known to affecting the dominant structure, species composition, or regeneration of several high conservation value sites within the country.

3. Known to be present on several high conservation value sites within the country. Impacts unknown, but suspected of having a significant impact.

2. Present distribution and/or numbers are not yet affecting high conservation value sites within the country, but species is thought to have the potential to do so.

1. Known to be present in the country, but distribution and impacts are unknown.

Problematic introduced species—mammals

Species	*Scientific name*	*Problem posed*
Horses	*Equus caballus*	Feral populations can damage native plants by eating and trampling.
Goats	*Capria hircus*	Goats, tahr, and deer have wide food preferences, and thin out .
Tahr	*Hemitragus jemlahicus*	Forest understoreys preventing regeneration.
Deer	*Cervus spp. and Dama dama*	
Pigs	*Sus scrofa*	An omnivore but populations are regionalised.
Possums	*Trichosurus vulpecula*	Occupy more than 90 per cent of the country. The most serious pest to the forest ecosystem. An opportunistic omnivore, its main food is vegetation, and it is estimated that the population consumes approximately 20,000 tonnes of plant matter per night.
Mustelids	*Mustela spp.*	Predators of ground and hole-nesting birds.
Stoats	*M. erminea*	
Ferrets	*M. putorius*	
Weasels	*M. nivalis*	
Rats	*Rattus spp.*	Eat eggs, chicks and lizards, and compete with birds for food.
Ship rats	*R. rattus*	
Norway rats	*R. norvegicus*	
Cats	*Felis catus*	Predators of ground-living birds.
Dogs	*Canis familiaris*	Predators of ground-living birds.

Source: The State of New Zealand's Environment—The State of Our Biodiversity. The Ministry for the Environment 1997.

Ecological weeds on conservation land in New Zealand: a database. Compiled by S. J. Owen. Department of Conservation 1997.

Forest Weed Control Manual. Revised by N.A. Davenhill. New Zealand Forest Research Institute Ltd. 1997.

65-68

Enquiry Table 11: The source for this table was Ministry of Forestry using historical records, current NEFD data and informed judgement. Work when completed from the NZLCDB project should enable refinements of the estimates to be made.

Norway

53, 54

Enquiry Table 2: None of the area groups in the table is being assessed directly, and the data have been derived from the available data sources by making some assumptions:

"Forest undisturbed by man" (data are estimates) is given as a very rough estimate of forest assumed not to be affected by any significant human intervention in several hundred years. This estimate is somewhat low, and the area showing natural forest dynamics is expected to be considerably higher.

"Plantations" have been interpreted as forest stands of introduced species established by planting in the process of afforestation or reforestation. This also includes tree species naturally occurring in Norway, but which have not evolved in the particular region where the forest stand is growing. The management regime of these areas is the same as for semi-natural forest, and the stand structure will often approach that of a semi-natural forest as the stand grows older.

"Semi-natural forest" (data are estimates) is assumed to be the rest of the forest area.

Area of "other wooded land" is distributed into the classes "undisturbed by man" or "semi-natural" by 10 per cent and 90 per cent, respectively. The percentages should be regarded as rough estimates, and are not based on an inventory. Commercial harvesting of wood is not taking place on any of these areas today, and the possible influence by man is rather limited. It is assumed that the area "undisturbed by man" is a rather low estimate.

Quantitative estimates of the long-term trends of the classes are not available. Most of the plantations are located in the coastal districts of western and northern Norway. The main part of these was established in the 1960s and 1970s, while planting activity has been decreasing during the recent decades. One reason for this decrease is a reduction in subsidies for afforestation purposes. The underlying circumstances may be a realization that maximum volume production is no longer a goal, together with a discussion on timber quality and environmental impacts from the plantations.

As regards "forest undisturbed by man", the trend is not so obvious. One aspect is that access to the forests has been continuously improved by road building, implying a possible decrease of such areas. On the other hand, forest area seems to expand especially on low-productive sites, and these areas are little utilized for wood production. At the beginning of the 20th century, the standing volume was only half of what it is today, indicating a rather intensive utilization of the forests in the late 1800s. 100-200 years ago the utilization of the Norwegian forests was in general rather heavy due to timber export, mining industry etc.

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Enquiry Table 8: The area of protected forest has been increasing over the last 10-20 years. When reporting to FRA-1990, the protected area was estimated at 68,000 ha.

In IUCN categories III-VI, protected landscape and "protection forest" (managed resource protection area) are included.

56-64

Enquiry Table 10: Only the 400 macro lichens have been taken into consideration when assessing the endangered species of lichens.

Total number of endangered species:

1839 (Red List from 1992)

~ 3000 (Revised Red List from 1996)

Source: Norwegian Forest Research Institute (Gundersen & Rolstad, in press), information mainly provided by the Directorate for Nature Management.

65-68

Enquiry Table 11: Data listed under "Extension of forest, including afforestation and reforestation of OWL, total" and "Natural colonization of non-forest land to other wooded land" are informed estimates and not inventory results.

69

Enquiry Table 12: Tree species mainly used for Christmas trees, decorative foliage etc. are excluded.

Poland

53, 54

Enquiry Table 2: The existing Polish statistics do not divide forests from the naturalness point of view. Data presented is the result of interpretation of TBFRA definitions.

Forest undisturbed by man (2.2): Following forest categories are included:

– strictly protected forests,

– forests in the timberline zone and other inaccessible forests,

– forest reservations greater than 100 hectares.

The categories listed above generally meet TBFRA criteria, with one exception – there is no data about the last or recent human interventions. The reason for including them was the stated purpose – to conserve or to re-create the natural state.

Plantations (2.4): In the Polish conditions, where forests occupy often very poor sites, and single species stands could be natural, the delineation between semi-natural forest and plantation is difficult.

Following categories are reported as plantation:

– stands, where one introduced species is dominating,

– artificially planted and maintained stands of poplar (usually hybrids) and other fast growing species, with short rotation period (30-40 years).

The most serious problem was connected with young stands, which had been planted with one or two tree species, even-age structure and regular spacing. Because of their relatively long rotation period (at least 80 years), similarity to their natural (potential) forest type, and the fact that regular spacing disappears during clearings and thinnings, we decided to include these stands into semi-natural forest.

General comments:

There are no statistical data describing the trends in the area of the categories mentioned above. According to expert information, one can state a decrease of undisturbed forest area in the last two centuries. The reasons were non-limited exploitation during the period of intensive industrial development, damage connected with wars (direct destruction and enlarged cuttings for military purposes). In the last decades, air and water pollution and general weakness of forest (pest outbreaks etc.) could have an influence on the present acreage of undisturbed forests. On the other hand the growing amount of strictly protected area can be observed. A part of that growth concerns the remaining undisturbed forest, while the rest is semi-natural forest left to natural succession.

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Enquiry Table 8: In the first group (8.2) "IUCN categories I and II" the forest area of National Parks, which meet the requirements of ICUN category II, are reported. Two National Parks classified as the ICUN category V are included in the next item.

The second group (8.3) "IUCN categories III to VI" was matched with the IUCN definitions IUCN and it consists of:

– forest areas in landscape parks,

– forest areas in nature reservations,

– forest areas of two National Parks that possess the IUCN category V (10,600 ha).

The data were obtained from the official Forestry 1997 yearbook: and refer to the status in 1996.

56-64

Enquiry Table 10: In this table, the numbers of species living in freedom (also introduced) are presented.

For the construction of this table, beside expert opinion, the following sources have been used:

Andrzejewski R., Weigle A., 1993: Polskie studium róznorodnosci biologicznej (Polish study of biodiversity). Narodowa Fundacja Ochrony Srodowiska, Warszawa.

Glowacinski Z., 1992 (ed): Polska czerwona ksiega zwierzat (Polish Red Data Book of Animals). Panstwowe Wydawnictwo Rolnicze i Lesne, Warszawa.

Buszko J., Maslowski J., 1993: Atlas motyli Polski. Czesc I. Motyle dzienne (*Rhopalocera*). Warszawa.

Mirek Z., 1995 (ed.): Vascular plants of Poland a checklist. Szafer Institute of Botany, Polish Academy of Science, Kraków.

Comments:

"Ferns" are regarded as a vascular plant, therefore in item "other vascular plants (flowers)" the number of vascular plants other than trees and ferns is presented.

As to "other vertebrates", only fish, amphibians and reptiles are reported.

As to "Butterflies" the number of species of the whole order of *Lepidoptera* is presented.

The experts for the Trees, Other vascular plants, Mosses and Mammals have done the separation of the forest-occurring species from the total amount only. The result is not unequivocal, the basic criterion for plants is the real occurrence of a species in the forest ecosystem, for the Mammals and Birds it was the use of forest habitat for at least one life activity (e.g. refuges).

65-68

Enquiry Table 11: Regeneration and extension of forest:

In this table the source data were the official information from the ten-year period 1987 -1996.

Polish statistics about artificial regeneration and afforestation are reliable and conformable with TBFRA definitions. Natural regeneration (11.2) and natural regeneration enhanced by planting (11.3) are reported together in Polish statistics; therefore that area was divided with the use of expert assessment.

Natural succession of non-forest land into forest (11.7) is the class, which is difficult to assess. In the last years, agricultural plots (private or state owned) of low productivity were temporarily or permanently abandoned. On a part of those areas natural regeneration has appeared, but in so far as the cadastral (official) status (arable, meadow) is not changed, those areas are still regarded as non-forest. That informational gap will disappear after our present inventory system is operational.

According to the Polish silviculture rules, indigenous species are primarily used as planting material. Introduced species are planted too, mainly for amelioration and reclamation of degraded lands, but their amount is insignificant.

69

Enquiry Table 12: The data is available for genus only, introduced species assumed as domesticated are planted but their amount is not significant. For each genus the most common species were listed. The total area of plantings is greater than the area reported in *Enquiry Table 11* "Regeneration and extension of forest", because it was enlarged by area of supplemental plantings. Generally planting material of known local provenance is used, planting of other material occurs occasionally.

According to Polish regulations, in the State Forests for the regeneration purposes seeds or seedlings of known and proper (local or regional) provenance must be used. In the private forests there are no such demands, but forest owners usually buy seedlings from local State Forests nurseries or they use natural regeneration.

Portugal

69

Enquiry Table 12: The legislation concerning planting certification is recent and it's foreseen that still during this year, there will be a new law concerning seedling certification, which will allow knowledge about planting material provenance.

Republic of Moldova

53, 54

Enquiry Table 2:

Trends in forest and other wooded land, 1965-1977

	Area (1000 ha)				
	1965	***1975***	***1985***	***1988***	***1990***
Forest	253.9	252.5	279.5	317.6	332.9
Forest undisturbed by man	-	-	-	-	-
Semi-natural forest	253.9	252.5	273.4	331.6	329.6
Plantations	-	-	6.1	6.0	3.3
Other wooded land	23.4	29.9	30.6	30.6	31.4
OWL undisturbed by man	-	-	-	-	-
Semi-natural OWL	23.4	29.9	30.6	30.6	-

56-64

Problematic introduced species: Box elder *(Acer negundo)*.

Romania

53, 54

Enquiry Table 2: Plantations: Area covered by Euro-American poplars.

Russian Federation

53, 54

Enquiry Table 2: Forest plantations may be created by a variety of methods, including the establishing of forest crops, hence two meanings are given under "Plantations" in the original reply: 17340/13480 thousand ha, of which 13480 thousand ha are the planted forests, so called "forest cultures" which are not "real" "plantations" in the national classification.

The areas of "Semi-natural forest" are estimated on the basis of the clear cuts areas for the last 30 years.

The likely ranges for categories "Forest undisturbed by man" and "Other wooded land undisturbed by man" are the same as in *Enquiry Table 1*.

The likely range for category "Plantations" is estimated at +- 0.5 per cent, the area of this category being defined more precisely.

Bushes and shrubs are assigned to category "Other wooded land undisturbed by man" - the main areas falling under this category occurring in the forest tundra zone.

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Enquiry Table 8:

1. The Russian Specially Protected Forest Areas (SPFA) system does not have a category corresponding to IUCN category VI.

2. The statistics do not show the division of SPFA land among the various categories, including wooded and unwooded land. They only give overall areas.

3. Information on natural monuments cannot be given for 1977 or 1987 owing to a lack of reliable figures covering those periods.

56-64

Enquiry Table 10: Data for forest occurring total species: The figure for "Other vascular plants" is between 10,000 and 12,000; for "Ferns" between 350 and 400; and "Lichens" between 650 and 700.

Data for total species: The figure for "Ferns" is between 500 and 600; for "Mosses" between 950 and 1,000; and "Butterflies" between 7,500 and 9,000.

The figure given in row "Other vertebrates" for total species includes fish species; the figure for forest-occurring species does not.

The figures given in row "Other vascular plants" cover all orders of vascular plants: *lycopodiaceae*, *equisetaceae*, *pteridophyta, angiospermae* and *gymnospermae.*

There is the second version of the reply to this table based on the "Red Book of the Russian Federation" which exists as supportive information in the reply to the enquiry which is available at the secretariat.

65-68

Enquiry Table 11: Introduced tree species are used (being planted) on areas less than 500 ha.

Slovakia

53, 54

Enquiry Table 2: An estimate of forest area undisturbed by man was taken from the monograph: Korpel, S., 1989: Virgin forests of Slovakia. Veda, Bratislava, 329 pp.

The area of plantations as a qualified estimate was taken from the database of the Permanent Forest Inventory of SR, status at December 31, 1996 (Lesoprojekt Zvolen). An estimated area of intensive plantations of other broadleaved tree species, as well as a small part of coniferous tree species, was added to the area of Euramerican poplars.

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Enquiry Table 8: Data were adjusted to comply with TBFRA-2000 (to 1 January 1997). Data were obtained from the Centre of Nature and Landscape Protection of the Slovak Environmental Agency (SAP), Banská Bystrica.

In IUCN category I and II: The area of forest lands of PR (Nature reserve) and of NPR (National nature reserve) was included into the category I according to IUCN. The areas of forest lands of NP (National park) were included into the category II. The forest land area includes also the areas of protection zones in hectares.

Legend:

H = commercial forests

O = protection forests

U = special purpose forests

PPF = agricultural land resource

LPF = forest land resource

There exists supportive information on "IUCN categories" in tabular form in the reply to the enquiry which is available at the secretariat.

"Other wooded land": Information sources:

1. J. Durkovic, et al.: General plan of the rational arrangement and utilization of land resources, Lesnícky výskumný ústav Zvolen, Final report 1997, 55 p., 22 tab., 8 separate annexes.

2. B. Ilavská, et col.: Valuation of production potential of agricultural land resource for the purposes of afforestation of agriculturally non-usable non-forest lands. Final report Bratislava, 1997, 45 p. + annexes.

There are 6,427 N- areas recorded in SR with an area of 42,846 hectares and 9,017 "white" areas with an area of 28,000 hectares. Using the method of Overlay maps analysis- pic. 4, lit. 1, with coloured drawn N- areas (by the method of scalegram) according to the districts, and the maps of Protected Nature Regions of SR (Kranárik 1996, status to 1 September 1996) the areas of the above mentioned plots were found located in the cadastre regions of NP, VCHÚ and other plots on forest lands. Of the area of 42,846 ha of N plots we can include 6500 hectares and 5700 ha of the IUCN Category V into the IUCN category II. The area of N- areas located on forest lands close to NP (OP) (that could be added to NP and CHKO) is 1,500 hectares and on the forest lands close to CHKO is 1,100 hectares (as it follows from the Decree of the Government 319/1992: General plan of supraregional territorial system of ecological stability of Slovakia - G-NRÚSES). Of the area of "white" plots 4,300 hectares should be in IUCN category II and 5,000 hectares should be in IUCN category V. From 1998 to 2002, 5,500 – 7,000 hectares of "white" and ´N´ – areas are planned to be afforested annually.

56-64

Enquiry Table 10:

1) In the table, the TBFRA-2000 definitions were taken into account.

2) The number of endangered plant species was determined according to the IUCN categories 1994.

3) The heading of the Table refers to species at risk or endangered - but in the data columns only numbers of Endangered species are required—and in spite of this the "R" and "I" species (usually far from being endangered) are included in the pre-1994 Endangerment Categories IUCN.

The data for endangered plant species (trees, other vascular plants, ferns, mosses, lichens) correspond with the pre-1994 IUCN ranks "Ex/E", "E", "V", "R", and "I". The data for endangered animal species (mammals, birds, other vertebrates, butterflies) correspond with the new ranks "EW", "CR", "EN", and "V"—e.g. endangered species "sensu stricto".

4) Endemic species in Other vascular plants and Ferns (flowering plants and ferns) correspond with data for all Western-Carpathian region or Western-Carpathians & Sudetic Region.

5) Following the definition of "Forest-occurring Species", all species of mammals and amphibians and reptiles can be found in the forest. Therefore also the total number of mammals is provided in item 10.6.

6) Data for "mammals" and "birds" also include the domesticated exotic species

7) In "other vertebrates", fish was conditionally excluded from the forest-occurring species although small water-streams are constituents of a forest.

8) Butterflies: We provide data for all butterflies and separately for diurnal butterflies. Data concerning diurnal butterflies include only species with permanent occurrence in our country. With regard to a small territory and large migration ability of butterflies, occasionally migrating or temporarily occurring diurnal butterflies native to more southward regions were not considered.

9) Updated but unpublished data and expert estimates were kindly provided from the Institute of Botany (Dr. Maglocky, Dr. Lackovicova, Dr. Kubinska) and Institute of Forest Ecology (Dr. Kristin) of the Slovak Academy of Sciences, and from the Slovak Environmental Agency of the Ministry of Environment. Some information was taken also from the following publications:

Daphne, 1996: Rámcová štúdia národnej stratégie pre ochranu biodiverzity v Slovenskej republike [Framework for the National Biodiversity Strategy]. Daphne & National Secretariat for the Convention on Biological Diversity, Bratislava, 42 p.

I. Pisut, 1993 : List of extinct, missing and threatened lichens in Slovakia - the second draft. Biológia 48 (1): 19-26.

A. Kubinska, K. Janovicova, V. Peciar, 1996: The list of extinct, missing and threatened bryophytes (*Bryophyta*) of Slovakia (1st version). Biológia 51(4): pp. 373-380.

F. Maglocky, V. Ferakova, 1993: Red list of ferns and flowering plants (*Pterydophyta* and *Spermatophyta*] of the flora of Slovakia. Biológia 48(4): pp. 361-385.

A. Stollmann, P. Urban, J. Kadleeik, M. Uhrin, 1997: Proposal of (red) list of Mammal fauna of the Slovak Republic. Ochrana prírody – Nature Protection 15: pp. 201-218.

Problematic introduced species

Robinia pseudoacacia – its share in tree species composition is 1.8 per cent. It is expansive, regenerating by root suckers. In lower altitudes it forms continuous forest stands and expands to the detriment of the oak species. In medium altitudes it occupies especially forest margins. It nearly fully prevents regeneration of other species by its aggressive root system and heavy shading.

Euroamerican hybrid poplars (*Populus x euroamericana*) share 0.63 per cent in the tree species composition. They have been planted near rivers, on floodplains and other suitable sites in the lowlands. Thanks to their cultivation, production of wood had increased several times in the lowland forests in the post-war period. Spontaneous hybridization of these hybrid poplars with indigenous black poplar represents an acute danger for the gene pool of the latter, however. The first measures aiming conservation of the indigenous black poplar were taken in our country in 1996-1997.

The share of other introduced tree species (Austrian pine, red oak, Douglas fir, eastern white pine, black walnut, horse chestnut) is low and in any case not problematical.

No invasions of exotic herbal or animal species which would have any considerable influence on forests and their management have not been encountered up to now.

65-68

Enquiry Table 11: Sources of data: Lesoprojekt, Permanent Forest Inventory (PIL) for the years 1987-1996, Lesoprojekt, average annual reforestation in SR (for the years 1987-1996), data of the Department for Non-Forest Lands Afforestation at the Forest Research Institute (LVU) Zvolen.

Part A. Forest regeneration (reforestation), total: The data were obtained from Lesoprojekt from permanent forest inventory for the years 1987-1996 and the annual average was calculated for the items as follows: (*a*) total regeneration; and (*b*) natural regeneration.

The data for root sprouts (Coppice sprouting) and combined regeneration (Natural regeneration enhanced by planting) cannot be separated out from the existing records as they are a part of recorded natural (Natural regeneration) and artificial regeneration (planting or seeding). Therefore the data in the table represent a qualified estimate.

The proportion of actually reforested introduced tree species within regeneration cannot be determined from existing records.

A qualified estimate was used with the help of the data of Lesoprojekt on planned reforestation, whereas the proportion of introduced tree species can be given only for artificial and total regeneration.

Part B. Forest expansion including afforestation and reforestation of other forest land; and Part C. Natural colonization of non-forest land to other wooded land: Based on available data, only the column "Planting or seeding of non-forest land" in Part B can be filled in, for other columns, it is supposed, the areas to be several hectares or tens of hectares per year respectively.

69

Enquiry Table 12: Mean total regenerated area according to tree species was obtained from the database of Permanent forest inventory carried out by Lesoprojekt, Zvolen. Other data represent a qualified estimate calculated from the records and data of the Seed Production Control of the Forest Research Institute (LVU), the Research Station Liptovský Hrádok.

A reproduction stock originating in the particular seed-collection zone is considered as a known local provenance.

A transfer of reproduction stock between seed-collection zones, or an import of known origin which is also certified by reliable documents, is considered as a known non-local provenance.

In case of introduced tree species we have for Austrian pine, Douglas fir and eastern white pine certified stands for seed collection, and these species are considered domesticated. In last seven years an import of seed or plants of these species was not realized. False acacia is practically regenerated to 100 per cent by sprouts.

The timber supplies (growing stock) and forest functions are connected with carbon sequestration (*Enquiry Tables 13-17*).

Slovenia

53, 54

Enquiry Table 2: Other wooded land was assessed by special inventory. Forest undisturbed by man includes natural forest reserves and protection forest.

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Enquiry Table 8:

Forest: An area of 55,400 ha (IUCN: I/V) is not included in results. There are no data on the classification of this area attainable at the moment.

Other wooded land: As it is impossible to get the data on other wooded land according to IUCN categories at the moment, the area is estimated through the percentage comparison of forest land and other wooded land.

56-64

Enquiry Table 10:

Birds: Of the 361 bird species, known so far in Slovenia, 169 are traditional nesting species. In all, there are 207 nesting species in Slovenia. This number includes irregular or occasional nesting species (J.U Gregori, S.U Matvejev, 1992).

Butterflies: According to scientific estimate, more than 60 per cent of all butterfly species depend on forest influences. The figure of 900 for Butterflies "Total number of forest occurring species" is the superior limit of 850-900. The figure of 750 for Butterflies "endangered forest occurring species" is the superior limit of 700-750.

Mammals: The data include all mammalion species (88) of wild fauna in Slovenia, out of which there are 69 species autochthonous in the land and 4 species of whale in the sea (which are observed very rarely).

A further 6 species are extinct (Ex); one of them in the sea (*Monachus monachus* Hermann,1779), one of them was successfully recolonized (*Lynx lynx* L.) in 1973 and is not endangered.

Four game species were colonized and a further 4 species were colonized by human activities.

One species colonized in a natural way (*Canis aureus L.*) - and is not included in endangered. All 4 species of whale are included as endangered.

Mosses: The data for "Mosses" include also Liverworts (*Hepaticae*) the total number of which is 157, of which 49 endangered). The total number of mosses (*Musci*) is 598, of which 212 are endangered.

Other vertebrates: In the figure of forest occurring species, the fish and lamprey species are not considered.

Reptiles: So far, 21 species of reptiles have been presented, but at least 26 species are probably to be found (24 species are endangered (MRSIC 1992)).

Amphibia: 20 names (*Amphibia*) have been included in the Red List and 20 species are endangered (Sket 1992).

Fish: In fresh and brackish waters of Slovenia, 94 fish species are found, of which 59 are endangered (Povz 1992).

Cyclostomata: In fresh waters of Slovenia, 4 species of lamprey are to be found (Povz 1992).

The total number of 950 for Forest-occurring species of (*Pteridophytes* and S*permatophytes*) includes "Ferns" and "Other vascular plants (Flowers)".

The data for other forest-occurring species: Other vascular plants included in Ferns.

65-68

Enquiry Table 11: Regeneration of forests by planting or seeding includes 500 ha (only 10 ha by introduced tree species—*Quercus rubra*). Planting or seeding of non-forest land and of other wooded land is negligible.

69

Enquiry Table 12: Last four years are representative index of species and quantity of reproductive material. All data for ten-year period were calculated from annual average over these years.

Spain

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Enquiry Table 8: Data source: For IUCN categories I and II: National inventory.

For IUCN categories III to VI: data from autonomous committees.

Area of forest and other wooded land without protection is 22,813,000 ha.

56-64

Enquiry Table 10: Data for "Trees" include data for "Other vascular plants".

There exists supportive information on "endangered species in Spain" in tabular form in the reply to the enquiry, which is available at the secretariat.

Sweden

53, 54

Enquiry Table 2: See *Enquiry Table 1* "Total area by main classes" for the definition of "Forest" and "Other wooded land".

Trends: The trend in Sweden over the last 100 years is that the forest area has grown due to two reasons: (1) large areas of low fertile farm land has either actively or passively been transferred to forest due to better productivity in the agriculture sector; and (2) large areas of other land and other wooded land have been transformed to forest land by draining swamps and low fertile (due to high groundwater levels) land. The exact areas which have been transformed from other land and other wooded land to forest are not possible to give due to lack of records and change in definitions. However, it is probably more than two million ha and less than four million ha. These are rough estimates of the gross figures, however, if net figures could be presented they would be significantly lower. The reason is that forest areas have also been transformed from forest to farmland, while both farmland and forest have given their share to public roads and other infrastructure development, etc.

The trends since the 1950s until about 1990 were as for the period above. Since 1990 the active transformation from other wooded land to forest (by draining swamps) has stopped due to nature conservation reasons. Still there is a slow trend in an active transformation of agricultural land to forest (about 3,000 ha/year in the last ten years).

Sweden has redefined the definition of "Forest undisturbed by man" which is as follows:

The old definition was:

National parks, nature reserves, all sub-alpine birch forests, the rest of the sub-alpine forest older than 100 years, all low productive forest with a production capacity less than 1 m^3 o.b./ha/year, and all other forest older than the lowest recommended final felling age where no treatments whatsoever have been conducted over the last 25 years.

The new definition is:

National parks, nature reserves, all sub-alpine birch forests, the rest of the sub-alpine forest older than 100 years, all low productive forest with a production capacity less than 1 m^3 o.b./ha/year, and all other forest older than the lowest recommended final felling age where no treatments whatsoever have been conducted over the last 25 years.

Excludes: (*a*) power lanes, roads, railways, agricultural land and urban land; (*b*) excludes areas influenced by ditching and (*c*) excludes areas influenced by fellings during the last 50 years.

(*a*), and (*b*) were actually excluded also in our previous answer, and now we have excluded also (c). This area (c) has been estimated as the area (on the previously reported area of "forest undisturbed by man") affected by cuttings the last 15 years times 50/15. This means that we deduct 238 000 ha * 50/15 = 793,333 from our previous figure and adds this figure to "semi-natural" forest instead.

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Enquiry Table 8:

See *Enquiry Table 1* "Total area by main classes" for the definition of "Forest" and "Other wooded land".

About five or six years ago the Swedish Environmental Protection Agency classified the Swedish national parks and nature reserves into IUCN classes. Unfortunately but naturally (as the new definitions were unknown at that time) these protected areas were not divided into forest, other wooded land and other land. Also, since then large areas have been formally protected by legislation in Sweden, but have not yet been classified. As the Swedish protection classes are poorly correlated to the IUCN classes, data cannot be easily retrieved on this from their National Forest Survey. Therefore Sweden chooses not to deliver any data for *Enquiry Table 8.*

Sweden knows that the World Conservation Monitoring Centre have figures on the IUCN areas in Sweden. These figures were delivered to WCMC by the Swedish Environmental Protection Agency some years ago, but were not classified in the new FRA-2000 classes "Forest" and "Other wooded land". As there is a possibility that the Swedish Environmental Protection Agency will start a new IUCN classification work this year, Sweden would like to ask ECE/FAO not to use the old figures on Sweden's IUCN areas. They would prefer to leave this table blank.

56-64

Enquiry Table 10: Only native species are included in this Table.

– Only regularly breeding birds are included.

– Endemic means only found and reported in Sweden, but the chance of existence in other countries is still there.

65-68

Enquiry Table 11: Source: National Board of Forestry.

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Enquiry Table 12: Source: National Board of Forestry.

Switzerland

53, 54

Enquiry Table 2: "Forest undisturbed by man": National parks and reserves. "Plantations": 5 per cent of young growth area.

Global trend (for the last 100 years): forest area is stable and amounts to about one fourth of the total area of Switzerland. During the second world war 12,000 ha of forest was clear-cut. Since 1950 an increase in forest area can be stated. It is however difficult to quantify these increases since the figures from Cantonal forest statistics are not comparable with results from the NFI due to different methods and definitions. The increase between 1986 and 1996, derived from the NFI results is about 40,000 ha. Reasons: Since about 1900 big clearcuts are forbidden by federal forest law and clearings have to be reforested. So, a man-caused decrease in forest area is impossible. The observed increase of forest area since 1950 is the consequence of increasingly extensive agricultural management.

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Enquiry Table 8: The data for OWL (in IUCN categories I and II) and (in IUCN categories III to VI) are raw estimates derived from the relationship of the data in Forest (in IUCN categories I and II) and (in IUCN categories III to VI). No other reliable data are available for the IUCN categories for other wooded land.

56-64

Enquiry Table 10: Data sources: different sources were used as e.g. red lists, expert guess, etc.

Trees (coniferous and broadleaved species)): total species, of which endangered: *Quercus cerris*, *Laurus nobilis*, *Sorbus domestica*, *Pyrus nivalis*.

Butterflies: The figure (182) for total number of species for butterflies is without moths.

Moths and butterflies: Total: 3,896.

65-68

Enquiry Table 11: The relationship of the area figures between natural and planting are derived from "Natural regeneration" of "Regeneration of forest (reforestation), total"—"Planting or seeding" of "Regeneration of forest (reforestation), total".

Enquiry Table 12: According to the Swiss National Forest Inventory, the proportion of natural regeneration amounts to about two thirds (pure natural regeneration 56 per cent, forest planting 21 per cent and mixed (that means natural and artificial)

regeneration 23 per cent). The use of plants for artificial regeneration has continuously decreased in the last ten years (1985: 8,8 Mio. plants; 1995: 4,4 Mio. plants).

– In Switzerland, the number of plants used in forest plantings was determined for the last 100 years. Thus, there are no values of the area. (Source: Swiss economy of forest and wood, yearbook 1995). Indications can only be given for the following tree “species": Norway spruce, others conifers, beech and other broadleaved trees.

– “unknown provenanc”: According to the forest law respectively the decree, article 21, paragraph 4, only forest reproductive material with proved provenance is allowed to be used for forest applications. The use of unknown provenance is thus not allowed.

– Known local provenance and known non-local provenance: There exists no information about this (The collecting of information would be fairly expensive).

The forest statistics in Switzerland provide only figures in “plants per year” but not figures for “ha/year”. In 1991, in total, 7,256,000 trees were planted.

Picea abies: 3,185,000

other coniferous: 954,000

Fagus sylvatica: 683,000

other broadleaved: 2,443,000.

Tajikistan

53, 54

Enquiry Table 2: Source: Information from the TBFRA-2000 National Correspondent Mr. G. A. Avsalov, Director General of the Forest Association “Tajikles", in reply to the Table of the TBFRA Essential Data, 20.11.1998.

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Enquiry Table 8: Source: Information from the TBFRA-2000 national correspondent Mr. G. A. Avsalov, Director General of the Forest Association “Tajikles", in reply to the Table of the TBFRA Essential Data, 20.11.1998.

The FYR of Macedonia

53, 54

Enquiry Table 2: The data for Forest area are secretariat estimates based on literature sources of information and the evaluation of the situation in neighbouring countries.

Turkey

53, 54

Enquiry Table 2: Virtually all of the forests in Turkey were originally natural forests. In the course of the history, those forests have been subject to human interference; therefore, they are considered to be semi-natural.

Plantations started in 1946. Planted area estimated by national coordinators taking into account the records of forest management plans and documents of Plantation and Erosion Control General Directorate.

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Enquiry Table 8: All forests (both high forest and coppice), that are not available for wood supply are protected forests. They are classified as nature parks, natural monuments, natural reserves, national parks, conservation forests, forests with conservative characters, gene protection areas, seed provenance. Four of these statutes match with IUCN categories:

Turkish category	*IUCN category*
Nature park	Protected landscape (V)
Natural monument	Natural monument (III)
Nature reserve	Strict nature protection area (I)
National park	National park (II)

65-68

Enquiry Table 11: Data for “Planting or seeding of non-forest land” and “Planting or seeding of other wooded land” are estimates.

Turkmenistan

53, 54

Enquiry Table 2: “Naturalness” is assessed by the secretariat on the basis of analysis of the situation in neighbouring countries, e.g. Kazakhstan, Tajikistan.

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Enquiry Table 8: Secretariat estimates are derived from the WCMC database of the protected areas. It is noted in the WCMC: there are 2 protected areas in Turkmenistan: *a*) Kaplangursky and b) Repeteksky, covering mainly non-forest areas.

56-64

Enquiry Table 10: The figure for other vascular plants is more than 2400.

The figure of 60 for other vertebrates is for fish.

The flora of Turkmenistan includes about 2600 species of plants where grass prevail. There are not so many tree and bush species . The fauna is several thousands of species of insects, 60 species of fish, 27 species of snakes (4 of which are referred to as poisonous snakes), 372 species of birds, 22 species of predators (source: http://www.iectm.org/turkmenistan.geogr/html).

65-68

Enquiry Table 11: Source for planting or seeding: Estimates are on the basis of the 1988 Forest Inventory results.

Ukraine

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Enquiry Table 8: Supplement to the Forest Survey Questionnaire—List of specially protected areas in Ukraine:

IUCN category I

1. Askania-Nova
2. Gorgany
3. Dneprovsko-Orelsky
4. Low-lying lower reaches of the Danube
5. Elanets steppe
6. Kanevsky
7. Karadagsky
8. Karpatsky
9. Krymsky
10. Lugansky
11. Medobory
12. Mys Martyan
13. Polessky
14. Rastochye
15. Ukrainian steppes
16. Yalta mountains/forests
17. Chernomorsky (Black Sea district)

IUCN category II

18. Azov-Sivashsky
19. Vyzhnitsky
20. Karpatsky
21. Podolskie Tovtry
22. Svyatye mountains
23. Sinovir
24. Shatsky

Note: A map showing the positions of these territories exists as supportive information in the reply to the enquiry which is available at the secretariat.

56-64

Enquiry Table 10: Source: Descriptor of higher plants in Ukraine (Kiev, 1987); Ukraine Red List. Plant World (Kiev, 1998); Ukraine Red List. Animal World (Kiev, 1996).

Problematic introduced species: *Quercus rubra, Robinia pseudacacia, Acer negundo, Fraxinus pennsylvatica, Fraxinus lanceolata, Amorpha fruticosa, Lutreola vison (mink).*

United Kingdom

53, 54

Enquiry Table 2: Trends and driving forces:

Late 18th century	Clearance of woodland to increase agricultural area, to feed growing urban population.
After 1815	Increased new planting, mostly small scale, but little systematic management.
1884-1914	Little change, about 4500 ha/yr. planting, mostly restocking.
1914-1918	Extensive conifer fellings; only best quality broadleaved much affected.
1920’s	Restoration of losses from 1914-18, replacement of felled oak with conifers.
1947-1980	50 per cent increase in woodland area, mostly state planting, for timber and rural employment.
1980-1997	Increasing proportion by private sector; more priority to environment and landscape.
All 20th century	Small amounts lost for roads and other developments; continuing decline in coppice.

The proportion of land area under forestry in Great Britain is shown in the following table, 1924--80 based on Woodland Censuses, adjusted to common definitions (excludes Northern Ireland):

1908	4.9 per cent	Increases: 1924 to 1996	Increases: 1924 to 1996
1924	5.3 per cent	GB total: Doubles	5.3 per cent to 10.6 per cent
1947	6.1 per cent	England: 50 per cent increase	5.1 per cent to 7.6 per cent
1965	7.6 per cent	Wales: More than doubles	4.9 per cent to 12.0 per cent
1980	9.4 per cent	Scotland: More than doubles	5.9 per cent to 15.2 per cent
	10.6 per cent		

Forest cover in Northern Ireland increased from less than 1 per cent in 1925 to 2.0 per cent in 1955 and 5.8 per cent in 1995.

The area of woodland has increased in Northern Ireland, from a very low base, with the most rapid increase being in the 1960s and early 1970s, but is still (in 1995) a lower percentage cover than any of the countries of Great Britain:

Northern Ireland

1925	< 1 per cent	Chairmont Report
1940	1.8 per cent	1939/40 Census
1950	1.7 per cent	CSO Annual Abstract of Statistics
1955	2.0 per cent	CSO Annual Abstract of Statistics
1960	2.4 per cent	
1965	3.1 per cent	CSO Annual Abstract of Statistics
1970	4.0 per cent	Same as above.
1975	4.6 per cent	Same as above.
1980	4.9 per cent	Same as above.
1085	5.2 per cent	Same as above.
1990	5.5 per cent	Same as above.
1995	5.8 per cent	Same as above.

Data for Forest undisturbed by man: Estimate corresponds approximately.

Data for Semi-natural forest: Data adjusted: Semi-natural (UK definition) plus some other areas of Scots Pine and broadleaved. Estimate corresponds approximately.

Data for Plantations: Data adjusted: Estimate = total less semi-natural. Estimate corresponds approximately.

Data for Other wooded land undisturbed by man: Estimate corresponds approximately.

Data for Semi-natural other wooded land: Data adjusted: wood pastures. Estimate corresponds approximately

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Enquiry Table 8: These estimates are considered to be better than estimates provided by WCMC in December 1997, but are subject to revision as the source is a draft paper that has not yet been subject to peer review.

Trends over the last 10-20 years in the area of FOWL in the IUCN protection categories:

Area of protected forest will have increased—no quantitative estimates available.

56-64

Enquiry Table 10: Figures not yet available for forest-occurring species.

Trees (10.1) include species in woodland, in parks and the countryside, but not those only in gardens and arboreta. Trees include more than 80 introduced naturalised species; endangered species is service tree.

Mammals & birds - none categorised as endangered in the Biodiversity UK Steering Group Report - to confirm.

Data for Other vascular plants include data for flowers (and shrubs and stonewort).

Data for Mosses include data for liverwort.

Data for Butterflies include data for moths.

Problematic introduced species: UK forests have been affected by a substantial number of invasive exotic species in recent decades. These include several mammals, notably the American grey squirrel (*Sciurus carolinensis*), muntjac deer (*Muntiacus reevesi*) and sika deer (*Cervus nippon*), and the more historically introduced European rabbit (*Oryctolagus cuniculus*). Invasive plants include the Rhodendron (*R ponticum*) in western upland native forests and Japanese knotweed in riparian areas. A few introduced trees are regarded as invasive in some circumstances, notably the sycamore in nature reserves and western hemlock which regenerates readily in shade. It is possible that other introduced species and shrubs could become more invasive in future as circumstances change. The UK tries hard to exclude harmful insect and fungal pests but some have become established in recent years, notably the Great Spruce Bark Beetle (*Dendroctonus micans*).

65-68

Enquiry Table 11: For introduced species, the percentage introduced for state and private was weighted by their shares of restocking and new planting.

Source: Annual averages from admin records: "Regeneration of forest (reforestation), total" and "Extension of forest, including afforestation and reforestation of other wooded land" from published statistics, "Natural regeneration & colonisation" from admin records, planting by subtraction. Proportions of introduced are species based on same data used for *Enquiry Table 12.*

69

Enquiry Table 12: Source data are for GB (FC records and private sector production forecasts). State and private then each rated up to planting totals used for *Enquiry Table 11.*

Provenance recorded on different basis from this table, so cannot be reported.

United States of America

53, 54

Enquiry Table 2: Forest and other wooded land undisturbed by man (natural) - All legally designated Wilderness areas are assumed to be natural and relatively undisturbed by man as well as all wooded land located in interior Alaska.

Plantations—Based on data from the 1992 national assessment database. Considerable areas in the western U.S. have supplemental planting to enhance stocking for regeneration after harvest, but are not considered plantations.

Semi-natural forest and other wooded land - All forest and other wooded land not in the previous categories.

55

Enquiry Table 8: The data reported here generally apply only to public lands. The various states and local governments within the United States have laws, statutes, and Best Management Practices (BMP) rules that provide protection in the form of restrictions or prohibitions of certain management activities aimed at improving water quality, forest health, soil conservation, wildlife habitat, or other broad land management goals that are in the general interest of the public.

The majority of forest land in the U.S. is in private ownership and is spread among some 10 million individuals and private corporations. In many cases this land has management restrictions based on State or local zoning or by preference of the owner. There are no accurate statistics available to quantify the private forest lands of the U.S. as 'protected' under current IUCN definitions. Thousands of hectares of land in the United States are also owned or managed by non-governmental conservation/ preservation organizations and are protected by organizational charter or written management plan but are not strictly protected by public law or statute. Complete data for these areas, which generally fall in categories IV-VI, are currently unavailable.

Trends in Protected Status - The area of forest and other wooded land in IUCN classes I and II has increased from 7.0 million hectares in 1970 (Forest Service report FRR-20, "The Outlook for Timber in the United States", 1970) to 19.2 million hectares in 1992 (Forest Service report GTR-NC-168, "Forest Resources on the United States, 1992 METRIC UNITS), an increase of 174 per cent. Historic data on IUCN classes III-VI unavailable.

There exists supportive information on "Publicly managed land encumbered for conservation purposes by legislative and administrative restrictions, 1993" (in tabular form) in the reply to the enquiry which is available at the secretariat.

56-64

Enquiry Table 10: Sources: Trees: The primary source for this is Little (Little, L. Elbert, Jr. 1979. Checklist of United States trees (native and naturalized). U.S. Department of Agriculture, Agriculture Handbook, page 541 and 375) and the PLANTS National Database/ ITIS Database located on the web at

http://rndhouse.nrcs.usda.gov/plantsproj/plants/project_database.html

Other vascular plants, ferns, mammals, birds, and other vertebrates: The Nature Conservancy (documentation available at the secretariat).

Butterflies, mosses, lichens: The National Biological Service (documentation available at the secretariat.)

Comments:

Exotic and introduced species: About 4000 exotic plant species and 2300 exotic animal species occur in the United States. About 15 per cent of those species cause significant problems. For example, exotics have contributed to the decline of 42 per cent of the T&E species in the United States. Recent article by The Nature Conservancy highlighted 12 of the most problematic exotic species. Six of those species affect forest ecosystems:

1) purple loosestrife (*Lythrum salicaria*) chokes wetlands and eliminates native plants and the species dependent on them.

2) Tamarisk (*Tamarix* spp.): outcompetes native vegetation in riparian forests, with negative effects on the aquatic and terrestrial habitat

3) balsam wooly adelgid (*Adelges picae*): has destroyed three-quarters of the spruce-fir forest of the south-eastern United States.

4) Miconia (*Miconia calvescens*): ornamental plant that invades native forest and eliminates native vegetation and associated species. Problem in Hawaii.

5) Chinese tallow (*Sapium sebiferum*): ornamental plant that displaces native species. Affects the south-eastern states.

6) Brown tree snake (*Bioga irregularis*): has eliminated most of Guam's native bird species. Current concern over whether it will succeed in invading Hawaii, and possibly the mainland.

Other problem species:

Cowbird: significant effect on neotropical migrants because of nest predation.

Total species for this table:

Every source seems to have a different count for species by taxonomic group. For most groups, the most recent data from The Nature Conservancy was used for consistency (they report native U.S. species). All sources are described below.

Tree species: Little (Little, L. Elbert, Jr. 1979. Checklist of United States trees (native and naturalized). United States Department of Agriculture, Agriculture Handbook, page 541 and 375) and the PLANTS National Database/ ITIS Database.

Other Vascular Plants: The Nature Conservancy lists 15,447 native flowering plants and 115 species of conifers. Assuming 833 total tree species, total other vascular plants is estimated to be (15,447 + 115) - 833 = 14,729.

Ferns: The Nature Conservancy lists 546 native fern species.

Mosses: The National Biological Service cited a total of 1,320 species for North America. It includes Canada, but not Hawaii, Puerto Rico, or Pacific Islands.

Lichens: The National Biological Service cited an estimated 3500-4000 species of lichens in the United States. The midpoint was used in the table. Not clear if the estimate includes species in Hawaii, Puerto Rico, and Pacific Islands.

Mammals: The Nature Conservancy lists 418 native mammal species in the United States.

Birds: The Nature Conservancy lists 776 native bird species in the United States.

Other vertebrates: The Nature Conservancy lists 278 native reptile species, 242 native amphibian species, and 822 native freshwater fish species.

Butterflies: The National Biological Service cited a total of 90,968 known insect species in the United States. Of the total, the *Lepidoptera* includes 11,300 species. Only about 12 per cent of *Lepidoptera* are butterflies. The Nature Conservancy lists 600 species of butterflies in the United States, which includes skippers.

Total Endangered Species by Taxonomic Group:

The United States Fish and Wildlife Service maintains a list of species federally protected as endangered or threatened. The species in *Enquiry Table 10* reflect information as of January 31, 1998 for United States species.

Other sources would suggest there are more species at risk than officially protected under the Endangered Species Act. The Nature Conservancy publishes an assessment of species at risk using five categories: presumed extinct, possibly extinct, critically imperiled, imperiled, and vulnerable. The total species count by taxonomic group using these designations is as follows:

Conifers:30 species

Flowering plants: 44 species (non-coniferous trees are not separated)

Birds: 93 species

Other vertebrates: 516 species (50 reptiles, 148 amphibians, 318 fish)

Butterflies:101 species

Endemic Species by Taxonomic Group: The only source found for number of endemic species was World Resources 1996-1997 (World Resources Institute). Estimates of endemic species in the United States were provided for plants, mammals, birds, reptiles, and amphibians.

Total endemic plants species was listed at 4,036. No information was provided on endemics by trees and other vascular plants. A rough estimate was made by assuming the same proportion of species is endemic for trees and other vascular plants. The WRI report estimated a total of 16,302 higher plant species. Therefore, approximately 25 per cent of all higher plants were considered endemic. Applying the same percentage to trees and other vascular plants results in an estimate of 216 endemic tree species and 3,674 endemic other vascular plants. It is likely that this approach overestimates endemic tree and underestimates endemic other vascular plants.

Endangered Endemic Species by Taxonomic Group: All numbers are based on counting endangered and threatened species that have a historic range only in the United States (including Hawaii, Puerto Rico, and the Pacific Islands- see table below). In some taxonomic groups, Hawaii, Puerto Rice, and the Pacific Islands contain a large proportion of the endemic species. (For those groups without endemic species, it may indicate a lack on information rather than the lack of endangered endemic species.)

Total Forest-occurring Species: The 1989 RPA Wildlife Assessment reported that about 90 per cent of resident or common migrant vertebrate species in U.S. use forested ecosystems. Generally, 90 per cent of bird, amphibian, and fish species, and 80 per cent of mammal and reptiles use forested ecosystems.

These percentages were applied to total species to provide rough estimates of forest-occurring species for mammals, birds, amphibians, fish, and reptiles. It was assumed that all tree species are forest-occurring.

Endangered Forest-occurring Species: Most recent list of federally listed species that occur in forest ecosystems:

35 mammals; 20 reptiles; 8 amphibians

54 birds; 61 fish; 9 butterflies

214 plants (2 conifers, 2 deciduous trees)

Endemic forest-occurring species: No estimates available

Endemic endangered forest-occurring species: Comparison of list of forest-occurring T & E species with range listing resulted in number of endemic species.

There exists supportive information on “U.S. endemic T & E species by geographic occurrence” (in tabular form) in the reply to the enquiry which is available at the secretariat.

65-68

Enquiry Table 11: Direct measures of regeneration are difficult to obtain from the current inventory system. However, annual planting records, conservation reserve programme data, and net change data from periodic inventories provide information for these estimates. Complete data for colonization and planting of other wooded land is not available and could not be reasonably estimated.

The only data for introduced species currently available are those from *Enquiry Table 12* “Species diversity and origin of planting material used in the forest”.

There exists supportive information on “Estimated average annual area of forest and OWL harvested in the United States, by ownership group, 1980-1990” and “Tree planting in the U.S. by major owner group, 1986-1995” (in tabular form) in the reply to the enquiry which is available at the secretariat. Most broadleaved harvest areas regenerate naturally.

69

Enquiry Table 12: Sources: National forest land planted with seedlings from known seed sources, 1997.

State Nursery data: Personal communication, Ron Overton, USDA Forest Service, State & Private Forestry.

The balance of annually planted stock is predominantly commercial southern pine species in the Southern U.S. from private nurseries.

Data are primarily available from most public and private nurseries.

Data from forest industry nurseries are generally not available.

Source: National Forest information in Reforestation and Timber Stand Improvement Report: National Summary Fiscal year 1997.

Uzbekistan

53, 54

Enquiry Table 2: Source for Forest undisturbed by man, Semi-natural forest, Plantations: Secretariat estimates based on literature sources, including the article “Biological diversity and genetic resources of forest in Uzbekistan", A. K. Kayimov and E. S. Alexandrovsky, FAO 1997.

55

Enquiry Table 8: Source: Secretariat estimates based on literature sources, including the article “Biological diversity and genetic resources of forest in Uzbekistan”, A. K. Kayimov and E. S. Alexandrovsky, FAO 1997.

Yugoslavia

53, 54

Enquiry Table 2: Source: “Mid-term Programme of Forestry Development of Serbia, 1996-2000".

55

Enquiry Table 8: The category of National park sometimes includes strict nature reserve/wildness area. For instance, the National park “Ficusca Gora” (25,393 ha) includes the area of 62 ha of strict nature reserve. There exists supportive information on “The list of National parks and World Natural heritage sites & Ramsar sites” in the original reply to the enquiry which is available at the secretariat.

56-64

Enquiry Table 10: There exists supportive information on “Number of species, and the levels of protection” (in tabular form) in the reply to the enquiry which is available at the secretariat.

65-68

Enquiry Table 11: Source: The Middle-term Programme of Forestry Development of Serbia 1996-2000.

CHAPTER V: FOREST CONDITION AND DAMAGE TO FORESTS AND OTHER WOODED LAND[1]

Introduction

The TBFRA-2000 enquiry has collected information from National Correspondents on the forest resources of temperate and boreal forests. The first such assessment was published in 1947, and concentrated very much on the wood resources of the boreal and temperate zones. Subsequent enquiries were similar in emphasis, although the 1990 assessment was extended to include non-wood goods and services. TBFRA-2000 differs from earlier assessments in that it has sought information not only on the extent of the resource, but also on its condition. There have been particular concerns over the issues of forest condition and forest damage, as the maintenance of forest condition is a clear prerequisite for the sustainable management of forest resources. Consequently, these issues have received a considerable amount of attention from both scientists and policy makers. This chapter provides a preliminary assessment of the information available on forest condition in the temperate and boreal region. At the same time, it highlights the difficulties associated with making such an assessment.

There is considerable concern about forest health and a general desire that forest health (also sometimes known as forest condition, or forest vitality) is maintained. This stems from observations of forests that are clearly unhealthy, such as those devastated by air pollution from smelters (e.g. at Nikel, Monchegorsk and Noril'sk in the northern part of the Russian Federation). However, there is no universal set of criteria for defining a healthy forest, and existing concepts vary widely. The idea of the forest as an ecosystem is now standard, so definitions based on the health of individual trees are no longer strictly applicable. However, trees form the dominant structural element of a forest, so their health plays an important part in the overall health of the ecosystem. Today most definitions of forest health fall in a continuum between the health of some form of super-organism (the forest ecosystem) and the long-term sustainability of the forest. As ideas on the subject are still being developed, it is not possible to say that any one definition is correct. This creates major problems for an inventory such as the TBFRA-2000.

Similar concerns exist over the extent of damage to forests. Strictly speaking, the term damage often implies an economic loss. However, this is rather inconsistent with the idea that forests perform multiple functions, some of which cannot at present be valued economically (see Chapter VI). As a result of this conceptual problem, combined in some cases with a lack of appropriate data, many countries had difficulties in providing quantitative or even qualitative estimates of the damage to forests caused by particular agents. A further difficulty was that the extent of damage qualifying for inclusion was not stated. All of the different damaging agents can cause differing degrees of damage. In some cases, damage is related to loss of yield, but this is very much an economic definition and is of questionable applicability in, for example, a forest reserve. There is also a problem with the reporting of damage. At what point does an area that was damaged in the past no longer count as damaged? For example, an area damaged by industrial pollution can be counted in the year that the damage occurred or in every year that the damage persists. Conversely, in the case of fires, the area of damage is normally reported in the year of the fire, but damage may persist much longer. With fire, there is the added problem that in some cases, it is a natural component of the ecosystem and the use of the term damage to describe its effects is therefore questionable.

In many countries, there are no formal inventories of forest health, although major inventories of tree defoliation exist in both Europe and North America. There are also records of fire frequency and extent in many countries. Information on other damaging agents is more scattered and, in many cases, the figures submitted by National Correspondents represent the best available estimates for particular damaging agents, rather than the results of specific surveys and inventories.

This chapter provides an overview of the data on forest condition in 55 countries, collected or collated by the TBFRA. Some statistical information is available from all countries involved in the TBFRA, and this has been summarized in Main Tables 70 to 78. The information covers the most important agents causing damage to forests, the number and extent of fires in forests and OWL and the extent of defoliation, a widely used indicator of tree condition. Two sets of tables (Main Tables 70-71, 72-75) therefore deal with the causes of damage to forest, whereas the third (defoliation, Main Tables 76-78) looks at the response.

[1] This chapter was prepared by Mr. John L. Innes (see Appendix V).

Material collected by the TBFRA-2000.

Information on forest condition for the TBFRA-2000 has been summarized in Main Tables 70 to 78. Main Tables 70 and 71 present information on the extent of damage to forests by known and unknown causes in each country. The material is based on the submissions made by individual countries. Main Tables 72-75 are based partly on the submissions from individual countries and partly on a separate forest fires database maintained by the Timber Section, Trade Division of the UN Economic Commission for Europe, also based on official data, supplied annually by countries. Main Tables 76-78 are drawn from the reports of the International Cooperative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (organized by the UN Economic Commission for Europe under the auspices on the Convention on Long-Range Transboundary Air Pollution) and the European Union Scheme on the Protection of Forests Against Atmospheric Pollution, supplemented with information supplied by individual countries. Additional tables are also presented in the text, and the sources of information for these are given individually.

Damage to forest and other wooded land (Main Tables 70 and 71).

The aim of these tables is to present sufficient data to enable the assessment of the condition of the forest and other wooded land, and the extent that the forest is under threat, and to provide information on damage to the forest from different causes. The indicators used for the condition of forests and other wooded lands, the level of threat and the causes of damage. are given below:

- Total area of forest and other wooded land with damage by known causes
- Primarily damaged by insects and disease
- Primarily damaged by wildlife and grazing
- Primarily damaged by fire
- Primarily damaged from known local pollution sources
- Primarily damaged by storm, wind, snow or other identifiable abiotic factors
- Total area of forest and other wooded land with damage from unidentified causes

The questionnaire requested information on the areas of forest damaged by specific agents. The level of damage that would qualify for entry was not specified, but countries were invited to comment on this. Very few did, although in Norway, the figures for damage refer to areas where growth has been reduced by more than 10 per cent. No data were supplied by Sweden (except for damage by wildlife and grazing) because of the uncertainties associated with the unclear terminology. The figures on damage by insects and disease for Slovakia represent the sum of slightly and heavily damaged areas.

In Poland, a variety of different concepts exist for damage. This means that the figures for each category cannot be directly compared. Damage by insects and disease refers to the area over which chemical control should be carried out. Damage by wildlife was assessed on the basis of where heavy damage occurred over at least 20 per cent of the stand area. Damage by fire refers to those forest areas destroyed by fire. Damage by abiotic factors was assessed by a questionnaire survey and refers to the areas in which significant damage was reported. Although producing problems for comparisons between different causes of damage, this approach seems more useful than an overall assessment of unspecified damage levels in forests.

A second source of information on this subject is the annual survey of crown condition undertaken by the ICP Forests programme. This is based on a systematic grid of plots across Europe (mainly 16 x 16 km), with each plot normally having a fixed number of trees (usually 24). An exception is Switzerland, where fixed-area plots are used. As the majority of the data set is compiled from variable-area plots, it is not possible to directly relate the data to the area of forest affected. The information is given in Table 5.1. The assessments are based on the presence or absence of a particular agent on a particular tree, so any one tree can be scored for having more than one damaging agent present. The nature of the original data collection form means that it is now difficult to ascertain from the forms whether a blank entry means that an agent was absent or that it was not assessed.

The interpretation of the data in Main Table 70 is complicated by differences in the ways individual countries handled the questionnaire. Some information was made available in the written comments to the questionnaire, or in subsequent discussions with the National Correspondents, but many uncertainties remain. A particularly important point is the differing nature of the data in Main Table 70. For some countries, the figures represent the mean damaged area for a particular 5- or 10-year period. In others, they are the values for a single year. In yet others, the figures represent the cumulative totals (over variable time periods) of forest areas damaged each year by specific agents.

No information was available for some countries. In Australia, for example, there is no national survey of forest damage although some information is available on the relative importance of pests and diseases (Table 5.2). Additional information relates to forest dieback that is widespread and severe in five States, widespread and having an adverse effect in the Australian Capital Territory (ACT), and widespread in the Northern Territory. Various causes are involved,

TABLE 5.1

Percentages of trees assessed in 1997 by ICP Forests for each damage type, based on the total tree sample for Europe

Damage type	Total Europe		
	Not assessed	Assessed and not present	Assessed and present
Game and grazing	61.8	37.2	1.0
Insects	56.4	34.8	8.8
Fungi	57.6	37.0	5.4
Abiotic agents	58.2	36.4	5.4
Action of man	58.0	38.1	3.9
Fire	61.1	38.5	0.4
Classical smoke damage	63.0	36.9	0.1
Other causes	59.7	35.6	4.7

Source: UN/ECE and EC 1988, Forest Condition in Europe, Geneva and Brussels, 1998.

TABLE 5.2

Pests and diseases in Australian forests, by State or Territory

Pest of disease	Australian Capital Territory	New South Wales	Northern Territory	Queens-Land	South Australia	Tasmania	Victoria	Western Australia
Vertebrates								
Dogs (***Canis familiaris***)	3	3	3	3	-	-	1	-
Foxes (***Vacis vulpes***)	5	4	1	5	3		3	5
Goats (***Capra hircus***)	1	1	3	3	1	2	1	-
Kangaroos (***Macropus* spp.**)	5	3	3	3	3	-	3	-
Mice (***Mus musculus***)	3	3	3	3	3	-	1	-
Pigs (***Sus scrofa***)	5	3	5	5	-	-	1	3
Possums	3	3	3	3	1	5	1	-
Rabbits (***Oryctolagus cuniculus***)	5	4	3	3	5	4	3	3
Pathogens and fungi								
Fungi (***Phytophthora* spp.**)	4	3	3	5	-	5	5	5
Invertebrates								
Bees (***Apis mellifera***)	4	-	3	3	-	3	3	3
Christmas beetle (***Anoplognathus* spp.**)	3	4	3	3	-	1	3	-
Grasshoppers (***Acridids***)	1	-	3	5	3	3	1	5
Mosquitoes (***Culicids***)	1	-	3	1	-	3	3	5
Sirex wasp (***Sirex noctilio***)	3	3	-	1	5	3	2	-
Plant pests								
Bracken fern (***Pteridium esculentum***)	3	-	-	3	5	3	3	-
Blackberry (***Rubus vulgaris***)	5	5	-	3	1	4	5	3
Grasses, exotic (Unidentified ***Poaceae***)	4	2	3	5	4	1	1	4
Lantana (***Lantana camara***)	-	3	1	5	-	-	1	-

1 Occurs but is not widespread, has little impact, and requires little or no control.

2 Extent and impact are limited but control measures are extensive.

3 Widespread or having adverse impacts.

4 Widespread and having adverse impacts.

5 Very widespread and having severe adverse impact.

Source: Montreal First Approximation Report (1997).

including tree age, changes to soil as a result of sheep and cattle grazing and increasingly intensive pasture production practices, changes to groundwater, depredation by insect attacks (such as pasture scarabs), attack by pathogens, and drought. *Phytophthora* and *Armillaria* species can cause dieback-like diseases. Other fungal pathogens, particularly native ones, are present and may affect forest trees under seasonal conditions, but do not appear to be the cause of any long-term problems. Several native and exotic insects are considered as pests in plantations and native forests managed for timber production.

In Australia, cats, dingoes, dogs, deer, donkeys, horses, goats, hares, rats, mice, possums, kangaroos and foxes are all widespread in forests and represent a serious threat to forest species and ecosystems. Possums and kangaroos can seriously damage regenerating young plantations by browsing on seedlings. Foxes are the most widespread exotic animals adversely affecting forest ecosystems. They occur across Australia and have severely limited populations of ground-dwelling mammals. Such mammals are important components of the ecosystem by helping to spread mycorrhizal fungi upon which the health of the trees depends. Feral animals may also spread disease that adversely affects trees and other plants. Pigs, for instance, are known to spread *Phytophthora cinnamomi* and may act as a feral "reservoir" of potentially devastating animal diseases such as footrot.

Similar problems exist in New Zealand, where there are also no national data available in the format required for Main Table 70. Significant damage has been done to the indigenous forest by introduced mammals, particularly the Australian brush-tailed possum (*Trichosurus vulpecula*) and a variety of deer species, but has not been quantified (see Table 5.3). This table illustrates the extent of the area of Department of Conservation land at risk from browsing mammals if no control operations were in place. Some 1.76 million hectares out of a total 7.97 million hectares of land areas administered by the Department of Conservation would be considered to be at risk of major change without control operations. Storm damage (primarily from wind) occurs infrequently in New Zealand. In the past, there were significant areas of plantation forest where blowdown was a serious risk but forest management practices have been developed to minimize the risk. The last significant storm damage was in 1988, when tropical cyclone Bola struck. This cyclone did more damage to the steep hill country cleared for grazing than to forested areas, although 5,000 ha of forest were estimated to have been damaged in 1988. About 1,000 ha of forest are thought to be primarily damaged by storms each year in New Zealand.

TABLE 5.3

The area of Department of Conservation (DoC) land in New Zealand at risk from browsing mammals

Likely impact if no control operations were in place [1]	North Island (ha)	South Island (ha)	Total DoC estate (ha)
Total forest collapse [2]	245 000	305 000	550 000
Major composition change [3]	364 000	681 000	1 045 000
Major loss of biodiversity [4]	20 000	149 000	169 000
Area at risk of major change	629 000	1 135 000	1 764 000
Minor loss of biodiversity [5]	213 000	1 100 000	1 313 000
Area at risk of major or minor change	842 000	2 235 000	3 077 000

[1] Control operations covered 1.3 million hectares in 1995/96, 70 per cent of the major risk areas.

[2] Total canopy loss, significant species loss, replacement of forest by shrubland/grassland.

[3] Significant canopy and species loss, change in forest structure from complex to simple.

[4] Significant species loss and change.

[5] Some species loss and change.

Source: The State of New Zealand's Environment 1997, Ministry of Environment, Wellington, pp. 8-45.

The figures for Canada are very large, reflecting the large forest area of the country. However, in the Canadian system, the areas affected by individual pests and diseases are reported separately, and the figures in Main Table 70 reflect the sum of all reported areas. Thus, if an area is affected by two different disorders, it will be reported twice. In addition, the figure is the sum of all areas affected in each year in the period 1986-1995. If a particular area was affected by the same problem in more than one year, it will have been counted more than once. Only areas with moderate (30 to 69 per cent) or severe (70 to 100 per cent) defoliation are reported. Figures for individual years are much lower, as shown in Table 5.4. There is substantial year-to-year variation in the incidence of particular pests (Table 5.5). In peak years, such as for the Forest Tent Caterpillar in 1991, the area of moderately and severely defoliated forest may be very large. For example, almost 19 million ha were affected in Quebec in 1991, a figure that is more than double the average of 8 million ha of damage reported from Europe from all causes (Main Table 70). To put these figures in perspective, the forest area of Quebec is 83.9 million ha, whereas the forest area of Europe is just over double, at 176.6 million ha.

Some countries, including Denmark, Iceland, Japan, Switzerland, and the United Kingdom indicated that their figures in Main Table 70 are estimates, as no formal inventory is undertaken. Germany was unable to supply any information on damage, although the National Correspondent noted that damage due to insects, wind and game was present. Similarly, no estimates were available for Greece, although the presence of disease problems in *Castanea* and *Cupressus* was noted.

Peak years of damage are reported in Main Table 71. As might be expected, there are no clear patterns in the data, although it is evident that damage by a specific agent in a particular year can be substantial.

TABLE 5.4

Selected major pests in Canada in 1994: area of moderate to severe defoliation

Province or Territory	Eastern Spruce Budworm	Jack Pine Budworm	Eastern Hemlock Looper	Forest Tent Caterpillar
	Choristoneura fumiferana	*Choristoneura pinus ssp. pinus*	*Lambdina fiscellaria ssp. Fiscellaria*	*Malacosoma disstria*
		(1000 ha)		
Newfoundland and Labrador	0.0	-	11.6	-
Nova Scotia	0.0	-	0.0	-
New Brunswick	0.0	-	0.0	392.0
Prince Edward Island	2.5	-	-	-
Quebec	2.0	0.3	0.4	3.7
Ontario	4266.7	419.3	1.1	166.1
Manitoba	48.5	0.0	-	4.5
Saskatchewan	52.3	0.0	-	23.1
Alberta	173.7	0.0	-	102.1
British Columbia	173.4[1]	-	5.2[2]	93.6
Northwest Territories	370.3	-	-	-
Yukon	-	-	-	-
Total	5089.4	419.6	18.3	785.1

[1] Includes other budworms.

[2] Includes Western Hemlock Looper (***Lambdina fiscellaria ssp. lugubrosa***).

Source: J. P. Hall, 1996, "Forest Insect and Disease Conditions in Canada 1994", Forest Insect and Disease Survey, Natural Resources Canada, Canadian Forestry Service, Ottawa.

Interpretation of Main Tables 70 and 71

The figures presented in Main Table 70 should be interpreted with care. In particular, comparisons should not be made between countries, as some countries cumulated damage during the reference period whereas others reported averages. Yet others only reported damage from a single year.

Insects and diseases

Insects and diseases represent the most important causes of damage in many forests. However, it is difficult to identify a level at which damage should be reported. In some countries (e.g. Norway), defoliation attributable to this cause was only reported if it was associated with significant growth losses. In others, it was related to mortality. In addition, some countries (e.g. Canada) assess insect damage by species, and a given area may be affected by more than one species at any one time. This means that the figures may represent double and triple counting in areas affected by more than one insect, inflating the extent of the total area defoliated. The majority of trees have some foliar damage caused by insects. This does not necessarily mean that growth losses or mortality will occur, and a tree may even recover the same season as the infestation. What is important to note is that the impacts of specific insects and diseases vary. For example, spruce budworm (*Choristoneura fumiferana* Clemens) can defoliate the same area for several years before there is mortality, but growth losses occur quickly after defoliation reaches about 30 per cent. In contrast,

TABLE 5.5

Area of moderate and severe defoliation caused by the Eastern Spruce Budworm (*Choristoneura fumiferana*) and Forest Tent Caterpillar (*Malacosoma disstria*) in Canada, 1990-1994

Province or Territory	1990	1991	1992	1993	1994
		(1000 ha)			
Eastern Spruce Budworm					
Newfoundland and Labrador	2.2	2.3	1.9	0.0	0.0
Nova Scotia	0.0	0.0	0.0	0.0	0.0
New Brunswick	237.0	266.0	84.3	0.0	0.0
Prince Edward Island	0.1	0.1	35.0	33.8	2.5
Quebec	871.8	290.0	20.7	0.4	2.0
Ontario	6 783.0	9 066.0	9595.8	8 991.2	266.7
Manitoba	19.0	30.0	26.3	13.8	48.5
Saskatchewan	18.7	16.0	87.0	22.6	52.3
Alberta	109.1	141.0	34.2	46.5	173.7
British Columbia	398.1	245.0	139.0	170.0	173.4
Northwest Territories	113.6	130.0	80.0	53.6	370.3
Total	**8 552.6**	**10 186.4**	**10 104.2**	**9 331.9**	**5 089.4**
Forest Tent Caterpillar					
New Brunswick	0	2.9	77.5	196.0	392.0
Quebec	92.0	50.0	37.0	39.9	3.7
Ontario	9 486.0	18 870.0	16 051.4	656.3	166.1
Manitoba	15.2	58.1	51.2	3.6	4.5
Saskatchewan	260.9	-	0.0	375.8	23.1
Alberta	609.2	129.9	0.0	19.0	102.1
British Columbia	206.0	131.0	47.3	86.0	93.6
Total	**10 669.3**	**19 241.9**	**16 264.4**	**1 376.6**	**785.1**

Source: J. P. Hall, 1996, "Forest Insect and Disease Conditions in Canada 1994", Forest Insect and Disease Survey, Natural Resources Canada, Canadian Forestry Service, Ottawa.

hemlock looper (*Lambdina fiscellaria* Guen.) defoliates quickly and can easily kill trees in one or two years, whereas forest tent caterpillar (*Malacosoma disstria* Hubner) defoliates extensive areas, causing growth losses but seldom causing mortality.

The data presented in Main Table 71 provide an indication of the peak amount of damage by a specific problem in the last ten-year reference period. In absolute terms, Canada had the largest area damaged by insects in any one year (41,900,000 ha. in 1992), but this may reflect the Canadian system of assessment, with some areas being counted more than once if they have two or more insect pests present. Relative to the national forest area, the greatest amounts of damage were reported in the Republic of Moldova (19.9 per cent of the forest area damaged by insects in 1990, Portugal (14.4 per cent in 1992), Albania (14.6 per cent in 1994) and Hungary (12.4 per cent in 1996).

Reporting of insect and disease damage is not done systematically in most countries. Indeed, the sporadic nature of the damage in part precludes such assessments. The extent and accuracy of the reporting is very much dependent on the density of forest managers and pest managers in different parts of the world, and reporting of such problems from privately owned forests may also be restricted. Consequently, the figures reported here are likely to under-represent the full extent of damage in the temperate and boreal region.

Wildlife and grazing

Many countries reported difficulties in the assessment of damage caused by wildlife and grazing. In most cases, the damage is primarily to regeneration, with selective browsing by ungulates being particularly important. However, in Australia and New Zealand, there is significant damage to mature trees caused by arboreal mammals. Other countries also have such damage, but the amounts reported were generally very low. In some cases, the damage is

associated with introduced species, such as the grey squirrel in the UK and the brush-tailed possum in New Zealand. Of those countries that made an assessment, damage by wildlife and grazing was generally less than that caused by insects and disease. However, exceptions to this occurred, and grazing/browsing damage was more important than insects and disease in a third of the countries reporting data (Austria, Belgium, Bulgaria, Denmark, Iceland, Japan, Liechtenstein, Norway, Poland, Romania and the United Kingdom).

Fire

The figures presented for fire in Main Tables 70 and 71 bear no relation to those presented in Main Tables 72-75. The information in the latter appears to be more reliable, and is discussed below.

Local pollution sources

Very few countries reported damage from local pollution sources. This is inconsistent with other published material, and the extent of damage by air pollution is much greater than reported here. For example, no damage was reported from the Russian Federation, yet official reports, including those of the UN/ECE, indicate that the extent of damage is substantial. There is, however, uncertainty over what constitutes a local source as this is scale-dependent. For example, should the photo-oxidant damage in the San Bernardino Mountains of California be classed as a local or regional problem? As for other forms of damage, there is also difficulty in determining for how long an area should be considered as damaged. Should the area around Sudbury, Ontario, still be considered as damaged even though trees are now being successfully established throughout most of the area?

The greatest levels of damage were reported in south-eastern Europe, with 11,900 ha in Albania, 7,000 ha in Austria, 18,000 ha in the Czech Republic, 66,900 ha in Romania and 64,900 ha in Yugoslavia. A further 12,000 ha of damage was reported from the USA. In relation to the forest area, Liechtenstein had the highest proportion of forest damaged by local pollution sources (4.05 per cent), followed by Yugoslavia (1.86 per cent), Albania (1.15 per cent), Romania (1 per cent) and the Czech Republic (0.68 per cent). In all other countries reporting this form of damage, the area affected was less than 0.5 per cent. The data reported in Main Table 70 do not suggest that air pollution from local sources is a serious problem, except in a few cases. However, while acute damage, involving visible symptoms, can be relatively easily diagnosed, chronic damage, involving invisible symptoms, may be much more difficult to recognize, and may only be apparent through the increased susceptibility of trees to other stresses (e.g. insect attack).

Storms, wind, snow or other identifiable abiotic factors

Damage by storms and other abiotic processes is highly episodic. Much research has gone into making plantations less susceptible to windthrow and some of this is now being translated into management activities.

Damage from unidentified causes

The extent to which the causes of damage can be identified in the field is highly dependent on the skills of the observer. In the surveys of crown condition coordinated by ICP Forests, assessments are usually made in July and August (i.e. mid- to late summer), when the causes of any damage may not be immediately apparent. There are clear differences to the way that this is reported. For example, in Switzerland, defoliation is only assigned to a specific cause if the observer is certain. In some other countries, an “educated guess” is made, based on the observers’ experience. Very few countries employ trained pathologists to look at the causes of damage in their inventories, and the figures should be interpreted with this in mind.

Forest fires (Main Tables 72-75)

The aim of these Tables is to provide information about the extent of fire damage and the average fire size, as well as about trends over time. The indicators used for forest fires (Main Tables 72-75) are:

- Total number of fires on forest and other wooded land for each year in the period 1986-1997
- Total area burned
- Area of forest burned
- Area of other wooded land burned

As forest fires are defined as fires which break out or spread on forest and other wooded land or which break out on other land and spread to forest and other wooded land, the total area burned is larger than the area of forest burned, as it includes “other land” affected by the forest fires.

Of the data collected on forest condition, the forest fire information is perhaps the most reliable. However, such data are of limited value when assessing the severity or distribution of fires within countries.

An analysis of wildland fire has recently been made in Canada (Canadian Forest Service 1997). On average, there are 9,500 fires each year, burning on average 3 million hectares. The 1994-1995 fire season was an exceptional one, and 12.75 million ha were burned. Of the area burned, on average 736,000 ha consist of commercial forest, representing an annual loss of about 70 million m^3 of wood with a value of about Canadian $ 1 billion. Fire policies in Canada vary markedly between Provinces. Although about 93 per cent of the fires are suppressed as quickly as possible, these only account for 36 per cent of the total area burned. The remaining 7 per cent of fires are not considered to represent significant threats to life, property or resources and therefore receive a modified response. Partly as a result, they tend to be much bigger, and they account for 63 per cent of the total area burned. Only 1.4 per cent of the fires in Canada exceed 1,000 ha in size, but these fires account for 93 per cent of the total area burned. The importance in Canada of a few very large fires is clear. However, in interpreting these figures, it is important to remember that large-scale fires are a normal part of the ecological processes operating in boreal forests. Some types of forest actually need to burn if they are to regenerate, and this is being increasingly incorporated into management policies.

There is a very high incidence of forest fires in the Russian Federation (Federal Forest Service of Russia, 1997). Between 1986 and 1996, there were between 12,000 and 30,000 wildfires annually. The amount of forest burned annually varied from 360,000 ha to 1,860,000 ha, and these figures would be considerably higher if OWL were included in the statistics. The numbers of fires each year has been increasing in the Russian Federation. In Canada, there has been a recent decrease in the annual fire frequency, although the long-term trend is for an increase in fire frequency. There are also substantial differences in the causes of fires between Canada and the Russian Federation. In the latter, 88 per cent of fires are caused by humans, and this figure rises to almost 100 per cent if only the European-Ural part of the country is considered. In contrast, 58 per cent of Canadian forest fires are started by man, with the remaining 42 per cent being started by lightning.

In the USA, fires are also very important. The use of prescribed burning and mechanical fuel treatments (both excluded from this assessment) has been increasing, from 123,290 ha in 1985 to 676,968 ha in 1998. However, wildfires, including fires on non-forest land, have remained at a fairly constant level since 1987 (with exceptional fire years in 1994 and 1996). The wildfire series that extends from 1918 to 1997 is of considerable interest and is shown in Figure 5.1. During this period, the US Forest Service developed an effective fire suppression policy, although this was then changed in the 1980s with the development of prescribed burning as a means of reducing the incidence of catastrophic fires.

In Europe, the numbers of fires and their extent is very variable, depending on the climate and fire control policies. The largest numbers of fires are found in southern Europe, with countries such as Greece, Italy, Portugal, Spain and Turkey being particularly affected. Between 1990 and 1997, the numbers of fires each year in Greece and Turkey remained similar, with an annual average of 1,874 fires in Greece and 1,973 fires in Turkey. Greater inter-annual variations occurred in Italy, where fire frequency was also higher (annual average of 11,470 fires). The frequency of fires in Portugal and Spain has increased between 1990 and 1997, and there is an annual average of 20,019 fires in Portugal and 17,429 fires in Spain. As with Canada, the numbers of fires alone give a poor impression of the trend in damage caused by fire. When the total areas burned are examined, a rather different picture emerges (Figure 5.2).

FIGURE 5.1

Wildfires in the USA

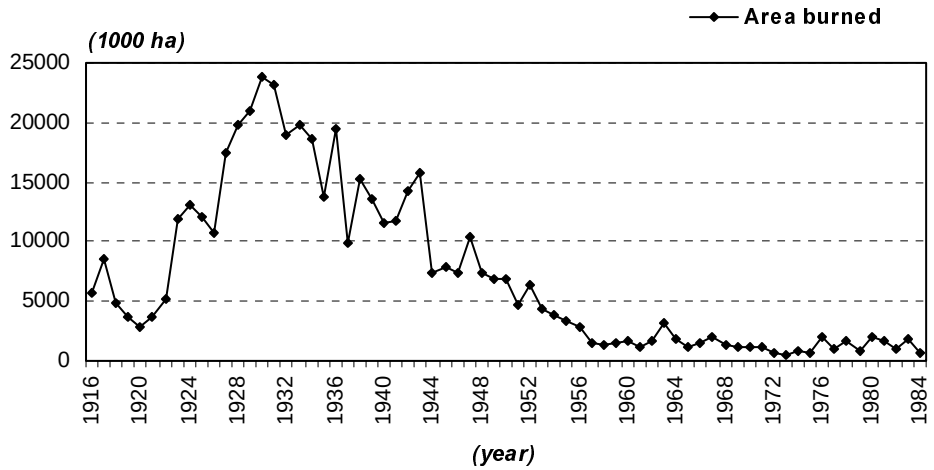


FIGURE 5.1 (*continued*)

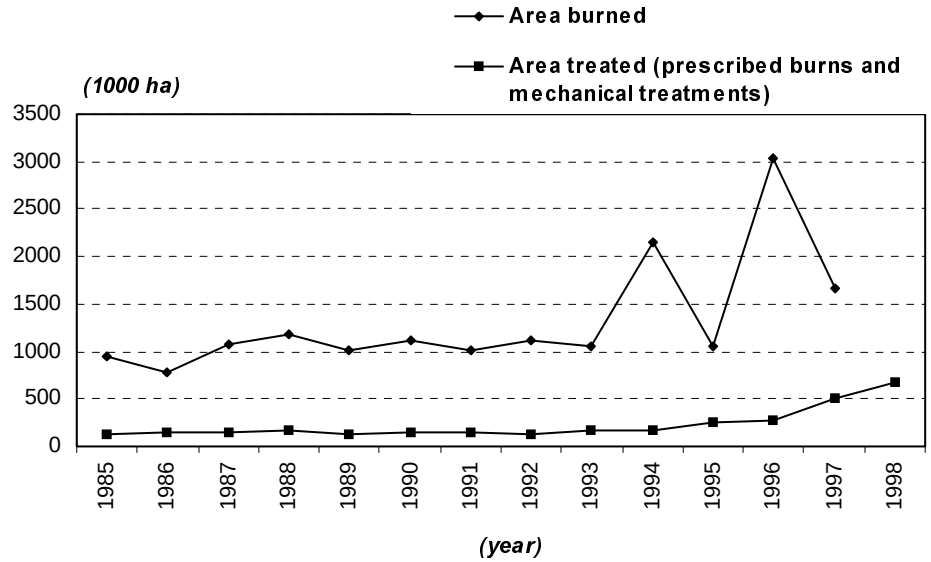
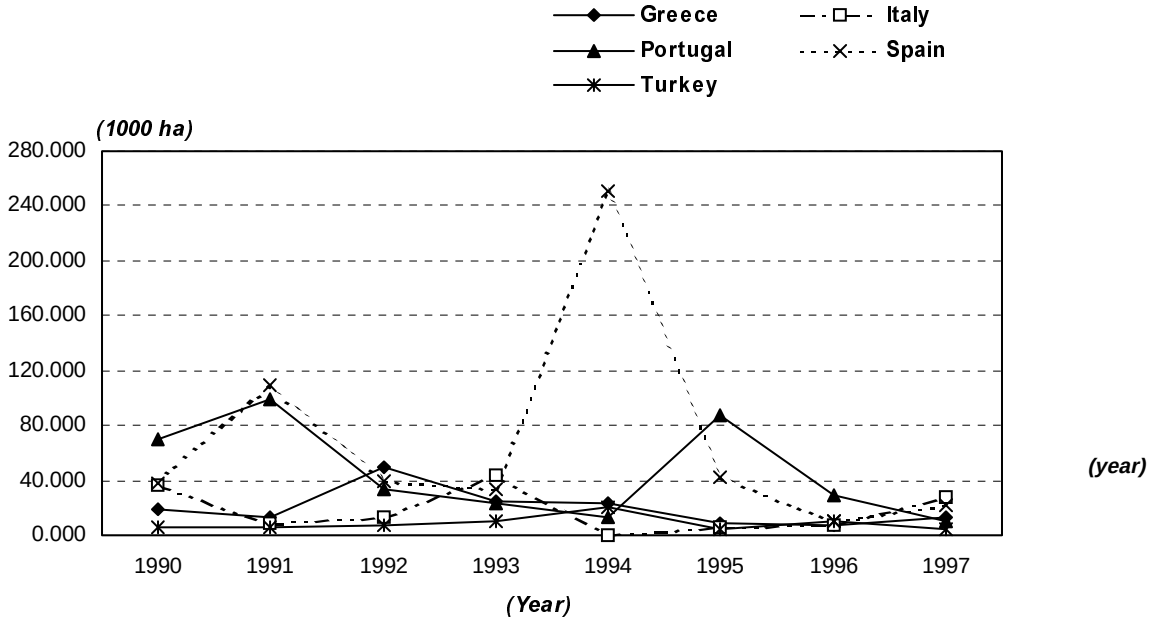


FIGURE 5.2

Area of forest burned by fires each year in southern European countries



Interpretation of Main Tables 72-75

In interpreting these tables, it is important to recognize that the role of fire in forests can be seen from a number of different perspectives. In plantation forestry, fire can be a major problem, and much effort is devoted to reducing fire hazard. When fires occur, steps are normally taken to bring the fire under control as quickly as possible and then extinguish it. In semi-natural and natural forests, the situation is less clear. In some countries, fire prevention remains a priority. In others, fire is seen as a normal ecosystem process and prescribed burning may be used as a management tool. In the USA, forests that have substantial accumulations of ground fuel as a result of fire suppression may actually be considered as unhealthy. This is because when a natural fire occurs, it may be as a destructive, stand-replacing fire. No separation was made in the data collected for Main Tables 72-75 between stand-replacing and ground-fires.

Fire is clearly a major factor influencing the condition of forests and OWL in the temperate and boreal regions. However, in some countries (e.g. the USA), there have been major changes in the ways in which fire is viewed. Rather than being a major damaging factor, it now tends to been seen as one of the normal processes operating in forests. However, years of fire suppression have substantially changed the structure of many forests, such that when fire does occur, it tends to be more damaging than it would otherwise be. The main problem is the buildup of fuel on the forest floor and below the canopy. This enables fire to reach the canopy, with subsequent damage to trees. In some areas, fuel

buildup is reduced by prescribed burning. However, it is worth noting that many structural attributes associated with the enhancement of biodiversity in forests (e.g. the presence of coarse woody debris) may actually lead to the forest being more susceptible to damaging fires.

In many areas, urban encroachment into forested land, as well as the expansion of forests into the urban periphery, has resulted in an increase in the number of reported fires. This is an issue that requires close attention, as the interaction of forest fires and residential properties results in very much higher costs than when it is only wood or other wooded land that is lost.

Defoliation (Main Tables 76-78 and Figures in Annex 5.1)

The aim of this material is to provide information on defoliation as an indicator of the extent of tree damage from one or a combination of causes, including air pollution. The indicators used are the percentages of trees of different defoliation classes for each year between 1986 and 1997, divided into equal to or less than 25 per cent and more than 25 per cent defoliation for all species, coniferous species and broadleaved species.

The use of defoliation as an indicator of forest health has been the subject of intensive debate. The definition of defoliation, as adopted by the UN/ECE International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests), is needle or leaf loss in the assessable crown as compared to a reference tree. Defoliation estimates are known to be subjective, and substantial differences exist in the values obtained by observers both within a country and between different countries. As pointed out in the original reports published by the ICP Forests, this means that the absolute values presented for different countries should not be compared.

One possibility is to compare trends over time between countries. Such a trend analysis assumes that there have been no changes in assessment methods over time. Given that the programme has been running for more than 10 years and that the assessments are based on subjective judgements, such an assumption seems questionable. Unfortunately, there is no reliable information available to indicate the consistency of the estimation methods over time. Although there is evidence of some trends in individual countries, these should be treated with great caution. The standard method of presentation is the percentage of trees with more than 25 per cent defoliation. There is no particular reason for this threshold, and it should not be seen as a threshold for health or damage. A more useful approach is to look at the overall distribution of defoliation classes, and the ways that this changes from year to year, but very few studies have attempted to do this. ICP Forests and the EU are increasingly presenting their transnational results as frequency distributions because of their greater objectivity. The frequency distributions follow all in all the same trends as the former results.

The figures in Annex 5.1 indicate that in about two thirds of the countries only small changes occurred, whereas defoliation increased in about one third of them. Defoliation decreased over the whole period of the observation in only a small number of countries (maybe three, depending on how small a decrease one wants to accept as such).

A comparison of the years 1992 and 1998 reveals that there are more plots in Europe (31.2 per cent) where mean crown condition deteriorated than plots where there was a significant improvement (15.4 per cent). Deteriorating plots are spread all over Europe, with an accumulation in the west (France) and south (mainly Italy). Plots with a significant recuperation are clustered in the so-called sub-Atlantic region, which mainly comprises Germany and Poland. In-depth evaluations show that in all other regions a slight deterioration took place during the last seven years. Mean crown condition remained on the same level only in the boreal region (mainly covering Scandinavia).

The difficulties associated with the interpretation of the data from individual countries (Main Tables 76-78 and the Figures in Annex 5.1) are illustrated by the data from France, Germany and the United Kingdom. In France the increase in defoliation is attributable to changes in assessment methods. In Germany, the apparent deterioration between 1991 and 1992 was an artifact caused by the combination of data from East and West Germany following re-unification. Similarly, the apparent improvement in the UK figures between 1992 and 1993 was a direct result of a change in assessment techniques. (Note: The Russian Federation's data are for Kaliningrad and Leningrad regions only). As only some such changes have been documented, evidence of changes in the data from an individual country should be treated with great care.

The tendency has been to look at overall defoliation data, regardless of species or environmental situation. Error estimates derived in Switzerland for the percentage of trees with 25 per cent or more defoliation indicate that the errors vary between species and between environments. In addition, for any interpretation of the data, it would be necessary to examine trends for individual species in specific environmental conditions, rather than aggregates arranged by political units.

Relationship between the TBFRA data and indicators for the sustainable management of temperate and boreal forests (the pan-European and Montreal Processes)

The maintenance of forest ecosystem health and vitality is listed as a criterion for the sustainable management of forest in both the Pan-European Process (Criterion 2) and the Montreal Process (Criterion 3). Extracts from the two international sustainable forest management initiatives relevant to the temperate and boreal zone are given below:

- Pan-European: Criterion 2. Maintenance of forest ecosystem health and vitality

  2.1 Total amount of and changes over the past 5 years in depositions of air pollutants (assessed in permanent plots)

  2.2 Changes in serious defoliation of forests using the UN/ECE and European Union defoliation classification (classes 2, 3, and 4) over the past 5 years

  2.3 Serious damage caused by biotic or abiotic agents

  a. severe damage caused by insects and diseases with a measurement of seriousness of the damage as a function of (mortality or) loss of growth
  b. annual area of burnt forest and other wooded land
  c. annual area affected by storm damage and volume harvested from these areas
  d. proportion of regeneration area seriously damaged by game and other animals or by grazing

  2.4 Changes in nutrient balance and acidity over the past 10 years; level of saturation of exchange capacity on the plots of the European network or of an equivalent national network

- Montreal: Criterion 3. Maintenance of forest ecosystem health and vitality

  a. area and percent of forest type affected by processes or agents beyond the range of historic variation, e.g. by insects, disease, exotic competition, fire, storm, land clearance, permanent flooding, salinization, and domestic animals
  b. area of forest subjected to levels of specific pollutants (e.g. sulphates, nitrate, ozone) or ultra violet B that may cause negative impacts on the forest ecosystem

Although both Processes refer to forest health and vitality, as indicated at the beginning of this chapter, the terminology associated with these concepts is complex and rather confusing. The Montreal and Pan-European agreements refer to “forest ecosystem health and vitality”, but these mean different things to different people. For example, in Canada, forest health has in the past been interpreted as the incidence of pests and diseases in forests, primarily because these impact on the allowable annual harvest. More recently, this has changed to an approach in which a healthy forest is seen as one that maintains biodiversity, resiliency, wildlife habitat, aesthetic appeal and resource sustainability. In the USA, forest health is often interpreted as its ability to fulfil its expected functions. In Europe, different approaches also exist, with forest health being equated partly with the crown condition of individual trees and partly with a number of other parameters such as the incidence of pests and diseases, soil chemistry, and nutritional status of the trees. As a result, it is impossible to provide a definition of forest health that is both universally applicable and meaningful, even within a single country, and the health of any particular forest needs to be determined in relation to the expected functions of that forest (Society of American Foresters 1997). A forest can only be considered as healthy if it meets the expectations of all its stakeholders. However, this can only be possible if individual stakeholders recognize that not all forests can satisfy all requirements. For example, the functions of a plantation of fast-growing *Pinus radiata* in New Zealand are very different to those of a forest of undisturbed, native vegetation maintained as a nature reserve. The ways in which the health of these two forest types are assessed will also differ, with different criteria and indicators being applicable.

The approach adopted in both the Helsinki and Montreal Processes is to look at both stresses to the forest and the forest responses. However, the manner in which this is done is inconsistent. For example, the area affected by particular pollutants is assessed, consistent with the use of the critical loads and levels concepts to identify areas at risk from pollution. The critical loads approach is widely accepted in Europe, partly accepted in Canada and generally not accepted in the United States, Japan, Australia and New Zealand. In contrast, storm damage assessment is not based on the magnitude-frequency relations on storms but on the extent of damage.

The TBFRA data represent an important contribution on indicators on forest ecosystem health and vitality in a context of sustainable forest management. However, there is a considerable amount of other information that needs to be collected, particularly in relation to the nature and distribution of stresses affecting forests.

Evaluation of forest condition from data submitted to the TBFRA-2000

It is apparent that there are a number of gaps in the material supplied to the TBFRA-2000 in relation to the internationally accepted indicators for forest ecosystem health and vitality. Specifically, there is little or no information on the following:

- air pollution, including changes in UV-B levels
- forest soil acidity, exchange capacity or nutritional status
- tree mortality
- damage specifically to regeneration
- the seriousness of any of the damage reported
- the relationship of any damage reported to the historical range of variation

Information on these is to a certain extent available, and future assessments should make use of these additional data, particularly those collected by the UN/ECE.

However, depending on how the term forest condition is interpreted, many other tables within the enquiry (Appendix II) could be relevant. In particular, Enquiry *Table 2* (Forest and other wooded land according to "naturalness"), *Enquiry Table 3* (Forest and other wooded land according to availability for wood supply), *Enquiry Table 7* (Changes in area of forest and other wooded land over time by main categories), *Enquiry Table 8* (Protection status), *Enquiry Table 10* (Forest-occurring species at risk or endangered), *Enquiry Table 11* (Regeneration and extension of forest), *Enquiry Table 12* (Species diversity and origin of planting material used in the forest), *Enquiry Table 15* (Increment), *Enquiry Table 16* (Fellings and removal), and *Enquiry Table 17* (Change in growing stock on forest available for wood supply), all contain information related to the condition of the forests in a particular country.

Main Tables 70-75 indicate that disturbances are widespread in temperate and boreal forests. How do these relate to forest health or forest condition and to what extent do they stress the forest ecosystem? Disturbances in forests can be viewed as events that significantly alter the pattern of variation in the structure or function of a system. As such, disturbances include both destructive events and environmental fluctuations, although in Main Tables 70-78 it is information about the destructive events that has been emphasized. Disturbance is being increasingly recognized as a key biological process in forests. All natural forests are subject to disturbance, and attempts by man to prevent these (e.g. through fire suppression policies) are now seen as in some cases having adverse effects on the health or condition of the forest ecosystem. Regular disturbances, such as low-intensity fires in pine forest ecosystems should be considered as a stress rather than a disturbance, whereas a fire suppression policy should be viewed as the disturbance to the forest ecosystem. This argument can also be extended to drought: the regular, seasonal droughts that occur in some climates should be seen as a stress, whereas a drought occurring in an ecosystem that has no adaptation to such a phenomenon should be seen as a disturbance. Consequently, a disturbance is seen as a normal, but infrequent, event within a system.

The problems of relating the incidence of disturbances to forest condition can be illustrated by the case of New Zealand, reported in "*The State of New Zealand's Environment 1997*" (Ministry for the Environment, Wellington). New Zealand has a land area of about 27 million ha, 33 per cent of which is covered by forests or other wooded land. The forest is divided into "undisturbed" (1,599,000 ha), semi-natural (4,799,000 ha) and plantations (1,542,000 ha). The plantations predominantly consist of *Pinus radiata* (90 per cent of the area), an exotic conifer from California, and the primary objective is wood production. With a rotation of 25-30 years, the plantations are considered to be highly productive. Pests and diseases are controlled, and nutrient deficiencies are remedied by fertilization. Consequently, most forest managers would consider the plantations to be healthy and in good condition. In contrast, the primary objective of the majority of "undisturbed" forests and much semi-natural native forest is conservation. These cannot be considered at present to be healthy. Substantial areas of forest are currently at risk, with 550,000 ha of Department of Conservation forest being considered to be at risk of total collapse (total canopy loss, significant species loss, replacement of forest by shrubland/grassland) in the absence of control operations for browsing mammals. A further 1.2 million ha would be at risk, in the absence of control measures, of either a major change in species composition or a major loss of biodiversity. Even with the controls that are in place, 800 species of 'higher' organism are listed as threatened, although these include non-forest species. Of the endemic species of land birds known to have occurred in New Zealand, 46 per cent are now extinct, and 74 per cent of the remaining species are threatened with extinction. Past habitat loss and the pervasiveness of introduced species mean that the majority of New Zealand's native forests must be considered as being in poor condition, or unhealthy.

Summary and conclusions

1. ***Causes of damage.*** The most important reported causes of damage to forests in the boreal and temperate zones are insects and fire. For example, up to 205 million ha of forest were reported to have been damaged by insects and disease in Canada in the period 1986-1995, and almost 29 million ha of Canadian forests were damaged by fire in the same period. Damage caused by grazing and browsing was also widely reported and, in a number of European

countries (e.g. Austria, Belgium, Bulgaria, Denmark, Iceland and Poland), the area of forest and OWL with such damage was greater than from any other identified cause.

2. ***Fire.*** This is the major cause of forest damage, although its significance is not directly proportional to either the number of fires or their spatial extent. Forest fires are very important in southern Europe, where a high population density and small-scale forest ownership combine to increase the likely significance of a particular fire.

3. ***Defoliation.*** The reported figures indicate that defoliation is much more widespread in Europe than in North America. In the USA, the proportions of trees with more than 25 per cent defoliation is generally less than 1 per cent. In Canada, it is generally less than 10 per cent, whereas in Europe in recent years, it has been more than 20 per cent. This almost certainly reflects differences in standards between Europe and North America. The European figures reflect a trend for increasing defoliation. The proportion of trees assessed every year between 1988 and 1997 with more than 25 per cent defoliation has increased from 13.2 per cent in 1988 to 23.1 per cent in 1997. No information is available on the cause of this reported increase in defoliation.

4. ***Progress in assessment of forest condition.*** The material presented in Main Tables 70 to 78 represents a step forward in the assessment of forest condition at an international scale. It illustrates the diversity of methods used in individual countries to address this important issue, and highlight the gaps in our current understanding of the most important agents damaging forests.

5. ***Alternative data sources.*** Future assessments should pay much greater attention to existing alternative data sources. In particular, efforts should be made to resolve any apparent discrepancies between official published figures and those used by the TBFRA. In addition, full use should be made of all existing TBFRA data: the restriction of analyses to the material presented in the main tables means that long-term trends, spanning two or more assessment periods, cannot be utilized.

6. ***Condition of forests and their functions.*** The condition of a forest is best assessed in relation to its most important functions, and these vary from forest to forest. Consequently, any statement about the health of forests in a country must take into account the functions of those forests. Currently, no methods exist that can be used to do this.

7. ***Evolving issues.*** Many of the difficulties associated with the identification of the condition of forests in the temperate and boreal zones stem from recent changes in the ways that forests are seen. Issues such as biodiversity, water quality and carbon sequestration have all become much more important than in previous years. Forest inventory methods have in earlier periods concentrated primarily on the assessment of wood resources. This is reflected in the data that have been collected for the TBFRA-2000.

8. ***Research.*** The Assessment indicates a need for research into the following areas:

   (i) Greater attention needs to be given to the assessment of indicators of the health/condition/state of forests, keeping in mind the efforts already made and successes achieved;

   (ii) The identification of appropriate indicators and ways to assess these worldwide and the collection of appropriate data will be a major challenge for countries and for forest scientists in the coming years;

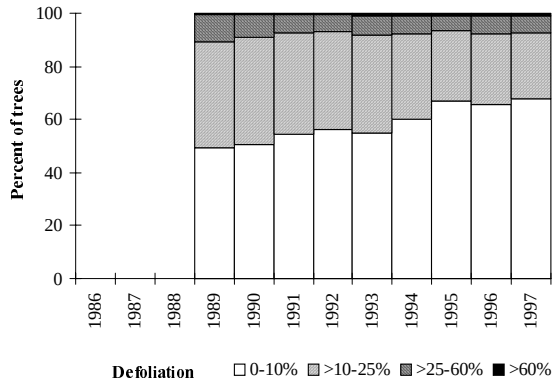
   (iii) The standardization of these methods between countries, thereby enabling comparisons to be made, will also require a major effort on the part of inventory specialists.

9. ***Objectives of data collection:*** In future assessments, it would be useful to examine the objectives of the data collection. It is possible to collect a wide array of data on forest condition, but this could swamp the data collection process. Consequently, data collection needs to be related to very precise questions, established before the design of the enquiry.

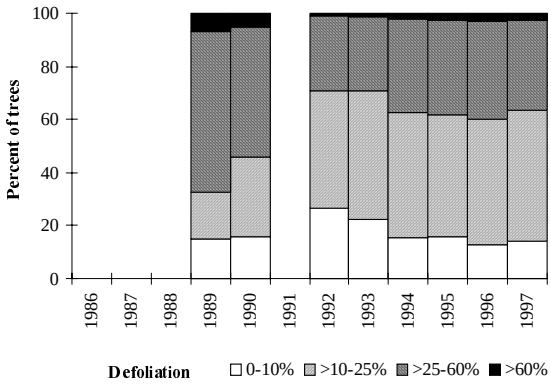
ANNEX 5.1

Changes in defoliation of all species (1986-1997)

Austria



Belarus



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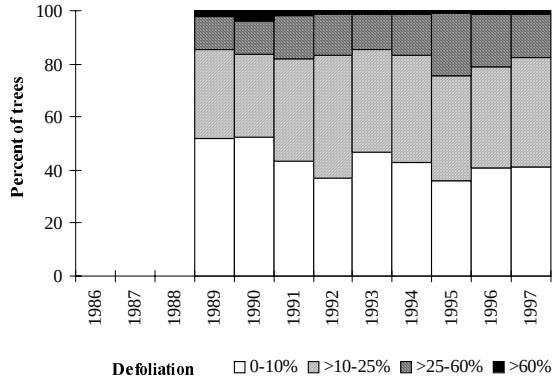
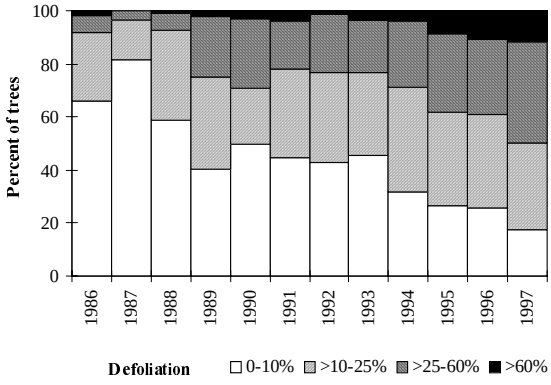
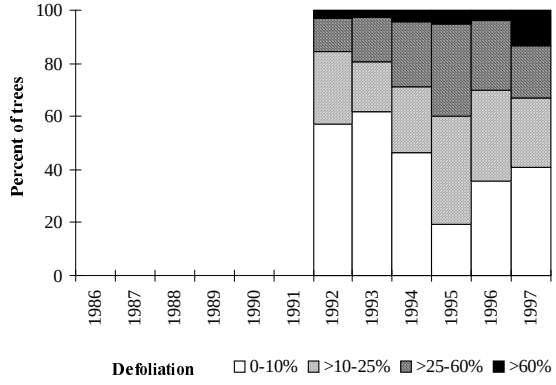


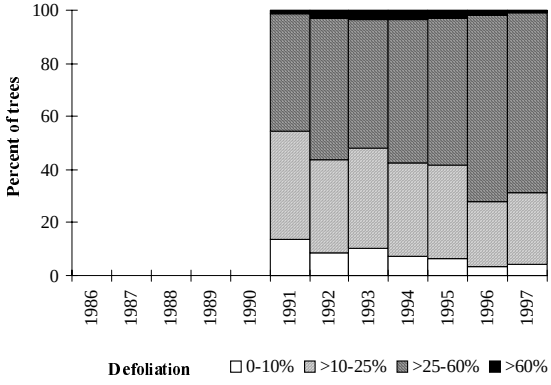
Bulgaria



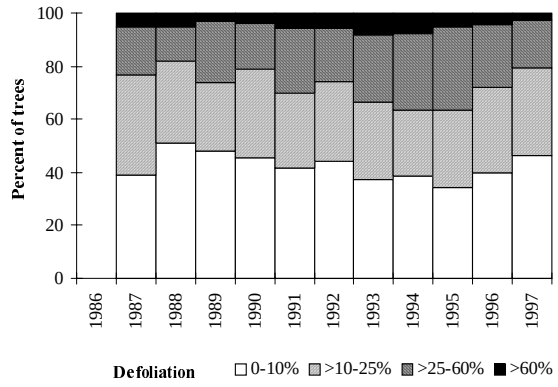
Croatia



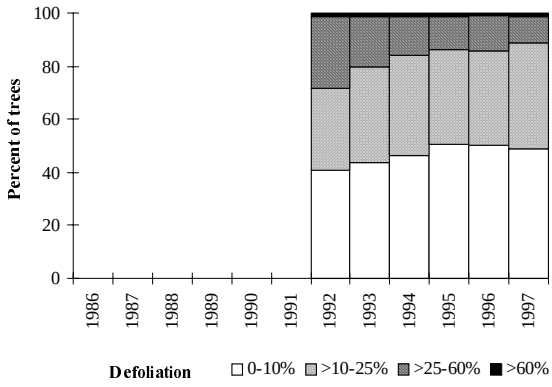
Czech Republic



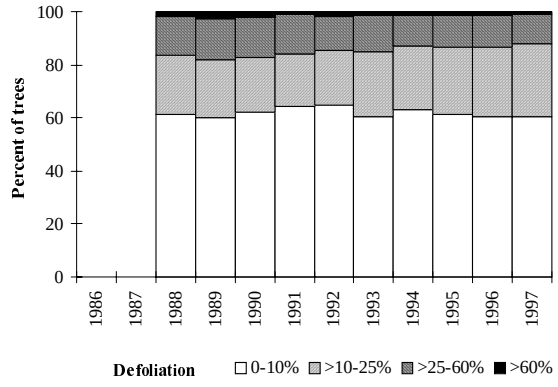
Denmark



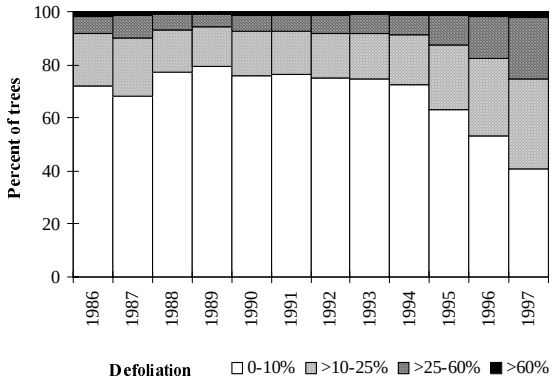
Estonia



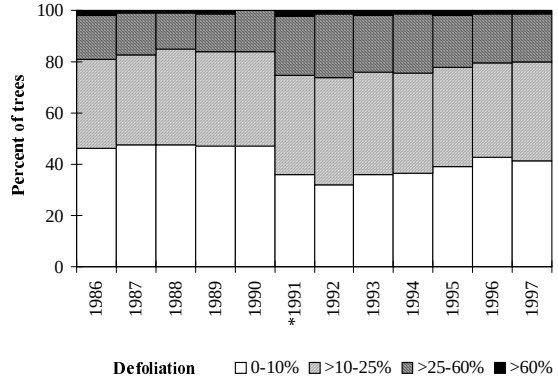
Finland



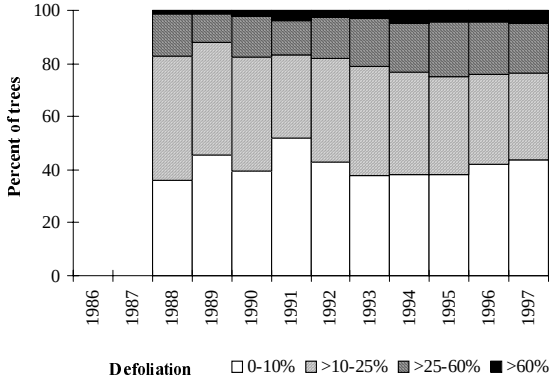
France



Germany

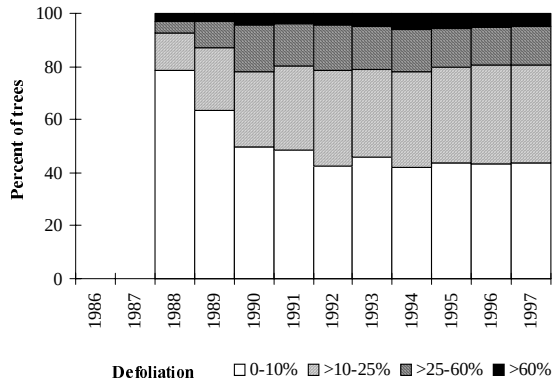


Greece

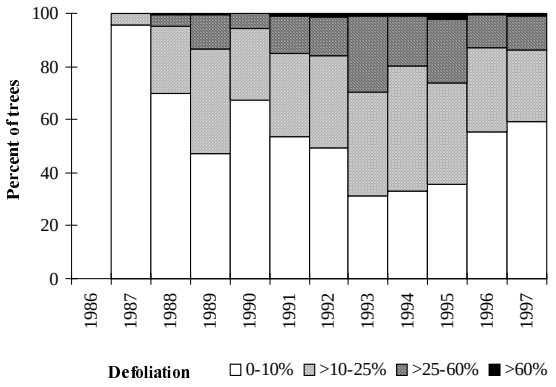


* since 1991 with former GDR

Hungary

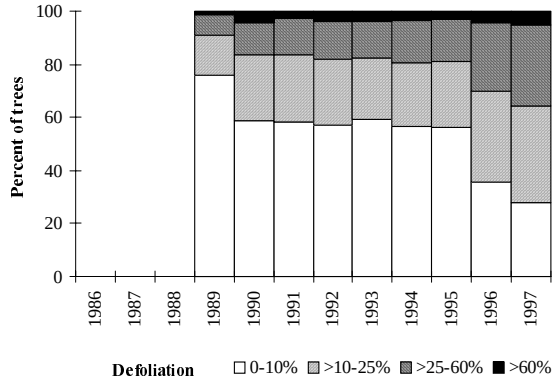


Ireland

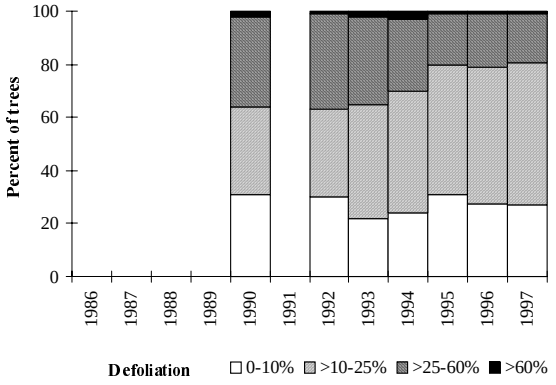


* only conifers assessed

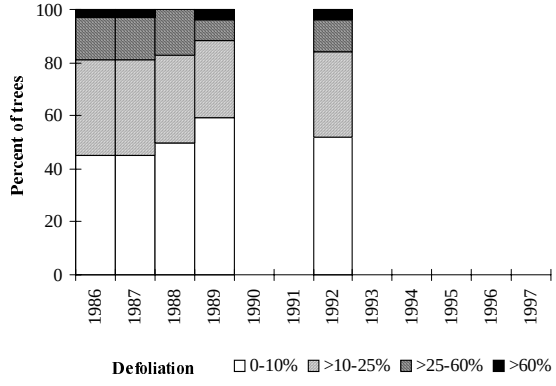
Italy



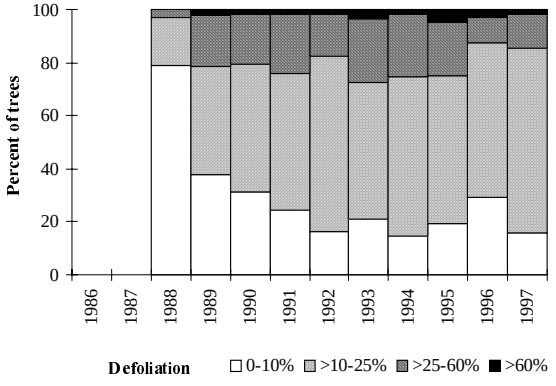
Latvia



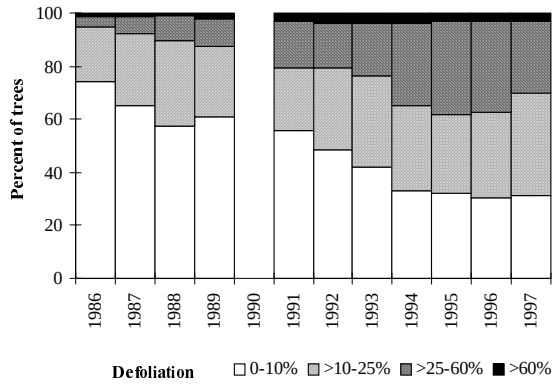
Liechtenstein



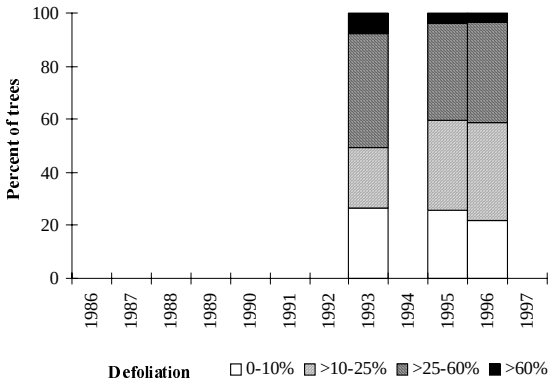
Lithuania



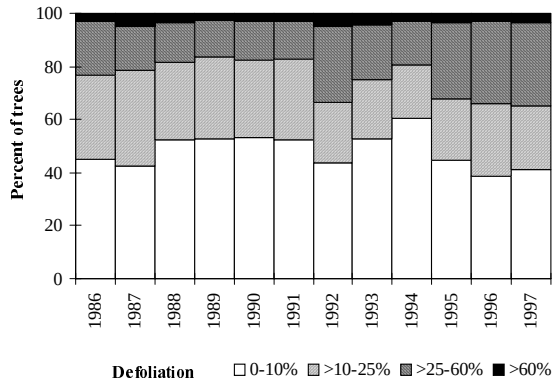
Luxembourg



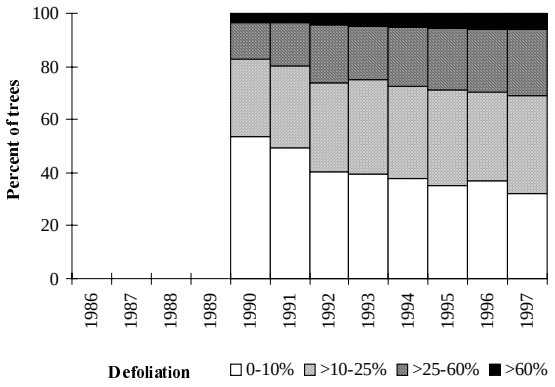
Republic of Moldova



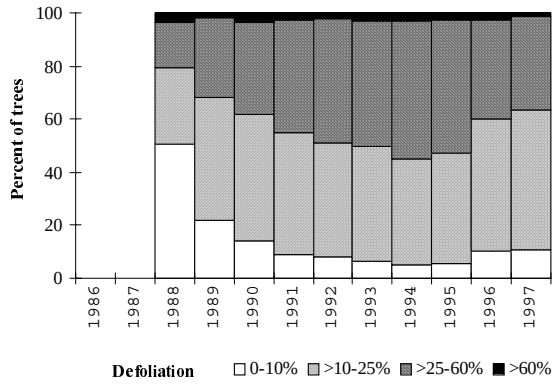
Netherlands



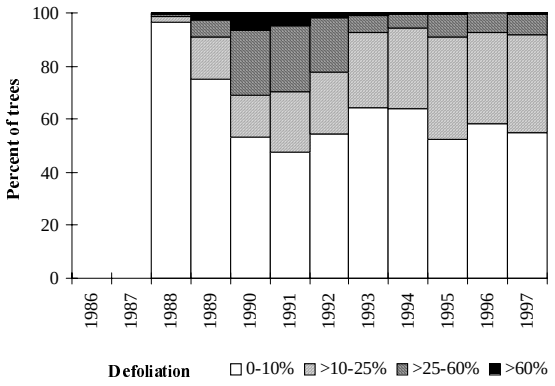
Norway



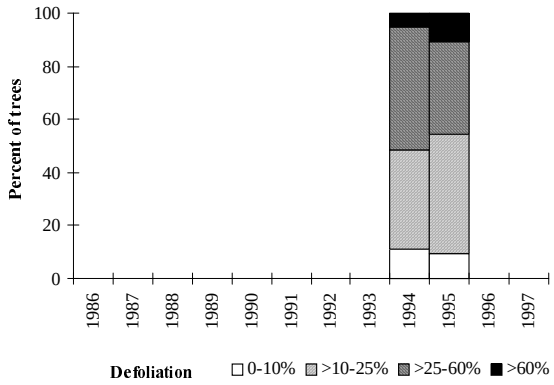
Poland



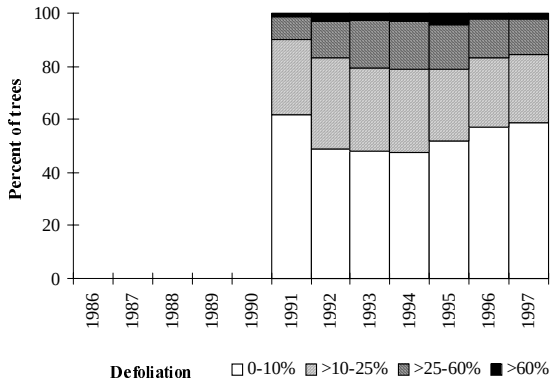
Portugal



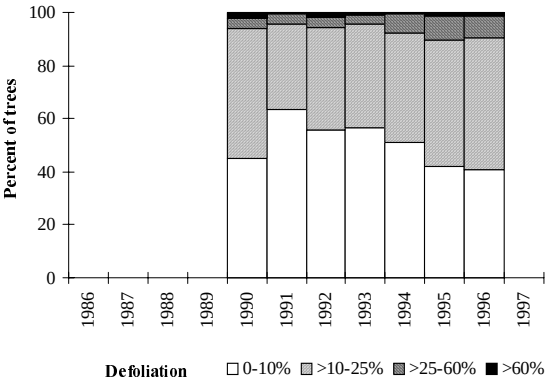
Romania



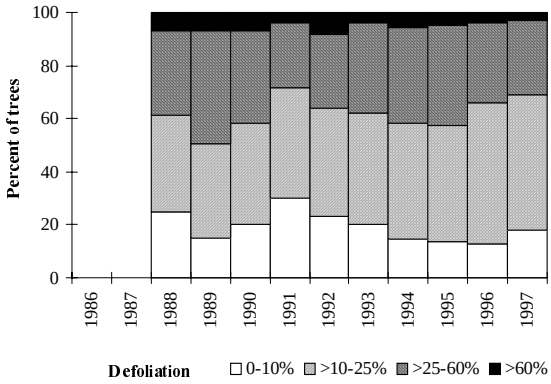
Russian Federation (Kaliningrad Region)



Russian Federation (Leningrad Region)

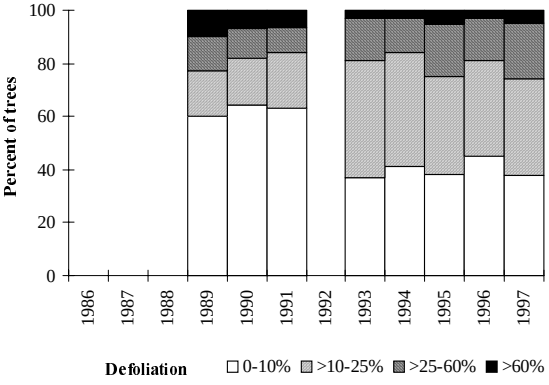


Slovak Republic

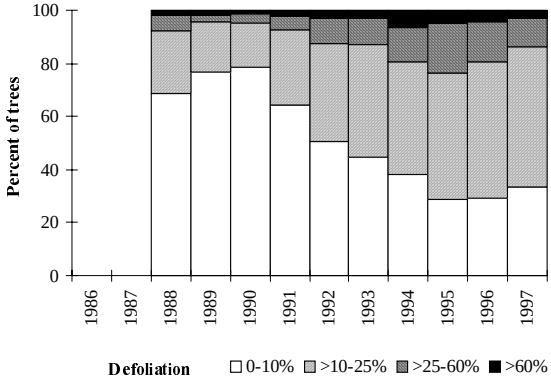


* only conifers assessed

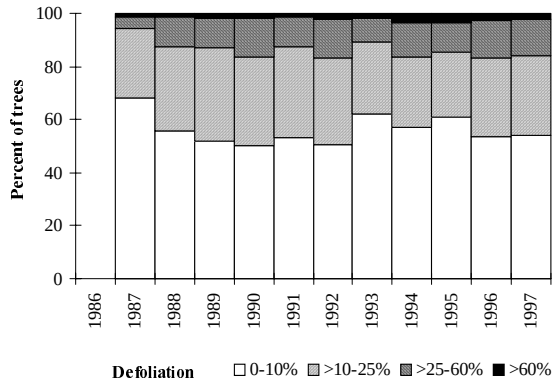
Slovenia



Spain

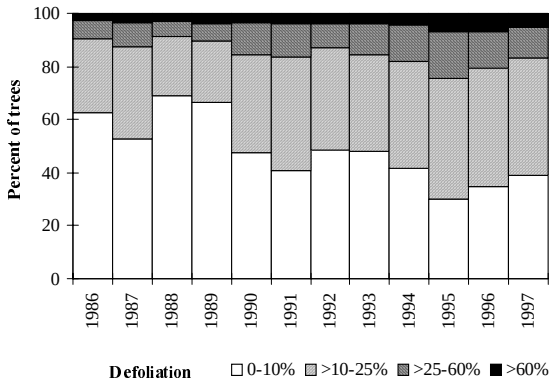


Sweden

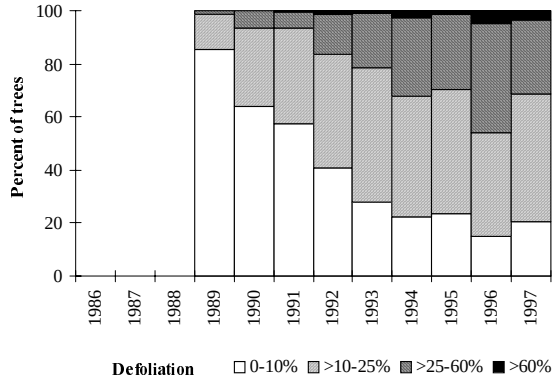


* only conifers assessed

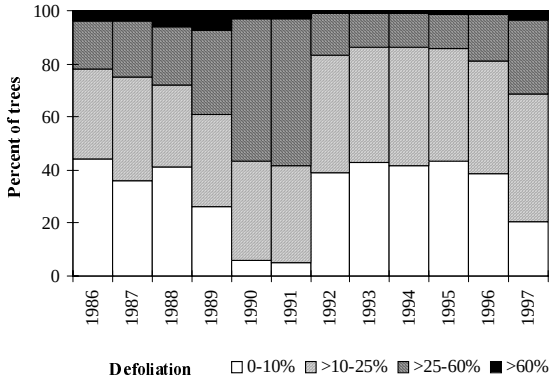
Switzerland



Ukraine



United Kingdom



Yugoslavia

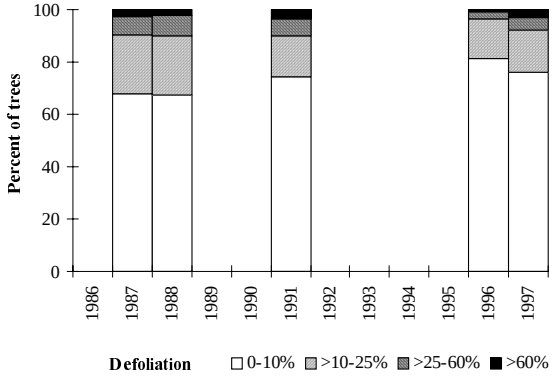


TABLE 70

Area of damage to forest and other wooded land

Country	Reference Period	Total area with damage by known causes	Primarily damaged by					Total area with damage by unidentified causes
			Insects and disease	Wildlife and grazing	Fire	Known local pollution sources	Storm, wind, snow or other identifiable abiotic factors	
		(1000 ha)						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	1988-94	718.2	691.0	12.7	2.6	11.9	0.0	0.0
Austria		163.0	68.0	72.0	0.0	7.0	16.0	1.0
Belgium ©	1988-97	90.0	42.9	45.8	1.3			0.0
Bosnia and Herzegovina								
Bulgaria		63.0	18.7	23.5	7.0		13.8	
Croatia	1986-96	16.0	15.0	1.0	11.0			
Cyprus	1987-96	0.3		0.2	0.1	0.0	0.0	0.0
Czech Republic ©	1988-97	451.0	355.0	30.0	4.0	18.0	44.0	13.0
Denmark ©	1990-95	3.7	0.0	2.5	0.2	0.0	1.0	
Estonia	1996	5.1	3.5	0.7	0.5		0.4	
Finland ©	1986-96	3,300.0	1,600.0	300.0	0.0	0.0	1,400.0	1,700.0
France ©	1983-93	235.0	150.0	45.0	30.7	0.0	9.3	0.0
Germany ©	1987-96							
Greece ©					37.2			
Hungary ©	1996	231.5	169.3	24.8	0.7		36.7	14.2
Iceland ©		10.0	3.0	5.0	0.0	0.0	2.0	
Ireland	1996	2.0	0.0	0.0	1.0	0.0	1.0	0.0
Israel ©	1997		5.0		0.6			
Italy	1995	129.6	66.0	6.0	40.0	0.1	17.5	6.5
Latvia ©	1996	1.6	0.9	0.2	0.3	0.0	0.2	0.0
Liechtenstein		0.7	0.1	0.4		0.3		
Lithuania ©	1992-96	220.6	101.0	40.5	3.1	0.0	76.0	0.0
Luxembourg			0.0	0.0	0.0	0.0	0.0	0.0
Malta ©								
Netherlands ©	1990-95	0.3	0.0	0.0	0.3	0.0	0.0	0.0
Norway ©	1994-96	1,164.0	112.0	218.0	0.0	2.0	832.0	0.0
Poland ©	1992-96		309.0	389.0	13.0		196.0	
Portugal ©	1995	603.0	391.0	23.0	88.0	0.0	101.0	38.0
Romania ©	1993-97	67.6	0.0	0.7	0.0	66.9		
Slovakia ©		124.3	86.0	5.7	2.1	4.4	26.1	3.2
Slovenia ©	1996	37.2	0.9	0.9	0.3	0.1	35.0	0.4
Spain ©	1990		500.0		100.0		1,000.0	1,000.0
Sweden ©	1992-96			551.0		0.0		
Switzerland ©		1.0	0.7		0.2	0.1		230.0
The FYR of Macedonia								
Turkey	1992-96	22.0	4.0		13.0		5.0	
United Kingdom ©	1995	240.0	30.0	67.0	8.0	0.0	135.0	10.0
Yugoslavia ©		78.2	8.8	0.2	3.5	64.9	0.8	0.0
Armenia	1983-96	4.8	2.0	0.5	0.3	1.0	1.0	1.0
Azerbaijan ©		0.1	0.1	0.0	0.0	0.0	0.0	0.0
Belarus ©		8.9	0.4	0.1	2.6	0.0	5.8	0.6
Georgia								
Kazakhstan	1997	226.9	0.0	0.0	226.9	0.0	0.0	0.0
Kyrgyzstan								
Republic of Moldova		61.2	61.2		0.0			
Russian Federation ©	1996	4,759.0	3,566.5	4.7	1,161.0	0.0	25.7	0.9
Tajikistan	1995							
Turkmenistan								
Ukraine	1992-96	100.9	49.0	0.4	33.1		18.3	0.4
Uzbekistan	1995							
Canada ©	1986-95		205,000.0		28,764.0			
United States of America ©		25,298.0	23,462.0	0.0	1,620.0	12.0	204.0	
Australia ©								
Japan ©	1991-95	67.0	3.0	8.3	2.6	0.0	52.0	0.0
New Zealand ©	1993-97	4.0			3.0	0.0	1.0	

© See notes and comments in Chapter V.

TABLE 71

The heaviest annual damage by known causes which occurred in most recent 10-year period

Country	Primarily damaged by									
	Insects and disease		Wildlife and grazing		Fire		Know local pollution sources		Storm, wind, snow or other unidentifiable abiotic factors	
	Year	Extent of damage	Year	Extent of damage	Year	Extent of damage	Year	Extent of damage	Year	Extent of damage
		(1000 ha)		(1000 ha)		(1000 ha)		(1000 ha)		(1000 ha)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Albania ©	1994	150.0	1995	2.5	1992	1.0	1988	3.0		0.0
Austria	1992	68.0							1990	45.0
Belgium ©	1997	18.8			1996	1.0			1990	20.0
Bosnia and Herzegovina										
Bulgaria	1997	24.8	1993	26.7	1993	17.3			1995	15.9
Croatia										
Cyprus		0.0		0.0	1988	0.8		0.0		0.0
Czech Republic ©	1993	104.0	1994	11.0	1992	1.0	1996	16.0	1990	38.0
Denmark ©	1994				1995				1996	
Estonia	1994	4.1	1995	0.8	1992	1.1			1994	0.4
Finland ©										
France ©	1993	50.0			1989	75.6			1990	40.0
Germany ©										
Greece ©					1988	88.0				
Hungary ©	1994	224.7	1991	40.6	1993	5.0			1993	76.1
Iceland ©	1993	5.0	1987	10.0					1995	10.0
Ireland										
Israel ©					1995	1.6			1992	0.4
Italy	1992	237.0	1995	6.0	1993	104.0	1992	1.0	1995	17.5
Latvia ©	1996	0.9	1994	0.3	1992	2.0		0.0	1993	0.6
Liechtenstein										
Lithuania ©	1995	78.0	1990	28.6	1992	1.0	1988	0.2	1993	73.0
Luxembourg									1990	5.0
Malta ©										
Netherlands ©		0.0		0.0	1995	0.1		0.0	1987	0.2
Norway ©									1992	25.0
Poland ©	1994	775.0	1990	389.0	1992	44.0			1996	196.0
Portugal ©	1992	498.0	1992	60.0	1991	125.0		0.0	1995	101.0
Romania ©		0.0		0.0		0.0		0.0	1995	12.4
Slovakia ©	1993	24.0	1990	1.9	1993	1.2	1995	1.1	1996	6.6
Slovenia ©	1993	6.3	1996	45.0	1993	1.6	1987	1.1	1996	35.0
Spain ©		500.0			1994	400.0			1995	5,000.0
Sweden ©	1997								1995	
Switzerland ©	1993	1.0			1990	1.1			1990	5.0
The FYR of Macedonia										
Turkey	1996	4.0			1994	21.0			1996	5.0
United Kingdom ©	1993	0.9			1994	1.0			1987	16.5
Yugoslavia ©	1997	141.5		0.0	1996	3.8		0.0	1990	42.0
Armenia	1992	1.0	1986	0.2	1995	0.2	1984	0.8	1986	0.8
Azerbaijan ©	1997	0.1		0.0	1992	0.0		0.0		0.0
Belarus ©	1994	0.6	1993	0.2	1996	5.0		0.0	1997	14.6
Georgia										
Kazakhstan		0.0		0.0	1997	156.9		0.0		0.0
Kyrgyzstan										
Republic of Moldova	1990	70.7			1994	0.1				
Russian Federation ©	1994	3,923.0	1995	67.9	1989	1,767.9	1986	88.0	1991	195.8
Tajikistan										
Turkmenistan										
Ukraine	1996	18.7	1992	0.2	1996	12.7			1996	6.9
Uzbekistan										
Canada ©	1992	41,900.0			1989	7,560.0				
United States of America ©	1995	27,370.0		0.0	1995	2,024.0	1996	12.0	1996	224.0
Australia ©										
Japan ©	1987	4.0	1993	9.0	1993	3.3			1991	15.8
New Zealand ©					1989	10.0			1988	5.0

© See notes and comments in Chapter V.

TABLE 72

Forest fires: number

Country	Year							
	1990	1991	1992	1993	1994	1995	1996	1997
	(Number)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	269	147	695	560	585	110	490	395
Austria ©	225	78	165	178	94	64	41	66
Belgium	82	65	26	36	43	40	185	35
Bosnia and Herzegovina ©		139	139	158	104	156	139	139
Bulgaria	208	73	602	1,196	667	114	246	200
Croatia		218	325	372	181	109	305	305
Cyprus	64	47	18	16	35	24	20	19
Czech Republic ©		961	2,586	1,951	2,052	1,331	1,421	1,398
Denmark ©	2	6	2	14	6	6	14	7
Estonia	164	39	348	207	289	188	273	359
Finland ©	571	287	852	286	1,054	1,031	1,289	1,125
France ©	5,881	3,888	4,002	4,769	4,618	6,563	6,401	7,200
Germany	1,610	1,846	3,012	1,694	1,696	1,237	1,748	1,467
Greece ©	1,322	858	2,582	2,406	1,763	1,438	1,508	3,113
Hungary ©								
Iceland ©	0	0	0	0	0	0	0	0
Ireland ©	721	194	156	123	149	143	143	143
Israel ©	1,211	697	1,057	939	765	1,030	1,031	942
Italy	14,477	11,965	14,545	15,380	8,669	6,225	9,093	11,408
Latvia ©		1,110	1,510	965	854	582	1,095	844
Liechtenstein	0	0	0	0	0	0	0	0
Lithuania	236	147	1,154	635	714	472	889	565
Luxembourg ©	23	11	8	15	7	4	3	5
Malta	3	8	8	1	3	8	12	4
Netherlands ©	95	117	76	83	51	77	77	68
Norway	578	976	892	253	471	181	246	510
Poland	4,137	3,008	9,305	4,421	5,152	4,143	4,546	3,624
Portugal	18,507	13,118	14,954	13,919	18,104	28,044	29,078	24,429
Romania	134	44	187	160	121	50	87	34
Slovakia ©	369	142	305	674	366	254	662	535
Slovenia	58	66	113	211	66	25	50	59
Spain	12,474	13,011	15,895	14,254	19,263	25,827	16,772	22,479
Sweden ©					2,500	1,100	6,240	3,280
Switzerland ©	216	157	111	99	52	56	61	77
The FYR of Macedonia		150	150	294	137	18	41	73
Turkey ©	1,725	1,445	2,110	2,547	3,221	1,768	1,631	1,339
United Kingdom ©	412	475	328	61	349	906	508	375
Yugoslavia ©		240	313	113	140	26	220	
Armenia	7	2	3	4	6	5	24	5
Azerbaijan ©		6	6	8	1	6		
Belarus	2,471	1,517	7,743	1,887	3,052	3,257	4,123	1,466
Georgia		6	6	6	6	1	6	11
Kazakhstan	605	1,194	518	354	881	1,320	1,003	2,257
Kyrgyzstan ©								
Republic of Moldova ©	91	18	14	1	33	3	0	12
Russian Federation		17,965	25,777	18,428	20,287	25,951	32,833	31,300
Tajikistan ©								
Turkmenistan ©		9	9	2	16	9	2	9
Ukraine ©	2,714	2,771	5,869	2,967	7,411	3,754	4,928	2,309
Uzbekistan								
Canada ©	10,058	10,267	9,026	6,018	9,727	8,367	5,853	5,681
United States of America ©	122,763	117,209	104,189	97,322	114,043	130,226	96,363	86,660
Australia ©								
Japan	2,858	2,535	2,262	3,191	4,534	4,072		
New Zealand ©	928	1,234	992	990	2,198	2,023	1,646	2,010

© See notes and comments in Chapter V.

TABLE 73

Forest fires: total area burned

Country	Year							
	1990	1991	1992	1993	1994	1995	1996	1997
	(1000 ha)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	0.42	0.25	1.01	0.52	0.71	0.15	0.41	0.42
Austria ©	0.20	0.05	0.13	0.11	0.06	0.03	0.03	0.04
Belgium	0.02	0.05	0.02	0.11	0.05	0.07	1.45	0.28
Bosnia and Herzegovina ©		0.88	0.88	1.30	0.71	0.63	0.88	0.88
Bulgaria	1.04	0.51	5.24	18.16	19.11	0.55	2.15	0.78
Croatia		4.54	11.13	20.16	7.94	4.65	11.21	11.12
Cyprus	1.45	0.11	0.01	0.07	0.18	0.07	0.12	0.17
Czech Republic ©		0.08	1.28	1.15	0.81	0.40	2.04	3.48
Denmark ©	0.14	0.14	0.28	0.01	0.00	0.00	0.06	0.01
Estonia	0.19	0.06	1.79	0.65	0.46	0.19	0.58	1.15
Finland ©	0.43	0.23	1.08	0.58	1.58	0.64	0.92	1.05
France ©	72.60	10.13	16.61	16.70	25.00	18.14	11.40	21.00
Germany	0.95	0.92	4.91	1.49	1.11	0.59	1.38	0.60
Greece ©	38.59	13.05	71.41	54.05	57.91	27.20	25.31	52.37
Hungary ©								
Iceland ©	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ireland ©	0.84	0.67	0.57	0.54	0.28	0.46	0.46	0.46
Israel ©	5.77	3.48	6.70	7.17	3.79	8.30	6.49	6.19
Italy	195.32	99.86	105.70	203.14	68.83	22.63	23.81	65.78
Latvia ©		3.10	8.37	0.57	0.35	0.54	0.93	0.60
Liechtenstein	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lithuania	0.12	0.05	0.86	0.31	0.30	0.32	0.39	0.17
Luxembourg ©	0.009	0.004	0.002	0.008	0.002	0.001	0.003	0.002
Malta	0.000	0.000	0.000	0.001	0.002	0.003	0.007	0.005
Netherlands ©	0.22	0.41	0.17	0.10	0.28	0.23	0.16	0.22
Norway	0.09	0.53	1.37	0.22	0.23	0.11	0.51	0.63
Poland	5.03	2.11	33.33	3.68	2.50	1.74	5.31	2.17
Portugal	129.84	182.49	59.07	49.96	77.32	169.61	83.05	26.07
Romania	0.46	0.28	0.73	0.55	0.31	0.20	0.26	0.06
Slovakia ©	0.57	0.21	0.59	0.52	0.10	0.09	0.22	0.04
Slovenia	0.60	0.71	0.67	1.86	0.91	0.26	0.29	0.49
Spain	204.04	244.71	104.59	89.33	437.64	143.48	59.82	88.29
Sweden ©			5.81	1.00	3.10	0.40	2.18	1.89
Switzerland ©	1.10	0.15	0.05	0.04	0.29	0.44	0.23	1.93
The FYR of Macedonia		5.18	5.18	10.07	5.37	0.13	1.78	5.31
Turkey ©	13.00	7.64	12.31	13.73	21.00	4.79	14.92	6.17
United Kingdom ©	0.46	0.11	0.19	0.15	1.04	0.54	0.59	0.33
Yugoslavia ©		1.54	1.97	6.90	1.58	1.65	4.59	
Armenia	0.01	0.02	0.01	0.00	0.02	0.15	0.10	0.02
Azerbaijan ©		0.06	0.08	0.03	0.01	0.05		
Belarus	1.04	0.32	23.82	1.25	2.11	3.78	8.95	0.97
Georgia		0.11	0.11	0.11	0.11	0.01	0.20	0.11
Kazakhstan	1.30	4.90	1.20	0.70	5.98	28.93	12.86	347.98
Kyrgyzstan ©								
Republic of Moldova ©	0.12	0.02	0.02	0.00	0.22	0.00	0.00	0.07
Russian Federation		1,126.22	1,142.78	1,200.44	723.08	462.86	2,311.93	983.72
Tajikistan ©								
Turkmenistan ©		1.25	1.25	0.01	2.34	1.40	1.05	1.60
Ukraine ©	2.43	1.78	4.25	3.21	10.04	4.00	127.06	47.03
Uzbekistan								
Canada ©	863.65	1,526.33	868.76	1,840.02	6,182.23	6,569.42	1,877.91	502.22
United States of America ©	2,208.00	1,431.00	762.00	650.00	1,915.00	931.00	2,455.00	1,473.00
Australia ©								
Japan	1.00	3.00	2.00	3.00	3.00	2.00		
New Zealand ©	1.78	3.60	1.00	2.24	2.81	3.07	2.66	3.70

© See notes and comments in Chapter V.

TABLE 74

Forest fires: area of forest burned

Country	Year							
	1990	1991	1992	1993	1994	1995	1996	1997
	(1000 ha)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania	0.42	0.25	1.01	0.52	0.71	0.15	0.41	0.42
Austria	0.20	0.05	0.13	0.11				
Belgium	0.02	0.01	0.02	0.01	0.02	0.01	0.78	0.01
Bosnia and Herzegovina				1.16	0.56	0.55		
Bulgaria	1.01	0.47	4.15	10.15	9.71	0.53	1.87	0.68
Croatia		0.81	1.70	3.62	4.59	3.02	6.51	6.99
Cyprus								
Czech Republic		0.08	1.28	0.57	0.20	0.21	0.35	3.48
Denmark	0.08	0.00	0.07	0.01	0.00	0.00	0.01	0.00
Estonia	0.11	0.03	0.78	0.13	0.13	0.07	0.15	0.31
Finland	0.43	0.23	1.08	0.58	1.58	0.64	0.92	
France	56.50	6.50						
Germany	0.48	0.92	4.91	1.49	1.11	0.59	1.38	0.60
Greece	18.49	13.05	49.56	24.20	23.39	9.04	7.59	12.60
Hungary								
Iceland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ireland		0.28	0.15	0.05	0.28			
Israel								
Italy	36.59	9.21	12.48	43.99		5.94	7.10	28.27
Latvia			3.00	0.29	0.20	0.20	0.50	
Liechtenstein	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lithuania		0.04	0.72	0.28	0.24	0.24	0.32	0.11
Luxembourg	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Malta	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
Netherlands	0.04	0.03	0.02	0.03	0.02	0.04	0.03	
Norway	0.09	0.53	1.37	0.22	0.23	0.11	0.51	0.63
Poland	5.03	2.11	33.33	3.68	2.50	1.74	5.31	2.17
Portugal	69.78	98.77	33.52	23.84	13.49	87.55	28.72	10.57
Romania	0.36	0.28	0.72	0.54	0.31	0.20	0.26	0.06
Slovakia						0.09	0.22	0.03
Slovenia		0.30	0.33	1.05	0.43	0.08	0.10	0.23
Spain	37.77	109.88	39.96	33.42	250.43	42.39	10.54	21.87
Sweden			3.25		2.40	0.28	0.59	
Switzerland	1.10	0.15	0.05	0.04	0.29	0.44	0.23	1.51
The FYR of Macedonia				10.07	5.37	0.01	0.84	0.53
Turkey	6.13	5.23	7.95	9.52	20.16	3.93	10.17	4.53
United Kingdom	0.46	0.11	0.19	0.15	1.04	0.54	0.59	0.33
Yugoslavia		1.54	1.97	6.90	1.58	1.65	3.93	
Armenia	0.00	0.00	0.00	0.00	0.00	0.15	0.02	
Azerbaijan		0.06	0.07	0.01	0.01	0.04		
Belarus	0.75	0.30	18.60	1.20	2.10	3.78	5.60	0.60
Georgia								
Kazakhstan	1.00	4.30	1.20	0.70				
Kyrgyzstan								
Republic of Moldova		0.02	0.02	0.00	0.08		0.00	
Russian Federation		682.05	691.48	748.62	536.79	360.14	1,853.51	726.74
Tajikistan								
Turkmenistan								
Ukraine	2.39	1.72	4.10	3.18	10.04	3.14	126.67	
Uzbekistan								
Canada	217.00	570.00	246.00	243.00	743.00	1,239.00	612.00	143.00
United States of America								
Australia								
Japan	1.00	3.00	2.00	3.00	3.00	2.00		
New Zealand	0.46	0.24	0.15	0.15	0.18	0.47	0.25	0.74

TABLE 75

Forest fires: area of other wooded land burned

Country	Year							
	1990	1991	1992	1993	1994	1995	1996	1997
	(1000 ha)							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Austria	0.00	0.00	0.00	0.00				
Belgium	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.05
Bosnia and Herzegovina				0.14	0.15	0.09		
Bulgaria	0.00	0.04	0.28	0.62	9.40	0.02	0.07	0.00
Croatia		1.33	2.78	5.91	3.20	1.07	3.52	2.52
Cyprus								
Czech Republic				0.00	0.00	0.00	0.79	
Denmark		0.00		0.00	0.00	0.00	0.00	0.00
Estonia	0.04	0.00	0.10	0.30	0.12	0.05	0.03	0.16
Finland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
France	16.10	3.60						
Germany		0.00	0.00	0.00	0.00	0.00	0.00	0.00
Greece				23.73	29.25	10.14	11.66	16.92
Hungary								
Iceland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ireland		0.00	0.00	0.01	0.00			
Israel								
Italy	0.00	0.00	5.66	9.57		2.22	1.55	9.25
Latvia				0.04	0.12	0.12	0.16	
Liechtenstein	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lithuania			0.07	0.01	0.05	0.06	0.04	0.02
Luxembourg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Malta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Netherlands	0.00	0.00	0.00	0.00	0.00	0.05	0.01	
Norway								
Poland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Portugal	50.78	53.75	18.45	26.12	63.84	82.06	54.32	15.49
Romania	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Slovakia						0.00	0.00	0.01
Slovenia		0.30	0.16	0.41	0.45	0.07	0.14	0.15
Spain	0.00	27.42	2.56	1.59	17.88	6.20	5.55	
Sweden			2.29		0.70	0.12	0.66	
Switzerland		0.00	0.00	0.00	0.00	0.00	0.00	
The FYR of Macedonia				0.00	0.00	0.11	0.86	0.08
Turkey	3.33	2.34	4.35	3.41	0.80	0.75	4.33	1.49
United Kingdom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yugoslavia							0.66	
Armenia	0.01	0.02	0.01	0.00	0.02	0.00	0.08	
Azerbaijan		0.00	0.01	0.02	0.00	0.01		
Belarus	0.04	0.00	5.20				0.10	0.00
Georgia								
Kazakhstan	0.30	0.60	0.00	0.00				
Kyrgyzstan								
Republic of Moldova							0.00	
Russian Federation		444.17	451.30	451.82	186.30	102.72	458.42	256.97
Tajikistan								
Turkmenistan								
Ukraine								
Uzbekistan								
Canada	647.00	956.00	605.00	1,547.00	5,439.00	5,330.00	1,146.00	359.00
United States of America								
Australia								
Japan								
New Zealand	1.31	3.36	0.85	2.09	2.63	2.60	2.41	2.96

TABLE 76

Forest condition: percentage of all trees species showing defoliation of 25 per cent or more (classes 2, 3 and 4)

Country	Year							
	1990	1991	1992	1993	1994	1995	1996	1997
	Per cent of total of sampled trees in damage classes 2, 3 and 4							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©								10.5
Austria ©	9.1	7.5	6.9	8.2	7.8	6.6	7.9	7.1
Belgium	16.2	17.9	16.9	14.8	16.9	24.5	21.2	17.4
Bosnia and Herzegovina								
Bulgaria	29.1	21.8	23.1	23.2	28.9	38	39.2	49.6
Croatia			15.6	19.2	28.8	39.8	30.1	33.1
Cyprus								
Czech Republic ©		45.3	56.1	51.8	57.7	58.5	71.9	68.6
Denmark	21.2	29.9	25.9	33.4	36.5	36.6	28	20.7
Estonia			28.5	20.3	15.7	13.6	14.2	11.2
Finland	17.3	16	14.5	15.2	13	13.3	13.2	12.2
France ©	7.3	7.1	8	8.3	8.4	12.5	17.8	25.2
Germany ©	15.9	25.2	26.4	24.2	24.4	22.1	20.3	19.8
Greece ©	17.5	16.9	18.1	21.2	23.2	25.1	23.9	23.7
Hungary	21.7	19.6	21.5	21	21.7	20	19.2	19.4
Iceland								
Ireland ©								
Israel ©								
Italy ©	16.3	16.4	18.2	17.6	19.5	18.9	29.9	35.8
Latvia	36		37	35	30	20	21.2	19.2
Liechtenstein ©			16					
Lithuania	20.4	23.9	17.5	27.4	25.4	24.9	12.6	14.5
Luxembourg ©		20.8	20.4	23.8	34.8	38.3	37.5	29.9
Malta ©								
Netherlands ©	17.8	17.2	33.4	25	19.4	32	34.1	34.6
Norway ©	17.2	19.7	26.2	24.9	27.5	28.8	29.4	30.7
Poland	38.4	45	48.8	50	54.9	52.6	39.7	36.6
Portugal	30.7	29.6	22.5	7.3	5.7	9.1	7.3	8.3
Romania		9.7	16.7	20.5	21.2	21.2	16.9	15.6
Slovakia	41.5	28.5	36	37.6	41.8	42.6	34	31
Slovenia ©	18.2	15.9		19	16	24.7	19	25.7
Spain ©	4.6	7.3	12.3	13	19.4	23.52	19.4	13.73
Sweden						14.2	17.4	14.9
Switzerland ©	15.5	16.1	12.8	15.4	18.2	24.6	20.8	16.9
The FYR of Macedonia								
Turkey								
United Kingdom ©	39	56.7	58.3	16.9	13.9	13.6	14.3	19
Yugoslavia ©		9.8					3.6	7.7
Armenia	10	6	7	7	7	8	20	30
Azerbaijan ©								
Belarus	54		29.2	29.3	37.4	38.3	39.7	36.3
Georgia								
Kazakhstan	0	0	0	0	0	0	0	0
Kyrgyzstan								
Republic of Moldova ©				50.8		40.4	41.2	
Russian Federation ©								
Tajikistan								
Turkmenistan								
Ukraine	2.9	6.4	16.3	21.5	32.4	29.6	46	31.4
Uzbekistan								
Canada ©	4.9	8.1	10	4.9	2.7	3.1		
United States of America ©	0.9	1.7	1.2	0.4	0.4	0.4	0.2	0.2
Australia ©								
Japan ©								
New Zealand ©								

© See notes and comments in Chapter V.

TABLE 77

Forest condition: percentage of coniferous species showing defoliation of 25 per cent or more (classes 2, 3 and 4)

Country	*Year*							
	1990	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*
	Per cent of total of sampled trees in damage classes 2, 3 and 4							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©								10.4
Austria ©	8.3	7	6.6	8.2	7.9	6.6	7.3	6.3
Belgium	23.6	23.4	23	18.3	21.2	21	25.8	19.2
Bosnia and Herzegovina								
Bulgaria	37.4	26.5	25.5	26.9	25	41.4	46.5	53.5
Croatia			26.2	33.9	39.3	57.5	57	68.7
Cyprus								
Czech Republic ©	46.9	46.3	57.9	51.5	59	60.7	74.9	71.9
Denmark	18.8	31.4	28.6	37	38.7	34.8	23.2	15.9
Estonia	20	28	29.5	21.2	16	14.2	14.6	11.4
Finland	18	17.2	15.2	15.6	13.1	13.7	13.7	12.8
France ©	6.6	6.7	7.1	8.2	8.2	9.2	13.5	16.2
Germany ©	15	24.8	23.8	21.4	21.6	18.3	16.7	15.4
Greece ©	10	7.2	12.3	13.9	13.2	13.6	14.4	13.8
Hungary	23.3	17.8	20.1	20.1	21.2	18.7	17.8	17.4
Iceland								
Ireland ©	5.4	15	15.7	29.6	19.7	26.3	13	13.6
Israel ©								
Italy ©	19.2	13.8	17.2	15.1	15	19.4	25.1	28.1
Latvia	43		45	41	34	23	24.8	21.9
Liechtenstein ©	7.1		18				0	
Lithuania	22.9	27.8	17.5	29.2	26.3	26.6	12.9	13.9
Luxembourg ©		7.9	6.3	9	12.8	12.9	12.7	8
Malta ©							0	
Netherlands ©	21.4	21.4	34.7	30.6	27.7	45.4	43.5	45.3
Norway ©	17.1	19	23.4	20.9	22.4	24	25.1	28.5
Poland	40.7	46.9	50.3	50.8	55.6	54.5	40.5	36.8
Portugal	25.7	19.8	11.3	7.1	5.4	6.6	5.6	7.8
Romania		6.9	10.9	16.6	15.5	15.2	10.4	10.3
Slovakia	55.5	38.5	44	49.9	50.3	52	41	42.2
Slovenia ©	34.6	31.3		27	19	33.6	26	32.5
Spain ©	4.4	7.3	13.5	14.6	19.6	18.1	18.1	11.6
Sweden	16.1	12.3	16.9	10.6	16.2	14.5	16.9	15.9
Switzerland ©	17.9	18	14.1	17.4	19.6	23.2	21.4	19.9
The FYR of Macedonia								
Turkey								
United Kingdom ©	45	51.5	52.7	16.8	15	13	13.9	17
Yugoslavia ©		15.9					4.4	7.9
Armenia		6	7	7	7	8	10	20
Azerbaijan ©								
Belarus	57		33.7	33.8	44	43.9	43.1	41.2
Georgia								
Kazakhstan	0	0	0	0	0	0	0	0
Kyrgyzstan								
Republic of Moldova ©				45.2		33.3	48.4	
Russian Federation ©								
Tajikistan								
Turkmenistan								
Ukraine	3	6.4	13.8	21.7	34.8	25.7	45.8	32.7
Uzbekistan								
Canada ©	3.1	4.7	8.1	6.3	3.5	3.7		
United States of America ©	1.3	2	1.3	0.2	0.4	0.4	0.2	0.2
Australia ©								
Japan ©								
New Zealand ©								

© See notes and comments in Chapter V.

TABLE 78

Forest condition: percentage of broadleaved species showing defoliation of 25 per cent or more (classes 2, 3 and 4)

Country	Year							
	1990	1991	1992	1993	1994	1995	1996	1997
	Per cent of total of sampled trees in damage classes 2, 3 and 4							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©								10.6
Austria ©	14.9	11.1	9.3	7.7	7.4	6.5	11.6	12.2
Belgium	10	13.5	11.8	11.7	12.8	26.6	18.5	16.1
Bosnia and Herzegovina								
Bulgaria	17.3	15.3	18	16.6	34.4	32.7	33	43.9
Croatia			13.6	15.6	26.4	35.2	26	27.8
Cyprus								
Czech Republic ©		37.6	29.2	54.4	48	30.6	34	26.5
Denmark	25.4	27.3	21.2	27	32.4	39.7	36.1	28.4
Estonia			0	1.1	2	1.1	5.3	7.4
Finland	11.6	7.7	10.1	12.8	12	11	10.3	8.4
France ©	7.7	7.4	8.5	8.4	8.4	14.3	20.1	29.9
Germany ©	23.8	26.5	32	29.9	30.1	29.9	30.8	28.6
Greece ©	26.5	28.5	25	29.8	35	38.2	34.6	34.9
Hungary	21.5	19.9	21.8	21.2	21.8	20.2	19.5	19.7
Iceland								
Ireland ©								
Israel ©								
Italy ©	15.6	17.1	18.5	18.3	20.7	18.5	31.2	38
Latvia	27		19	17.8	15	10	11.4	11.3
Liechtenstein ©								
Lithuania	15.8	14.9	17.6	23.8	23.3	20.8	12.2	15.9
Luxembourg ©		33.9	30.5	31	46.8	51.4	49.8	41.8
Malta ©								
Netherlands ©	11.5	9.4	31.1	13.1	5.1	10.8	19.2	17.8
Norway ©	18.2	25.1	38.9	42.1	47.6	47.4	45	38.9
Poland	25.6	34.8	40.4	45.6	51.5	46.7	37.4	35.8
Portugal	34.1	36.6	29.1	7.5	5.8	10.4	8.3	8.6
Romania		10.4	18.4	21.4	22.9	23.1	18.7	16.9
Slovakia	31.3	21.1	30	29.1	35.6	35.8	28	23.3
Slovenia ©	4.4	5.8		11	13	19.3	15	21.4
Spain ©	4.8	7.4	11.2	11.4	19.3	28.7	20.7	15.8
Sweden						7.9	20.7	6.1
Switzerland ©	12.3	13.3	11.1	12.7	16.2	27	19.8	12.5
The FYR of Macedonia								
Turkey								
United Kingdom ©	28.8	65.6	67.8	17.1	12.4	14.5	15	22
Yugoslavia ©		8.2					3.5	7.4
Armenia	10						10	10
Azerbaijan ©								
Belarus	45		14.8	16.6	18.6	22.9	29.2	23
Georgia								
Kazakhstan	0	0	0	0	0	0	0	0
Kyrgyzstan								
Republic of Moldova ©				50.9	21.9	40.5	41.1	30
Russian Federation ©								
Tajikistan								
Turkmenistan								
Ukraine	2.7	6.4	20.2	21.6	29.9	33	46.2	30.7
Uzbekistan								
Canada ©	10.3	18.5	16	1	0.8	1.1		
United States of America ©	0.4	1.4	1.1	0.6	0.3	0.5	0.1	0.1
Australia ©								
Japan ©								
New Zealand ©								

© See notes and comments in Chapter V.

NOTES AND COMMENTS RELATING TO CHAPTER V

Main Tables	Comments

Albania

70, 71

Enquiry Table 18: The most important damages are by pests and diseases, about 96.2 per cent (or 691,000 ha) of the total area damaged; in second place are areas damaged by grazing and wildlife, about 1.8 per cent (or 12,650 ha); in third place are areas damaged by known local pollution sources, about 1.7 per cent (or 11,900 ha) and, in last place there is areas damaged by fires about 0.4 per cent (or 2,630 ha).

72-75

Enquiry Table 19: The data for 1997 are secretariat estimates.

76-78

Enquiry Table 20: The health situation of our forests is not so good. The mean defoliation of trees in the classes 2-3-4 of defoliation is the highest in Europe, together with Czech Republic, Slovak Republic and Poland.

Approximately, 10.4 per cent of our forests, particularly in mountainous areas, has been suffering due to air pollution.

Australia

70, 71

Enquiry Table 18: National data on damage to forest are unavailable, see the following text:

Currently, there are no quantitative national data on the pests and diseases that occur in Australia's forests, or on the damage they cause. Due to the climatic range across Australia very few pests and diseases are nationally distributed. Many of the pests and diseases are significant at a sub-continental scale.

There exists supportive information on "Pests and Diseases of Australian forest, by State or Territory" in tabular form in the reply to the enquiry which is available at the secretariat.

Damage to forest by insects and disease: Forest dieback is widespread and severe in five States, widespread and having an adverse effect in the Australian Capital Territory (ACT), and widespread in the Northern Territory. It is caused by various factors, including tree age, changes to soil as a result of sheep and cattle grazing and increasingly intensive pasture production practices, changes to groundwater, depredation by insects (such as pasture scarabs), attack by pathogens, and drought. The two most widespread pathogens in Australia, *Phytophthora* and *Armillaria* species, cause dieback-like diseases.

Various other fungal pathogens, especially native ones, may affect forest trees under some seasonal conditions but generally do not cause long-term problems.

A number of native and exotic insects are considered pests in plantations and native forests managed for timber production. These include defoliators and leaf miners, sap-suckers and wood and bark borers.

Damage to forest by wildlife and grazing: Cats, dingoes, dogs, deer, donkeys, horses, goats, hares, rats, mice, possums, kangaroos and foxes are all widespread in Australian forests and represent a serious threat to forest species and ecosystems. Possums and kangaroos may seriously damage regenerating young plantations by browsing on seedlings.

Foxes are the most widespread exotic animals adversely affecting forested ecosystems. They occur across mainland Australia and have severely limited populations of ground-dwelling mammals. Such mammals are important components of the ecosystem by helping to spread mycorrhiza fungi upon which the health of the trees depend. Feral animals may also spread disease which adversely affect trees and other plants. Pigs, for instance, are known to spread Phytophthora cinnamomi and may act as a feral "reservoir" of potentially devastating animal diseases such as footrot.

Damage to forest by fire: There are no national data on the amount of forest burnt annually by either bushfire or prescribed burning. However, 1994 reviews of fire management strategies and practices undertaken by State fire authorities and land management agencies in New South Wales, Queensland, Tasmania and Western Australia revealed a change in traditional approaches to fire management as governments are providing fewer resources to land management agencies to undertake fire management and are placing greater demands on volunteers. As a result, there is a reduction in expertise to ensure that prescribed burning meets prescriptions. In general, the area of forest subjected to prescribed burning each year has declined in recent years.

Damage to forest by local pollution sources: At present there is no systematic data collection to allow for reporting on pollution damage to forest. However, it is believed that few, if any, forests are affected by air pollutants.

Australia is establishing a National Pollutant Inventory. This will be a publicly available database containing information on annual releases of toxic and hazardous substances from industrial and diffuse sources, covering urban and rural areas.

Data Source: State of the Forest Report (1998).

after R. Boyle, P. Dewundege, J. Hazi, D. Hearn, C. McIntosh, A. Morrell, YL Ng and R. Serebryanikova, (1996), Report on the Air Emissions Trials for the National Pollutant Inventory, Vol.1, Environment Protection Authority, State Government of Victoria.

72-75

Enquiry Table 19: Extensive fire damage occurs in Australia, but no data are collected on a national basis.

76-78

Enquiry Table 20: No data available. See the following text:

Forest dieback is responsible for a significant decline in tree number and health. Dieback is widespread and severe in five States, widespread and having an adverse effect in the ACT, and widespread in the Northern Territory. It is caused by various factors, including fungal pathogens, insect pests and mammalian browsers and a combination of stresses imposed by the environment including tree age, changes to soil as a result of sheep and cattle grazing and increasingly intensive pasture production practices, changes to groundwater and drought. Interactions between these factors can cause stress and that may also induce disease if prolonged or intensified. A lack of regeneration in some areas compounds the problem.

The two most widespread pathogens in Australia are the *Phytophthora* and *Armillaria* species. *Phytophthora* spp. kills a range of species in all States and has caused significant dieback and death of commercially important eucalypt species in Western Australia, Victoria and Tasmania. Due to its prevalence in Western Australia, significant resources are being put towards identification and control.

Insects affect trees by defoliating them, sucking their sap or boring into the wood. This can limit tree growth or damage the wood, reducing the economic value of timber harvested from the forest. Many moth, beetle and sawfly species eat eucalypt leaves, particularly new growth, at some stage of their life cycle. For this reason, they can sometimes cause extensive damage in young plantations and regrowth forests, as well as harm young trees in mature forests.

The extent of mammalian browsing varies depending on the level of pest control imposed by forest managers and the influence of seasonal factors. Where browsing occurs, the extent of damage varies. Animals may eat out the growing tip, eat half the plant, bite the plant off at ground level, and even pull it fully out of the ground. They may also strip away bark to get the layer underneath or take off the side shoots.

Some studies indicate that eucalypts can tolerate moderate browsing without ill effect. Heavy browsing can kill young plants, or at least seriously stunt growth and cause bent or multiple stems that reduce the commercial value of the log at time of harvest.

Among the native animals, kangaroos, pademelons, possums, rats and wallabies are all extensive and sometimes serious browsing pests in many forests and eucalypt plantations. Of the introduced species, rabbits are the most destructive, causing damage to both eucalypts and pines. Additionally, goats, hares and rats all cause serious damage in some places.

Data Source: State of the Forest Report (1998). Australia's First Approximation Report for the Montreal Process, 1997.

Austria

72-75

Enquiry Table 19: The data for 1997 are secretariat estimates.

76-78

Enquiry Table 20: Only trees 60 years and older are assessed for the following:

In 1995: for All species;

In 1994 and 1995: for Coniferous;

In 1992, 1994 and 1995: for Broadleaved.

Only trees 50 years and older are assessed for the following:

In 1993: for Coniferous and Broadleaved.

Azerbaijan

70, 71

Enquiry Table 18: The figure 0.033 ha given for "Primarily damaged by fire" refers to the period 1992-1997.

72-75

Enquiry Table 19: Data are provided by the National Correspondent.

76-78

Enquiry Table 20: There is no information on defoliation in Azerbaijan. The country does not participate in annual surveys.

Belarus

70, 71

Enquiry Table 18: A hurricane struck Belarus on 23-24 June 1997; forests in the Brest and Minsk oblasts suffered the worst damage. The total damaged area needing clearing was 6,753 hectares, with 868,000 m^3 of timber. The costs of the clear-up ran to 56 billion roubles, or about 2 million US$.

Belgium

70, 71

Enquiry Table 18: For the Walloon Region: 1) Stands attacked by insects or diseases: taken into account when more than 25 per cent of affected trees; 2) Stands damaged by fauna: taken into account when more than 25 per cent of affected trees.

"Primarily damaged by insects and disease": In 1997, in Flanders Region, 18,800 ha of poplars have been affected by *Melampsora larici*-populina.

"Primarily damaged by storm, wind, snow etc".: Damage caused by the 1990 storms is now no longer noticeable.

Bosnia and Herzegovina

72-75

Enquiry Table 19: The data for1991, 1992, 1996 and 1997 are secretariat estimates.

Canada

70, 71

Enquiry Table 18: The figure given for area primarily damaged by insects and disease includes areas of moderate to severe defoliation due to insects such as the spruce budworm and mortality due to the mountain pine beetle.

Defoliation does not always result in mortality. For example, stands with moderate defoliation often recover and may not lose much growth. Defoliation is mapped on an insect-by-insect basis, and a given area may be afflicted by more than one insect at a time. This may result in double and triple counting on areas affected by more than one insect, exaggerating the extent of the total area defoliated. Also, since the figure given is the sum of areas affected in each of ten years, there is likely multiple counting of areas that were affected in more than one year.

72-75

Enquiry Table 19: The figures for 1996 and 1997 are estimates.

The figures reported are for forest and other wooded land only. Areas of non-stocked timber-productive land are included in the area of other wooded land burnt.

76-78

Enquiry Table 20: Percentages are based on area infested.

Data for defoliation by insects only. There is minimal defoliation by other causes.

Data for broadleaved trees relate mostly to defoliation by aspen twoleaf tier, forest tent caterpillar and gypsy moth.

There is minimal defoliation by other insects. Some areas may be infested by more than one insect, resulting in overestimation of area infested.

It is assumed that coniferous and broadleaved species occur on the forest land of Canada in the ratio 75/25.

Czech Republic

70, 71

Enquiry Table 18: No forest damage from radio contamination. There is information (in tabular and graphic form) on identifiable abiotic factors in the original reply to the enquiry, which is available at the secretariat.

72-75

Enquiry Table 19: Areas of burnt "other land" not reported.

76-78

Enquiry Table 20: Mainly trees older than 60 years assessed for the following:

In 1997: for All species, Coniferous, and Broadleaved.

Denmark

70, 71

Enquiry Table 18: No statistics or collected data exist on these matters. The figures are rough subjective estimates.

Concerning "Primarily damaged by wildlife and grazing": It is difficult to estimate in a proper way. Most young stands in the eastern part of the country will be damaged by roe deer or sometimes hares if they are not fenced. In the western and central part of Jutland red deer often can make such severe damage on the bark of conifers that the wood will be unusable by the timber industry.

The figure for "Primarily damaged by wildlife and grazing" is a rough, subjective estimate on how big a forest area annually is damaged so much by wildlife that the 'stands break down' and should be re-established. Much of the damage is taking place on the same areas period after period. Therefore the sum of about 3,715 ha can not be multiplied directly, e.g. over 100 years it would come to an area almost as much as the total Danish forest area.

72-75

Enquiry Table 19: The data for 1988, 1989 and 1991 are secretariat estimates.

Finland

70, 71

Enquiry Table 18: Damage due to competition between trees (300,000 ha) is now included in "Total area of forest and other wooded land with damage from unidentified causes". Damage describes the current state. The occurrence year of the heaviest damage is not available.

72-75

Enquiry Table 19: The data for 1997 are secretariat estimates.

France

70, 71

Enquiry Table 18: Source: Ministère de l'agriculture et de la Pêche, Département de la santé des forêts.

Data for "Total area of forests and other wooded land with damage by known causes": minimum area.

Data for "Primarily damaged by insects and disease": the reference period extends between 1983 and 1993.

The area of forest in which there have been significant losses attributable to insects or fungal diseases but the future of the stands is not jeopardized is put, by expert estimates, at 150,000 hectares. The area of forest needing to be reconstituted following insect or fungal damage is estimated at 2,500 hectares.

The most serious damage by insects and diseases was recorded in 1993. Of the estimated 200,000 hectares damaged, 50,000 hectares were due to an infestation of *Lymantria dispar* which culminated in France between 1992 and 1994. Locally, this caused extensive die-offs of trees, particularly in the Centre-West region and in Alsace, where almost 20,000 hectares of broadleaved high forest were defoliated in 1993, 3,000 of them completely. It has not been possible to estimate the total area of France defoliated by this pest. The extent of the damage indicated here (50,000 hectares) should be regarded as a minimum.

Data for "Primarily damaged by wildlife and grazing": The damaged area shown (45,000 ha) is a minimum, according to a 1993 survey (see below).

In the aftermath of a spectacular increase in the population of deer (50,000 head in 1995), roe deer (1,200,000 head), and wild boar (250,000 head), damage due to large game animals is now an extremely important problem in France, although in the case of forests it has not been quantified. According to a 1993 survey, between 40,000 and 45,000 hectares of land under regeneration (i.e. 12-14 per cent of the total area under regeneration) is protected against large game animals at any time. Land under regeneration is of course not the only woodland suffering damage by wild animals, but no estimate for other types of woodland is available.

Data for "Primarily damaged by fire" the reference period extends from 1986 to 1995.

Data for "Primarily damaged by storm, wind, snow or other identifiable abiotic factors": the reference period extends from 1985 to 1994. Damage due to drought has not been taken into account under damage due to abiotic factors. Although often significant, water shortages being one of the main factors affecting forest growth and vigour, such damage is very difficult to estimate.

There were a number of storms at the beginning of 1990, on 25 January, 3 February, 12 to 15 February and from 26-28 February onward, among others. They resulted in extensive windblow (7 million m^3, 30 per cent of it coniferous and 60 per cent beech), chiefly in Lorraine, Picardy and Normandy, i.e. the northern half of France. The area-equivalent of the volume destroyed has been calculated from the average volume per hectare of normal high forest, which is the type of woodland most commonly affected by windblow. The storm in Brittany in October 1987 caused 6 million m^3 of windblow.

72-75

Enquiry Table 19: Data for 1997: Provisional figures for 1997.

Source: Ministry of Agriculture and Fisheries, Countryside and Forests Directorate, and SCEES.

Remarks: After a fire, it is difficult to distinguish between forest and other wooded land in the south of France. For this reason, it has not been possible to assign burnt areas between forest and other wooded land since 1992. The data do not include burnt areas of "other land".

76-78

Enquiry Table 20: All species in 1987: regional survey, and lost trees (280) not included.

Coniferous in 1987: lost trees (194) not included.

Broadleaved in 1987: regional survey, and lost trees (84) not included.

Germany

70, 71

Enquiry Table 18: Area with damage: Precise areas cannot be reported as damage affects single stems and only the affected timber volume is covered. Damage is caused by insects, wind and game.

76-78

Enquiry Table 20: In 1991 for "All species", coniferous and broadleaved: since 1991 with former GDR.

Greece

70, 71

Enquiry Table 18: Damage occurs regularly from disease to *Castanea* and *Cupressus*, but no data are available.

72-75

Enquiry Table 19: The figures in the table relate only to fires on forest and other wooded land. Data are available on request covering fires on pasture and other agricultural land.

76-78

Enquiry Table 20: For "All species", coniferous and broadleaved: excluding maquis.

Hungary

70, 71

Enquiry Table 18: The source of the data is the "Forest damage early warning system" run by the Forest Research Institute except for fire. For fire: Extrapolation of data on fires in state forests. Source: Report on forest fires. Journal of Forestry, October 1997.

72-75

Enquiry Table 19: No data are available on forest fire statistics.

Iceland

70, 71

Enquiry Table 18: Numbers are very rough estimates.

Under major individual episodes: very heavy snow during winter 1994-95 caused extensive damage.

72-75

Enquiry Table 19: Forest fires are extremely rare in Iceland.

Ireland

72-75

Enquiry Table 19: The data for 1995, 1996 and 1997 are secretariat estimates.

76-78

Enquiry Table 20: In 1986: not assessed. From 1987 to 1997: only coniferous assessed.

Israel

70, 71

Enquiry Table 18: The disease damage data are related especially to *Matsucocus josephi.*

72-75

Enquiry Table 19: The data for 1997 are secretariat estimates.

76-78

Enquiry Table 20: No defoliation observed in most of the years.

Damage under "Primarily damaged by insects and disease" (*Enquiry Table 18)*: causes defoliation up to 100 per cent.

Italy

76-78

Enquiry Table 20: In 1996 and 1997 for "All species", coniferous and broadleaved: excludes Sardinia.

Japan

70, 71

Enquiry Table 18: Estimates of annual average damage are made by the secretariat and based on the data sent by the National Correspondent.

76-78

Enquiry Table 20: Basically, Japan has not made public information on defoliation to show tree damage.

Kyrgyzstan

72-75

Enquiry Table 19: No data available on forest fires.

Latvia

70, 71

Enquiry Table 18: In the summer of 1992, the situation with forest fires was disastrous, resulting in over 2000 ha of forest burnt. In 1994 there started an outbreak of *Ips typographus* which is still going on. In 1996, there was outbreak of *Lymantria monacha* and *Gilpinia pallida.* We have no data about the extent of forest damage before 1991.

72-75

Enquiry Table 19: The date for 1997 are secretariat estimates.

Liechtenstein

76-78

Enquiry Table 20: No survey from 1993 to 1997.

Liechtenstein does not participate in the annual ICP surveys. Our annual national monitoring distinguishes 5 classes: healthy; slightly sick; sick; withering; dead. The percentage of trees in the last 3 classes (roughly equivalent to more than 25 per cent defoliation) was the following:

	spruce	*fir*		*spruce*	*fir*
1986	2.9	17.4	1992	4.6	20.0
1987	2.1	18.9	1993	8.8	18.7
1988	2.6	16.3	1994	11.3	23.5
1989	2.2	14.3	1995	11.1	28.6
1990	3.2	16.1	1996*	6.6	8.7
1991	4.0	17.7	1997*	8.7	13.8

* The classification was changed.

Lithuania

70, 71

Enquiry Table 18: In 1993 great windthrow damage was caused on 73 thousand ha of forest area followed in 1994-1995 by outbreaks of insects. Spruce stands were severely damaged by *Ips typographus*, while pine stands to a smaller extent by *Dendrolimus pini.*

Luxembourg

72-75

Enquiry Table 19: The data for 1997 are secretariat estimates.

76-78

Enquiry Table 20: In 1991 for all species: defoliation and discolouration. In 1991 for Coniferous: trees under/over 60 years. In 1995 for Broadleaved: including underwood.

Malta

70, 71

Enquiry Table 18: See *Enquiry Table 19* "Forest fire".

76-78

Enquiry Table 20: Very little damage is visible. The most occurs on coastal sites due to saline winds.

Netherlands

70, 71

Enquiry Table 18: Sources: Storm 1990 Ekkelboom, J. NBT 62 nr 8. No gross stormfellings, Insects 1995. Moraal L., 1995 NBT 68 nr. 3. No gross damage by insects.

General comments: Data on other damage to the forest are inventoried occasionally when substantial damage occurs. There is no intention to conduct a more continuous inventory-system on this subject.

72-75

Enquiry Table 19: The data for 1997 are secretariat estimates.

Sources: IKC-natuurbeheer, 1995. Statistiek van branden in bos- en natuurterreinen in 1993. Werkdocument IKCN nr. 75. Wageningen. Bosdata 1997. Enquiry on forest fires 1994-1996.

There is every year more burnt area in so called 'natuurterreinen' (nature areas) which can not be classified as other wooded land. They are not presented in this table.

General comments: Data on forest fires were available from the administration system of forest fires upto 1995. The registration system was recently stopped.

76-78

Enquiry Table 20: In 1991 for All species: defoliation and discolouration.

New Zealand

70, 71

Enquiry Table 18: No national data in this format are available for New Zealand. Significant damage has been done to the indigenous forest by introduced mammals (see *Enquiry Table 10* "Forest-occurring species at risk or endangered") but this is not quantified in the format of this table. Storm damage (primarily from wind) occurs infrequently. In the past there were significant areas of the plantation forest where blowdown was a serious risk but forest management practices have been developed to minimise the risk. The last significant storm damage was in 1988 when tropical cyclone Bola struck. This cyclone did more damage to the steep hill country cleared for grazing than to forested areas but no quantitative data are available on the extent of the damage to forested areas. It is considered that on average less than 1,000 hectares of forest are primarily damaged by storm each year in New Zealand.

72-75

Enquiry Table 19: The figures are for the year ended June.

The source of this table is the New Zealand Fire Service Commission. Forest fires in New Zealand in terms of the areas reported as burnt each year are not nationally significant, but this is because of the precautions taken to minimise the risk of fire damage occurring in the forest plantations. Most of the fires reported are in shrubland (other wooded land) rather than in forest. The total area reported does not include "burnt other land".

76-78

Enquiry Table 20: Data in this format cannot be supplied as New Zealand does not compile national forest condition statistics. Defoliation from introduced pests, especially possums, is a significant forest condition problem in New Zealand but is not currently quantified at the national level. Likewise, forest inspections are made to assess forest health, especially for some fungus diseases. The information for these inspections is not quantified at the national level.

Norway

70, 71

Enquiry Table 18: Area with damage refers to stands in which the production have been reduced by more than 10 per cent. The extent of heaviest damage is a rough estimate of the area more or less totally destroyed by storm in 1992.

The area primarily damaged from known local pollution sources is the estimate which includes areas where occasional damage to needles or leaves has been observed, but not necessarily any detectable reduction of production or increased mortality. Changed lichen vitality may have been detected over larger areas, but this cannot be described as a "forest damage".

76-78

Enquiry Table 20: From 1992 to 1997 for broadleaved: special study on birch.

Poland

70, 71

Enquiry Table 18: For damage caused by wildlife and storm etc, data for one year are only available.

Detailed interpretation of this table is as below:

The source data used in this table originates from different sources and periods. For some groups of damage data are incomplete, for others relevant information was not available. Due to those problems the "significant" damage qualifier has a different meaning in each class of agents.

– "Primarily damaged by insects and disease": the presented data (average for 1992-1996 period) are of the area where chemical control should be carried out;

– "Primarily damaged by wildlife": results of periodical wildlife damage inventory (conducted in 1990) are presented. Stands were shown as significantly damaged where the heavy damage occurred over at least on 20 per cent of stand area;

– "Primarily damaged by fire": the average area of forests destroyed by fire is presented. In the mentioned period the heaviest losses occurred in 1992, with two big forest fires in Rudy Raciborskie (9,062 ha of burnt forest) and Potrzebowice (4,980 ha of burnt forest);

– "Primarily damaged by known local pollution sources": no available data;

– "Primarily damaged by storm, wind, snow and other identifiable abiotic factors": the presented figure originates from the results of the questionnaire on biotic and abiotic damages of forest (in 1996). Forest Districts reported the areas where losses from abiotic agents occurred in a significant way, but with differentiated intensity.

Due to the differentiated intensity of every kind of reported damage, incompleteness of data and high probability of several types of agents occurring at the same area, the correspondents decided not to show the total area of forest with damage done by known causes.

Portugal

70, 71

Enquiry Table 18: Observing the general evolution trend we consider that in Portuguese forests the damage follows closely the occurrence of drought. The years of 1989, 1990 and 1991 were extremely dry (damage rose and was maximal in 1991). During dry years insect attacks and fungi infestations were stronger; at the same time fires were more devastating compared to years with higher precipitation.

The years of 1992, 1993 and 1994 still were dry to a certain extent, but rain occurred during the spring and the beginning of summer. The changing patterns of precipitation thus explain the changes in forest condition; 1995 again was a very dry year, and this was accompanied by again increasing forest damage. *Quercus suber* and *Quercus ilex* rotundifolia have their main occurrence in southern Portugal, where rain is more scarce. It is there also that the most damaged trees are recorded.

Republic of Moldova

72-75

Enquiry Table 19: The data for 1997 are secretariat estimates.

76-78

Enquiry Table 20: In 1994 and 1997: only broadleaved assessed.

Romania

70, 71

Enquiry Table 18: The heaviest damage occurred in 1995-1996.

Primarily damaged by insects and disease: Infestations of forests by pests occur yearly. Due to predictions and treatments carried out, significant damage is prevented.

Primarily damaged by fire: An estimated annual average forest area (for the reference period) of 300 ha is reported; the forest is hardly damaged by fires.

Primarily damaged from known local pollution sources: Forest area moderately to severely affected, according to studies carried out for the main local pollution sources.

Primarily damaged by storm, wind, snow or other identifiable abiotic factors: Statistics don't provide data on the forest area specifically damaged by abiotic factors. Wind and snow damages occur, but the respective area is usually recorded in the same category as "occasional cuttings" (clear-cutting for forest roads, lines between compartments, for geology, mining or hydrology works, electric power transportation facilities). However, when important events take place, due attention is given consequently, as it is the case in 1995-1996, when an estimated 139,100 ha of forest was affected by wind and snow damage, of which 12,400 thousand ha heavily.

Russian Federation

70, 71

Enquiry Table 18: Damage is calculated from the total area of stands damaged by insects and disease or by fire, or stunted by various (biotic and abiotic) factors.

All information comes from the reports of the Russian Federal Forestry Service, annual reports on forest (protection) conservation (statistical form No. 12-LX) and State Committee on Statistics information (fires).

To relate form 12-LX data to forests managed by all Government departments, the indicators available are multiplied by a coefficient of 0.06 (according to the forestry fund account report for 1 January 1993, forests managed by other departments represent 6 per cent of the total).

Data on forest fires from Goskomstat cover all forest resource owners: the Russian Federal Forestry Service, the forestry complex enterprises of the former USSR Ministry of Forestry, the Ministry of Agriculture and Food, the Ministry of Environmental Protection and Natural Resources and the Ministry of Defence.

76-78

Enquiry Table 20: Information for only some regions (Kaliningrad and Leningrad regions) available.

Slovakia

70, 71

Enquiry Table 18: A source of information was a statistical document matter L116: Hlásenie o výskyte škodlivých cinitelov ...(Report on the occurrence of injurious agents...) and literary sources processed every year from available data. They are as follows:

– J. Novotný, et al. 1995: Evidencia skodlivých cinitelov v lesoch Slovenska za rok 1994 a prognóza ich vývoja na rok 1995. (Records on injurious agents in the forests of Slovakia for 1994 and trends for 1995). Deposited at LVU Zvolen, 45 p.

– D. Surovec, et al. 1992: Evidencia skodlivých faktorov v lesoch SR za rok 1991 a ich prognóza na rok 1992. (Records on injurious factors in the forests of SR for 1991 and trends for 1992). Deposited at LVU Zvolen, 64 pp.

– D. Surovec, et al. 1993: Evidencia skodlivých faktorov v lesoch SR za rok 1992 a ich prognóza na rok 1993. (Records on injurious factors in the forests of SR for 1992 and trends for 1993). Deposited at LVU Zvolen, 68 pp.

– M. Turcáni, et al. 1994: Evidencia skodlivých cinitelov v lesoch Slovenska za rok 1993 a prognóza ich vývoja na rok 1994. (Records on injurious agents in the forests of Slovakia for 1993 and trends for 1994). Deposited at LVU Zvolen, 38 pp.

– J. Varínsky, et al. 1996: Evidencia skodlivých cinitelov v lesoch Slovenska za rok 1995 a prognóza ich vývoja na rok 1996. (Records on injurious agents in the forests of Slovakia for 1995 and trends for 1996). Deposited at LVU Zvolen, 45 pp.

In the row “area damaged by insects and diseases”. the value given represents the sum of slightly and heavily damaged areas (by leaf-eating insects).

A synergetic impact of several agents on the same plot is not excluded.

For bark beetles, abiotic agents, fungal diseases, air pollutants and unidentifiable causes of damage, the forest statistics are not giving the area of damaged stands but the volume of damaged wood. A resultant value for certain specific agents (excluding leaf-eating pests) was calculated as a sum of reduced area damaged in young stands (ha) and of the volume of attacked area in older stands in hectares (it was calculated as a proportion of the volume of damaged wood in m^3 of mean growing stock per 1 ha-400 m^3).

A conclusive value of the data is relatively high as until 1989 the data were provided by the bodies of State Forests which managed almost 100 per cent of the area of stands in SR. After 1989, when also other, non-state, bodies started to manage the forests, the area of the stands, according to available information, has decreased to about 85 per cent.

The following are the important events of recent years:

– an outbreak of gypsy moth (*Lymantria dispar*) in the years 1993-1994

– a whirlwind in the region of Horehronie-July 1996.

72-75

Enquiry Table 19: The source of information was a statistical document L116 (Report on the occurrence of injurious agents...) and literary sources processed every year from available data.

Because insufficient information for recent years was available, the data of the PTEU Bratislava (the Technical and Expert Institute for Fires) were also used. As both sources (LVU, PTEU) did not provide equivalent information, in some cases interpolations had to be made. In future data obtained from the forest statistics (L116) at LVU will be used as a basis for area (ha) and for damaged wood (m^3). This will be complemented by the data on the number of fires and their causes from PTEU.

Slovenia

70, 71

Enquiry Table 18: The figure of 45,000 ha for the extent of damage by “Primarily damaged by wildlife and grazing” refers to time period 1986-1996.

76-78

Enquiry Table 20: In 1991 for All species: combined assessment method. No survey in 1992.

Spain

70, 71

Enquiry Table 18: The data for "Primarily damaged by fire" are > 400.

Not all of the areas shown in "Primarily damaged by storm, wind, snow or other identifiable abiotic factors" and "Total area of forest and other wooded land with damage from unidentified causes" were damaged. Damage occurred within these total areas.

76-78

Enquiry Table 20: In 1994, for all species, coniferous and broadleaved: excludes Canary Islands.

Sweden

70, 71

Enquiry Table 18: See *Enquiry Table 14* "Total woody biomass and the volume of growing stock".

Data available on "Forest" only.

Source: Swedish University of Agricultural Sciences / Department of Forest Resource Management and Geomatics. Section of Forest Survey / BSc (For) Hans Toet.. (Kompletterande uppgifter Table 18 SLU/Resgeom).

Sweden has chosen not to deliver any data (n.a.) in most cells in this column. There are two reasons for this:

1) the table is difficult to fill in for logical reasons. How many trees have to be damaged per ha to consider the stand damaged? Is the limit 1, 2, 10, 100 or what? To some extent of course all stands are damaged. One can always find trees that have either small or big insect damage, root rot, snow-breaks or something else. Also, how long is a damage considered a damage? For example a damage by insects can fade away after a couple of years, but one will still have a permanent impact on the growth, etc.;

2) The National Forest Survey is basically depending on a sample plot inventory, where most of the plots are temporary, and the knowledge of the stand history is limited to what can be seen on the plot. Therefore the reason for the damage and the year of damage are more or less impossible to decide with any accuracy.

However, the presented figures are about wildlife and grazing damages as these are more easily defined and can be better determined in the field.

72-75

Enquiry Table 19: The date for 1997 are secretariat estimates.

Switzerland

70, 71

Enquiry Table 18: "Most Recent 5-year period, Annual average": "Total area of FOWL with damage by known causes": Estimation;

"Primarily damaged by insects and disease": The calculation of the annual average (in 1000 ha) is based on the damaged volume (in m^3). Assumption: average volume per ha: 500 m^3.

"Primarily damaged by wildlife and grazing": No quantitative analysis yet available.

"Primarily damaged from known local pollution sources": Estimation

"Primarily damaged by storm, wind, snow or other identifiable abiotic factors": No data available. Only remarkable events are recorded.

"Total area of FOWL with damage from unidentified causes": 19 per cent of the forest trees show a defoliation of >25 per cent — > 230,000 ha of 1,200,000 ha.

"Total area of FOWL with damage from unidentified causes"--"extent of damage": Reduced data-set.

72-75

Enquiry Table 19: "Area of forest burnt" and "Area of OWL burnt", no differentiation made between forest and other wooded land.

76-78

Enquiry Table 20: In 1992, 1993 and 1994 for "All species" and "Coniferous", and in 1993 and 1994 for "Broadleaved": weighted according to diameter at breast height (d.b.h.).

Tajikistan

72-75

Enquiry Table 19: Data are not available.

Turkey

72-75

Enquiry Table 19: Traditionally, forest fire control activities have always been given higher importance. Both the forestry community and the public itself are very sensitive to forest fires. The average annual recurrent cost (for operations only, investments and prevention activities are not included) for forest fire control is around 60-70 million US $.

Turkmenistan

72-75

Enquiry Table 19: The data for 1997 are secretariat estimates.

Ukraine

72-75

Enquiry Table 19: The data for 1997 are secretariat estimates.

United Kingdom

70, 71

Enquiry Table 18: Information on date, extent, etc. where there have been major individual episodes (e.g. a large wind-blow, snow storm, etc.):

Wind-blow: October 1987, affected most of Southern England; Insects: 1993 Pine Beauty moth.

Other comments:

Area with damage has been interpreted as area in which there is some damage present; not all this area is damaged.

"Primarily damaged by wildlife and grazing": The data are estimates from Countryside Survey 1990; FC Research unable to offer alternative.

"Primarily damaged by storm, wind, snow or other identifiable abiotic factors": estimate is 100,000 windblow + 35,000 other (drought, etc), where windblow is compromise between estimate of 125,000 ha with windblow in CS1990,and range based on Forest Research monitoring areas.

Area in defoliation classes 3 + 4 (estimate 75,000 ha, to be checked against table 20) has been split 30 insects + diseases, 35 other abiotic, 10 unidentified (rough guesses, to be checked).

"Primarily damaged by fire": The data are rough guess based on annual damage. The data for extent of damage represent State forest only.

"Primarily damaged from known local pollution sources": It is negligible (much less than 1000 ha).

"Extent of damage" for single year is the area damaged.

Item 18.2 of this *Enquiry Table* from S Gregory (Forest Research); and Item 18.4 from *Enquiry Table 19.*

18.6 of this *Enquiry Table* from C. Quine (Forest Research) - area requiring clearance after 1987 storm.

72-75

Enquiry Table 19: Figures are for financial years, running from April to March of following year and cover land owned by the Forest Enterprise, including other (non-forest) land.

76-78

Enquiry Table 20: There is a clear discontinuity in the United Kingdom data between 1992 and 1993. There is a change in the assessment method after 1992. The assessment of defoliation is the same - the change is between comparing sample trees with an "ideal" tree, or with a "local" tree. Comparisons are now compiled on both bases.

United States of America

70, 71

Enquiry Table 18: Source: Fire data from *Enquiry Table 22* "Indigenous and tribal peoples" source. Other data based on 1996 data from USDA Forest Service, State & Private Forestry Branch, Forest Health Protection staff.

Information on major individual episodes (e.g. a large wind snow storm, etc.):

Strong winds, hurricanes, tornadoes		*Area (ha)*
1995	– Idaho, Utah, Colorado	12,141
	– North-eastern U.S.	99,627
	– Alabama (25 per cent of forest)	2,218,970
1995	– North-eastern U.S.	607
	– N. Carolina, Virginia (Bertha, Fran)	107, 518
Drought		
1995	– North-eastern U.S.	4,212
1996	– Arizona	24,739
Flooding		
1993	– Midwest	4,452
1994	– Iowa	532
1995	– Missouri	73,273
1996	– Iowa, Vermong	5,463
Ice		
1993	– Iowa	62
Air pollution		
1996	– Northeast U.S. (sulfur dioxide)	12,141

Extent of damage due to wildlife and grazing is currently unknown for the United States. Methods of obtaining better information are under review.

72-75

Enquiry Table 19: Source: USDA Forest Service, Fire & Aviation Management Wildfire Statistics for all burnt acreage.

Data presented are for all fires reported to the national reporting system. This includes fires on non-wooded as well as wooded lands. Recent data for federal lands suggest that about 25 per cent of fires and 33 per cent of acreage burnt were on non-forested areas. The user may wish to use this information to extrapolate from the data presented, but is cautioned to note all such extrapolations. Information to separate forest from other wooded land was unavailable.

In the section on forest fires, the data for the United States include wildlife on all lands (not just forest and other wooded land).

The numbers of prescribed burning and mechanical treatment for the United States are efforts by the Forest Service only, not the United States in total.

76-78

Enquiry Table 20: Source: USDA Forest Service, State & Private Forestry Branch, Forest Health Protection staff.

Defoliation of trees in classes 0 and 1 is not visible from the air and was not measured. Also, data not collected by percent of sample trees but as area affected. These areas were converted to percent of total forest. Some areas may be affected by more than one pest causing a slight overestimate.

Yugoslavia

70, 71

Enquiry Table 18: Statistical Bulletin “Sumarstvo” 1996, 1997, 1990.

72-75

Enquiry Table 19: Statistical Bulletin “Sumarstvo” 1991-1996.

76-78

Enquiry Table 20: The figures for 1991 are for former Yugoslavia excluding Croatia and Slovenia.

No survey was done in 1992, 1993, 1994 and 1995.

The figures for 1996 are for Serbia and Montenegro.

CHAPTER VI: SOCIO-ECONOMIC FUNCTIONS OF FOREST AND OTHER WOODED LAND[1]

Overview

Chapter VI summarizes information from the TBFRA-2000 *Enquiry Tables 21* to *25* on the socio-economic functions of forest and other wooded land. These functions are recognized as extremely important, but are often difficult to quantify because of the lack of both reliable and comparable data. Therefore, much of the information for this section is descriptive rather than quantitative. The data collected in these tables are summarized in four sections: protective functions of forests and other wooded land, use of forests and other wooded land by indigenous and tribal peoples, public access to forest and other wooded land, and goods and services from forest and other wooded land.

Protective functions of forest and other wooded land

The primary source of quantitative data on protective functions was *Enquiry Table 21*, which focused on the management of forest and other wooded land for soil protection. A number of country replies provided information on additional protective functions either in their comments to that table or in response to section 5 of *Enquiry Table 24*. The information from both sources is summarized in this section.

Thirty-seven countries provided complete data in *Enquiry Table 21* on the amount of forest and other wooded land managed primarily for soil protection in two reference periods. Three countries provided data for one reference point. Although Cyprus did not provide quantitative estimates, the response indicated that between 5 and 10 per cent of forest and other wooded land is managed for soil protection. In some cases, data were not available for the entire country. For example, Australia reported that about 3.6 million ha on some State Forests are managed for soil protection, but data are unavailable on other forests and for other wooded land. Belgium included only public forests in Wallonia, where rules exist for protecting soil where slopes exceed 15 degrees. Estonia was not able to estimate the protective area on other wooded land.

In the 40 country responses, the proportion of forest and other wooded land area being managed primarily for soil protection varied from 0 per cent to 100 per cent in the most recent reference period (Table 6.1). Finland, Ireland, Norway, Sweden and the United Kingdom reported that soil erosion is not a problem on forest and other wooded land, resulting in either zero or a small percentage of land managed for soil protection. Therefore, a zero or low percentage of area designated does not necessarily indicate inadequate soil protection. For example, in the Netherlands, tree planting undertaken in the 19th century continues to protect against wind erosion, so that little area is currently designated for protection. Most countries (29 of the 40) reported an area less than 30 per cent being managed primarily for soil protection. Two countries (Greece, Kazakhstan) reported 100 per cent of the forest and other wooded land being managed primarily for soil protection.

Of the 37 countries which provided trend data, 25 countries showed an increase in the area managed primarily for soil protection. Countries that indicated a change in area greater than 30 per cent between the two reference periods included Albania, Belgium, Bulgaria, Poland, Turkey, and Yugoslavia. Only one country showed a decline (Slovenia), but the area affected was small. The remaining countries showed no change.

The importance of forest and other wooded land for soil protection is particularly significant for countries with extensive problems of soil erosion. Countries as disparate as Iceland and Turkey emphasized the role of forests in soil conservation. Soil erosion from deforestation and overgrazing is the greatest environmental problem facing Iceland. As a result, conserving existing forest and other wooded land and land reclamation by afforestation is important. Soil erosion is a serious threat to natural resources in Turkey, caused by natural climatic conditions, loss of vegetation covers, overgrazing, human settlement and other factors. Over 3 million ha of Turkish forest and other wooded land are managed for soil and water protection, and no production activities are allowed.

Although soil protection is important, numerous difficulties exist in evaluating the data for this indicator. First, countries seemed to be using different interpretations of “managing primarily for soil protection.” A very strict

[1] This chapter was prepared by Ms. Linda Langner (see Appendix V).

interpretation was taken by most countries that have specific designations for protective functions. The Czech Republic classifies forest in three categories: protection forests, special purposes forest, and commercial forest. A subset of forest within the special purpose class is considered important primarily for soil protection. The protected area in Japan included only forests managed to protect against soil erosion and landslide. The Russian Federation also has a strict classification process for protective forests, including 20 subdivisions for particular protective functions such as pollution abatement and water retention. Protection forests are a specific designation in Slovenia, where protection is the chief determinant of management actions. Portugal did not include more than 1 million ha of cork oak and green oak that combat desertification, even though soil protection is clearly one of the purposes of that forest area. Denmark included forest area managed for protection against sand dunes, protection against water pollution, and other wooded land in shelter belts and windbreaks. For those countries that explained the basis of their estimates, the tendency was to narrowly define the area that qualified as primarily for soil protection. However, other countries may have taken a less strict approach.

Second, several countries commented on the difficulty of responding to the question in cases where multiple use management is the dominant approach to forest management. Australia commented on the difficulty of reporting data when protective functions clearly overlap. Denmark noted the difficulty of estimating the area of forests with special purposes for protection when the main concept of Danish forestry management is multiple use. Canada and the United States did not provide data for *Enquiry Table 21* because it was not possible to isolate separate protection functions, although soil and water protection is an overriding consideration in development of forest policy and forest management. Both Australia and New Zealand noted that it was not possible to estimate such an area separate from other functions. However, New Zealand noted that removals of forest cover in the past led to severe erosion and flooding in some areas. As a result, much of the plantations have been and will continue to be planted on lands withdrawn from more erosive uses.

Because of difficulties with the comparability of responses, different approaches to management, and variations in the importance of soil erosion across countries, drawing conclusions from the current data must be done cautiously. Of particular concern is the number of protective functions that are excluded from Table 6.1, but are equally important as described below.

The country responses clearly indicated that public awareness of the value of the protective functions of forest and other wooded land has grown. As a result, demand for these functions is increasing throughout the temperate and boreal regions. Forests play a major role in protecting communities against avalanche, landslide, flood, noise, wind erosion, soil erosion, and air and water pollution. In coastal areas, forests play a key role in dune stabilization. Trees are often used in reclamation of mineral workings and other sites. Tree planting and afforestation programmes are often undertaken to address protective functions. The placement of trees in urban areas for screening noise, absorbing pollutants, and providing energy savings, is increasingly important. The increasing importance of the urban forest for providing climate, biodiversity, and social values was noted by several countries. Malta noted the importance of afforestation for watershed management and for amenity purposes, as well as enhancing the rural landscape to attract tourists. In the United Kingdom, trees are important on industrial sites to provide screening and for landscaping. Roadside plantings are used as noise barriers.

Numerous quantitative examples were provided of management for protective functions. France responded that about 350,000 ha of public forests are managed primarily for protection of the physical environment; only 55 per cent of that area was included in Table 6.1, the area that protects against avalanche, rock slides, and gullying. Lithuania only reported 2 per cent of its forest and other wooded land managed primarily for soil protection, but 13.2 per cent of the total forest area is classified as protection forests. Norway estimated only 1,000 ha were important primarily for soil protection, but a total of 4.38 million ha of forest and other wooded land (FOWL) are officially declared protection forest which included multiple protective functions. In addition to the area protected for soil protection, Poland has increased the area of FOWL providing protection for water, climatic reasons and for emissions control. Switzerland included 40 per cent of FOWL area in Table 6.1, but 52 per cent of the total forest area has the potential to protect against soil erosion.

Forests on mountainous or hilly terrain play a key role in preventing soil erosion in Armenia, Albania, and Azerbaijan because much of the forest is located on steep slopes, about 70 per cent in Armenia. The forests in Azerbaijan serve to retain water and soil and serve as the public's main protection against avalanche, landslide, and noise, while forests in the foothills and valleys serve for soil protection, climate regulation, and other environmental purposes. Tree strips are often planted as field protection by the Belarus Ministry of Forestry on collective and state farms. Hungary, United Kingdom, and the United States also mentioned the importance of forests in protecting agricultural lands. In Croatia, forests provide protection from water and wind erosion in coastal and hilly terrain, protection from air pollution in cities and industrial plant surroundings, and protection from floods. In Cyprus, forests play an important role in prevention and control of soil erosion from torrential rains, which is increasingly important in preventing siltation in water dams. About 30 per cent of the forests in Estonia provide some type of protective function, although only 4 per cent of the area was considered managed primarily for soil protection. Lithuania's protective forests include areas that protect water, and agricultural fields.

Several responses emphasized that forestry management practices are designed to minimize soil erosion and other environmental degradation. All Australian States and Territories have codes of practice or similar procedures in public forests for avoiding soil erosion in wood harvest and road operations. Efforts are being made to extend these codes onto private commercial forest land, especially on plantations. In addition to riparian strips, wildlife habitat strips, and special protection zones (e.g., steep areas), areas of forest are also managed for water catchment protection purposes. "Best management practices" are used in Canada and the United States to protect soil and water resources during management activities. Similar management approaches are used in other countries.

Given the broad array of protective functions described by countries, it would be safe to conclude that the area shown in Table 6.1 underestimates the total forest and other wooded land area managed for protective functions. Countries are giving increasing attention to the role of forest and other wooded land in providing environmental protection. Five countries provided estimates of the value of protective functions of forest. Germany estimated the additional cost per ha of managing forests to ensure the welfare functions at $25/ha. Poland provided estimates of the per ha value of several protective functions, ranging in value from $7 to $12/ha/year. Similarly, Slovakia provided estimates of several protection functions ranging from $.10 to $.20/ha/year. Switzerland estimated the replacement value of protection functions at $2.3 billion per year, while the management cost of ensuring those functions was estimated at $96 million per year. Austria estimated the total value of protective functions, including water protection, to range from $1 to $3 trillion per year.

Indigenous and tribal peoples

Few of the countries in the TBFRA regions have populations of indigenous and tribal peoples as defined by ILO. Seven countries reported information about indigenous and tribal peoples. There are several distinct geographic areas within the temperate and boreal zone covered by TBFRA where indigenous cultures remain in close contact with forest environments: the northern boreal zones of Scandinavia and the Russian Federation, North America, and Australia and New Zealand in the Pacific.

Northern Scandinavia is the traditional home of the Saami people. Norway and Sweden reported an estimated total population between the two countries of 57,000. The Saami have traditionally used the forest and other wooded land for reindeer grazing. Occasional harvesting of fuelwood or fencing materials also occurs. In Norway, approximately 3.24 million ha of forest and other wooded land are used by the Saami. On most of the land, only occasional grazing occurs, so that no significant conflicts exist between grazing and forestry. The domesticated reindeer population is estimated at 190,000. Total annual income to reindeer owners is estimated at $7.3 million.

Saami who own reindeer have the right to graze reindeer in Sweden. They do not own the forest collectively. Reindeer grazing is allowed on 16.5 million ha, of which 10-13 million ha is forest and other wooded land. The Saami also have the right to hunt and fish on some areas, mostly in alpine and sub-alpine regions. The reindeer population in 1991 was estimated at 310,000. The value of the lichen production, which is the main reindeer food, was estimated at about $100 million per year.

Finland reported no indigenous and tribal peoples.

The Russian Federation has an estimated indigenous peoples population of 504,900 individuals. Seventeen different groups of indigenous people were identified, some of which belong to larger groups and families. The majority (380,000) are Yakuts, followed by Nenets (34,200). The population figures primarily counts those indigenous people currently having difficulty in surviving, so the total is not limited to indigenous people associated with forests.

Of those indigenous peoples using Russian forest resources, the main uses are hunting, fishing, gathering berries, fungi, nuts, medicinal herbs, and wood cutting for personal use. In 1995, the Northern Minorities (Nomadic Community) Act initially granted 13.2 million ha of forest for the long term use of indigenous populations of the Republic of Sakha (Yakutia); another 2.1 million ha was subsequently granted. Long-term use was defined as 49 years. The Russian Forest Code imposes legal constraints on the use of forests in areas traditionally inhabited by indigenous minorities and ethnic groups. Use of these areas must uphold the traditional lifestyle of such people and ethnic communities, and the land must not be diverted to other uses.

North America has the largest population of indigenous peoples among the regions covered by TBFRA. Canada had 799,010 Aboriginals in 1996, of which 554,290 were North American Indians and the remainder were Métis or Inuit. The United States had 1,937,391 Native Americans, Eskimos, and Aleuts, according to the 1990 Census. A more restrictive definition of Native Americans is individuals who are enrolled in federally recognized tribes, which was estimated at 1,426,270 individuals.

Canada had 1,132,000 ha of Aboriginal land in 1994. About 72 per cent of those lands were managed. The ownership statistics are continually changing, as land claims are resolved. The actual area used is greater than land owned. For example, Aboriginal peoples are significant users of the public lands. Legal access to public forests is evolving as a result of land claims negotiations, treaty development, and/or modernization and other interpretations by

the courts. Generally, it is recognized in Canada that Aboriginal peoples have unique and special rights relative to public forests. A number of provinces have amended their forest legislation and regulations and practices to address Aboriginal rights.

The United States has the largest population of indigenous peoples in the temperate and boreal region. There are 555 federally recognized Native American tribes in the United States. No information exists on the percentage of the Native American population which uses forest for subsistence or other uses. Tribes own about 6.9 million ha of forest and other wooded land. In addition, they have rights of harvest and collection on an estimated 70 million ha of federal lands.

The uses of forest lands by indigenous and tribal peoples are similar in Canada and the United States. Many of the tribes have aboriginal-owned and managed forest products businesses, commercial fish operations, and guiding and outfitting operations for hunting and other types of recreation. Products harvested for tribal use include fish, furbearers, game for meat and hides to make clothing and other goods, firewood, plants for food and medicinal uses, and materials for crafts such as basketry. The forest also has important symbolic and cultural values, often associated with sites of spiritual or cultural significance.

Australia and New Zealand also have indigenous populations. New Zealand is the home of the Maori. About 15 per cent of the population of New Zealand is Maori, although most are not living in traditional style. The Maori have a spiritual and cultural relationship with indigenous forests, as these forests were traditionally a source of food and materials for health and shelter. Their cultural heritage and customary law is deeply embedded in the natural environment. Some of these traditional uses remain. All indigenous forests that contribute to the cultural, social, and spiritual needs of the Maori are subject to protective legislation. The whole question of indigenous rights in New Zealand is currently the focus of considerable attention. Forest ownership will continue to change as land claims are resolved under the Treaty of Waitangi Act.

In Australia, the population of Aboriginal and Torres Strait Island people is estimated at 352,970. About 12.6 per cent of the total area of forest and woodlands (almost 20 million ha) is under Aboriginal tenure, and is used by indigenous peoples for collection and harvesting of non-wood goods and services. This area includes Aboriginal freehold, Aboriginal leasehold, and Aboriginal reserve. Because of the intricate linkages between nature and the Aboriginal culture, it is important to identify and protect indigenous heritage values when undertaking assessments of forest and woodlands.

The main difficulty in providing useful data on this topic is trying to isolate the use of forest environments by indigenous and tribal peoples. Population censuses do not provide information on the percentage of the indigenous people living in or using forest and other wooded land. Not all indigenous peoples have strong ties to forest land. As a result, the data must be carefully interpreted since the total indigenous population may not be forest dependent, and traditional use is not necessarily tied to forests.

The legal rights of indigenous peoples, and their ownership of land tend to be complex and vary greatly between countries. In both the Pacific and North American countries, legal rights and land ownership are still evolving.

Access to and use of forest and other wooded land

Ownership patterns and property rights affect public access to forest and other wooded land. The data in *Enquiry Table 23* were used to summarize current access policies, show trends in access, and describe differences in the temperate and boreal region. Information on visitation from *Enquiry Table 23* is discussed in the section on leisure services of forest and other wooded land.

Access to public forest and other wooded land

Most countries that responded to *Enquiry Table 23* indicated that the public has access to most public forest and other wooded land for the purposes of recreation and gathering of forest products for personal use (Main Table 81). The exception is Azerbaijan, which reported that only 100,000 ha of the public forest are available for visits by the public.

Some types of public land restrictions occur in all countries, but these restrictions normally affect a small percentage of the public lands. The most common restrictions were related to protection of scientific reserves, ecologically sensitive areas, wildlife reserves, water catchment areas, and health and safety concerns. Restricted access to military lands was mentioned by numerous countries. Areas under specific management regimes often have restricted access. For example, forest regeneration areas, experimental plots, and stands for seed supply have restricted access in Poland. Belarus and the Ukraine reported restricted access to areas with radiation contamination. Restrictions may also exist for collection of forest products, such as mushrooms and berries.

The rules governing public access often vary by the type of public ownership. Forest and other wooded lands in the countries of the Commonwealth of Independent States (CIS), Albania, Bulgaria, and Malta are unique in that all

forest and other wooded land is owned by the central government. Other countries have a mix of public ownerships, including national and sub-national units such as states, provinces, cantons, counties, and local municipalities.

Laws that address access to public forest and other wooded lands vary by country. Albania has special articles in law that address protection of forest resources with national and international values, fees and payments for forest uses aimed at recreation, health, climate, and tourism, and for entrance and payments in national park territories and forest fund parks. Several countries described national laws that govern hunting, including Albania, Cyprus, Hungary, Liechtenstein, and Lithuania. In other countries, hunting laws and regulations are determined by provinces, states, or other units of government, so they often vary in different regions of the country. Many countries use a combination of licenses, season limits, quotas, and penalties in regulating hunting. Hunting may be prohibited entirely on some types of public lands, such as national parks in the United States.

Laws and regulations governing use of non-wood goods on public lands also vary considerably, although most countries allow personal collection of non-wood goods. Both Austria and Slovenia indicated that personal collection of mushrooms is limited to 2 kilos per person per day (on private land as well). Lithuania has a Mushroom Gathering Act and a Small Non-Wood Products Act that govern uses. Liechtenstein has a Nature Conservation Act that includes rules on gathering mushrooms. In the Flanders area of Belgium, access to public forests for gathering non-wood products such as mushrooms, mosses, and ferns requires special authorization from the Forest Inspection. Cyprus also requires a license to collect products from state forests. In Italy, specific regional rules guide the collection of forest products. Slovakia has limits on the collection of fruits in national parks.

Commercial use of forest and other wooded land normally requires special permits and some type of payment to the State, particularly for the harvest of wood products. Canada closely regulates the wood harvest on public lands, usually through a tenure system. In the United States, permits are issued for the collection of non-wood goods on national forests, while the wood harvest is conducted using a bid system. In Poland, commercial harvest of non-wood goods requires an agreement with the local forest district. Harvest for manufacturing or commercial purposes in the Ukraine requires payment for a special permit.

In addition to the types of access restrictions described above, there are often restrictions to prevent conflicts between uses. For example, access to timber harvest areas is often restricted for public safety purposes. Some types of recreation use are confined to specific routes to avoid resource damage. These types of restrictions are often seasonal or temporary, to adapt to changing resource conditions and shifts in harvesting activity.

Access to private forest and other wooded land

The countries in the TBFRA area generally fall into one of two categories of private land access policies. The majority of countries that have private forest land have a policy of open public access for recreation and gathering of forest products for personal use. In these countries, there is little difference between access to public and private lands, although the rights of landowners to restrict access varies. In most countries, access can be restricted for health and safety reasons, and during hunting seasons. Several countries restrict access to private lands to the daylight hours, including Denmark and Estonia. In some cases, use is restricted to paths and roads, or traditional routes of access. In Sweden, the public is not allowed to collect logging waste, branches, or the cones of wind-thrown trees without landowner permission. Although New Zealand and Turkey fall into this first category, both countries indicated it is customary to seek permission from the landowner before entry.

The second policy is to allow access only with the permission of the landowner. Only nine countries reported a policy where private property rights supersede public access (Australia, Belgium, Canada, France, Hungary, Ireland, Poland, United Kingdom, United States of America). Even in these countries, access is often allowed. Poland passed a new Polish Forest Act that allows owners to forbid access, but that right has not been commonly applied. In France, access is most often denied for the hunting season, or when the pressure from tourism is intense, or when the landowner is reserving the right to harvest products. At the same time, communities and user associations in France are working to make access to private lands easier. Finland requires that hunters receive a permit from the landowner in order to hunt on private land. In Hungary, the written permission of the landowner is needed to collect non-wood goods. In the United Kingdom, the public is allowed to use traditional rights of way through private land.

The effect of access restriction on public opportunities is difficult to assess. In countries such as Canada, the effect is likely to be minor, since more than 90 per cent of the forest and other wooded land is in public ownership. However, eastern Canada has a higher proportion of private land, which could affect public opportunities. In countries where a majority of forest and other wooded land is privately owned (Belgium, France, United Kingdom, and United States of America), access restrictions may limit public opportunities to enjoy forest land. However, access restrictions protect the interests of landowners to manage and use their lands for their own goals. The potential for commercial exploitation of non-wood goods is limited if harvest rights cannot be guaranteed. Access policies will remain an important factor in addressing increasing demand for many non-wood goods across the TBFRA area.

Trends in access to public and private forest and other wooded land

Forty-three of the responses provided information on trends in access to public and private lands: opportunities for recreation and gathering of forest products can be affected by changes in the area of forest and other wooded land, changes in the ownership distribution that changes access rights, changes in property rights, and policy changes. The restitution process being undertaken in several eastern European countries has affected ownership distribution. Increased use of legal protection for ecologically sensitive sites has also affected access.

Twenty-three countries reported that the trend in access to public and private land was stable. In most of these countries the ownership distribution and access policies remained stable. In cases where ownership distribution changed (e.g., the Czech Republic), public access is guaranteed on private and public land so that access was not considered to be affected.

Five countries (Albania, Armenia, Belgium, Ireland, Slovenia) reported a trend toward increased access on public lands. Increased access in Belgium was a result of public land acquisition. In Ireland, afforestation of public land has increased the area of public forest land. The increase in Slovenia was a result of a transfer of about 16,000 ha of military lands to other public ownership which had fewer access restrictions.

Seven countries (Estonia, Hungary, Japan, Lithuania, Slovakia, Ukraine, USA) reported decreasing access to public lands. In most cases, decreasing access was not attributed to a decrease in the area of public lands. Instead, increased restrictions or other barriers to access were the cause. In Hungary and Ukraine, the public is not allowed access to new forest reserve areas. The area of public land decreased in Lithuania as a result of restitution. Increasing restrictions on public land to protect sensitive nature areas, and a banning of economic activity has resulted in decreased access in Slovakia. In the United States, decreased access is a result of private development adjacent to public lands that has affected traditional routes of access.

Private land access has changed in twelve countries. A trend of increased access was indicated in six countries (Albania, Denmark, Estonia, Japan, Lithuania, United Kingdom). Increased access in Denmark was attributed to a recent law on nature protection that opened most privately owned forest to public access. In Lithuania, the area in private land has increased as a result of restitution. The United Kingdom has several incentive programmes for private landowners to allow public access.

Decreasing access to private forest land was reported by six countries (Hungary, Iceland, Poland, Slovakia, USA, Yugoslavia). The new Forest Law in Hungary allows forest owners to restrict access during forest activity, hunting, and to protect public safety. In Iceland, fragmentation of private land for summer cottage development has limited public access, since the public is not allowed on small lots with summer houses. Poland has seen an increase in private land area and has allowed private owners to forbid access. Therefore, the potential exists for decreased access. Decreasing access in the United States is based on a survey of landowners that indicated a smaller percentage of owners allowing general public access than 10 years ago. Fragmentation is one reason for the reduced access.

Overall, access policies to forest and other wooded land have remained fairly stable. The restitution process in several countries has shifted the distribution of land between public and private owners, but does not seem to have had major impacts on access to date. Increasing restrictions for environmental purposes reflect increased interest in protecting sensitive ecological areas and wildlife species. At the same time, development pressures are affecting forest and other wooded land, particularly adjacent to growing urban areas, which tends to negatively impact the land available for public access.

Goods and services from forest and other wooded land

The final section addresses the non-wood goods and services of forest and other wooded land. *Enquiry Table 24* asked for descriptive information about goods and services, while *Enquiry Table 25* asked for data on the quantity and value of goods harvested or collected from forest and other wooded land. This section organizes the information from *Enquiry Tables 24 and 25.*

The responses to the Enquiry demonstrated that forest and other wooded land produces an extremely diverse list of goods and services. Fortunately, several groups of goods and services were reported by a large number of countries. Therefore, the following summary primarily focuses on common goods and services. The section is broken into the following categories: wood products, mushrooms and berries, medicinal plants, decorative foliage, fodder and forage, hunting and game products, other non-wood products, leisure services, and aesthetic, cultural, historic, spiritual, and scientific values.

Not surprisingly, data about wood products were the most widely available across countries. Data availability for non-wood goods and services varied widely. Despite the lack of complete and consistent data across these goods, several messages were clear. First, the general trend is increasing demand for most of the goods and services. Second, the lack of supply information limits current ability to manage these resources. Finally, existing and potential conflicts between users, combined with the increasing demand are creating immediate challenges for managers.

There are several groups of users that affect demand, although in many cases the distinctions between the groups are not clear. Commercial demand is the dominant force for most wood products, but is less important for many of the non-wood products. However, the growing demand for "natural" products in many countries has spurred commercial interest in products such as mushrooms and medicinal plants. Therefore, commercial demand was reported as increasing for many products. Although many of these goods are produced in relatively small quantities, "wild" species often command a significant price premium over the cultivated species. Commercial collection includes a variety of users, from small-scale collectors that sell in local markets, to leases of large areas by multinational corporations.

Subsistence demand, personal use demand, and recreation demand were also used to describe different users. Personal use demand seems to be a more general term that includes both subsistence and recreation demand. Subsistence use is difficult to define. Indigenous people are often dependent on non-wood products for in-kind income. Gathering non-wood products is also an important part of their culture and the social fabric of the community. However, a number of other people also collect non-wood goods for food, to use in barter, or as inputs to other products that are then sold. A few countries indicated that demand for traditional collecting of non-wood products has declined as populations have become more urban. The recreation demand component of personal use was seen as increasing in most countries.

Lack of information about the supply of non-wood goods makes it difficult to assess the sustainability of current use, or appropriate management techniques. Many of the non-wood species are highly variable in production in response to climatic variation, and therefore are difficult to inventory and monitor. The growing demand, both domestically and internationally, for many of these products has led to the potential threat of over-use, destructive production techniques, and possible harm to the productivity of the resources. Few countries have a coherent management policy for non-wood products. Planning and control of sustainable harvest of non-wood products is growing in Australia. Two States currently have management programmes for the harvest of native flora for trade; other States are developing programmes. In the Russian Federation, the Russian Federal Forestry Service oversees harvest of a variety of non-wood products from their enterprises.

Conflict between users is growing in many countries. For example, an increasing number of recreation users from urban areas in Italy are travelling to rural areas to collect mushrooms and berries. Lack of knowledge and inexperience can cause damage to the resource and also provide direct competition to local users who have traditionally used the resource.

The quantities and value of the goods and services were provided for different years and in different currencies. In some cases, countries provided an average of production over multiple years. As a result, it is not possible to present the data in a common year. All currencies were converted to U.S. dollars, using an average exchange rate as close to the year of the data as possible (Table 6.2). The dollar values are nominal values, not real values. Therefore, any comparison between countries must be done with caution. The basis of the value estimates was often not provided by the countries. Where information was provided, the source of the value is described.

Wood products

Thirty-eight countries were able to quantify wood production and value. In addition to wood, a number of countries provided data on Christmas trees, and four countries provided data on cork production.

Demand for wood products was reported as increasing by most countries that commented on demand. It was difficult to determine whether the assessment of demand was limited to domestic demand or total demand, since international demand is important for countries that export wood products. New Zealand specifically reported that domestic demand was stable, and that increasing domestic production would be used to meet export demand. Belgium and Latvia reported stable demand, while Liechtenstein reported stable or possibly declining demand. Turkey reported that demand for fuelwood is declining.

The outlook for wood supply was reported by only 11 countries. Countries with active afforestation programmes or increasing plantations, which includes Ireland, New Zealand, and the United Kingdom, expect increasing supply in the future. Increases in growing stock are expected to increase wood supply in Finland, Poland, and USA. Supply was expected to be stable in Lithuania and the Ukraine, and decreasing in Slovenia. Latvia reported a potential supply of 8.5 million cubic metres per year. Although actual growing stock may be increasing in many countries, Finland's response raised the point that measures such as protecting old growth forest and conservation of rare biotopes may limit the availability of the supply. Azerbaijan indicated that much of the current merchantable wood in the country cannot be harvested for economic or environmental reasons. Therefore, current production is only a fraction of total potential supply.

The data on quantity and value of wood are shown in Table 6.3. Quantities of wood production were generally reported in cubic metres, although Israel reported wood production in metric tons. A number of countries provided information on a variety of wood products, some of which were not in comparable units. The data in Table 6.3 include only production reported in cubic metres. The Russian Federation data do not include pulp, paper, and cardboard production, which totalled 7.8 million tons valued at more than $5 billion. Fuelwood was included in some country

totals, but not in others. Japan reported 140.6 million cubic metres of fuelwood, valued at almost $18.4 million, which was not included in Table 6.3. In many cases, standard economic accounts do include all wood products. Armenia reported that 150,000 cubic metres of wood were harvested in 1996, but only 85,000 cubic metres are included in the production data. The Netherlands data included 100,000 cubic metres (valued at $500,000) that do not enter standard economic accounts.

Although cubic metres were the standard measure, most countries did not indicate whether the quantity was measured overbark or underbark. If total wood production reported in Table 6.3 are compared to total fellings data, production was usually equal to or less than reported overbark fellings. The exceptions included Belarus and Slovenia, both with production slightly greater than overbark fellings. Croatia and Cyprus also had greater production, but the data for production was for 1996, while the felling data were an average over a 10-year period.

Several types of values were provided. Denmark provided net national income, while Portugal provided estimates of income to forest owners. Canada provided total sale value of the forest industry. Finland provided gross stumpage earnings. France, Lithuania, New Zealand, and Norway provided values based on roadside value. Croatia, Japan, Slovakia, and Switzerland provided market prices. Wholesale prices were indicated for the Netherlands, Russian Federation, and the United States. If per unit values are calculated from these data, it is clear that countries are not valuing wood at the same stage of production. For example, the values for Japan and USA were based on wholesale product prices, not raw wood values. Therefore, wholesale values for Netherlands and Russian Federation are not comparable to Japan's value. Given the wide range of values provided, and the lack of clear definitions, caution must be used in any comparisons across countries.

Seventeen countries reported data on Christmas tree production and/or value, and four countries reported cork production (Table 6.4). Christmas tree production may include trees from Christmas tree plantations as well as harvest of individual trees from other forest areas, but not all countries included both sources of trees. Export of Christmas trees accounts for a large proportion of the production in some countries. The value of Christmas trees was based on wholesale value in Canada, income to the forest owner in Cyprus, net national income in Denmark, and retail prices in France, Netherlands, New Zealand, Norway, Slovakia, Slovenia, and Switzerland.

Cork is only harvested in a small number of countries in the TBFRA area because of the climatic requirements. Italy, Portugal, and Spain are the main producers in the region, with Portugal being the most important producer.

Mushrooms and berries

Mushrooms and/or berries were mentioned by thirty-four countries. This category covers a wide variety of species, only a small portion of which are collected for personal or commercial use. A few of the most often named mushrooms included chanterelles, boletes, matsutake, and morels. The most frequently named fruit species included bilberries, blueberries, cranberries, cloudberry, cowberries, lingonberries, and raspberries.

A few countries noted a decline in traditional collection of these products, including Belarus, Sweden, and Ukraine. In Sweden, the decline was attributed to an increasingly urban population who does not have time for collection and would prefer purchasing the product. In Norway, the demand for berries was assumed to be stable or decreasing, while mushrooms appear to be gaining in popularity. Stable demand was reported for Croatia and Latvia. Belgium and Slovenia indicated demand was increasing, particularly close to urban areas. Demand for berries and/or mushrooms was reported as increasing in Australia, Italy, and the United States. Finland noted that the demand for exporting mushrooms to Central Europe will likely increase in the future. Italy noted that the increase in demand is particularly marked for truffles. Lithuania reported that demand for forest berries is limited by supply.

Harvest of mushrooms and berries appears to be dominated by personal use, whether for subsistence or recreational purposes. Germany reported that commercial use is rare, since access for personal collection is free. In the Czech Republic, about 80 per cent of households picked berries, while 72 per cent picked mushrooms, according to a 1994/95 survey. Household use of mushrooms and berries is common in Estonia, including use of many species that are not commercially used. Lithuania estimated that 70-80 per cent of the collection of mushrooms and berries was for personal use.

Although personal use may be dominant in most countries, commercial demand for mushrooms and berries appears to be increasing throughout the region. In the Canadian province of British Columbia, 35 mushroom species are commercially harvested. Export demand in Europe and Japan is the primary target of the mushroom harvest. About 7 types of berries are commercially harvested, including currants, blackberries, blueberries, and huckleberries. Estonia exports bilberry, lingonberry, and cranberry. In Lithuania, 20-30 per cent of the quantity collected is for sale, including exports of red bilberries, cranberries, blueberries, and ashberries. About 20-25 per cent of collected products are bought for processing. However, the quantity of mushrooms and berries exported from Lithuania has declined since the 1970s and 1980s. Almost all of the national production of mushrooms in Portugal has been exported over the last few years. In addition, juniper berries and strawberries are used in brandy production, estimated at 3100 tons per year. Licensed commercial collection in the United Kingdom is only done locally on a small scale. The United States reported increasing commercial demand for mushrooms. In the Pacific Northwest region, commercial harvest is done

largely for export markets, primarily to Asia and Europe. Matsutakes are the most valuable of the mushrooms harvested, with 70 per cent of the harvest exported to Japan. Although most countries indicated use of mushrooms and berries was for human consumption, France reported the collection of bilberries for use in cosmetics and pharmaceuticals.

Few countries were able to comment on the supply situation for mushrooms and berries. The Nordic countries appear to have supplies well in excess of current demand. Finland estimated that only 10 per cent of the natural yields of mushrooms and berries are being harvested. Norway also indicated that supply is much greater than demand. Potential supply in Latvia also appears to be greater than demand at this time, estimated at 38,000 m.t. per year for three species. The Russian Federation estimated the average annual biological stocks of mushrooms at 43 million tons, and wild berries at 9.5 million tons. Current estimated production is currently less than 1 percent of the stock estimate. Lithuania noted that supply was considered a potential limiting factor and Poland noted an apparent decrease in supply of mushrooms. Lack of information on supply is a problem in the United States as attempts are made to manage a resource under increasing pressure.

Twenty-two countries provided quantitative estimates for mushrooms, truffles, and berries (Table 6.5). Quantities were uniformly reported in kilograms or tons. The quantities reported are not necessarily inclusive of total harvest. Some countries were able to include an estimate of personal use (e.g., Czech Republic, Finland, and Sweden), while others reported only commercial production (Slovakia and USA). In the case of the United States, data were available from only one region of the country. The responses that defined values included estimates of market price (Cyprus), income to the collectors (Finland, USA), and producer prices (Norway). In Finland, the value of domestic use was estimated using the market price for collectors. The value for Slovakia includes the value of forest fruits exported and processed domestically. Although the Russian Federation did not include a total value estimate, the average price for cranberries and bilberries was estimated between $1.50-$2.00 per kilo.

Medicinal and herbal plants

Twenty-three countries listed medicinal or herbal plants as a non-wood product of the forest collected for personal or commercial use. In several countries, such as Finland, interest in collecting medicinal plants had declined over the past few decades, but recently interest in these species has increased. Increasing demand for these products was noted in Australia, Canada, Estonia, France, Finland, and the USA. In the USA, demand grew more rapidly for herbal medicine that for over-the-counter drugs between 1986 and 1990. Lithuania noted that supply is not sufficient to meet demand for several medicinal plants. Demand was assumed to be stable in Croatia.

These “natural” remedies are seen as an alternative to conventional or synthetic medicine. Collecting medicinal plants for traditional uses by indigenous peoples remains an important use in some regions. Ten species of medicinal plants are collected in Armenia. About 70 species of medicinal herbs are used in Belarus, including birch bark for the production of medicinal tar. Most medicinal herbs in Estonia are home made, although some species are receiving scientific attention. The Russian Federation reported that more than 3000 species are used in folk and conventional medicine, although only 190 species are authorized for conventional medicine. Collection for personal use appears to be the dominant use of these plants, but commercial exploitation is growing in response to growing markets.

Pharmaceutical companies are involved in collecting medicinal plants in Canada, particularly in the western province of British Columbia. According to a survey of harvesters and foresters in the province, about 22 known medicinal species are commercially harvested. France noted that increasing quantities of plants are being collected for pharmaceutical use. Pharmaceutical companies in Lithuania process herbal materials from forest land, a large proportion of which is exported. However, export levels have declined considerably over the last three decades. In some cases, wild species have been the source of pharmaceuticals that are subsequently synthesized in the laboratory. One example is the Pacific yew, which was harvested for the extraction of taxol. Demand for Pacific yew in the USA has virtually disappeared since the semi-synthesis of taxol was achieved. Some herbal or medicinal plants are also raised under cultivation. However, wild plants often sell for a premium price. Wild ginseng in the USA can sell for up to 25 times the price of cultivated ginseng.

Twelve countries reported quantity and/or value data for medicinal plants (Table 6.6). The data for Albania are based on a medicinal plant inventory undertaken in 1988; the quantities represent potential productivity, not current production. The data for the Russian Federation is based on the quantity produced from enterprises of the Russsian Federal Forestry Service. The data for Slovakia include the quantity and value of plants exported and processed in domestic industries. Swiss quantities include only the amount harvested for commercial use. Although Poland did not provide total quantities, several species were listed that were in the greatest demand, including up to 100 tons of bark of sessile oak.

Decorative foliage

Decorative foliage includes a wide range of species used primarily in the floral industry. Tree branches and boughs of evergreen species are often harvested for seasonal use, while other species are collected throughout the year. Mosses and lichen are also collected for decorative use in a number of countries. Live plants, such as ferns, are often taken from the forest. Several countries listed leaves, which may be used in decorative crafts or shredded to make landscape mulch. Some uses of leaves may be for non-decorative purposes. Other products include species collected for crafts, such as willows for basketry.

Few countries provided an assessment of supply and demand trends for these products. Increasing demand was reported by Belgium and the United States, while stable demand was reported for Latvia and Liechtenstein.

Australia has a significant industry based on the export of wildflowers, foliage, and live plants, although not all of these species are from forest and other wooded land. In fact, increased cultivation of the most popular species has decreased the harvest of wild species. The export of lichen and mosses was reported by Finland, New Zealand, Slovakia, and the USA. The collection of lichens in France is for use in perfume and cosmetic processing. In Iceland, use of wood for home crafts is one of the main end uses of the wood harvest. Ornamental branches are taken during thinning operations and during intermediate and final cutting in Lithuania. Supply from these sources is expected to increase in the future as more wood is produced on special plantations. New Zealand reported that about 100,000 logs from giant tree ferns are collected each year. Norway reported that the lichen harvest was decreasing, but has stabilized in the last few years. In the northwest region of the USA, about one-quarter of decorative foliage products were exported to Europe.

Data were provided by ten countries on decorative foliage (Table 6.5). The data include information on decorative branches and boughs, mosses, lichens, leaves, flowers, and pine cones. These products were reported in metric tons (except in Switzerland). The quantity for Albania represents potential productivity. Denmark's value is net national income. The quantity and value for Finland and New Zealand are for export quantity of lichens or mosses only. For Slovakia, a small portion of the total (6.2 tons; $32,750) is based on the export of mosses and lichens, while the remainder of the quantity is based on the sale of leaves and branches from state forests both for export and domestic use. The value in Norway and the USA is wholesale value, while the value in Switzerland is based on retail prices. The value reported for the United States is limited to commercial collection in the Pacific Northwest region.

Fodder and forage

Twenty-five countries mentioned the use of forest and other wooded land for fodder and forage for domestic livestock, although this category was not considered an important product in most countries. Grazing is forbidden in the forest in Czech Republic, Lithuania, and Poland. In New Zealand, the native forests are not used for grazing. However, sheep and cattle sometimes graze farm forestry blocks before canopy closure. Other countries indicated that grazing in the forest is considered undesirable.

Customary grazing rights are important in rural areas of some countries but tend to be declining in importance. In Finland and Sweden, reindeer husbandry is an important local means of livelihood, and is the only important form of forest grazing. The value of reindeer meat of Finland was estimated at $21.8 million in 1996. Croatia reported decreasing demand for forage from forests. Estonia indicated that use of the forest for grazing and making hay has decreased and occurs only on a small scale locally. Grazing in woodlands is tending to decline in France as a result of more intensive animal husbandry techniques. Iceland forest and woodland is used chiefly for summer sheep grazing. Winter grazing and harvesting of birch and willow shoots is no longer practiced. In fact, overgrazing is considered one of the greatest environmental problems facing Iceland. Natural meadows and pasture have decreased in Lithuania, mostly as a result of declines in horse populations. Grazing is allowed in meadows and grazing grounds in Slovakia. Grazing is allowed only in limited areas where no forest damage will occur in Slovenia. Use is declining and is of little economic importance.

Alpine meadows have been an important source of fodder for centuries in Austria. Recently, conflicts have arisen between grazing and forest protection in sensitive areas. In Belarus, controlled cattle grazing is allowed on meadowlands with the forest area, an area of 41,700 ha. But grazing within the forest is considered undesirable. Cyprus allows grazing on only 3.5 per cent of the state forests. Although demand is increasing for grazing, the official policy is to not expand grazing. Meadowlands and pastures within the forest are important sources of green and coarse fodder in the Russian Federation. About 1.5 million ha of meadowland and pasture occur in the European and Uralic part of the Federation, while over 18 million ha occur in the Asian part.

Other countries are using grazing as a management practice. In the Flanders region of Belgium, demand for forage is increasing as a result of the extension of grazed areas for nature conservation purposes. Fodder from forest land is also important in Israel, where grazing is used for forest management and for meat production. Fodder and grazing of cows is used as a nature conservation measure in areas of the Netherlands. Although not the source of substantial income at this time, increased use of grazing may increase the potential for income from selling meat. The

rare instances of grazing in woodlands in the United Kingdom occur in conjunction with special management regimes. In some areas in the south, pony grazing is a locally significant tradition.

Although most countries indicated a declining trend for forage, there were several exceptions. Armenia indicated that grazing is not allowed where damage to the forest could occur. However, the economic situation in rural areas and customary local rights are considered in these decisions. The result has been increasing grazing in rural areas, particularly for pigs. The potential for grazing in Norway is still below current use. Only part of that potential is on forest and other wooded land. Increasing populations of sheep and cattle could impact these lands in the future.

A few countries provided quantitative estimates of forage production. Armenia produced 3,170 tons of fodder in 1996, valued at $40,000. Austria estimated the value of fodder at $1 to 1.4 million. In Azerbaijan, 38,000 ha of meadow and pasture yield 900 to 1,000 tons of hay and 100-130 tons of clover per year. Annual hay production from forest and other wooded land in Croatia was estimated at 7500 tons, valued at $2.5 million. Kazakhstan reported 32,238 tons of hay, valued at $189,300. The Republic of Moldova reported 2,515 tons of hay, valued at $27,000. Forage production from 150,000 ha of Swiss forest and other wooded land was estimated to be 42.5 million kilograms in 1996, valued at $12.7 million. In addition, 115 tons of forage (valued at $25.2 million) were estimated to be consumed by wild herbivore. Livestock grazing on the forests in the southern USA consume between 5 and 7 million tons of forage annually.

Hunting and game products

Hunting might have been included as a recreational activity, but is discussed separately for three reasons. First, hunting is more closely regulated than most recreation activities. As a result, countries have more data on hunting than on most recreation activities. Second, hunting produces tangible products that can be quantified. Third, in some countries, for example in Germany, hunting is considered as a form of utilization of natural resources on a sustained basis and as wildlife management supervised by the government. The products described by country responses include game harvest numbers, weight of game meat, and number of trophies. The harvest of pelts and furs is also included in this section.

Trends in hunting varied across countries. Austria, Croatia, Lithuania, and Portugal reported increasing demand. Part of the increased demand in Lithuania is from foreign hunters. Stable demand was reported in Finland, although the value of the game bag increased from $43-49 million to $57-63 million in the last 10 years.

Italy reported declining demand. The main reasons for declining demand in Italy were more restrictive rules and increased interest in other activities. The amount and value of hunting were reported as declining in the Netherlands as a result of anti-hunting sentiment. In the United States, the percent of the population participating has been declining over several decades. Only recently has the total number of hunters also declined, although demand for some types of hunting is expected to increase in the future. Some reasons for declining hunting participation include an increasingly urban population, and time constraints.

Hunting is a source of significant income to both private landowners and the public management agencies. Most countries have requirements for licenses and associated fees which accrue to the managing agencies. Hunting rights must be leased on public and private lands in some countries, while access is free in other countries. Often, requirements for leasing vary within a country. For example, although permission to enter private land is required in the United States, hunting access is often granted at no charge.

About $13 million of income is generated from hunting leases in Belgium. Denmark estimated that net national income from hunting was $25 million in 1996. Hunting rights are rented in Finland, but often at quite low rates, such as $0.21-0.44/ha/yr. Incomes from leases are important in Germany, with an annual lease fee of between $6 and $35/ha, depending on the location and quality of the site. Hunters also spend much time and money improving the ecological conditions of their hunting districts. Hunting produced $20 million of income in Hungary in fees from services associated with hunting. In addition to the value of game meat, Hungary reported the value of game trophies in 1996 at $1.2 million for almost 25,000 trophies. The value of hunting trophies and horns in Lithuania totaled $161,000. In the Netherlands, hunting rates were estimated at between $12 and $21/ha/yr. The 1996 annual report of forest owners reported that hunting rights provided $1.1 million to forest owners; State forests were estimated to generate about $1 million per year. Almost 61,000 trophies of various Cervidae species were harvested in Poland in 1996. Hunting licenses generated $5.5 million of revenue for Portugal in 1995. In addition to meat value, trophies in Slovakia in 1995-96 generated $1.5 million. The value of 13,000 trophies taken in Slovenia in 1996 was estimated to be $7.4 million. Much of the venison harvested in the United Kingdom is exported.

Many hunters spend significant amounts of money on equipment, guide fees, and travel. Belarus estimated that the value of hunting and tourism in 1995-1996 was $118,200. In Ireland, hunting and fishing are seen as having real potential to add economic value to the forest, since increasing tourist demand is partly based on demand for natural amenities. Italy is a major importer of game and meat. Italian hunters spend $15-21 million per year abroad, mostly in Eastern Europe. Average expense per hunter was estimated at $920 per year.

Game meat or harvest was reported by twenty-three countries (Table 6.7). Several countries provided an average value over several years. In some countries, the commercial sale of game meat is an important economic activity, including the export of game meat. The quantities in Table 6.7 vary in whether they are estimates of the weight of total harvest or the portion of harvest that is commercially sold. The value of game meat reported was described as market price in Cyprus, retail value in the Netherlands, and as the value of export, domestic consumption, and industrial processing in Slovakia. Game meat in New Zealand includes venison from feral populations only. The value is based on wholesale price at the meat plant. Game harvest for the United States includes only the most commonly hunted species associated with forest land.

Data provided for furs may include production from fur farms, and therefore may overstate the importance of forest and other wooded land for fur harvest. Demand for furs has been erratic over the last several decades, largely reflecting public attitudes towards furs and trapping. In Lithuania, 90 per cent of the fur harvest used to be exported. Today, no furs are being exported from lack of demand. A total of 25,300 furbearers were harvested in 1996, although only 8,040 were valued in Table 6.6. Fur production is important in rural areas of Sweden, but the demand is less than the potential supply. The future outlook for furs in the USA will be affected primarily by international demand, since domestic demand is expected to be stable or declining. In Norway, increasing number of elk hides are being processed for clothing. Australia also reported an increasing number of animal products being used commercially.

Eleven countries provided fur or pelt data (Table 6.7). The largest number of pelts is produced in Canada, the Russian Federation, and USA. The Canadian and USA quantity and value are of the total harvest, which includes species that are not associated with forest and other wooded land. Values are generally producers' price, i.e., the price received by the trapper or hunter. Slovakia's data include only furs that were exported.

Several countries provided information about fishing, although it is difficult to separate harvest that occurred in association with forest and other wooded land. Sport fishing often occurs in forest environments. The management of forest and other wooded land directly affects the quality of fish habitats, which in turn affects the populations available for commercial and recreational use. In most countries, fishing is a more popular activity than hunting. The Czech Republic reported an annual average of 3,000 tons of fish production. Italy reported annual fishing production at 300 tons. Total production in Sweden was 26,000 tons, valued at $61.4 million. The reported harvest for the USA is restricted to salmon species, which spend part of their life in forest environments. Salmon harvest in 1995 was 517,000 tons, valued at $521 million.

Other non-wood products

A variety of other non-wood products were reported, including ants' eggs, bamboo shoots, barks for tannin extraction, birch sap, bird sap, carob, honey, gums, lacquer, nuts, peat, propolis, resin, maple syrup, and tar. A number of edible plants were mentioned that were not included under mushrooms, berries, or medicinals, such as wild rice. A number of forest products are used to produce industrial extracts, essential oils, and cosmetics. Slovenia reported that about 120 species are used for industrial extracts, but the quantities gathered are small.

Resin is still being produced in some countries, although production has been stopped in Finland, Poland and Slovenia. Portugal has had a decline in resin production because of desertification in rural areas, higher labour costs, and external market competition. In 1995, Portugal produced 40,000 tons, valued at $80.7 million. France reported 2,550 tons of resin, valued at $1.6 million, but also noted that production has become marginal. Lithuania also reported a decline in resin production. In the Russian Federation, almost 1.7 million ha are possibly being tapped for resin to produce rosin and turpentine. Turkey reported 113 tons of resin valued at $120,000 in 1996.

Honey production was mentioned by eighteen countries, of which fourteen were able to provide data (Table 6.8). In most cases, it was not possible to provide production data for forest and other wooded land separately. For instance, Slovakia reported that the production includes honey from agricultural lands as well as forest land. The data from Slovakia include the quantity and value of honey exported and processed domestically. The data from New Zealand are limited to honey produced from indigenous tree areas, and are valued using retail prices. Honey is widely harvested from forest and other wooded land in Australia, as well as from pasture and heathlands. Belarus reported that the full potential of honey from forest and other wooded land is not being exploited. An increase in beekeeping has occurred in Finland, partly on forest lands. France reported a high demand for honey from forest lands. Israel reported increasing total demand. Norway has stable demand, and noted that the harvest potential for honey is four times the current amount produced. The increasing demand and associated production in Portugal have resulted in investments in automation for processing. In the Russian Federation, linden stands can produce between 500 and 1,000 kg of honey per ha. Production is currently taking place on about 2.6 million ha. Slovakia reported that about 20 per cent of the potential supply of honey is currently being used, but that includes supply from both forestry and agricultural production.

Various species of nuts are harvested from forest and other wooded land. Data on production and value of nuts are shown for ten countries in Table 6.8. Chestnuts, acorns, hazelnuts, and pinions were listed by several countries. About one-third to one-half of Portugal's chestnut production is exported. Chestnuts are harvested in Slovenia to use in

the production of tannins. The value of chestnuts in Slovakia is income to collectors. Hazelnuts are a specialized crop that is concentrated in several regions of Italy. Acorns were once an important crop in Italy, but their use has declined. However, some increased activity in acorn collection has begun recently. Pinions are collected in Portugal. Pinions are the main direct economic value of *Pinus pinea*, but stands are not managed for pinion production, which currently produce about 700 tons per year. Pine nuts, acorns, and chestnuts are collected in Turkey, mostly by local villagers.

Production and value data were provided for several other products by a small number of countries. Belarus reported 5,000 tons of birch sap were harvested in 1995-1996, valued at $500,000. Japan reported 1996 data on lacquer (3,190 kg, $1.25 million), bamboo shoots (53,083 tons, $106 million), and wax (85 tons, $2.2 million). Five countries provided data on seeds: Albania (500 tons, $1.9 million), Germany (919 tons, $9.1 million), Italy (1,827 tons, $3.9 million), Switzerland (42 tons, $143,000) and Turkey (644 tons, $528,000).

Both Azerbaijan and Kazakhstan reported a number of agricultural products. The forestry authorities have jurisdiction over some agricultural lands, on which they produce agricultural products as secondary products to forest products. The system was set up under the soviet system, and is still practised in some CIS countries. The goal of these enterprises is to mitigate any food shortages in country markets.

Leisure services

The importance of forests for leisure and recreational use is increasing across the TBFRA area. Increasing demand for recreation was noted by most countries that commented on demand trends. One exception to the trend was reported in Lithuania, where recreation use has declined significantly since the mid-1980s. However, visitation is expected to rebound in the future, partly as a result of foreign visitors.

Forests are often the preferred environment for leisure activities such as picnicking, hiking, camping, horseback riding, and mountain biking. In Armenia, 80 per cent of resorts are located either within a forest estate or adjacent to forest lands. Forests are rare in Iceland, yet they are the most popular sites for recreation. In Cyprus, hunting, outdoor recreation, and skiing were listed as the most important social values for State Forests. Both Poland and the Russian Federation reported that visiting the forest is the country's main leisure activity.

A variety of leisure activities take place on forest and other wooded land. A survey from Denmark indicated that 90 per cent of adult Danes visit the forest at least once a year. The most popular activity (63 per cent participation) was walking, followed closely by enjoying nature (55 per cent). Walking was also the most popular activity in France, Netherlands, and USA. In a 1996 survey of Swedes, only 5 per cent of respondents indicated that they never visit the forest, 47 per cent indicated they visited between 1 and 20 days per year, and 40 per cent visited more than 20 days per year.

One indicator of the increasing demand for recreation is the trend in recreation facilities or special designations for recreation use. Canada reported an increasing number of campsites and other recreation facilities. In Finland, increasing demand has resulted in additional sites and parks reserved and managed for recreation. An increased number of forested areas with trails for skiing, hiking, and snowmobiling are also needed. The Turkish Ministry of Forests is responsible for developing recreation sites and facilities within suitable forest areas to meet increasing demands. In Slovenia, it is possible to declare a forest area "forest with a special purpose" which can emphasize recreation in its management. If such a designation results in a loss of income for a landowner, the owner can claim compensation.

Enquiry Table 23 included a question about visitor use of forest and other wooded land. Since the responses focused on recreational use, the results are included in this section. The unit of measure for visitation varied, and visitation information was often available only for a sample of site. Most data were limited to visitation on public lands. The reliability of the data also varies greatly. In some cases, actual counts are made, or use can be estimated based on fees or permits. Estimates in other cases may be based on expert judgement or other less rigorous sampling methods. In many cases, visits cannot be separated by occurrence on forest and other wooded land versus other land cover types.

Australia provided visitor use estimates for a portion of National Parks, state forests, and other Crown land. About 40 per cent of the National Parks accounted for 36 million visits in 1995. Approximately 11 million of those visits were to forest and other wooded land on the National Parks. A small sample of Australian state forest units (4 per cent of all units) had a total of 8.2 million visits to forest and other wooded land, while another small sample (6 per cent of all units) of other Crown land recorded 30.5 million visits. Cyprus estimated that 1.8 million people visited state-owned forests in 1997. State forests in Iceland receive about 140,000 visitors per year. Lithuania had 17.8 million visitor days in 1990, but the number declined to 7 million in 1996. About 2 million visitor days were estimated on private forest land. In the Netherlands, it was estimated that between 180 and 230 million visits were made to the forest every year. Sweden estimated an average of 420,000 visitors per day to forest and other wooded land, based on a 1996 survey. Turkey estimated about 10 million people visit recreation sites annually. State-owned lands in the United Kingdom had about 55 million day visits, while other public lands had 185 million day visits. Total recreation visits to all federal lands in the United States were about 1.6 billion in 1996. Yugoslavia reported 500,000 visitors per year to state forests.

Data on recreation use of private lands were more limited than for public lands. Estonia reported one example of a 26,000 ha private forest that was visited by 15,000 visitors per day. The United Kingdom reported 75 million day visits to privately owned woodland, and another 35 million visits to areas owned by voluntary organisations.

The density of recreation use was reported by several countries. Belarus reported a density of 800 visitors/ thousand ha/year. Average visitation in the Czech Republic was estimated at between 24 and 37 people/ha. Kazakhstan estimated that about 2.1 persons/ha visited state-owned lands in 1997. Poland reported a range of 2-14 persons/ha/year on state forests. Slovakia reported visitation for several national parks that ranged from 287 to 365 visitors/ha/yr. Slovenia was able to estimate density by ownership: 1.2 visitors/ha/yr on state forest, 2 visitors/ha/yr on other public forests, and 0.8 visitors/ha/yr on nonindustrial private land.

Several countries emphasized the importance of forest and other wooded land in close proximity to population centres. Belgium noted the increasing importance of forest near urban centres, while the Czech Republic reported that recreation use is more important than commercial use near urban centers. In New Zealand, the need for readily accessible recreation facilities as a result of ongoing urbanization is receiving increased attention from urban authorities. Poland has 388,500 ha of forests around cities and towns. Most of that area is under intense visitation pressure. The United Kingdom mentioned the importance of having opportunities for recreation close to towns.

A few quantitative examples of visitation near urban areas reinforce the importance of forest and other wooded land near urban areas. In the Flanders region of Belgium, 350,000 people visit state forests each weekend. Denmark reported that 20 per cent of recreation visits occur on less than 2 per cent of the forest area. In Estonia, a public forest of 240,000 ha was identified as receiving high visitation, recorded at 293,000 visits per day. Iceland reported 250,000 visitors/year to 2 municipal forests, which exceeded estimated visits to all state forests. The Netherlands provided two examples of high intensity use: a reserve of 5,600 ha receiving 5 million visits/year and a state area of 2,000 ha receiving 2 million visits/year. Slovakia categorizes forest area by the intensity of recreation. About 2 million ha were identified as being in the two highest use categories, accounting for 790,000 visitors per year.

The data provided are not sufficient for estimating total recreation use in the TBFRA area. However, the data and other comments underscore the importance of forest environments for recreation. Recreation and tourism have also become increasingly important to both national and local economies. The growth in nature-based tourism can be beneficial to rural communities in forest areas, as well as to national economies in general. Forest and other natural environments are often an important attraction for tourists. For example, a survey of international visitors to New Zealand in 1995-6 indicated that 63 per cent of visitors visited a national forest or maritime park. International ecotourism was cited as one factor behind increasing demand for recreation in Finland and Ireland. Agritourism is increasingly important in Italy, which resulted in $46 million for businesses in 1992. In Canada, the revenue to outfitter and guide services in 1993 was $252.7 million, a substantial increase over previous years. The Netherlands reported an income for forest owners of $1.3 million for camping and recreation.

Forest and other wooded land are also valued for social benefits that are not directly related to leisure activities. These values are most evident around urban areas, where the value of trees for climate regulation, noise protection, and aesthetics is important. Belgium specifically mentioned the importance of forests around urban centres for climate, biodiversity, and other social functions. In Iceland, urban residents are actively involved in afforestation for aesthetic and other purposes. Many people value forests regardless of any intent to visit those forests. These types of values are termed “passive use” or “non-use” values.

Aesthetic, cultural, historic, spiritual and scientific values

The values covered in this section are extremely diverse. Protected area designations are often used to conserve aesthetic, cultural, historic, spiritual, and scientific values. It is difficult to draw comparisons across countries, since the definitions for these designations vary greatly.

Most countries reported that the demand for these types of values is increasing, at least partly in response to increased public knowledge and appreciation of the role which forest and other wooded land plays in maintaining or enhancing such values. In a few cases, demand was reported as stable. A number of countries have special legislation or other types of programmes to protect these values. Finland has a national programme to protect important rural landscapes with special importance for cultural, historic, or aesthetic reasons. The Norwegian Forest and Forest Protection Act requires that biological diversity, recreational landscape, and cultural and historic values be considered in management action. Increasing efforts are being made to instruct forest owners in managing to protect these values.

A number of archaeological and cultural monuments are located in forest areas in Armenia. Cultural and spiritual sites for indigenous peoples are often located in forests. The dominance of forests in the Canadian landscape is reflected in their literature, painting, sculpture, and music composition. Long interaction with forests is also reflected in the culture, history, and spiritual values of the Portuguese. In the United Kingdom, woodlands that were designed in the 17th and 18th centuries have historic importance. Sweden has increased attention to saving remnants of old settlements associated with logging and other forest activities as part of the cultural heritage. In the United States, the

Heritage Program protects historic and cultural sites on National Forests. National Monuments and National Historic Areas are also designed to protect both natural and human sites of historic significance.

Forests are often important sites for scientific research. Scientific values associated with forest and other land includes biodiversity, endemism, and rare and endangered flora and fauna. A number of academic and industry institutions in Azerbaijan conduct ecological, biological, and historic research in the forest. A network of forest reserves was created 20 years ago in Slovenia for research into forest ecosystems. Educational values are also important. Slovenia has nature trails designed for educating school children about forest ecosystems. In the United States, Research Natural Areas and National Scenic Research Areas are used for research studies.

In the Czech Republic, almost 12,000 square km of forest are in some type of protected area designation, including National Parks, National Nature Reservations, National Nature Monuments, and Natural Monuments. The largest portion falls under the Protected Landscape Area designation. About 6 per cent of the forest area in Estonia is in some type of protected territory, including National Parks, Nature Reserves, Landscape Reserves, and Botanic Reserves. Approximately 5,000 ha of Ireland's forest and other wooded land are designated for aesthetic, cultural, and scientific purposes, mostly in parks or nature reserves. An additional 1,000 ha are in botanic gardens, arboretums, parks, and small areas of native woodland. Protected areas in Poland have increased dramatically since 1980, currently totalling about 9.6 million ha. The largest proportion of the total area are areas of protected landscapes (6.6 million ha), with the remained divided among National Parks, forest reservations, landscape parks, forest monuments, and forest promotion areas. Many of these areas protect ecological and other values. About 92 million ha are part of a national network of national parks, natural monuments, nature reservations and other protected areas in the Russian Federation. About 333,500 ha of protected area play a vital role in protecting biodiversity and natural and cultural value in Turkey. Turkey's National Parks emphasize scientific and aesthetic values; Nature Parks emphasize vegetation, wildlife, and recreation, while Nature reserves emphasize scientific and educational purpose. In the United States, the National Park System was created primarily to protect areas of outstanding scenic value. Special designations such as Scenic Byways and Wild and Scenic Rivers also protect areas with outstanding aesthetic values. The National Wilderness Preservation System protects biological diversity on relatively pristine areas, and serves as a useful living laboratory. National Monuments and National Historic Areas protect sites of both natural and human historic significance.

Summary and conclusions

The goods and services from forests provide a wide range of benefits. The TBFRA 2000 attempted to describe these goods and services more fully than previous assessments. The result is a sometimes bewildering array of products and services. The protective functions of forests are receiving increasing attention, at least partly in response to international attention to issues such as biodiversity, global climate change, and forest health. A number of countries are exploring approaches to alter or enhance forest inventory systems to better measure the protective functions of forests. Possibly future assessments will be better able to include comparable data on a wider array of protective functions.

Forests play an important role in many indigenous and tribal cultures. The information in this chapter was brief, and only begins to describe the importance of these lands to indigenous and tribal peoples. A more complete treatment would require consultation with the tribal peoples and other experts.

Data on the quantity of non-wood goods from forests are limited in most countries. At best, some countries collect data on the most important goods, or have data on commercial production or exports. The measures of quantity were fairly standard across countries, although it was often not clear whether all types of production were included (particularly for personal use). Personal use often accounts for the largest share of use. However, since that use is not seen as economically important in many countries, there is little incentive to collect data. Additional attention may be directed to this topic in cases where personal use has the potential to harm the resource, or where personal and commercial collection are in conflict.

Even where data were available for production, the estimates are seldom based on recurring, statistically designed inventories. As a result, no confidence intervals can be provided, and it is difficult to assess the reliability of the data. A similar issue existed for values associated with products, since products can be valued at many stages of production. Although some countries defined the basis of their value estimate, many did not. At a minimum, future assessments should provide clearer definitions for the products, and require better information about the source and coverage of the data.

Data on services, such as recreation, tend to be even more problematic. With the possible exception of hunting, statistically reliable data for leisure activities are fairly rare. Even where data exist, separating the component that occurs on forest and other wooded land is difficult. Consideration should be given to whether trying to separate forest and other wooded land use is a practical or desirable approach. A more logical approach may be to describe leisure activities in natural environments, and then assess the forest component where feasible.

Plans for future assessments will need to consider what goods and services are important to report at the international scale. Several criteria can be considered:

1) the importance of the forest in supplying the good or service;
2) the geographic scope of the good or service;
3) the economic importance of the good or service;
4) ability of countries to provide common measures of quantity and value; and
5) whether the good or service is part of national or international reporting requirements.

A number of the goods and services described in this chapter appear to have potential for future assessments. However, any significant progress beyond current information will likely require additional data collection, as well as coordination with organizations that may have data or expertise unavailable in the traditional agencies participating in forest assessments.

TABLE 6.1

Area and per cent of forest and other wooded land managed primarily for soil protection

Country	Year	FOWL area managed primarily for soil protection	Per cent of FOWL area managed primarily for soil protection
		(1000 ha)	(per cent)
Albania	1995	107.3	10
Armenia	1993	235	26
Austria	1996	839	21
Azerbaijan	1988	940.7	95
Belarus	1997	0	0
Belgium	1997	143.4	21
Bulgaria	1995	524.2	13
Croatia	1996	48	2
Czech Republic	1995	2	<1
Denmark	1990	58	11
Estonia	1994	97	4
Finland	1991	0	0
France	1997	192	1
Germany	1993	480	4
Greece	1992	6513	100
Hungary	1996	164	9
Iceland	1998	116	89
Ireland	1996	0	0
Israel	1997	3	2
Italy	1995	553	5
Japan	1996	2073	8
Kazakhstan	1993	16673	100
Latvia	1997	44	1
Lithuania	1996	45.7	2
Netherlands	1996	4	1
Norway	1996	1	<1
Poland	1996	255.67	3
Portugal	1995	95	3
Republic of Moldova	1997	52.5	15
Romania	1990	812.5	12
Russian Federation	1993	151352.7	17
Slovakia	1996	294	14
Slovenia	1996	68.3	6
Spain	1996	22134	85
Sweden	1996	33	<1
Switzerland	1996	493	40
Turkey	1996	3246	16
Ukraine	1996	2915	31
United Kingdom	1995	0	0
Yugoslavia	1995	433.29	12

TABLE 6.2

Exchange rates applied in Chapter VI

Country	Currency National	Currency per USD	Date
Armenia*	AMD	500	
Australia	AUD	1.28	1996
Austria	ATS	10.59	1996
Belgium	BEF	35.12	1986 to 1996 average
Canada	CAD	1.37	1995
Cyprus	CYP	0.47	1996
Denmark	DKK	5.8	1996
Estonia	EEK	12.03	1996
Finland	FIM	4.59	1996
France	FRF	5.57	1989 to 1995 average
Germany*	DEM	1.7	
Hungary	HUF	152.65	1996
Italy	ITL	1628.9	1995
Japan	JPY	108.78	1996
Kazakhstan	KZT	67.3	1996
Lithuania	LTL	4	1996
Netherlands	NLG	1.69	1996
New Zealand	NZD	1.45	1996
Norway	NOK	6.62	1994 to 1996 average
Poland	PLN	2.7	1996
Republic of Moldova	MDL	4.6	1995
Russian Federation*	RUR	4566	1995
Slovakia	SKK	30.84	1993 to 1995 average
Slovenia	SIT	135.36	1996
Switzerland	CHK	1.24	1996
Turkey*	TRL	81137	1996
United Kingdom	GBP	0.63	1995

* Rate provided by country.

All other rates from 1996 IMF International Financial Statistics Yearbook.

TABLE 6.3

Quantity and value of wood from forest and other wooded land

Country	Year	Total wood produced (1000 m^3)	Value of wood produced (million USD)
Albania		740	4.4
Armenia	1996	85	0.8
Australia	1993 to 1994	18793	2681.0
Austria		20000	1180.0
Azerbaijan	1988	60	
Belarus	1995	9830	39.2
Belgium	1986 to 1995	4400	160.0
Canada	1995	188433	51800.0
Croatia	1996	3000	144.0
Cyprus	1996	41	1.0
Czech Republic	1993 to 1995	11568	363.1
Denmark	1996	1900	60.3
Finland	1996	46915	1769.1
France		40600	1974.9
Germany		39272	1990.0
Hungary	1996	5321	173.9
Iceland	1998	0.15	0.15
Ireland	1996	2350	80.0
Israel*	1997	115	2.0
Italy	1995	10101	550.3
Japan	1996	15255	3875.3
Kazakhstan	1996	1039	16.1
Lithuania	1996	5537	101.0
Netherlands		1080	53.7
New Zealand	1996	16930	642.1
Norway	1994 to 1996	9340	482.5
Poland	1996	22100	922.2
Portugal	1995	8978	241.6
Republic of Moldova	1991 to 1996	362	
Russian Federation	1993 to 1995	112400	3745.0
Slovakia		5459	187.0
Slovenia	1996	2400	129.3
Sweden		55400	2362.0
Switzerland	1996	5400	435.5
Turkey	1996	15311	759.3
United Kingdom	1995	7951	309.5
United States of America	1994	472900	91200.0
Yugoslavia	1995	3058	

* Quantity in metric tons.

TABLE 6.4

Quantity and value of Christmas trees and cork from forest and other wooded land

Country	Year	Christmas trees (number) (1000)	Value of Christmas trees (1000 USD)	Cork (tons)	Value of cork (1000 USD)
Albania				18100	7200
Canada	1997	4535	48620		
Cyprus	1996	7	57		
Denmark	1996	7000	24138		
Estonia	1996	350	1455		
Finland	1996	250	2179		
France	1985 to 1995	5600	75404	4000	1300
Germany		20000	235294		
Iceland	1998	8	45		
Ireland	1996	120	700		
Italy	1995			10374	7200
Lithuania	1996	280	525		
Netherlands	1996	1800	21302		
New Zealand	1996	450	1517		
Norway	1994 to 1996	1000	21150		
Poland	1996	339			
Portugal	1995			135000	145300
Slovakia	1993 to 1995		19455		
Slovenia	1996	300	3693		
Sweden		2000	10000		
Switzerland	1996	400	4274		
United Kingdom	1995	3000	66667		

TABLE 6.5

Quantity and value of mushrooms, truffles and berries from forest and other wooded land

Country	Year	Mushrooms and truffles *(tons)*	Value of mushrooms and truffles *(million USD)*	Fruits and berries *(tons)*	Value of fruits and berries *(million USD)*
Albania		100	0.4	60000	114
Armenia	1996			409	0.02
Belarus	1995 to 1996	10100	15.15	8100	8.1
Cyprus	1996	80	0.26		
Czech Republic		23900	39.13	22700	39.2
Estonia	1996	4130	6.9	8043	8.7
Finland	1996	6000	14.1	40000	67.1
France		8200	107.7	1000	2.7
Italy	1995	2413	44.7	496	2.8
Japan	1996	321676	2435.8		
Kazakhstan				295.3	0.2
Lithuania	1996	3026	9.9	4328	2.5
Norway	1994 to 1996	1200	5.4	25000	45.3
Poland	1996	940		5683	
Republic of Moldova				351.4	0.02
Russian Federation	1993 to 1995	133		808	
Slovakia	1993 to 1996			6301	9.6
Slovenia	1996	800	3.7	600	1.5
Sweden		8500	31.8	20700	30.1
Switzerland	1996	735	6.5		
United States of America			41.1		
Yugoslavia		1395		100	

TABLE 6.6

Quantity and value of medicinal plants and decorative foliage from forest and other wooded land

Country	*Year*	Medicinal plants	Value of medicinal plants	Decorative foliage	Value of decorative foliage
		(tons)	*(1000 USD)*	*(tons)*	*(million USD)*
Albania		7200	5000	198500	143
Azerbaijan	1996	1.25			
Belarus	1995 to 1996	297	30		
Denmark				25000	49.8
Estonia					
Finland	1996		4357	254	1.6
Kazakhstan		5.75	2		
Lithuania	1996	44	95		
New Zealand	1996			1200	8.3
Norway	1994 to 1996			375	1.2
Republic of Moldova		15.4	14.6		
Russian Federation	1993 to 1995	563			
Slovakia	1993 to 1996	178	230	8303	2.2
Switzerland	1996	25	2.5	11750*	
Turkey	1996	9482	24900		
Ukraine				300	
USA					128.5
Yugoslavia		10.2			

* Quantity in cubic metres.

TABLE 6.7

Quantity and value of game meat, harvest, and pelts from forest and other wooded land

Country	Year	Game meat	Game harvest	Value of game	Pelts	Value of pelts
		(tons)	(number) (1000)	(million USD)	(number) (1000)	(1000 USD)
Belarus	1995	2830		4.79		15
Belgium	1986 to 1996			15.8		18800
Canada	1995 to 1996				1344	
Cyprus			25	0.47		
Czech Republic	1990 to 1994	6790	695			
Estonia	1996	600		2	5.8	80
Finland	1996	7894		64		
Germany	1996 to 1997			176		
Hungary	1996	4021		11.5		
Lithuania	1996	781		1.2	8	200
Netherlands	1996		1148	19.2		
New Zealand	1996	1000		4	250	860
Norway	1994 to 1996	6600		66.5	50	630
Poland	1996	8153				
Portugal	1995		1812	20		
Russian Federation	1993 to 1995		6827		20684	
Slovakia	1993 to 1995	834		1.8		30
Slovenia	1996	840		3.7		
Sweden		17119		76.13	163	1340
Switzerland	1996	1597		11.2	30	240
United Kingdom		850		5.6		
United States of America	1995		30611		5740	40600
Yugoslavia			137			

TABLE 6.8

Quantity and value of honey and nuts from forest and other wooded land

Country	Year	Quantity of honey	Value of honey	Quantity of nuts	Value of nuts
		(tons)	(1000 USD)	(tons)	(1000 USD)
Armenia	1996	2	12		
Belarus	1995 to 1996	30	110	20	30
France	1989 to 1995	600	4500		
Hungary	1996	6000	13800		
Italy	1995			94944	95200
Japan	1996			20360	81600
Kazakhstan		20	60	7748	264
New Zealand	1996	2550	6100		
Norway	1994 to 1996	1500			
Portugal	1995	3500	2800	20700	22500
Republic of Moldova		11	20	47.5	20
Russian Federation	1993 to 1995	142	430	218	
Slovakia		2748	4900		
Slovenia	1996	1500	5900	1500	2200
Switzerland	1996	513	6310	12	50
Turkey	1996			131	1600
Yugoslavia		14000			

TABLE 79

Areas where forest and other wooded land is managed primarily for soil protection

Country	Reference period 1	Reference period 2	Forest and other wooded land		Forest managed primarily for soil protection		Other wooded land managed primarily for soil protection	
			Reference period 1	Reference period 2	Reference period 1	Reference period 2	Reference period 1	Reference period 2
			(1000 ha)					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	1950	1995	0	107	0	107	0	0
Austria ©	1986 - 90	1992 - 96	825	839	741	755	84	84
Belgium ©	1982	1997	7	143	2	138	5	5
Bosnia and Herzegovina								
Bulgaria	1985	1995	220	524	220	524	0	0
Croatia	1986	1996	37	48	35	39	2	9
Cyprus ©	1990	1997		21				
Czech Republic ©	1986	1995	2	2	2	2	0	0
Denmark ©	1980	1990	50	58	30	34	20	24
Estonia	1983	1994	89	97	89	97		
Finland ©	1991	1996	0	0	0	0	0	0
France ©	1990	1997	192	192	144	144	48	48
Germany ©	1993	1997	480		480		0	
Greece ©	1964	1992	6,472	6,513	2,512	3,359	3,960	3,154
Hungary	1990	1996	142	164	142	164	0	0
Iceland ©	1990	1998	115	116	15	16	100	100
Ireland	1987	1996	0	0	0	0	0	0
Israel	1990	1997	3	3	0	0	3	3
Italy ©	1985	1995	429	553	232	299	197	254
Latvia ©	1988	1997	44	44	39	40	5	4
Liechtenstein		1995		3				
Lithuania	1987	1996	39	46	37	44	2	2
Luxembourg								
Malta ©	1986-96	1997						
Netherlands ©	1990	1996	4	4	4	4	0	0
Norway ©		1994-96		1		1		0
Poland	1987-91	1992-96	196	256	196	256	0	0
Portugal ©	1985	1995	95	95	53	53	42	42
Romania	1980	1990	729	813	729	813	0	0
Slovakia ©	1988	1996	261	294	261	294	0	0
Slovenia ©	1986	1996	69	68	61	59	8	9
Spain ©		1994		22,134		10,055		12,079
Sweden ©	1985-89	1992-96	33	33	33	33		
Switzerland ©		1996				493		
The FYR of Macedonia								
Turkey	1963-72	1973-96	167	3,246	67	1,133	100	2,113
United Kingdom	1980	1995	0	0	0	0	0	0
Yugoslavia ©	1980	1995	295	433	178	281	117	152
Armenia	1983	1993	215	235	185	206	30	29
Azerbaijan ©	1983	1988	876	941	827	889	49	52
Belarus	1994	1997	0	0	0	0	0	0
Georgia								
Kazakhstan	1988	1993	15,097	16,673	9,309	10,504	5,788	6,169
Kyrgyzstan								
Republic of Moldova ©	1988	1997	31	53	0	22	31	31
Russian Federation ©	1988	1993	145,546	151,353	90,832	92,368	54,714	58,984
Tajikistan	1988	1995						
Turkmenistan								
Ukraine	1988	1996	2,200	2,915	2,191	2,904	9	11
Uzbekistan	1988	1995						
Canada ©								
United States of America ©								
Australia ©								
Japan ©	1987	1996	1,848	2,073	1,848	2,073		
New Zealand ©								

© See notes and comments in Chapter VI.

TABLE 80

Changes over time in areas where forest and other wooded land is managed primarily for soil protection

Country	Reference period 1	Reference period 2	Forest and other wooded land		Forest		Other wooded land	
			Change between periods	Annual average change	Change between periods	Annual average change	Change between periods	Annual average change
			(1000 ha)					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Albania ©	1950	1995	107.30	2.38	107.30	2.38	0.00	0.00
Austria ©	1986-90	1992-96	14.00	2.33	14.00	2.33	0.00	0.00
Belgium ©	1982	1997	9.10	0.61	9.10	0.61	0.00	0.00
Bosnia and Herzegovina								
Bulgaria	1985	1995	304.20	30.42	304.20	30.42	0.00	0.00
Croatia	1986	1996	1.10	0.11	0.40	0.04	0.70	0.07
Cyprus ©								
Czech Republic ©	1986	1995	0.00	0.00	0.00	0.00	0.00	0.00
Denmark ©	1980	1990	8.00	0.80	4.00	0.40	4.00	0.40
Estonia	1983	1994	8.00	0.73	8.00	0.73		
Finland ©	1991	1996	0.00	0.00	0.00	0.00	0.00	0.00
France ©	1990	1997	0.00	0.00	0.00	0.00	0.00	0.00
Germany ©								
Greece ©	1964	1992	1.46	0.05	47.10	1.68	-44.78	-1.60
Hungary	1990	1996	22.00	3.67	22.00	3.67	0.00	0.00
Iceland ©	1990	1998	1.00	0.13	1.00	0.13	0.00	0.00
Ireland	1987	1996	0.00	0.00	0.00	0.00	0.00	0.00
Israel	1990	1997	0.00	0.00	0.00	0.00	0.00	0.00
Italy ©	1985	1995	124.00	12.40	67.00	6.70	57.00	5.70
Latvia ©	1988	1997	0.00	0.00	1.00	0.11	-1.00	-0.11
Liechtenstein								
Lithuania	1987	1996	6.90	0.77	6.50	0.72	0.40	0.04
Luxembourg								
Malta ©								
Netherlands ©	1990	1996	0.00	0.00	0.00	0.00	0.00	0.00
Norway ©		1994-96						
Poland	1987-91	1992-96	59.56	11.91	59.56	11.91	0.00	0.00
Portugal ©	1985	1995	0.00	0.00	0.00	0.00	0.00	0.00
Romania	1980	1990	7.60	0.76	7.60	0.76	0.00	0.00
Slovakia ©	1988	1996	33.00	4.13	33.00	4.13	0.00	0.00
Slovenia ©	1986	1996	-0.30		-1.30		1.00	0.10
Spain ©								
Sweden ©	1985-89	1992-96	0.00	0.00	0.00	0.00	0.00	0.00
Switzerland ©								
The FYR of Macedonia								
Turkey	1963-72	1973-96	3,079.00	128.29	1,066.00	44.42	2,013.00	83.88
United Kingdom	1980	1995	0.00	0.00	0.00	0.00	0.00	0.00
Yugoslavia ©	1980	1995	138.65	9.24	103.60	6.91	35.05	2.34
Armenia	1983	1993	20.00	2.00	21.00	2.10	-1.00	-0.10
Azerbaijan ©	1983	1988	64.80	12.96	62.20	12.44	2.60	0.52
Belarus	1994	1997	0.00	0.00	0.00	0.00	0.00	0.00
Georgia								
Kazakhstan	1988	1993	1,576.00	315.20	1,195.00	239.00	381.00	76.20
Kyrgyzstan								
Republic of Moldova ©	1988	1997	22.10	2.46	21.90	2.43	0.00	0.00
Russian Federation ©	1988	1993	5,806.30	1161.26	1,535.90	307.18	4,270.40	854.08
Tajikistan								
Turkmenistan								
Ukraine	1988	1996	715.00	89.38	713.00	89.13	2.00	0.25
Uzbekistan								
Canada ©								
United States of America ©								
Australia ©								
Japan ©	1987	1996	225.00	25.00	225.00	25.00		
New Zealand ©								

© See notes and comments in Chapter VI.

TABLE 81

Area of forest and other wooded land where access to public is legally allowed and not allowed

Country	Reference period	Forest and other wooded land in public ownership			Forest and other wooded land in private ownership		
		Area with public access excluded	Area with public access	Area with public access as per cent of total	Area with public access excluded	Area with public access	Area with public access as % of total
		(1000 ha)		(Per cent)	(1000 ha)		(per cent)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Albania	1997	56.26	974	94.5	0.00	0	
Austria	1992-96	30.00	682	95.8	162.00	3,050	95.0
Belgium	1997	10.70	278	96.3	97.25	286	74.6
Bosnia and Herzegovina	1995	0.00	2,125	100.0	0.00	584	100.0
Bulgaria	1995	73.19	3,830	98.1	0.00	0	
Croatia ©	1996	0.00	1,651	100.0	0.00	454	100.0
Cyprus	1997	0.00	162	100.0	0.00	118	100.0
Czech Republic	1995	121.50	2,091	94.5	0.00	418	100.0
Denmark ©	1990-97	5.00	148	96.7	2.00	384	99.5
Estonia	1994	7.00	1,971	99.6			
Finland	1997	306.00	6,466	95.5	47.00	15,949	99.7
France	1997	45.00	4,183	98.9	12,761.00	0	0.0
Germany		0.00	5,762	100.0	0.00	4,978	100.0
Greece	1992	108.00	5,223	98.0	23.00	1,159	98.1
Hungary	1996	3.70	1,165	99.7			
Iceland	1998	0.00	39	100.0	5.00	86	94.5
Ireland	1996	0.00	391	100.0	0.20	200	99.9
Israel	1997	0.00	168	100.0	1.00	1	50.0
Italy	1995	6.00	3,681	99.8	0.00	7,155	100.0
Latvia	1997	4.00	1,674	99.8			
Liechtenstein	1995	0.00	7	100.0	0.00	1	100.0
Lithuania	1996	29.20	1,654	98.3	8.00	359	97.8
Luxembourg	1994-97	0.00	41	100.0	0.00	47	100.0
Malta	1996	0.35	0	0.0	0.00	0	
Netherlands ©	1990	20.50	153	88.2	34.86	131	79.0
Norway	1994-96	0.00	2,936	100.0	0.00	9,064	100.0
Poland	1996	666.29	6,783	91.1	1,493.00	0	0.0
Portugal	1995	3.00	264	98.9	0.00	3,200	100.0
Romania		0.00	6,320	100.0	0.00	360	100.0
Slovakia ©	1996	54.00	1,079	95.2	34.00	864	96.2
Slovenia	1996	5.00	342	98.6	0.00	819	100.0
Spain							
Sweden ©	1992-96	77.00	6,070	98.7	0.00	24,112	100.0
Switzerland	1993-95	0.00	850	100.0	0.00	384	100.0
The FYR of Macedonia	1995	0.00			0.00		
Turkey ©							
United Kingdom	1995	20.00	1,052	98.1			
Yugoslavia	1995						
Armenia	1996	0.00	392	100.0	0.00	0	
Azerbaijan	1988	0.00	990	100.0	0.00	0	
Belarus	1997	147.80	8,788	98.3	0.00	0	
Georgia	1995						
Kazakhstan	1997	0.00	16,673	100.0	0.00	0	
Kyrgyzstan	1995	0.00	797	100.0	0.00	0	
Republic of Moldova	1988-97	44.10	311	87.6	0.00	0	
Russian Federation	1997	0.00	886,538	100.0	0.00	0	
Tajikistan	1995	0.00	730	100.0	0.00	0	
Turkmenistan	1995	0.00	3,754	100.0	0.00	0	
Ukraine	1996	500.00	8,994	94.7	0.00	0	
Uzbekistan	1995	0.00	2,170	100.0	0.00	0	
Canada	1997	0.16	388,927	100.0	27.21	27,179	99.9
United States of America ©	1992						
Australia	1997	2,941.00	407,401	99.3	28,683.00	85,926	75.0
Japan	1997	0.37	10,573	100.0	0.00	14,573	100.0
New Zealand ©	1996	0.00					

© See notes and comments in Chapter VI.

NOTES AND COMMENTS RELATING TO CHAPTER VI

Main Tables — Comments

Albania

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Enquiry Table 21: The area of forest and other wooded land protected primarily for soil protection is increasing because of the risk of erosion.

81

Area of FOWL to which public is legally not allowed access

Expert's estimation—the figures were taken from "The plan on conservation and management of the National Park of Dajti (Albania)", (The last report PHARE, February 1997) and has been reduced by 30 per cent to take account of other areas.

Reasons for not allowing public access

Reason for not allowing public access is because forests are scientific reserve/strict nature reserve, national parks.

Regimes of access to forest for non-wood goods

There are some special articles in law No.7623 date 13.10.1992 on "Forests & service police" on their management for example: article no. 11, 18, 19, 20, 21, 22, 23, 33, 34, 35, 36, 37; also in Law No. 7875, date 23.11.1994 on "Protection of wildlife and hunting" on their management, for example, article No. 1,34.

There are some special regulations on management, for example:

Regulation No. 577 dated 8.2.1993 on "Protected forest nature resources with national and international values".

Regulation No. 2 dated 3.3.1993 on "Fees and payments for forest uses with recreation, health, climate and tourism aims".

Regulation No. 3 dated 3.3.1993 on "For entrance and payments in national park territories and forest fund areas, declared with social functions".

Goods (wood and non-wood) and services

Enquiry Table 24: The demand for wood would increase after improving of the laws according to rules of the market economy, but would always be under the annual allowable cutting values.

Enquiry Table 25: The estimated figures are received by the inventory of medicinal plants, carried out along the year 1988, by the Station of Forest and Oil-bearing Culture.

The wood value belongs to wood standing in the forests, (based on the stampage price) while the value for the other non-wood products belongs to all harvested and prepared products to deliver at the port, when they would be exported or at the store-places, and when they would be used inside the country, but, always manufactured. The official data (OD) only, for wood was received by the Annual Report on Situation of Forest in Albania, prepared by the Institute of Forest and Pasture Researches while, the estimated figures (EST) are received by the inventory of medicinal Plants, carried out along the year 1988, by the Station of Forest and Oil-bearing Cultures (At present, the Institute of Forest and Pasture Researches).

The figures in the table on non-wood products represent their production potential. If we would manufacture them and would sell at the present prices of the international market, incomes would be approximately three times higher.

Indigenous and Tribal Peoples

Enquiry Table 22: In Albania, there is no any indigenous or tribal peoples within the definition used in this enquiry.

Armenia

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Reasons for not allowing public access

Not applicable.

Regimes of access to forest for non-wood goods

According to the legislation of Armenia (Environmental Law, Forest Code, Law on Especially Protected Areas) the collection of the plant species included in the Red Data Book is prohibited. Hunting licences are issued by the Ministry of Nature Protection.

Goods (wood and non-wood) and services

Enquiry Table 25: Prices are set by the Forest Service (minimum prices plus VAT). Exchange rate 1 US$ = 500 Dram (December 1997).

Indigenous and Tribal Peoples

Enquiry Table 22: 99 per cent of the population of Armenia consists of native Armenians. All forest areas are free for use by the population, which is authorized by the Forest Code (1994), regardless of whether this is forest or other wooded land. The utilization of the forest resources and lands is regulated by a number of special permits and licenses, issued by Armenian State Forest Service in consultation with local governments.

Australia

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Enquiry Table 21: See the table and notes below:

	Change (1000 ha)
Area where forests are managed primarily for soil protection	3562 *
* reported on 1997 reference period only)	
– Forests (State forests—some States only)	3562 **
** Data are not currently available nationally. Every State and Territory has Forest Codes of Practice, specifically relating to soil protection; however, digital (GIS) data are only currently available for 6.7 million ha of Australia's commercial forests. It will be very difficult to report on this indicator in the future due to overlaps with other protection functions, e.g., fauna corridors on riparian strips).	
– Other wooded land	No data

Data source: Australia's First Approximation Report for the Montreal Process, 1997.

81

Area of FOWL to which public is legally not allowed access

With regard to the data given above, the following are the comments:

Area of "Publicly owned forest and other wooded land" to which public is legally not allowed access: Access to scientific sites, defence areas, or catchment areas identified by water boards legally requires the general public to obtain the prior permission of the managing agency. National Forest Inventory, 1997.

Area of "Forest and other wooded land owned by indigenous peoples" to which public is legally not allowed access: This figure is for Aboriginal freehold land only as the terms and conditions of leasehold land are not available.

Area of "Privately owned forest and other wooded land" to which public is legally not allowed access: This figure is for freehold land only as the terms and conditions of leasehold land are not available.

Data Source: Australia's First Approximation Report for the Montreal Process, 1997.

Other comments

In principle, all public forested lands except some scientific reserves, cultural areas or where operations preclude it, are available and actively managed for general recreation and tourism. Data on leasehold or private land actively managed for recreation are not currently available. The data that are available are shown in the following table.

Area and percentage of forests managed for general recreation and tourism, in relation to the total area of forests:

Tenure category	***Total area of forest in Australia excluding plantations (ha)***	***Area of forested land reported by States as managed for recreation***	***Percentage of forested land managed for recreation (per cent)***
State forests	13,350,989	13,282,000	99.48
Nature conservation reserves	17,580,191	10,825,947	61.58
Other Crown land	15,596,781	11,966,731	76.73
Private land	42,017,712	10,384	0.02
Total	**155,834,648**	**33,387,576**	**21.43**

Data Source: State of the Forest Report (1998).

Reasons for not allowing public access

Restricted access by the general public to publically owned land ensures public safety and ensures the integrity of management objectives for these specialized land uses. Restricted access by the public to privately owned land is at the discretion of the land owner as control of access is a right and responsibility of the owner.

Regimes of access to forest for non-wood goods

No data.

Goods (wood and non-wood) and services

Enquiry Table 24: Consumer demand for forest products and services drives industries based on a wide range of products. The most dominant of these is timber, although water production and tourism are seen increasingly as valuable contributors to the national economy and the well being of the community.

Overall, the State and Territory legislation and the policies and procedures adopted by managing agencies are designed to ensure maintenance of the productive capacity of public forest available for timber production. A large body of scientific research and operational experience has resulted in the development of codes of practice that have maintenance of the forests' productive capacity as their focus. Forest planning is very well developed and the tight control over public land use by State and Territory agencies means that plans are implemented. The wide public interest in forest management helps to secure this result. Management of private lands is not subject to the same level of planning and control.

Data Source: Australia's First Approximation Report for the Montreal Process, 1997.

State of the Forest Report (1998).

Enquiry Table 25: Wood products: Data Source: Australia's First Approximation Report for Montreal, 1997. Data are not available at a national level for non-wood products.

Indigenous and Tribal Peoples

Enquiry Table 22: Australia has a number of processes for recognising cultural, social and spiritual needs and values. For most of these it is not yet possible to measure the area of land identified with them. We can measure the area of land that is formally recognized as being under Aboriginal tenure as one component of this indicator. All of society gains from the spiritual and cultural values of forests and woodlands, either directly or indirectly.

The area of forest and woodlands under Aboriginal tenure is 12.6 per cent of the total forest and woodlands. In Australia, Indigenous peoples' cultural heritage and customary law is deeply embedded in the natural environment. Nature and culture are so intricately interwoven they cannot be separated. Indigenous peoples have an inherent responsibility to their Law, culture and land and have a right to ensure the continuation of their religious beliefs. Consequently, Indigenous peoples have been identified as key stakeholders in land-management and planning processes in forest and woodland areas.

The comprehensive regional assessments, and the regional forest agreement process in general, involve consultation with the Indigenous community, to identify and protect Indigenous heritage values in forests and woodlands.

Sources for the table: Data Sources for Population of indigenous or tribal peoples: Australian Bureau of Statistics Web Site (1998).

The figure of 19,647,797 ha for the area of forest and other wooded land used by indigenous or tribal peoples for the collection and harvesting of wood, and non-wood goods and services: this equates to 12.6 per cent of total forest area in Australia. Other land tenure including, pastoral lease is used by Indigenous people, however data are not available on the amount of pastoral lease under forest or proportion used by Indigenous people.

(3) Date source for "Area of forest and other wooded land used by indigenous or tribal peoples" is National Forest Inventory, 1997.

(4) Australia's First Approximation Report for the Montreal Process, 1997.

Austria

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Enquiry Table 21: Previous reference period is adapted to the TBFRA-2000 definition of "forest" and "other wooded land".

"Other wooded land" is part of the protection forest (see also comments on *Enquiry Tables 1 and 7*).

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Reasons for not allowing public access

Regulations by the Austrian Forest Act 1975 and provincial acts to protect sensitive areas, e.g. nature conservation, afforestation, etc.

Regimes of access to forest for non-wood goods

According to provincial laws mushroom gathering is limited to a maximum amount of 2 kg/person/day. According to provincial laws, regulations on special "recreation areas" for game could affect public access to forests.

Goods (wood and non-wood) and services

Enquiry Table 24: Source: Woergoetter A.: Evaluation überbetrieblicher Leistungen der oesterreichischen Land- und Forstwirtschaft; Institut fuer Hoehere Studien; Wien 1992.

Enquiry Table 25: Source: Providing reliable figures is more or less impossible, therefore Austria chooses a likely range as follows:

Wood: 10—15 billion ATS.
Game meats, mushrooms, berries, honey: 0.1—0.15 billion ATS.
Fodder and forage: 0.01—0.015 billion ATS.
Hunting trophies, Christmas trees, decorative foliage: 10—15 billion ATS.
Water function: 11200—29400 billion ATS.
Protection: 10—4500 billion ATS.
Social function: 1740 billion ATS.

Azerbaijan

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Enquiry Table 21: Most of Azerbaijan's forests (95 per cent of the total area) are on mountain sides, and serve principally to retain soil and water. Forest in the foothills and valleys (5 per cent) serves soil-protection, climate-regulation and other environmental purposes.

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Long term change in the area to which the public has legally had access

There is a trend for the area of forest to change towards more forests for recreational and incidental uses.

Reasons for not allowing public access

No such trend.

Regimes of access to forest for non-wood goods

Visitors generally come to the forests in summer and winter, and respect the normal visiting rules.

Goods (wood and non-wood) and services

Enquiry Table 25: The data for wood belong to the reference period 1988.

There exists supportive information on this table for the years 1995 and 1997 (forecast) in the reply to the enquiry, which is available at the secretariat.

Total profit for the year 1996 for all the items excepting wood mentioned in this table: 390611.0 million manats.

Indigenous and Tribal Peoples

Enquiry Table 22: In the entire 7.5 million strong population of Azerbaijan, there are no tribal or indigenous peoples. All the forest and other wooded land (989,500 ha) is used by the population for recreational purposes.

All forests and wooded land are State property. The population of the country can use them for recreation and to pick fruits, of which there is a substantial volume. Specific qualitative and value indicators are given *in Enquiry Table 25.*

Belarus

81

Reasons for not allowing public access

Nature reserves and radiation contamination.

Belgium

79, 80

Enquiry Table 21: In the Flanders Region, there is no particular soil protection. Figures in the table are those of the Walloon region for soils with a slope gradient over 15°, peat and hydromorphic soils for which protection measures are specified in the management circular of 14.2.1995 that applies obligatorily only to public forests.

81

Area of FOWL to which public is legally not allowed access

The figure of 10,700 ha for Publicly-owned forest and other wooded land includes 9,000 ha of military domain from Flanders region and 1,700 ha from Brussels region of Belgium.

The figure of 97,247 ha for privately owned forest and other wooded land belongs to the Flanders region of Belgium.

Reasons for not allowing public access

Belgium (Brussels): Soil protection in some valleys with a view to protecting against erosion and trampling.

Belgium (Flanders): To privately-owned forests and other wooded land, the general public is legally not allowed access, due to protection of the privacy of the private owners. Private owners can decide themselves to open their forests for the public.

Belgium (Walloon): In private forests, public access is forbidden on the basis of private property rights. It is up to the owner to decide on the right of access. The Code of Forestry forbids access away from the roads since 1995. The decree on forest traffic (16.2.1995) allows differentiated access according to the type of user: the access is limited to roads for motor vehicles, to tracks for other venicles and to paths for pedestrians.

In practice, a dense network allows those types of access to the majority of forest areas.

Regimes of access to forest for non-wood goods

Belgium (Brussels): Leisure activities, biking, horse-riding, walking, orienteering.

Belgium (Flanders): For access to forests for gathering mushrooms, mosses and ferns,..., special authorization of the Forest Inspection is required. Authorization is given on a case by case basis for non-commercial use only.

Belgium (Walloon): Hunting rights belong to the forest owner; in public forests, it is most of the time rented by public adjudication. Harvesting of fruits, mushrooms, etc. is tolerated if for non-commercial use.

Goods (wood and non-wood) and services

Enquiry Table 24: The Brussels--Capital region owns a suburban forest called “Soignes” forest. There exists production of woody material which attracts certain industries. Some sensitive zones are protected against excessive trampling and erosion. The recreational function of the “Soignes” Forest and other wooded land is very important for the local urban population and in the neighbourhood. The forest is attractive for different leisure activities, such as: jogging, walking, horseback-riding, bicycling. It also attracts youth associations and naturalists.

Enquiry Table 25: Other incomes (royalties for the rights of way of gaz or water pipelines,...) amount to about BF 40 million per year in public forests.

Indigenous and Tribal Peoples

Enquiry Table 22: This table does not apply to Belgium.

Bulgaria

81

Reasons for not allowing public access

Nature reserve.

Canada

79, 80

Enquiry Table 21: Information on the “area where forests and other wooded land are managed primarily for soil protection” is not available for Canada. In fact, this type of information lacks relevance in the context of forest management in Canada because soil and water protection are over-riding considerations in the development of forest policy and in forest management practices. Soil and water protection are two of many elements that are considered in developing management regimes that maintain ecosystem function. There is a broad range of other elements that are simultaneously considered, including (but not limited to) site regeneration, water quality, habitat, aesthetic impacts, landscape diversity, endangered species, cultural/spiritual impacts, and others. Therefore, it is difficult to isolate areas in terms of being managed primarily for soil protection.

Measures to protect water and soil values have been in place for a time; however, these measures are constantly being reviewed, updated, revised, and improved (e.g., BC Forest Practices Code).

Management factors that can affect water and soil quality include harvesting close to streams and rivers, road construction techniques, harvesting on steep slopes, skidding methods, mechanized harvesting on soils sensitive to soil compaction, winter harvesting vs. summer harvesting operations, and post harvest site treatments (such as scarification, treatment of debris, etc.). Potential soil disturbance (or degradation) factors include compaction, erosion, loss of organic matter, and loss of productivity. Some areas are more susceptible to damage from these factors than others. For example, sensitive sites include riparian zones, steep slopes, wet and poor soils, shallow soils over bedrock, and soils susceptible to compaction.

In general, the creation of riparian buffer zones is now standard practice throughout most of the country. These zones range from 30—50 metres on either side of streams. Most provinces also have stringent guidelines for road construction to minimize reductions in soil and water quality and aquatic habitats. Mechanized harvesting has accounted for an increasing proportion of the total Canadian harvest over the last 20 years. The use of heavy equipment in the forest environment has the potential to cause problems relative to soil compaction. However, two factors mitigate or reduce potential problems related to reductions in soil quality. First, a significant proportion of annual harvest occurs in winter months when the ground is frozen. Second, through various new decision support tools such as forest ecosystem classification frameworks, management agencies are improving their understanding of a) which types of sites are sensitive to soil disturbance, b) where these sites are situated, and c) the kinds of modifications in management practices and equipment required to minimize the impacts of harvest operations.

81

Area of FOWL to which public is legally not allowed access

The following table shows the distribution of forest land in Canada according to ownership and general legal accessibility by the Canadian public.

Public access to forest land by ownership class:

Ownership	*Area of forested lands where the public has the right for general legal access for non-consumptive uses*	*Area of forested lands where the public does not have legal access*
	(1,000 hectares)	*(1,000 hectares)*
Provincial forest land	295, 010	
Territorial forest land	73,765	
Private industrial forest land		4,060
Private non-industrial forest land		21,173
Municipal		155
Unspecified private land		1,973
Aboriginal forest land		1,133
Other federal land	19,995	
Total	**388,770** **93 per cent**	**28,494** **7 per cent**

Source: Canada's Forest Inventory 1991, 1994 version.

Other federal land: This includes National Parks, Department of National Defense lands, and lands held by other departments. Generally, access fees apply to National Parks. Access by the public to Department of National Defense lands is restricted.

The total area of forest land in Canada is 417,585,000 hectares. The sum of column one and two is 417,264,000 hectares. The difference is the result of the fact that there are 317,000 hectares of forest land with unspecified ownership status in the national inventory. It is not possible to determine the extent to which the public has legal access to these lands.

Long term change in the area to which the public has legally had access

About 94 per cent of the forest land base is currently held by provincial and federal governments. Canada retains the second highest percent of its total forest land base under public ownership of all OECD countries. This feature of Canada's forest is the result of a combination of historical opportunity and societal choice. The need for conservation and preservation policies of Canadian forests and a more scientific approach to resource management began to be recognized in Canada at the turn of the century. With the exception of southern Ontario and Quebec and the Maritime provinces, much of the Canadian forest landscape was unpopulated and undeveloped and by default remained under government control. The forest has largely been retained in public ownership since that time.

However, the fact that the majority of forest lands have been retained in public ownership does not mean that the public has unrestricted legal access to these forests. Generally, all provinces have a statutory requirement to manage public forest lands for multiple use purposes. Implementation of multiple use is achieved by integrated land use planning, and development and approval of long, medium, and short term management plans that reflect management objectives in a particular area. Public consultation processes are employed to guide resource managers in establishing management priorities and broad policy objectives.

In general, the public is not permitted to settle, make a claim of ownership, construct permanent structures or facilities on public lands, or convert public forest lands to alternative uses (such as crops or grazing land).

The list of goods and services obtained from the forest resource by the Canadian public is broad and diverse. It includes commercial timber resources, firewood and fuel wood, various types of botanical products (including mushrooms, berries, nuts, wild rice, fiddleheads, and other botanical products), hunting, fishing, trapping, subsistence uses, and various types of outdoor recreation activities. The degree of legal access to public forests by the general public varies widely. In some cases (such as for timber harvesting), public access is closely regulated and controlled by public agencies through the use of tenure systems. These tenure systems allocate property rights to public timber to individuals using various legal mechanisms. In return for the rights to public timber, the holder of these property rights accepts certain obligations and responsibilities.

In the case of non-timber goods and services, the degree of legal public access varies widely depending on the particular resources in question and the particular province in which they occur Also, the instruments used to control and regulate access vary widely. In some cases public access is controlled by the payment of access fees (for example, access to National and Provincial parks may require the payment of a fee). Public access for the right to hunt, trap and/or fish on public lands is regulated through licences systems, quotas, and penalties for illegal use. Public access for non-consumptive uses (such as hiking, camping, skiing, snowmobiling) is unregulated in some areas and regulated in other areas.

Therefore, in conclusion, it is difficult to generalize and develop a single number which estimates the area of forest land to which the public does or does not have access, or the extent to which there has been any significant historical change in accessibility over time.

Reasons for not allowing public access

The main reasons for restricting and controlling access to public forest lands include:

– The need to ensure that resources are utilized and managed sustainably and that resources will be available for future generations.

– The need to ensure that the forest resource is managed for multiple use and that one use does not dominate or extinguish other uses.

– The need to ensure public safety (e.g., access or use may be restricted during severe forest fire activity or during periods when the risk of fire is high).

The main reason for laws that restrict access of the public to private forest lands (i.e., trespass laws) is to preserve and protect the property rights of the land owner.

Regimes of access to forest for non-wood goods

There is no such thing as a general access regime in Canada. Land use and land use priorities vary from area to area and from owner to owner depending on land use, management planning, and operational planning priorities. These planning processes involve varying degrees of public participation.

Future events that may affect how forests are used and the degree of public access for particular uses will be: a) the future creation of parks and protected areas, b) negotiation, resolution and settlement of land claims, c) new forest practices codes, public participation processes, and planning priorities, and d) road development into remote areas.

Goods (wood and non-wood) and services

Enquiry Table 25: Please see detailed information in *Enquiry Table 24*. *Enquiry Tables 24 and 25* have been combined into a single response that provides (*a*) descriptions of wood and non-wood goods and services obtained from Canada's forest land base, (*b*) an assessment of the socio-economic importance of these goods and services, (*c*) qualitative and quantitative (where possible) assessments of current use, and (*d*) broad estimates of the outlook for these various goods and services.

Indigenous and Tribal Peoples

Enquiry Table 22: Population of aboriginal peoples:

The following table shows the total 1996 population of Canada's Aboriginal peoples by cultural group:

Aboriginal group	*Population*
North American Indian	554,290
Métis	210,190
Inuit	41,080
Total	799,010

Source: 1996 Census of Population.

Croatia

81

Regimes of access to forest for non-wood goods

Special regime of access (register of visitors) applies for strict reserves and national parks only.

Other comments

Enquiry Table 23: All the publicly and privately owned forests and forest land are open to public.

No quantitative data for this table are available at the moment.

Cyprus

79, 80

Enquiry Table 21: It is estimated that 5—10 per cent of the total forest and other wooded land is managed primarily for soil protection (Estimate made by the secretariat: 7.5 per cent of forest and other wooded land).

81

Regimes of access to forest for non-wood goods

Forest products can be collected from state forests only after a licence issued by the Director Department of Forests.

Hunting in any state forest is controlled by the Game Law of 1974. Services are offered in Picnic and Camping sites in state owned forests.

Goods (wood and non-wood) and services

Enquiry Table 25: Exchange rate: 1 Cyprus pou (CY£) = 1,8640 US$. Date: 15.01.98

Czech Republic

79, 80

Enquiry Table 21: The forest sub-category 2d—soil protection forests could overlap with the sub-category of pollution damaged forests. In 1994, a special research was done to assess the correct size. The category changes in area very slowly, in tens of ha annually.

81

Reasons for not allowing public access

Military forests 83 thousands of ha, game preserves 38,496 ha.

Regimes of access to forest for non-wood goods

Recreation areas are located in mountainous regions and the use of them is characterized by “short-time visits” (2-7 days). The visitor intensity in the 1990s has remained about the same as previously. 8 per cent of the area is designated as of “high” recreation value and 14 per cent of “medium” value.

Goods (wood and non-wood) and services

Enquiry Table 24: For more details please see “Country report of the Czech Republic on Non-Wood Goods and Service of Forests", prepared for ad hoc “Team of Specialists on Non-Wood Goods and Services of Forests” (1995).

Enquiry Table 25: Prices: Wood—domestic prices at roadsite; estimates for other products—domestic prices estimated.

Denmark

79, 80

Enquiry Table 21: The values are very rough estimates. The forest protection area is calculated as follows:

Protection against dunes and sand-drift primary in Western Jutland:

	(ha)
Half of the afforestated area of the state-owned 'dune-forest-districts':	15,000
Protection against ground-water-pollution—estimate of the counties regional-plans concerning this item:	15,000
Total:	30,000
Other wooded land: the entire amount of shelterbelts and windbreaks:	20,000

81

Long term change in the area to which the public has legally had access

Under the recent law on nature protection almost all private forest land has been opened to the public. This has caused an immense increase in the average person’s possibility to visit forests.

Reasons for not allowing public access

Either wildlife reserves or military use.

In private areas there is only access for the public from 7.00 a.m. until sunset, only on paths and roads, not closer than 150 m to dwellings and not on days when the forest is closed for hunting. Bicycles are only allowed on consolidated paths and roads.

Other comments

Enquiry Table 23: Sources: Frank Søndergaard Jensen and Niels Elers Koch: Friluftsliv i skovene 1976/77—1993/94.

Forskningsserien nr. 20, 1997. Den Kgl. Veterinær- og Landbohøjskole and Forskningscenteret for Skov og landskab. 215 pages.

Goods (wood and non-wood) and services

Enquiry Table 25: 1 US$ = 6.9 DKR.

Indigenous and Tribal Peoples

Enquiry Table 22: A majority of the Danish population are indigenous and a major part of the Danish forest area is owned by Danes. It is not known at what amount, probably more than 95 per cent of the forest area.

Estonia

81

Reasons for not allowing public access

Public access is not allowed in the Nature Reserves and strictly protected areas as nature preserves. In the privately owned forests public access is restricted from sunset to sunrise.

Regimes of access to forest for non-wood goods

Use of non-wood goods is regulated by Forest Act (1993), hunting by Hunting Management Act (1994).

Finland

79, 80

Enquiry Table 21: Soil protection not necessary due to climatic and geographic conditions.

81

Reasons for not allowing public access

In Finland, access is limited only on Nature Reserves and on a 0.5—3 km wide border zone near the Russian border and in some small areas reserved for other use. With a specific permit, anyone can enter the border zone, also.

Regimes of access to forest for non-wood goods

Gathering of mushrooms and berries and hiking is possible in all forests in Finland, except some limited areas listed against the area of forest and other wooded land to which the general public is legally not allowed access.

Hunting requires a permit from the land owner.

Goods (wood and non-wood) and services

Enquiry Table 25: For berries and mushrooms, the value is the sum of collecting incomes for market supply and domestic use.

The value of domestic use is calculated with the market price for collectors. The amount of wood is the commercial roundwood production.

The price of wood is the gross stumpage earnings of all forest ownership categories.

For recreation, it is impossible to estimate the value.

Indigenous and Tribal Peoples

Enquiry Table 22: No indigenous or tribal people exist.

France

79, 80

Enquiry Table 21: Source: National Forests Office, "Mountain forests and natural hazards" survey, 1990.

Pursuant to the Mountain Land (Restoration and Conservation) Act, 1882, the State acquired 382,000 hectares of land, 260,000 hectares of which are now forest. According to the survey cited above, 192,000 hectares of State-owned land perform a clear soil-protection function. These figures go to show that the area of forest and other wooded land managed primarily for soil protection has diminished over a long period. The National Correspondent considers that this area did not change significantly between 1990 and 1997.

The National Forests Office also intervenes to stabilize 400 km of coastal dunes subject to the constant action of the tides and winds.

81

Long term change in the area to which the public has legally had access

In France, entering someone else's property is an infringement of property rights. Strictly speaking, private forests are therefore off-limits to the general public. None the less, many forest owners do allow the public access to their woodland. If they do not, the main reasons are that:

(*a*) The forest is dedicated to hunting;.

(*b*) The property is in a much-frequented area, either near a large conurbation or in a popular tourist district;

(*c*) The owner wishes to reserve his right to harvest fruit or fungi.

The area of private forest subject to strong tourist pressure is put at 1,368,000 hectares (source: SCEES/ESSES 1976—1983, Statistical survey of economic structures in forestry). France also has a very dense network of public roads and rural paths open to the public. It is thus possible to go to the woods without going on to private property.

Over the past decade, public communities and users' associations have put a good deal of effort into making public access to woodland easier by marking and maintaining paths and creating and maintaining facilities.

Reasons for not allowing public access

For private forests and other wooded land, the main reasons are given above. Public forests and other wooded land comprise, in the main, military training grounds and strictly controlled biological reservations. The area off-limits to the public has remained stable over the past ten years.

Regimes of access to forest for non-wood goods

According to the "Living conditions and aspirations in France" survey (CREDOC, 1996—DERF-IFEN), the main activities engaged in on forest land are as follows:

Hunting or fishing	4.20 per cent
Long hikes	10.40 per cent
Walking	61.30 per cent
Sport (riding, jogging, training circuits…)	4.20 per cent
Mushroom- or berry-picking	9.20 per cent
Picnics, relaxation	2.60 per cent
Biking, mountain biking	3.10 per cent
Plant- and animal-watching	1.80 per cent
Motorbike scrambling	0.20 per cent
Car drives	0.50 per cent
Wood-cutting and gathering	2.40 per cent
Don't know	0.10 per cent

Goods (wood and non-wood) and services

Enquiry Table 24: Source: The document "Les indicateurs de gestion durable des forêts françaises", 1995, Ministry of Agriculture and Fisheries, Countryside and Forests Directorate.

Enquiry Table 25: Data for Holly roots: The actual data for the quantity are 150 to 200 tonnes and the value is 2 to 3 million FRF.

Data for Pine honey: The actual data for the value are 20 to 30 million FRF.

Data for Wood: Volume harvested, see table 16; value from the yearly survey of wood value at the roadside in 1995, Ministry of Agriculture and Fisheries, Countryside and Forests Directorate. The value of commercial extractions only is shown here, estimated at the market price for offloaded timber.

Data for all products (excepting wood and christmas trees): From "Les indicateurs de gestion durable des forêts françaises", 1995, Ministry of Agriculture and Fisheries, Countryside and Forests Directorate. Product value estimated at market prices.

Data for Christmas Trees: Purchases of Christmas trees by individuals in France in 1997, source SOFRES ONIFLHOR. Tree value estimated from retail prices. Many of these trees come from French forests; a small proportion re imported. There is no statistical survey of Christmas tree production in France.

Indigenous and Tribal Peoples

Enquiry Table 22: There are no indigenous or tribal peoples in Metropolitan France.

Georgia

Goods (wood and non-wood) and services

Enquiry Table 24: Special attention is being given in Georgian forestry to harvestable resources. Georgians have traditionally harvested such forest products as wild hazelnuts, different fruits and mushrooms. Besides timber and other tree products, rhododendron, fresh water fish and wild game are also on the list of intensively harvested resources. Hot water, peat and other potential energy-related resources in addition to timber, are presently being studied as an important and suitable use of natural resources:

(source: http://www.grida.no/prog/cee/enrin/...georg/....biodiv/impacts/...htm)

Germany

79, 80

Enquiry Table 21: Latest reference period: Special assessment, being reviewed (reference period 1997). Data will be supplied later.

81

Reasons for not allowing public access

Only in a few areas, access of the roads is prohibited for reasons of nature conservation. Data in particular broken down to public and private forest ownership are not available.

Gathering for own requirements is allowed. Hunting is strictly regulated, shooting-ground regime.

Goods (wood and non-wood) and services

Enquiry Table 25: 1 US$ = 1.70 DM.

Greece

79, 80

Enquiry Table 21: We consider the data for the 1997 survey to be more accurate and may not be totally comparable with those of 1964, which were assessed using a different methodology.

81

Reasons for not allowing public access

Forests are generally accessible to the public, except for virgin areas, protected wildlife habitats and some suspect areas, where ruins have been left from past war.

Goods (wood and non-wood) and services

Enquiry Table 25: Source: a) Prof. Papanastasis V., Sector of Range-Wildlife and Freshwater Fisheries, Department of Forestry and Natural Environment, Aristotle University of Thessaloniki; Greece. For Prices: b) GSF&NE; c) National Statistical Service of Greece; d) Directorate of Agricultural Policy and Documentation, Ministry of Agriculture; e) Directorate of Forest and Forest Environment Management, SGF&NE, Ministry of Agriculture; f) Pastures and grazing forests, Interim Announcement, Strategy study for the development of the Greek Forestry and Wood Industry, 1986, Ministry of Agriculture.

Data for "Prices" refer to prices received by the producer.

Hungary

81

Reasons for not allowing public access

The general public is not allowed access to the new forest reserve areas. The new Forest Law authorises the forest owner to restrict the access to his forest in case of danger to human safety, or during forestry activities and hunting. If the duration of the restriction exceeds 3 months the owner must ask for approval of the forest authority.

Regimes of access to forest for non-wood goods

Hunting can be practised in accordance with the Law on Hunting. Resin can be collected after an approval from the forest authority. Decoration materials can be collected by the forest owner or on his authorisation. Mushrooms, fruits and herbs for personal use can be collected free in public forests. In private forests and for commercial purposes in public forests collecting is legal only on written permission from the forest owner. Visit to forests for recreation is free, with the exception of forest reserves and periods of temporary restrictions.

Area of forest released from public domain for restitutional purposes, where the restitution process has yet to be finished is displayed as private. In fact, there are no real owners of these forests, but they are included in the forest management plans. Emergency measures to protect forest health and vitality should be initiated and financed by the forest authorities.

Goods (wood and non-wood) and services

Enquiry Table 25: Hunting produces and additional income of approximately 3 billion HUF as fee for associated services.

Iceland

79, 80

Enquiry Table 21: All forest and other wooded land in Iceland that is not specifically managed for other purposes serves a soil erosion protection purpose.

81

Reasons for not allowing public access

Increased partitioning of privately owned FOWL and sale to individuals as lots for summer cottages over the last 30 years. The public has legal access to privately owned FOWL, even if it is fenced, but not to small lots with summer houses.

Regimes of access to forest for non-wood goods

Only hunting is specifically regulated and only in some forests, the hunter often paying a daily fee to the forest owner.

Goods (wood and non-wood) and services

Enquiry Table 25: Quantitative information on other goods not available.

Indigenous and Tribal Peoples

Enquiry Table 22: There are no indigenous or tribal peoples in Iceland.

Ireland

81

Reasons for not allowing public access

The general public here has no legal right to enter property which is in private ownership.

Regimes of access to forest for non-wood goods

The total area of forest land which the public have access to is about 390,000 ha. Recreational activities include walking, picnicking, orienteering, mountain-biking and pony trekking.

Goods (wood and non-wood) and services

Enquiry Table 25: The values shown above reflect the market value and are based on Coillte Teoranta's annual report for 1996.

Indigenous and Tribal Peoples

Enquiry Table 22: No indigenous or tribal peoples.

Israel

81

Reasons for not allowing public access

Closed areas in Natural reserves.

Regimes of access to forest for non-wood goods

Mainly for recreation.

Italy

79, 80

Enquiry Table 21: Source: National Forest Inventory 1985 and successive estimates.

81

Reasons for not allowing public access

Protection of particular delicate ecosystems.

Regimes of access to forest for non-wood goods

Specific regional rules for hunting, mushrooms and truffles collection, public areas use, and so on.

Goods (wood and non-wood) and services

Enquiry Table 24: Non-wood products represent an important part of the forest production in the Mediterranean area. In Italy they contribute to improve the economy of the mountain and hill regions and permit both activities which are available in all the forest area such as hunting, fishing, mushroom harvest, recreation, agritourism and activities restricted to some areas with particular ecological features such as cork, chestnuts and truffles harvest.

The assessment of non-wood products value states that their contribution to the forest economy is not marginal. Nevertheless a notable variability for some products (mushrooms, truffles, hazelnuts etc...) is related to seasonal factors.

A greater firmness is noticed as far as other products are concerned such as pine seeds, chestnuts and cork. The enhancement of the value of non wood products depends on the improvement of silvicultural techniques which should take into consideration also the additional productions.

Japan

79, 80

Enquiry Table 21: Forests for soil protection in *Enquiry Table 21* include two types of forests which are managed to protect against soil erosion and landslides. Though some forests have both functions, the figure in the table simply sums up these two types of forests. Thus, the figure of soil protection area is over-estimated. Area for soil erosion protection is 2,026,000 ha. Area for landslide protection is 47,000 ha.

81

Reasons for not allowing public access

To protect nature.

Goods (wood and non-wood) and services

Enquiry Table 25: All items show market prices.

Latvia

79, 80

Enquiry Table 21: Total area of anti-erosion forests has not been changed in recent years. Part of other wooded land is converted to forest.

81

Reasons for not allowing public access

Public access is not allowed in strictly protected zones of state nature reserves and National parks. The purpose is to keep these forests undisturbed by man.

Regimes of access to forest for non-wood goods

There is no special regime of access to forests, which differs from general access regime.

Goods (wood and non-wood) and services

Enquiry Table 25: The quantities mentioned are potential supplies.

Liechtenstein

81

Reasons for not allowing public access

Public access in every area is guaranteed.

Regimes of access to forest for non-wood goods

Mushroom gathering: According to the provisions of the Nature Conservation Act.

Hunting: According to the provisions of the Game Management Act.

A strong trend is that forests are becoming more and more the physical basis for a number of outdoors sports such as mountain-biking but at the same time are being recognized as the only more or less quiet area where real recreation and solitude can be found. The recreational function of the forest is becoming important.

Lithuania

81

Reasons for not allowing public access

The process of restitution and privatization started in 1992.

In 1996, privately owned forest comprised 18 per cent, in the future it will increase up to 40-50 per cent.

Public access is not allowed in state nature reserves and strictly protected zones of National parks . In privately owned forest public access is restricted for 100 metres around owner's house. According to Forest Act (1994) and Environment Protection Act (1993).

Regimes of access to forest for non-wood goods

Non-wood goods use are regulated by Public Visitors in Forest Act (1996), Mushroom Gathering Act (1996), Small Non-wood Products Use Act (1996), Game Act (1994).

Goods (wood and non-wood) and services

Enquiry Table 25: Wood price-average roundwood: price at roadside. Other goods: market price.

1 LTL = 0.25 USD.

Malta

79, 80

Enquiry Table 21: Our afforestation schemes are managed also for watershed management and for amenity purposes.

81

Regimes of access to forest for non-wood goods

All woodland is public and accessible to all, but during the bird hunting and trapping season the general public is advised to visit the woodlands on Sundays and public holidays from noon onwards when hunting and trapping is prohibited.

Goods (wood and non-wood) and services

Enquiry Table 24: The primary aims of afforestation are:-

a) Watershed management and prevention of soil erosion;

b) Amenity purposes including bird hunting and trapping;

c) Enhancing the rural landscape of a heavily populated country, bearing in mind the tourism industry.

Enquiry Table 25: No revenue is generated from the woodlands in Malta.

Indigenous and Tribal Peoples

Enquiry Table 22: This table is not applicable to Malta.

Netherlands

79, 80

Enquiry Table 21: Coastal plantations in the dunes and some hill-sides in the country "Limburg".

A very few areas have a protection function. In the 19th century, large areas were planted to protect soil against wind erosion (Veluwe, dunes in the coastal areas). Since the danger of wind erosion no longer exists just a small area can be considered as protection forest. It is a crude estimate of about 3,000 ha since the term protection forest is not used in the management plans.

In the southern part of the Netherlands (Zuid Limburg) some steep hillsides are under forest for protection against water erosion, although cutting trees in these areas is allowed. Here also it is a crude estimate of about 1,000 ha since the term protection forest is not used in the management plans.

81

Reasons for not allowing public access

The reason for not allowing public access is in general for nature conservation purposes, wildlife reservations and nesting/ foraging areas as well as fear for damage to extremely vulnerable nature areas.

Regimes of access to forest for non-wood goods

Most forest areas are accessible on roads and paths. People are guided by marked routes throughout the forest. Special routes are marked for horses. Intensive recreational use concentrated around parking places, restaurants with picnic places and other facilities. In general going beyond the paths and roads is forbidden, although picking mushrooms/berries is not stopped. Picking protected species of flowers/mushrooms is forbidden.

Other comments

Enquiry Table 23:

Sources: B. Derksen, 1995. Bos en natuur: 'Open of gesloten?'. Inventarisatie openstelling en toegankelijkheid bos- en natuurterrreinen in Nederland. Grontmij.

M. H. A. Ham, E. Hoogendam, C. L. M. Spinnewijn and R. H. M. Peltzer. 1997.

Bos zonder slagbomen. Een kwalitatief onderzoek naar de openstelling en toegankelijkheid van bos. IBN-DLO Rapport 308, Wageningen.

E. Hoogendam. Stichting Rekreatie, Postbus 80547, 2508 GM 's Gravenhage. Pers. Med.

Goods (wood and non-wood) and services

Enquiry Table 25: Source: Staatsbosbeheer Annual Report, 1994.

When excluding the income of rent of not forest land and buildings, the income if divided, is 48 per cent from wood and 52 per cent of other goods and services.

Source for Game meat: KNJV. A rough estimate by counting just the forest occurring species which are shot in 1996 gives the following figures. The prices are consumer prices at the game-shop and include also the turnover from game dealers.

As can be seen in the comments on *Enquiry Table 24* "Goods (wood and non-wood) and selected services provided by forest and other wooded land", an overview of the revenues from forests divided into the different goods and services cannot be given.

The annual reports of some forest owners however gives an idea about the magnitude of the income from non-wood goods and services:

Private forest owners: The yearly enquiry on forest economics for forest owners which is carried out by LEI-DLO gives the following figures published in the Annual Report of Bosschap, 1995:

	Income	***(Hfl/ha/year)***
Wood	161	44 per cent
Other	50	13 per cent
Subsidy	158	43 per cent

Vereniging voor natuurmonumenten: This nature conservation union with about 26,000 ha show in their Annual Report 1996 the following figures:

Income	***(million Hfl)***	***(million US $)***
Wood	1.26	0.63
Rent	2.06	1.03 most of it not forest land
Hunting and fishing	0.24	0.12
Other	2.40	1.20
Total	5.96	2.98

While disregarding the income from rent, about 32 per cent of the income is from wood and about 68 per cent from others, the so-called non-wood goods and services.

General comments:

Data on "socio-economic functions" (*Enquiry Tables 21 to 25*) are spread over a great number of institutions. Some of the data are assessed regularly (e.g. wood-production, hunting) while others are investigated in ad-hoc projects. Most data on this subject are not focused just on forest land or do not cover the whole country, which means that additional assumptions had to be made while filling in the enquiry.

As can be seen in *the Enquiry Tables 24 and 25*, estimates on several subjects (e.g. hunting) vary dramatically. Differences in definitions on the population, costs and prices can cause considerable differences in estimates. There is also from national point of view a lack of an infrastructure on data collection and presentation of the available information and a need for feasible definitions of desired information.

New Zealand

79, 80

Enquiry Table 21: The area of forest and other wooded land managed primarily for soil protection is not separately available for New Zealand.

81

Reasons for not allowing public access

In general the public are allowed access to all forest land unless the owner specifically prohibits it for health and safety reasons. However, in the case of privately owned forest it is customary to ask permission from the forest owner. This is generally to ensure that the persons wishing to visit the forest are informed of those parts of the forest which they should not access because of hazardous forestry operations being undertaken. For forests on defence land open right of access is generally not available because of military hazards. For forests in drinking water supply catchments access is usually controlled for public health reasons.

Regimes of access to forest for non-wood goods

There is limited information readily available on visitor use of forests. The New Zealand Tourism Board carries out a regular survey of activities undertaken by international visitors whilst visiting New Zealand and from these some limited details can be extracted. Information from the 1995/96 International Visitors' Survey shows that the total number of international visitors who visited a national forest or maritime park in the year ended March 1996 was 712,000 or 63 percent of all international visitors. Most visitors went to more than one park and 15 per cent spent at least one night in a national or forest park such as Mount Cook, Fiordland and Tongariro. Most of the parks visited by international visitors are in the category of State-owned (i.e. national parks and forest parks) and it can be assumed that these visits were to see unique features of the New Zealand landscape and its forest cover. New Zealanders make extensive use of the forests for recreational purposes (i.e. tramping or trekking, mountain bike riding, bush walks, feral deer and pig hunting, etc.) but there are no national data compiled on these activities.

For hunting purposes in State-owned forest it is usual practice to obtain a permit. In the case of access to privately-owned forest for hunting purposes it is usual to seek permission from the forest owner.

Mushroom and berryfruit gathering are not activities undertaken in New Zealand forests as these products do not grow in the dense, dark and damp indigenous forest cover. Likewise the plantation forests do not provide suitable growing conditions for these other products.

Unlike the situation in other countries—especially those in Central Europe—there is not a legal backing for open access to both public and privately owned forests. Custom has tended to mean that persons seeking access gain permission from the forest owner, but whether the owner can legally prohibit access in general would depend on the particular circumstances.

Other comments

Enquiry Table 23: Data on public and private ownership on other wooded land are not available in *Enquiry Table 5* on "Ownership".

Goods (wood and non-wood) and services

Enquiry Table 25: The information in this table has been estimated by the Ministry of Forestry using various sources such as industry associations, export statistics and knowledgeable persons. The values are indicative only but help to place an order of magnitude on the importance of these forest products.

Punga logs are used for a variety of ornamental garden purposes such as for building fences or retaining walls, etc. where a rustic image is sought.

Indigenous and Tribal Peoples

Enquiry Table 22: The data for the population of indigenous or tribal peoples is from the 1996 Census of Population and is the number of persons who identified themselves with the Maori ethnic group.

Area of Forest and OWL used by indigenous or tribal peoples for the collection and harvesting of wood and non-wood goods and provision of services: There are no specific estimates given for the sole use of forest land by persons of the Maori ethnic group. Persons of Maori ethnic identification are, in the main, fully incorporated with the general population in their use of forest and OWL. Prior to the arrival of the first Europeans the indigenous Maori people were dependent on the forests and forest resources for

their well-being and survival, however a much greater agricultural emphasis has developed with the arrival of the Europeans to New Zealand.

The whole question of indigenous peoples' rights is currently the focus of considerable attention in New Zealand.

Norway

79, 80

Enquiry Table 21: Area managed primarily for soil protection comprises forests in outer coastal districts of Southwest-Norway, expected to be at risk of sand drift and erosion by wind.

A total area of 4,280,000 ha of forest and other wooded land is officially declared as protection forest. The protective functions are multiple, including the protection of soil, reducing the risk of avalanches and mud slides, in addition to protection of the forest itself due to harsh climate and difficult regeneration conditions. Different functions are not separated from each other and assigned to any specific area. Erosion and soil degradation are not considered as significant problems in Norway. Therefore only small areas are managed primarily for soil protection.

Goods (wood and non-wood) and services

Enquiry Table 25: Wood: The quoted value is producer's price at roadside. Wood cut for own consumption or ceded on usufruct is included, the average price assumed to be the same as on roundwood for sale. Prices obtained from Statistics Norway.

Christmas trees: The value is an estimated retail price, while the producer's price is expected to be approximately one third of this. Trees cut for own consumption are included in the quantity. Price obtained from Ministry of Agriculture.

Decorative foliage: Estimated wholesale price (Ministry of Agriculture).

Decorative lichens: Listed in this table is an estimated wholesale price. Estimated compensation to landowner is NOK 345,000. Information was provided by a wholesale firm.

Berries: The estimated value is an average producer's price, provided by a wholesale firm. The quantity is given as a rough estimate, based on information published by Ministry of Environment.

Mushrooms: Estimated quantity and value provided by a wholesale firm (producer's price).

Game meats: Estimated quantity is based on information from Statistics Norway, value as a rough estimate (producer's price).

Hides and skins: Information on quantity and value provided by the Norwegian Association of Hunters and Anglers and wholesale firms (producer's price is quoted).

Poland

81

Area of FOWL to which public is legally not allowed access

Publicly owned FOWL: Public access to the forest could also be not allowed temporarily during periods of fire threat or of application of chemical agents.

Privately owned FOWL: Total area of private forests where public access could be forbidden legally.

Long term change in the area to which the public has legally had access

According to the new Polish Forest Act private forest owners are allowed to forbid access for the public. Up to now this regulation is not commonly applied, but an increase of private forest area which is closed to the society is probable.

Reasons for not allowing public access

According to the Forest Act of 28th September, in the following forest categories public access is permanently forbidden:

– forest plantations (regeneration areas) up to 4 metres height: about 300,000 ha
– experimental plots: 23,973 ha
– stands selected for seed supply: 240,421 ha
– refuge of protected animals: 55,689 ha
– areas of riverheads: ..
– areas endangered by erosion: ..
– private forests, where public access can be forbidden: 1,493,000 ha

Beside this, public access is not allowed to the total of protected forests: 46,202 ha

Regimes of access to forest for non-wood goods

Non wood forest products harvesting for commercial purpose is limited (an agreement with local forest district should be made).

Goods (wood and non-wood) and services

Enquiry Table 25: Non-wood goods data mean yield purchased for commercial purposes only.

PLN = 0.28 USD, 29th January 1998—official rate.

Portugal

79, 80

Enquiry Table 21: Cork oak and green oak areas (more than 1 million ha) are not included in these values; that is very important in the combat against desertification, as referred in *Enquiry Table 24* "Goods (wood and non-wood) and selected services provided by forest and other wooded land".

81

Reasons for not allowing public access

The reason for not allowing public access is the protection of protected species.

Goods (wood and non-wood) and services

Enquiry Table 25: Considering US$ 1 = 185$767 (Escudos).

Wood, resin, cork, honey and chestnut: income to forest owners.

Republic of Moldova

79, 80

Enquiry Table 21: Change due to transfer of forest (21,900 ha) into this (protection) category.

81

Reasons for not allowing public access

Forest Reserves regime. Conservation arrangements.

Regimes of access to forest for non-wood goods

Hunting is regulated (licensed).

Goods (wood and non-wood) and services

Enquiry Table 25: Total of all products: Without the account of the tax by the population: 15511.6 thousands lei.

Russian Federation

79, 80

Enquiry Table 21: According to article 55 of the Russian Forest Code (1997), "Forest resources shall be divided into forest groups, and group I forests into different categories of protection, in accordance with their economic, environmental and social importance... and the purpose they serve." Article 56 divides forests into different basic categories of protection, but all categories of protected forest perform a role in soil conservation. We show below the distribution (in percentages) of group I forests among the basic categories of protection according to material relating to the two most recent base periods:

Percentage of forest chiefly serving for:	*1988*	*1993*
Water retention	43.7	43.6
Protection	14.5	9.7
Pollution abatement	10.8	10.8
Special purposes	31	35.9

81

Regimes of access to forest for non-wood goods

Under article 19 of the Forest Code, "Forest resources and forests on defence land are Federal property. Article 21 states that "Citizens are entitled to free access to [the country's] forest resources and woodlands not forming part of those resources except where otherwise provided by law." Hence all forests are open to the public.

Goods (wood and non-wood) and services

Enquiry Table 25: Rows relating to timber, pulp and paper (9 items):

1. The figures for physical output volumes of trade timber and principal wood products in 1995 come from official State Committee on Statistics data (Promyshlennost' Rossii, handbook, (Moscow, 1996)).

2. The figures for output value in 1995 were obtained by multiplying the physical output by average wholesale prices for the year (in thousands of roubles per unit of volume: logwood, 89 per m^3; sawnwood, 284 per m^3; plywood, 1260 per m^3; compressed wood, 446 per m^3; fibreboard, 2.5 per m^2; cellulose, 3253 per tonne; paper, 2847 per tonne; cardboard, 2353 per tonne—NIPIEIles-prom data). The average exchange rate of the US dollar over the course of 1995 was 4566 roubles.

Rows relating to fruits and berries, nuts, mushrooms, medicinal materials, honey: present data on quantities harvested by Russian Federal Forestry Service enterprises over the course of 1995 (disregarding harvesting by other agencies and produce gathered by the local population for its own use).

Rows relating to Ungulates, fur-bearing animals, wildfowl and waterfowl and fur: present figures on procurement of fur and game meat in 1993 by all hunting and trapping agencies.

Indigenous and Tribal Peoples

Enquiry Table 22: There exists supportive information on the "Distribution of indigenous and tribal peoples whose lifestyle is associated with the utilization of forest resources (figures from 1989 census)" in tabular form in the reply to the enquiry, which is available at the secretariat.

The following are the additional comments on the area of forest and other wooded land used by indigenous or tribal peoples for the collection and harvesting of wood and non-wood goods and the provision of services:

In 1995, under the Northern Minorities (Nomadic Community) Act, the indigenous population of Republic of Sakha (Yakutia) was given, initially, 13,205,800 ha of forest for its long-term (49 years) use, and subsequently another 2,136,000 ha in total.

In accordance with the Law on "Nomadic minority people communities of the North of the Russian Federation", more than 13,206 thousand hectares of Forest Fund lands were turned over to indigenous people of the Republic of Sakha (Yakutia=, and then additionally 2,136 thousand hectares (total area of forest lands). Article 124 of the "Forest Code of the Russian Federation" regulates the order of utilization of the Forest Fund lands on the territories of traditional living (residing) of indigenous minority peoples and ethnic communities. According to this article, the forest utilization should maintain the traditional tenor (structure) of life of these people and ethnic groups. At the same time, the lands are not supposed to be taken away from the Forest Fund.

Slovakia

79, 80

Enquiry Table 21: The areas of forest protection are the categories based on data of Lesoprojekt, from the Total Forest Management Plan (SLHP) 1988, (tab. C1, page 6) and from the Permanent Forest Inventory (PIL) 1996, (tab. C0, page 3). The area of protection forests was presented in the stand area. This was calculated for forest land by using a coefficient calculated from the proportion of forest and stand area of forests in Slovakia.

81

Reasons for not allowing public access

The reasons are the 5th and the 4th degree of protection according to the Act 287/1994 on the protection of nature and landscape which implies the ban on economic activities, ban or restriction of sporting activities and recreation with the exclusion of the least necessary movement on marked routes.

Regimes of access to forest for non-wood goods

Without the permission of forest owners and of the organs of state administration of nature and landscape protection, access for motor cars is forbidden, excluding the access to recreational facilities, hunting grounds, etc.

Access to forest stands by motor cars is forbidden excluding cases of the management of forests and implementation of hunting rights. Excluding the 5th and the 4th degree of protection, hiking, biking and skiing in forests is not restricted.

Other comments

Enquiry Table 23: The source of information for this table is the Forest Act (14/1994), the Act on Nature and Landscape Protection No. 287/1994 Coll. and the Final Reports of the research.

The legal limitation, or prevention of access to, the forest was amended in Act No. 287/1994 Coll. on Nature and Landscape Protection, as well as the Forest Act No. 14/1994 Coll. partly.

According to the above mentioned Act, these are the forests where small-scale protected areas with the 5th and 4th degrees of nature protection have been established (protected areas, nature and national reserves, natural monuments) with the area of basic and protection zones of 87,450 ha.

Movement and collection of fruits are partly limited in the national parks (NP) with the area of forest stands of 283,600 ha.

The area of national parks, national and natural reserves, nature monuments increases each year which consequently causes a decrease of forest area where the public have legal free access with a possibility to use utility forest products. It is possible to enter freely the forest on foot, by bicycle, on skis all year long, except the areas of small-scale protected regions (natural monuments) (5th and 4th degrees of nature protection), newly-afforested plots, etc.

The Act on forests banishes access to forest stands by motor cars, except cars ensuring the forest production and game management performance. It is not possible to use forest roads without a permission as well.

We created a classification of forests according to number of visitors, they are as follows: principal, above-average, average, below-average, negligible. The regions of the High Tatras, Low Tatras and Slovak Paradise are considered the principal ones. The forests with above-average number of visitors include Malá Fatra, Velká Fatra, Slovenské Rudohorie, Kysucké Beskydy, Oravské Beskydy and Kremnické vrchy. These two degrees of classification are the basis for data quantification for an estimate of forest areas with a great number of visitors in forest per year. Intensive visits of forests (790,000 visitors per year) do not relate to 2,016,100 ha of forest, i.e. approximately 41 visitors per 100 ha.

On the basis of forest area according to various ownership rights (841,000 ha in state ownership, 283,000 ha in the ownership of other public bodies and 892,000 ha in private ownership), a partial estimate of the number of visitors has been made. It shows that state-owned forests are visited by 297,000 visitors annually, forests owned by other public bodies are visited by 287,000 visitors annually and privately-owned forests are visited by 365,000 visitors (about 300 persons/ha/year).

From the forestry point of view, it is possible to increase the number of visitors in the region of Slovak Paradise, where information on possibilities of utilization of recreational forest function is not sufficient, especially for foreign visitors. It is necessary to develop small and medium enterprises mainly in border regions which are less visited than other parts of Slovakia. In the region of Martinské hole, Stráne and Jasenská valley, it is recommended to signport the information routes and to build tracks for tourists.

Goods (wood and non-wood) and services

Enquiry Table 24: Production of other wood products:

Production of other wood products represents, according to the Statistical Office of SR, 132 million SKK. Of those the sale of products of basket-making represents 9.4 million SKK. Interest in wood products is increasing.

Enquiry Table 25: The prices were obtained from buyers of single products. They are purchase prices.

The value of 5.2 million SKK from game management is 10 per cent from the value for shooting of charges.

Production of other wood products represents according to the Statistical Office of Slovakia, 132 million SKK, out of which the sale of products of basket-making represents 9.4 million SKK. An interest in wood products increases.

Data source for sale of live game: Hunting Statistics of SR 1996.

For all other data sources: Please see table 24 "Goods (wood and non-wood) and selected services provided by forest and other wooded land.

Note: V = export; PS = industrially processed in SR; D = domestic consumption.

Exchange rate:

31 December 1996: 1 US$ = 31.71 SKK.

1 January 1998: 1 US$ = 35.27 SKK.

Slovenia

79, 80

Enquiry Table 21: Land covered with Pinus mugo is classified as other wooded land.

81

Reasons for not allowing public access

There are three reasons:

1) Military reasons: the area where access is not allowed has been reduced from 18,800 to 2,300 ha.
2) Water pumping areas: 700 ha EST—no change.
3) Game fence: 2000 ha—no change.

Regimes of access to forest for non-wood goods

Mushroom gathering is limited to 2 kg per person daily. In protected areas, mushroom gathering is not allowed.

Hunting is strictly regulated (based on plans) and carried out by hunting clubs.

Where private forests are grown predominantly for non-wood goods, local authorities may restrict gathering in those forests.

Goods (wood and non-wood) and service

Enquiry Table 25: These are data of the Ministry of Agriculture, Forest and Food Production.

Spain

79, 80

Enquiry Table 21: The data given are estimates

Sweden

79, 80

Enquiry Table 21: Source: National Board of Forestry.

The total area of officially declared protection forest is only 33,000 ha, thus amounting to 1 per cent. Only soil protection is considered here.

81

Area of FOWL to which public is legally not allowed access

The figure here is 77,000 ha of which 42,000 ha are not allowed access to during parts of the year for wildlife sanctuary or military reasons. The rest of the area 35,000 ha is not legal to access any time of the year.

Reasons for not allowing public access

- Military reasons.

- Wildlife sanctuary reasons (mainly during parts of the year)

Other comments

Enquiry Table 23: Source: National Board of Forestry.

Goods (wood and non-woods) and services

Enquiry Table 25: Field hare (Lepus europeus), Mountain hare (Lepus timidus).

Berries and mushrooms picked for local consumption.

Mushrooms: Include berries for sale.

Indigenous and Tribal Peoples

Enquiry Table 22: Source: National Board of Forestry.

(Item: 22.1) Population of indigenous or tribal peoples: According to Erik Persson at the County Board of Forestry in Västerbotten (Erik is the National Board of Forestry's Saami expert) the population is about 17,000 Saami's. According to representatives for the Saami people there are 15,000 to 20,000 Saami's.

(Item: 22.2) Area of forest and other wooded land used by indigenous peoples: about 115,00,000 ha.

Switzerland

79, 80

Enquiry Table 21: 42 per cent of forest area of Switzerland.

81

Regimes of access to forest for non-wood goods

No reliable information exists related to visitor patterns for the forests in Switzerland. No comments can be given to this question.

Goods (wood and non-wood) and services

Enquiry Table 24: Data provided in this table originate from the publication: Criteria and indicators for sustainable management in Switzerland. All available data on non wood goods and services as well as background information are given in this paper, other data do not exist.

Information originating from the Swiss NFI on the topic Importance of recreation near dwellings (surrounding within 2 km) can be given. Only 3 per cent of the Swiss forests are very important recreation zones, 6 per cent have been judged as fairly important and 90 per cent are of little importance for recreation.

Turkey

81

Enquiry Table 23: Access to forest is free except for “Nature reserves” (strict nature protection areas, 21,119.7 hectares). For access to privately owned forest land, the permission of land owner needed.

Also during the fire season and in fire sensitive areas, temporary access restrictions may be declared.

Goods (wood and non-wood) and services

Enquiry Table 25: Wood Products in Turkey: The quantities harvested for wood products are for 1996. All the prices are marketing prices and dont include taxes. As for some important non-wood products the quantities harvested isare for 1996.

1 USA Dolar = 81137 Türkish Liras average in 1996.

1 DM = 53830 Türkish Liras average in 1996.

Ukraine

81

Reasons for not allowing public access

The main reasons are: the creation of reserves; contamination (radioactive and other); and the demarcation of areas of special economic importance.

Regimes of access to forest for non-wood goods

Citizens are permitted free access to forest land for general use; they may gather wild herbaceous plants, flowers, berries, nuts and other fruit, and fungi free of charge for their personal consumption except where otherwise provided by legislation. The

harvesting of non-wood items for manufacturing and commercial purposes is categorized as a special use and may be engaged in against payment on the basis of a special permit—the "forest ticket".

Goods (wood and non-wood) and services

Enquiry Table 24: Under its forest legislation, Ukraine's forests are part of its national wealth and serve, by design and by virtue of their situation, chiefly environmental (water-retention, protective, pollution-control, reclamation, recreational), aesthetic, educational and other purposes. They are of limited exploitative value.

Enquiry Table 25: Providing information for Ukraine as a whole under *Enquiry Table 25* is not for the moment possible.

United Kingdom

81

Area of FOWL to which public is legally not allowed access

Access to private woodland.

The public normally only has right of access to a small proportion of private woodland, where this is a condition under grant or other government scheme, or where there is a public right of way. But public access may (or may not) be permitted to other private woodlands, at the discretion of the owner. The Government provides financial incentives to woodland owners to encourage access.

Long term change in the area to which the public has legally had access

Increase due to increasing area of private woodland and access being promoted through grant schemes. Where traditional rights of way cross woodland, the woodland will be legally accessible. Public woodlands generally provide a welcome to people on foot wherever and whenever this can be done in harmony with management objectives: visitors are in effect present with permission and not breaking any law.

Reasons for not allowing public access

In England, woods are often small, and owned by individuals who value the woods for their own recreation, for conservation values or for privacy; a recent study showed that such owners wish to retain a degree of control over who visits and what activities take place. Access legislation is currently under review, and there is an increasing view that public support should be matched by public benefits. For public woodland, main reason is military use of woodland owned by Ministry of Defence.

Regimes of access to forest for non-wood goods

In state owned forests, permits are made available for a whole range of activities, e.g. motor rallies, gathering fuel, etc. This position is analogous to agreements and arrangements made between users and private owners. In two state forests (New Forest & Forest of Dean) commoners have special rights in respect of forest products, including rights to minerals.

Goods (wood and non-wood) and services

Enquiry Table 25: The data in this table are for Great Britain only—exclude Northern Ireland.

Christmas trees include trees grown on land not classified as forest in some earlier assessments.

Wood valued at mix of standing and roadside values, venison at wholesale value, Christmas trees at retail value.

United States of America

79, 80

Enquiry Table 21: Given the very similar situation for the United States and Canada on this issue, the following comments are an excerpt from the Canadian response adapted for the United States.

Information on the "area where forests and other wooded land are managed primarily for soil protection" is not available for the United States. In fact, this type of information lacks relevance in the context of forest management in the United States because soil and water protection are over-riding considerations in the development of forest policy and in forest management practices. Soil and water protection are two of many elements that are considered in developing management regimes that maintain the ecosystem function. There is a broad range of other elements that are simultaneously considered, including (but not limited to) site regeneration, water quality, habitat, aesthetic impacts, landscape diversity, endangered species, cultural/spiritual impacts, and others. Therefore, it is difficult to isolate areas in terms of being managed primarily for soil protection.

Measures to protect water and soil values have been in place for a time; however, these measures are constantly being reviewed, updated, revised, and improved (e.g., Federal Clean Water Act, Best Management Practices Legislation in the various States, etc.).

Management factors that can affect water and soil quality include harvesting close to streams and rivers, road construction techniques, harvesting on steep slopes, skidding methods, mechanized harvesting on soils sensitive to soil compaction, winter harvesting vs. summer harvesting operations, and post harvest site treatments (such as scarification, treatment of debris, etc.). Potential soil disturbance (or degradation) factors include compaction, erosion, loss of organic matter, and loss of productivity. Some areas are more susceptible to damage from these factors than others. For example, sensitive sites include riparian zones, steep slopes, wet and poor soils, shallow soils over bedrock, and soils susceptible to compaction.

In general, the creation of riparian buffer zones is now standard practice throughout most of the country. These zones range from 30—50 metres on either side of streams. Most States also have guidelines for road construction to minimize reductions in soil

and water quality and aquatic habitats. Mechanized harvesting has accounted for an increasing proportion of the total harvest in recent years. The use of heavy equipment in the forest environment has the potential to cause problems relative to soil compaction. However, two factors mitigate or reduce potential problems related to reductions in soil quality. First, timing harvest activities to minimize site degradation such as winter harvesting in areas where it is feasible or avoiding harvest during seasonal wet periods. Second, through various new decision support tools such as forest ecosystem classification frameworks, management agencies are improving their understanding of *a*) which types of sites are sensitive to soil disturbance, *b*) where these sites are situated, and *c*) the kinds of modifications in management practices and equipment required to minimize the impacts of harvest operations.

Specifically, the Conservation Reserve Program in the 1980s and 1990s planted over one million acres (405,000 ha) of non-forest land to forest for the purpose of soil protection. The Great Shelterbelt Program of the 1930's was also designed to protect soil and planted upwards of 4 million hectares in the central prairie region of the United States.

81

Long term change in the area to which the public has legally had access

Changes in access over time (Data source: National Private Landowners Survey (NPLOS) conducted in 1995-1996).

Public lands: DECREASING access because of adjacent development closing off traditional routes of access.

Private lands: access by permission only. Laws on posting, trespass vary widely by state. Traditions vary regionally for providing access.

NPLOS comparison showed DECREASING access to private lands by general public:

About 40 per cent of landowners posted their land against trespass.

One-third of owners closed access to all but family.

About 50 per cent allowed access outside the family.

Only 15 per cent allowed access to strangers (25 per cent in previous survey).

Three percent of landowners reported leasing land for recreation.

71 per cent of owners participate in recreation on their own lands

Use estimates: the NPLOS provided some estimates of use, but they cannot be aggregated nationally.

Reasons for not allowing public access

Public lands: urban and suburban development adjacent to public lands has reduced routes of access, particularly for leisure activities.

Private lands: all access is by permission of the owner, whether for a fee or free.

Comparison of two surveys of private landowners indicates the area available for general public access has declined between 1992 and 1996.

The main reasons for restricting and controlling access to public forest lands include:

- The need to ensure that resources are utilized and managed sustainably and that resources will be available for future generations.

- The need to ensure that the forest resource is managed for multiple use and that one use does not dominate or extinguish other uses.

- The need to ensure public safety (e.g., access or use may be restricted during severe forest fire activity or during periods when the risk of fire is high).

The main reason for laws that restrict access of the public to private forest lands (i.e., trespass laws) is to preserve and protect the property rights of the land owner.

Regimes of access to forest for non-wood goods

There are no general access regimes in the United States. Land use and land use priorities vary from area to area and from owner to owner depending on land use, management planning, and operational planning priorities. These planning processes involve various degrees of public participation.

Future events that may affect how forests are used and the degree of public access for particular uses will be: *a*) the future creation of parks and protected areas, *b*) negotiation, resolution and settlement of land claims, *c*) new forest practices codes, public participation processes, and planning priorities, and d) road development into remote areas.

Other comments

Enquiry Table 23: Sources: National Survey on Recreation and Environment (NSRE) (1994-5).

Recreation: statistically-based population sample of United States for all wildlife-related recreation, Draft 1995 RPA recreation assessment.

General comments:

The situation for the United States is very similar to that for Canada. In general, the public is not permitted to settle, make a claim of ownership, construct permanent structures or facilities on public lands, or convert public forest lands to alternative uses (such as crops or grazing land).

The list of goods and services obtained from the forest resource by the United States public is broad and diverse. It includes commercial timber resources, fuelwood, various types of botanical products (including mushrooms, berries, nuts, wild rice, fiddleheads, and other botanical products), hunting, fishing, trapping, subsistence uses, and various types of outdoor recreation activities. The degree of legal access to public forests by the general public varies widely. In some cases (such as for timber harvesting), public access is closely regulated and controlled by public agencies through management plans and contracts which allocate public timber to individuals using various legal mechanisms. In return for the rights to public timber, the holder of these rights accepts certain obligations and responsibilities.

In the case of non-timber goods and services, the degree of legal public access varies widely depending on the particular resources in question and the particular public ownership in which they occur. Also, the instruments used to control and regulate access vary widely. In some cases public access is controlled by the payment of access fees (for example, access to State and National parks may require the payment of a fee). Public access for the right to hunt, trap and/or fish on public lands is regulated through licenses systems, quotas, and penalties for illegal use. Public access for non-consumptive uses (such as hiking, camping, skiing, snowmobiling) is unregulated in some areas and regulated in other areas.

Therefore, it is difficult to generalize and develop a single number which estimates the area of forest land to which the public does or does not have access, or the extent to which there has been any significant historical change in accessibility over time. The following comments may be useful in developing a broad sense of the situation.

Other comments:

Item 23-4 of *Enquiry Table 23* on the pattern of visitor use of different ownership categories of forest:

General patterns:

National Parks—The primary mandates of the National Park system are to preserve ecological integrity, and promote public understanding, appreciation, and enjoyment of National Parks. Although some National Parks are highly developed (i.e. residential and commercial establishments, alpine ski operations, golf courses, resort hotels) these developments were based on previous policies. The adoption of policies focusing on preserving the ecosystem has resulted in a review of policies relative to the development of commercial facilities within park boundaries. In terms of development of accommodation services, park policies favour the development of basic accommodation facilities such as campgrounds, hostels, and shelters.

National Forests—National Forests contain both reserved (Wilderness, etc.) and unreserved areas. Non-reserved forest lands are managed for multiple use. Hierarchical planning processes are established to develop management objectives at broad and local scales. These planning processes (which rely heavily on public participation processes) ensure that development and use of public lands best serves the interests of society.

State Parks and Forests—In addition to the National Park system, there are systems of parks within each State established and maintained by State and local governments. Generally, extractive activities such as harvesting are not permitted in State Parks or Wilderness areas, and the primary mandates of such areas are to protect ecosystems and habitat and provide the opportunity to experience nature for individuals. Harvesting may be allowed in unreserved State Forest areas in compliance with State laws and guidelines on appropriate management practices. In most cases some form of environmental impact statement must be prepared for management activities.

Private industrial forest land—The primary use of forest on private industrial forest lands is timber production. Management plans for these lands provide compliance with federal, State, and local laws on appropriate management practices. Major forest industry landowners also provide many opportunities for the public to enjoy their lands for recreation, hunting, fishing, and gathering as a integral part of their land management programs.

Private non-industrial forest land—The management objectives of private forest land owners are diverse and vary from owner to owner. In some cases, owners actively manage their woodlots and periodically harvest and sell roundwood to a mill. Some woodlot owners produce maple syrup products from sugar bushes (common in the northeastern United States).

Some individuals manage their land for the production of Christmas trees. In other cases, woodlot owners manage their forest to provide habitat for wildlife. Still in other cases, owners do not manage their forest land and simply maintain a natural forest. Periodic national studies are conducted to determine the attitudes and objectives of this group relative to forest ownership. Land access patterns are not currently surveyed.

Specific patterns:

National Survey on Recreation and Environment (NSRE) (1994-5) provides national participation rates and mean number of trips and days for all outdoor recreation activities. These are not linked to visits to any particular ownership and not restricted to forest areas. Examples of activities associated with forest environments:

6 per cent of population (16 years and over) participate in camping
24 per cent of population participate in hiking

Data on hunting fishing, and non-consumptive wildlife recreation (1996 data):

Big game hunting:	11,268,000 participants
Wildlife viewing:	23,652,000 participants

Source: Statistically-based population sample of United States for all wildlife-related recreation.

Number of visits to federal sites by agency (to nearest hundred thousand) in 1996:

Forest Service:	859,200,000
National Park Service:	265,800,000
Bureau of Reclamation:	38,300,000
Corps of Engineers:	375,700,000
Bureau of Land Management	58,900,000
Fish and Wildlife Service:	29,500,000
Tennessee Valley Authority:	600,000
Total visits in 1996:	1,628,000,000

(Official agency estimates, but not necessarily from statistically based data) Source: Draft RPA recreation assessment.

These visits are totals for federal lands, which includes non-forested areas. One possible approach would be to look at the proportion of forest within the ownerships, and assume visitation is proportional to land area. This most likely is an extremely conservative approach, since there are some large tracts of non-forested federal lands that receive little visitation, and because forested areas are probably more attractive for recreation. However, using this approach, a total "forest" visitation would be 791 million visits:

Forest Service land is 64 per cent forested, which would provide 550 million visits.

Bureau of Land Management lands are 12 per cent forested, which would provide 7 million visits.

Other federal holdings: 30 per cent is forested, which would provide 234 million visits.

Goods (wood and non-wood) and services

Enquiry Table 24: There exists detailed information on all the items under the item heads of this table.

Enquiry Table 25: Source of value is detailed below:

a) mushrooms: value is wholesale value (price to purchaser of raw mushrooms from forest)

b) floral greens and ornamentals: wholesale value

c) furbearer: based on raw pelt values (wholesale)

d) salmon: dockside value of raw fish (wholesale)

Indigenous and Tribal Peoples

Enquiry Table 22: Federally recognized tribes in the US total 550. The population of Native Americans enrolled in federally recognized tribes is 1,426,270. Population is from 1990 US Census, self-determined.

Many tribes provide recreation opportunities to generate income- no estimate available.

Recreation fish potential on tribal lands: over 100 reservations in 23 states; 10,000 miles (16,000 km) of rivers and streams, and 750,000 acres (304,000 ha) of lakes and impoundments

Federal lands available to Indian tribes under treaty:

1) Columbia River Intertribal Fish Commission: 40.9 million acres (16.6 million ha), 4 tribes

2) Northwest Indian Fish Commission: 42 million acres (17 million ha), 20 tribes

3) Chippewa-Ottawa Treaty Fish Commission: 12.8 million acres (5.2 million ha), 3 tribes

4) Great Lakes Indian Fish and Wildlife Commission and MN-WI-MI Tribes: 58.4 million acres (23.6 million ha), 23 tribes

Total lands available to tribes: 154.1 million acres (62.4 million ha)

There exists supportive information on "Estimate forest and other wooded land in Indian ownership" (in tabular form) in the reply to the enquiry, which is available at the secretariat.

Yugoslavia

79, 80

Enquiry Table 21: The Assessment is based on the adopted ecological criteria and map of the soil erosion of Serbia (1983).

Appendix I

Terms and definitions applied in the UN-ECE/FAO Temperate and Boreal Forest Resources Assessment 2000

No.	*Terms*	*Definitions*	*Relevance to Enquiry Table(s) No.*	*Relevance to Main Table(s) No.*
1.	Above-stump woody biomass	**The mass of the woody part (stem, bark, branches, twigs) of trees, alive or dead, shrubs and bushes, excluding stumps and roots.**	14	40-41
2.	Annual fellings	**Average annual standing volume of all trees, living or dead, measured overbark to a minimum diameter of 0 cm (d.b.h.) that are felled during the given reference period, including the volume of trees or parts of trees that are not removed from the forest, other wooded land or other felling site.** *Includes:* silvicultural and pre-commercial thinnings and cleanings left in the forest; and natural losses that are recovered (harvested).	16	47-48, 52
3.	Annual removals	**Average annual of those fellings that are removed from the forest, other wooded land or other felling site during the given reference period.** *Includes:* Removals during the given reference period of trees felled during an earlier period and removal of trees killed or damaged by natural causes (natural losses), e.g. fire, windblow, insects and diseases.	16	49-52
4.	Broadleaved	**All trees classified botanically as Angiospermae** They are sometimes referred to as “non-coniferous” or “hardwoods”.	3, 13-17, 20	3-6, 27, 31, 35-36, 38, 41, 43-49, 51-52, 78
5.	Coniferous	**All trees classified botanically as Gymnospermae** They are sometimes referred to as “softwoods".	3, 13-17, 20	3-6, 26, 30, 35-36, 38, 41,43-49, 51-52, 77
6.	Coppice and coppice with standards	**Forest composed of stool-shoots or root suckers with or without scattered trees (standards), which may be of seedling or coppice origin.**	4	5, 6
7.	Coppice sprouting	**The regrowth from coppice stools after the previous stand has been cut.**	11	66, 68
8.	Damage to forest	**Disturbance to the forest which may be caused by biotic or abiotic agents, resulting in death, or a significant loss of vitality, productivity or value of trees and other components of the forest ecosystem.**	18	70-75

No.	Terms	Definitions	Relevance to Enquiry Table(s) No.	Relevance to Main Table(s) No.
9.	Defoliation classes	**The extent of visually assessed defoliation of trees, as developed by the International Co-operative Programme (ICP Forests) of the Executive Committee for the Convention on Long-range Transboundary Air Pollution in Europe.** Damage classes are from 0 to 4, as follows: Class Needle/Leaf loss Degree of defoliation **0 up to and including 10% none** **1 > 10 to 25 % slight (warning stage)** **2 > 25 to 60 % moderate** **3 > 60 to < 100 % severe** **4 100% dead** * For methods of assessment and other concepts, see ICP documentation.	20	76-78
10.	Domesticated introduced tree species	**Introduced tree species planted outside their natural biotope, area or region, which have become established sufficiently well after at least one generation that they have grown satisfactorily, have not shown themselves prone to serious insect or fungal (or other diseases) attack and have been able to regenerate themselves naturally.**	9	…
11.	Endangered species	**Species classified by an objective process (e.g. national "Red Book") as being in IUCN categories "critically endangered" and "endangered".** A species is considered to be a critically endangered when it is facing an extremely high risk of extinction in the wild in the immediate future. It is considered "endangered" when it is not critically endangered but is still facing a very high risk of extinction in the wild in the near future.	10	56-64
12.	Endemic species	**Species is endemic when found only in a certain strictly limited geographical region, i.e. restricted to a specified region or locality.**	10	56-64
13.	Even-aged (high forest)	**High forest in which the predominant proportion of the trees falls into the same age class, generally resulting in a single storey forest.**	13	25-32
14.	Forest available for wood supply	**Forest where any legal, economic, or specific environmental restrictions do not have a significant impact on the supply of wood.** *Includes:* areas where, although there are no such restrictions, harvesting is not taking place, for example areas included in long-term utilization plans or intentions.	3-5, 7, 13-17	3, 5, 8, 12-13, 15-16, 25-38, 41, 43-52
15.	Forest	**Land with tree crown cover (or equivalent stocking level) of more than 10 per cent and area of more than 0.5 ha. The trees should be able to reach a minimum height of 5 m at maturity in situ. May consist <u>either</u> of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground; <u>or</u> of open forest formations with a continuous vegetation cover in which tree crown cover exceeds 10 per cent. Young natural stands and all plantations established for forestry purposes which have yet to reach a crown density of 10 per cent or tree height of 5m are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention or natural causes but which are expected to revert to forest.**	1-3, 5-8, 11, 14-17, 19, 21	1-4, 7-8, 11, 13-16, 18, 21-22, 33-35, 37-39, 41-45, 47-51, 53-55, 65-69

No.	Terms	Definitions	Relevance to Enquiry Table(s) No.	Relevance to Main Table(s) No.
		Includes: Forest nurseries and seed orchards that constitute an integral part of the forest; forest roads, cleared tracts, fire-breaks and other small open areas within the forest; forest in national parks, nature reserves and other protected areas such as those of special environmental, scientific, historical, cultural or spiritual interest; windbreaks and shelterbelts of trees with an area of more than 0.5 ha and a width of more than 20 m. Rubberwood plantations and cork oak stands are included. *Excludes*: Land predominantly used for agricultural practices.		
16.	Forest Fire	**Fire which breaks out and spreads on forest and other wooded land or which breaks out on other land and spreads to forest and other wooded land.** *Excludes*: Prescribed or controlled burning, usually with the purpose of reducing or eliminating the quantity of accumulated fuel on the ground.	18, 19	70-75
17.	Forest industries (owned by)	**Forest and other wooded land owned by private wood-processing enterprises or industries.**	5, 23	12, 15, 81
18.	Forest not available for wood supply	**Forest where legal, economic or specific environmental restrictions prevent any significant supply of wood.** *Includes*: (a) Forest with legal restrictions or restrictions resulting from other political decisions, which totally exclude or severely limit wood supply, *inter alia* for reasons of environmental or biodiversity conservation, e.g. protection forest, national parks, nature reserves and other protected areas, such as those of special environmental, scientific, historical, cultural or spiritual interest; (b) Forest where physical productivity or wood quality is too low or harvesting and transport costs are too high to warrant wood harvesting, apart from occasional cuttings for auto-consumption.	3, 4, 7, 14-16	6, 8, 17, 33-35, 39, 41, 43-45, 47-48, 50
19.	Forest/other wooded land with damage from unidentifiable causes	**Forest/other wooded land with damage, the cause of which is unknown or could be a combination of a number of agents.**	18	71
20.	Forest/other wooded land undisturbed by man	**Forest/other wooded land which shows natural forest dynamics, such as natural tree composition, occurrence of dead wood, natural age structure and natural regeneration processes, the area of which is large enough to maintain its natural characteristics and where there has been no known significant human intervention or where the last significant human intervention was long enough ago to have allowed the natural species composition and processes to have become re-established.**	2	53, 54
21.	Gross annual increment	**Average annual volume of increment over the reference period of all trees, measured to a minimum diameter breast height (d.b.h.) of 0 centimetres (cm).** *Includes*: The increment on trees which have been felled or die during the reference period.	15	42-43
22.	Growing stock	**The living tree component of the standing volume.**	14, 17	34-38
23.	High forest	**Forest normally composed of trees of seedling origin, but may also include trees from vegetative reproduction, e.g. poplars.** *Includes*: stands in process of transformation into high forest.	4, 13	5, 29-32

No.	Terms	Definitions	Relevance to Enquiry Table(s) No.	Relevance to Main Table(s) No.
24.	Holding	**One or more parcels of forest and other wooded land which constitute a single unit from the point of view of management or utilization. For State-owned forest and other wooded land a holding may be defined as the area forming a major management unit administered by a senior official, .e.g. a Regional Forestry Officer. For forest and other wooded land that is owned publicly, other than by the State, or owned by large-scale forest owners, e.g. forest industries, a holding may constitute a number of separated properties which are, however, managed according to one corporate strategy. Under any category of ownership, other than State-owned, one holding may be the property of one or several owners.**	6	18-24
25.	Indigenous tree species	**Tree species which have evolved in the same area, region or biotope where the forest stand is growing and are adapted to the specific ecological conditions predominant at the time of the establishment of the stand.** May also be termed native species or autochthonous species.	9, 12	65-67, 69
26.	Indigenous and tribal peoples	**Indigenous and tribal peoples in independent countries are defined as those who:** **(1) are regarded as indigenous on account of their descent from the populations which inhabited the country, or a geographical region to which the country belongs, at a time of conquest or colonization or the establishment of present state boundaries and who, irrespective of their legal status, retain some or all of their own social, economic, cultural and political institutions;** **(2) are tribal peoples whose social, cultural and economic conditions distinguish them from other sections of the national community, and whose status is regulated wholly or partly by their own customs or traditions or by special laws and regulations.** **For both categories (1) and (2) self-identification as indigenous or tribal shall be regarded as the fundamental criterion for determining the groups.** (Source: ILO Convention No. 169 on "indigenous and tribal peoples").	5, 22, 23	9-17, 81
27.	Inland water	**Area occupied by major rivers, lakes and reservoirs.**	1	1
28.	IUCN Protection categories	Guidance on interpretation of these definitions may be obtained from IUCN. (see footnote in "Definitions to Table 10", page 26 of the enquiry)	8	55
	I. Strict nature reserve/ wilderness area	**Protected area managed mainly for science or wilderness protection.** These areas possess some outstanding ecosystems, features and/ or species of flora and fauna of national scientific importance, or they are representative of particular natural areas.They often contain fragile ecosystems or life forms, areas of important biological or geological diversity, or areas of particular importance to the conservation of genetic resources. Public access is generally not permitted. Natural processes are allowed to take place in the absence of any direct human interference, tourism and recreation. Ecological processes may include natural acts that alter the ecological system or physiographic features, such as naturally occurring fires, natural succession, insect or disease outbreaks, storms, earthquakes and the like, but necessarily excluding man-induced disturbances.	8	55

No.	Terms	Definitions	Relevance to Enquiry Table(s) No.	Relevance to Main Table(s) No.
	II. National Park	**Protected area managed mainly for ecosystem protection and recreation.** National parks are relatively large areas, which contain representative samples of major natural regions, features or scenery, where plant and animal species, geomorphological sites, and habitats are of special scientific, educational and recreational interest. The area is managed and developed so as to sustain recreation and educational activities on a controlled basis. The area and visitors' use are managed at a level which maintains the area in a natural or semi-natural state.	8	55
	III. Natural monument	**Protected area managed mainly for conservation of specific natural features.** This category normally contains one or more natural features of outstanding national interest being protected because of their uniqueness or rarity. Size is not of great importance. The areas should be managed to remain relatively free of human disturbance, although they may have recreational and touristic value.	8	55
	IV. Habitat/ Species management area	**Protected area managed mainly for conservation through management intervention.** The areas covered may consist of nesting areas of colonial bird species, marshes or lakes, estuaries, forest or grassland habitats, or fish spawning or seagrass feeding beds for marine animals. The production of harvestable renewable resources may play a secondary role in the management of the area. The area may require habitat manipulation (mowing, sheep or cattle grazing, etc).	8	55
	V. Protected landscape/ seascape	**Protected areas managed mainly for landscape/seascape conservation and recreation.** The diversity of areas falling into this category is very large. They include those whose landscapes possess special aesthetic qualities which are a result of the interaction of man and land or water, traditional practices associated with agriculture, grazing and fishing being dominant; and those that are primarily natural areas, such as coastline, lake or river shores, hilly or mountainous terrains, managed intensively by man for recreation and tourism.	8	55
	VI. Managed resource protection area	**Protected area managed for the sustainable use of natural ecosystems.** Normally covers extensive and relatively isolated and uninhabited areas having difficult access, or regions that are relatively sparsely populated but are under considerable pressure for colonization or greater utilization.	8	55
29.	Individuals (owned by)	**Forest and other wooded land owned by individuals or families, including those who have formed themselves into companies.** *Includes*: individuals and families who combine forestry with agriculture (farm forests), those who live in or near their forest holdings, and those who live elsewhere (absentee owners).	5, 23	12, 15, 81
30.	Introduced tree species	**Tree species occurring outside their natural vegetation zone, area or region.** May also be termed non-indigenous species. *Includes*: Hybrids	9, 11	…

No.	Terms	Definitions	Relevance to Enquiry Table(s) No.	Relevance to Main Table(s) No.
31.	Invasive species	**Species of fauna and flora of non-local origin which has established itself or has been introduced into a given area and has spread in the natural conditions on an undesirable scale, e.g. to the extent that it has replaced or seriously suppressed the species previously occupying this specific area.**	10	…
32.	Land area	**Total area, excluding inland water.**	1	1, 2
33.	Legal right of access	**Where the public are legally entitled to visit forest and other wooded land, whether publicly owned or owned by third parties. Some activities by the visiting public may however be forbidden or restricted.**	23	81
34.	Local provenance	**Genetic material which has originated from a place and a source considered as local for the area where it has been planted.** *Excludes*: provenance from seed-orchards.	12	69
35.	Managed forest/ other wooded land	**Forest and other wooded land which is managed in accordance with a formal or an informal plan applied regularly over a sufficiently long period (five years or more). The management operations include the tasks to be accomplished in individual forest stands (e.g. compartments) during the given period.**	5	9-10, 14-17
36.	Mixed forest/other wooded land	**Forest/other wooded land on which neither coniferous, nor broadleaved, nor palms, bamboos, etc account for more than 75 per cent of the tree crown area.**	3	3-6, 28, 32
37.	Natural colonization of non-forest land	**The colonization of non-forest land with forest trees through stages of natural succession without human intervention.** Natural colonization may frequently occur after other (non-forest) land has been abandoned or withdrawn from its former utilization, e.g. farming or pasturing.	11	65, 67-68
38.	Natural conversion of other wooded land to forest	**The conversion of other wooded land to forest as a result of natural processes.** The process may occur without intentional intervention by man, but may be aided by human interventions such as the withdrawal of animal grazing from the land allowing tree regeneration to succeed, soil scarification, or actions to protect the area from fire, over-cutting, etc.	11	65, 67-68
39.	Natural losses	**Average annual losses to the growing stock during the given reference period, measured to a minimum diameter of 0 cm (d.b.h.), due to mortality from causes other than cutting by man, e.g. natural mortality, diseases, insect attacks, fire, windthrow or other physical damage.**	15-16	44, 48
40.	Natural regeneration	**Re-establishment of a forest stand by natural means, i.e. by natural seeding or vegetative regeneration.** It may be assisted by human intervention, e.g. by scarification or fencing to protect against wildlife damage or domestic animal grazing.	11	66, 68
41.	Natural regeneration enhanced by planting	**Natural regeneration which has been combined with artificial planting or seeding, either to ensure satisfactory restocking with the naturally regenerated species or to increase species diversity.**	11	66, 68
42.	Net annual increment	**Average annual volume over the given reference period of gross increment less that of natural losses on all trees to a minimum diameter of 0 cm (d.b.h.).**	15	42, 45-46

No.	Terms	Definitions	Relevance to Enquiry Table(s) No.	Relevance to Main Table(s) No.
43.	Non-local provenance	**Genetic material which has originated from a place and a source not considered as local for the area where it has been planted.** *Includes*: provenance from seed-orchards.	12	69
44.	Other land	**Land not classified as forest or other wooded land as they are defined in this enquiry.**	1	1
45.	Other private institutions (owned by)	**Forest/other wooded land owned by private corporations, co-operatives or institutions (religious, educational, pension or investment funds, nature conservation societies, etc).**	5, 23	12, 15, 81
46.	Other public institutions (owned by)	Forest/other wooded land belonging to cities, municipalities, villages and communes. *Includes*: Any publicly owned forest and other wooded land not classified as being “in State ownership".	5, 23	12, 15, 81
47.	Other wooded land	**Land either with a tree crown cover (or equivalent stocking level) of 5-10 percent of trees able to reach a height of 5 m at maturity in situ; or a crown cover (or equivalent stocking level) of more than 10 percent of trees not able to reach a height of 5 m at maturity in situ (e.g. dwarf or stunted trees) and shrub or bush cover.** *Excludes*: Areas having the tree, shrub or bush cover specified above but of less than 0.5 ha and width of 20 m, which are classed under “other land” ; Land predominantly used for agricultural practices.	1-3, 5, 7-8, 11, 14-16, 21	1-4, 7-8, 11, 14, 37-39, 42, 47, 50
48.	Plantation (s)	**Forest stands established by planting or/and seeding in the process of afforestation or reforestation. They are either:** **– of introduced species (all planted stands), or** **– intensively managed stands of indigenous species which meet all the following criteria: one or two species at plantation, even age class, regular spacing.** *Excludes*: Stands which were established as plantations but which have been without intensive management for a significant period of time. These should be considered semi-natural.	2	53-54
49.	Planting and seeding	**The act of establishing a forest stand (e.g. plantation) or re-establishing a forest stand by artificial means, either by planting of seedlings or by scattering seed.** The material used may be of indigenous or introduced origin. Planting and seeding may take place on forest, other wooded land or other land.	11	66-68
50.	Predominantly bamboos, palms, etc.	**Forest/other wooded land on which more than 75 percent of the crown cover consists of tree species other than coniferous or broadleaved species (e.g. tree-form members of the bamboo, palm, fern families).**	3, 13	3-6
51.	Predominantly broadleaved	**Forest/other wooded land on which more than 75 percent of the tree crown cover consists of broadleaved species.**	3, 13	3-6
52.	Predominantly coniferous	**Forest/other wooded land on which more than 75 percent of the tree crown cover consists of coniferous species.**	3, 13	3-6
53.	Primarily damaged by fire	**Forest and other wooded land, the vegetation on which, including the trees, has been wholly or largely destroyed by fire.**	18	70, 71

No.	Terms	Definitions	Relevance to Enquiry Table(s) No.	Relevance to Main Table(s) No.
54.	Primarily damaged by insects and disease	**Forest and other wooded land where insect attack or disease has been identified as the primary cause of damage.**	18	70, 71
55.	Primarily damaged from known local pollution sources	**Forest and other wooded land where damage can be attributed with reasonable certainty to pollutant deposition from an identified local source or sources.**	18	70, 71
56.	Primarily damaged by storm, wind, snow or other identifiable abiotic factors	**Forest and other wooded land on which the trees have been felled or damaged by storm, wind, snow or other abiotic factors such as avalanches, landslides or flooding.**	18	70, 71
57.	Primarily damaged by wildlife and grazing	**Forest and other wooded land where damage has been caused by wildlife or grazing by domestic animals.** *Includes*: Grazing or browsing of young plants, preventing or delaying the establishment or regeneration of the stand.	18	70, 71
58.	Private ownership (in)	**Forest/other wooded land owned by individuals, families, co-operatives and corporations which may be engaged in agriculture or other occupations as well as forestry; private forest enterprises and industries; private corporations and other institutions (religious and educational institutions, pension and investment funds, nature conservation societies, etc).**	5, 6, 23	9-18, 20, 22, 24, 81
59.	Protection	**The function of forest/other wooded land in providing protection of soil against erosion by water or wind, prevention of desertification, the reduction of risk of avalanches and rock or mud slides; and in conserving, protecting and regulating the quantity and quality of water supply, including the prevention of flooding.** *Includes*: Protection against air and noise pollution.	21	79-80
60.	Public ownership (in)	**Forest/other wooded land belonging to the State or other public bodies.**	5, 6, 23	9-19, 21, 23
61.	Reference period	**The year or years during which the national forest inventory or other method of collection of the data reported in the forest resources assessment was carried out.**	General application	General application
62.	Regeneration	**Re-establishment of a forest stand by natural or artificial means following the removal of the previous stand by felling or as a result of natural causes, e.g. fire or storm.**	11	65-66, 68
63.	Removals for commercial use	**Annual removals that generate revenue for the owner of the forest or other wooded land or trees outside the forest.** *Includes*: Removals of wood destined for domestic consumption after further processing, e.g. into sawnwood, fencing or construction material. *Excludes*: Removals of wood for direct auto-consumption, e.g. of fuelwood.	16	47-48, 50
64.	"Rotation age"	**"The planned number of years between the establishment or regeneration of a tree crop or stand and its final cutting at a specified stage of maturity".**	…	…
65.	Semi-natural forest/other wooded land	**Forest/other wooded land which is neither "forest/other wooded land undisturbed by man" nor "plantation" as defined separately.**	2	53-54

No.	Terms	Definitions	Relevance to Enquiry Table(s) No.	Relevance to Main Table(s) No.
66.	Shrubs and bushes	**Woody perennial plants, generally of more than 0.5 m and less than 5 m height, and often without a definite stem and crown.**	14	40-41
67.	Species at risk	**Species in IUCN categories "vulnerable", "conservation dependent" and "near threatened".** A species is "vulnerable" when it is not critically endangered or endangered (see "Endangered species"), but is facing a high risk of extinction in the wild in the medium-term future. A "conservation dependent" species is one which is the focus of a continuing species-specific or habitat-specific conservation programme, the cessation of which would result in the species qualifying for one of the threatened species categories within a period of five years. "Near threatened" species are ones that do not meet the criterion of conservation dependent but which are close to qualifying as vulnerable.	10	56-64
68.	Species occurring on forest/other wooded land	**Species of fauna and flora which occurs on forest or other wooded land for at least part of its everyday existence, e.g. for shelter, feeding, nesting or breeding.**	9, 10	56-64
69.	Standing volume	**Volume of standing trees, living or dead, above-stump measured overbark to top (0 cm). Includes all trees with diameter over 0 cm (d.b.h.)** *Includes*: Tops of stems, large branches; dead trees lying on the ground which can still be used for fibre or fuel. *Excludes*: Small branches, twigs and foliage.	14	33
70.	State ownership (in)	**Forest/other wooded land owned by national, state and regional governments, or by government-owned corporations; Crown forest and other wooded land.**	5, 23	12, 15, 81
71.	Stumps and roots	**Parts of the whole tree volume, which exclude the volume of the above-stump woody biomass.** The height of the stump is taken to be that at which the tree would be cut under normal felling practices in that country or region. *Excludes*: Small roots.	14	40
72.	Total area	**Total area of country, including area of inland water bodies.** *Excludes*: offshore territorial waters.	1	1
73.	Tree	**A woody perennial with a single main stem or, in the case of coppice, with several stems, having a more or less definite crown.** *Includes*: Bamboos, palms and other woody plants meeting the above criterion.	9-10, 14-15, 20	33-34, 39-42, 47, 56, 76-78
74.	Trees outside the forest	**Trees on land other than forest or other wooded land.** *Includes*: Trees on land that meets the definitions of forest and of other wooded land except that the area is less than 0.5 ha and the width is less than 20 m; scattered trees in permanent meadows and pastures; permanent tree crops such as fruit tree orchards and coconut palm plantations; trees in parks and gardens, around buildings, in hedgerows and in lines along streets, roads, railways, rivers, streams and canals; trees in shelterbelts and windbreaks of less than 20 m in width and 0.5 ha in area.	14, 15, 16	33, 39, 42, 47, 50

No.	Terms	Definitions	Relevance to Enquiry Table(s) No.	Relevance to Main Table(s) No.
75.	Under regeneration	**Forest being prepared for regeneration or in the process of reforestation by planting, seeding or natural regeneration after the previous stand was totally or partly removed, e.g. by felling, fire or windblow.** *Includes*: Stands of seed trees.	13	29-32
76.	Uneven-aged (high forest)	**High forest in which there is a mixture of different age classes. Usually, the trees can not be separated into different storeys.**	13	25-28
77.	Woody biomass	**The mass of the woody parts (wood, bark, branches, twigs, stumps and roots) of trees, alive and dead, shrubs and bushes, measured to a minimum diameter of 0 mm (d.b.h.).** *Includes*: Above-stump woody biomass, and stumps and roots. *Excludes*: Foliage.	14	40-41

APPENDIX II

TBFRA-2000 Enquiry Tables

LIST OF TABLES

***

Symbols used

ha	- hectare
cm	- centimetre
m	- metre
m^3	- cubic metre, solid volume
m^3 o.b.	- cubic metre overbark, solid volume
m^3 u.b.	- cubic metre underbark, solid volume
m.t. o-d.	- metric tonne, oven-dry
*	- unofficial figure or estimate
-	- nil or less than half a unit
..	- figure unknown or not available.

Section I

General Forest Resource Information

(Tables 1 to 7)

The basic parameter of the forest resource assessment, to which all the others refer, is the area of forest and of other wooded land. This first section of the TBFRA-2000 therefore concentrates on the size and basic nature of the forest resource and of changes over the last decade or so. Attributes such as ownership, "naturalness", intensity of management (or lack of it) and basic silvicultural characteristics, will influence to a large degree the forest's biological diversity, its ability to supply wood or sequester carbon, its vulnerability to certain forms of damage and its ability to carry out its social and protection function. For that reason, these basic parameters are grouped together at the beginning of the TBFRA-2000.

Correspondents' attention is drawn to two major aspects:

– the definitions of "forest" and of "other wooded land" have been changed from those in FRA-1990, in order to achieve comparability with data for the tropical regions, notably with regard to the dividing line between "forest" and "other wooded land". Every effort should be made to ensure that national data are adjusted to fit the agreed international definitions. In the interests of transparency and scientific accuracy, correspondents are requested to record, in detail, the source of the original data, how they have been adjusted to the international definitions, and the likely range within which the true value is likely to be. Taken together, these pieces of information will make it possible to make a quantified and objective assessment of the inter-country comparability of the TBFRA-2000 data and of the range of uncertainty surrounding the final aggregations.

– in the global forest policy debate, the extent of forest undisturbed by man, which it is being converted to other types of forest or non-forest land use have received much attention: however even in the tropical regions, there has been little objective information to measure trends, while in the temperate regions, the situation is complicated by many centuries of low intensity management or disturbance, affecting almost all forest areas. There are no reliable and comprehensive sets of internationally comparable data on the extent of natural forest in temperate regions (the question was not asked in FRA-1990). Correspondents are therefore requested to make every effort to provide information on forest and other wooded land undisturbed by man, which correspond to the agreed definition, and to provide the requested information on the criteria used and choices made, so that the data published in TBFRA-2000 may be as comparable between countries as possible. Likewise, the same care should be taken for the identification of "plantations", as the definition agreed is new and does not necessarily coincide with normal usage in many countries.

TABLE 1

Total area by main classes

Purpose: (a) To show the relative importance of forest and other wooded land as compared with other land cover; and (b) to provide the reference area for many other parameters covered in the enquiry.

Country:

Reference period:

Ref.		Area (1000 ha)
1.1	**Total area**	
1.2	**– Inland water**	
1.3	**– Land area**	
1.4	**– Forest and other wooded land**	
1.5	**– Forest**	
1.6	**– Other wooded land**	
1.7	**– Other land**	

Check:
(1.2) Inland water + (1.3) Land area = (1.1) Total area OK
(1.4) Forest and other wooded land + (1.7) Other land = (1.3) Land area OK
(1.5) Forest + (1.6) Other wooded land = (1.4) Forest and other wooded land OK

Data source and quality

Source: .....

Adjustment: Were source data for the following parameters adjusted to bring them into conformity with TBFRA-2000 definitions?

Forest: Yes/No

Other wooded land: Yes / No

If adjusted, description of adjustment process: Attached/Not attached

Specifications of known deviations from TBFRA-2000 definitions: Attached/Not attached

Likely range: Taking account of errors due to measurement, sampling, and adjustment, please indicate the range within which the true value is likely to be, for the following parameters:

Forest: from ..... to ..... thousand ha

Other wooded land: from ..... to ..... thousand ha

Comments: .....

TABLE 2

Forest and other wooded land according to "naturalness"

Purpose: To provide an indication of the extent to which the natural forest cover has been modified by man, and the intensity of management.

Country:

Reference period:

Ref.		Area (1000 ha)
2.1	**Forest**	(=1.5) 0
2.2	**– Forest undisturbed by man**	
2.3	**– Semi-natural forest**	
2.4	**– Plantations**	
2.5	**Other wooded land**	(=1.6) 0
2.6	**– Other wooded land undisturbed by man**	
2.7	**– Semi-natural other wooded land**	

Please describe on a separate sheet:

1. The trends in the area of the above classes over the last 100-200 years, concentrating on trends since 1950s, with quantitative estimates, if possible.
2. The nature and driving forces of these structural trends and underlying circumstances.

Check: (2.2) Forest undisturbed by man + (2.3) semi-natural forest = (2.4) Plantations = (2.1) Forest OK
(2.6) Other wooded land undisturbed by man + (2.7) Semi-natural other wooded land = (2.5) Other wooded land OK

Data source and quality

Source:.....

Adjustment: Were source data for the following parameters adjusted to bring them into conformity with TBFRA-2000 definitions?

Forest undisturbed by man: Yes/No
Semi-nautral forest: Yes/No
Plantations: Yes/No
Other wooded land undisturbed by man: Yes/No
Semi-natural other wooded land: Yes/No

If adjusted, description of adjustment process: Attached/Not attached
Specifications of known deviations from TBFRA-2000 definitions: Attached/Not attached

Likely range: Taking account of errors due to measurement, sampling, and adjustment, please indicate the range within which the true value is likely to be, for the following parameters:

Forest undisturbed by man: from..... to ..... thousand ha
Semi-natural forest: from..... to ..... thousand ha
Plantations: from..... to ..... thousand ha
Other wooded land undisturbed by man: from..... to ..... thousand ha
Semi-natural other wooded land: from..... to ..... thousand ha

Comments:.....

TABLE 3

Forest and other wooded land according to availability for woood supply

Purpose: To provide an estimate of wood supply potential, broken down by species groups.

Country:

Reference period:

Ref.		Area (1000 ha)
3.1	**Forest, total**	(=1.5) 0
3.2	**– Predominantly coniferous**	
3.3	**– Predominantly broadleaved**	
3.4	**– Predominantly bamboos, palms, etc.**	
3.5	**– Mixed**	
3.6	**Forest available for wood supply**	
3.7	– Predominantly coniferous	
3.8	– Predominantly broadleaved	
3.9	– Predominantly bamboos, palms, etc.	
3.10	– Mixed	
3.11	**Forest not available for wood supply**	
3.12	– For conservation/protection reasons	
3.13	– For economic reasons	
3.14	**Other wooded land**	(=1.6) 0
3.15	– Predominantly coniferous	
3.16	– Predominantly broadleaved	
3.17	– Predominantly bamboos, palms, etc.	
3.18	– Mixed	

Note: If th area of forest voluntarily excluded from wood supply, i.e. forest which is legally economically "available for wood supply" but where the forest owner has decided not to harvest wood, can be quantified, please specify.

Check:

Sum of (3.2+3.3+3.4+3.5) = (3.1) Forest, Total	OK
Sum of (3.7+3.8+3.9+3.10) = (3.6) Forest available for wood supply	OK
Sum of (3.12+3.13) = (3.11) Forest not available for wood supply	OK
Sum of (3.15+3.16+3.17+3.18) = (3.14) Other wooded land	OK

Data source and quality

Source:.....

Adjustment: Were source data for the following parameters adjusted to bring them into conformity with TBFRA-2000 definitions?

Predominantly coniferous:	Yes/No
Predominantly broadleaved:	Yes/No
Predominantly bamboos, palms, etc.:	Yes/No
Mixed:	Yes/No

If adjusted, description of adjustment process: Attached/Not attached
Specifications of known deviations from TBFRA-2000 definitions: Attached/Not attached

Likely range: Taking account of errors due to measurement, sampling, and adjustment, please indicate the range within which the true value is likely to be, for the following parameters:

Predominantly coniferous:	from.....	to	thousand ha
Predominantly broadleaved:	from.....	to	thousand ha
Predominantly bamboos, palms, etc.:	from.....	to	thousand ha
Mixed:	from.....	to	thousand ha

Comments:.....

TABLE 4

High forest and coppice

Purpose: The wood supply potential, the biodiversity and other factors are strongly affected by whether the forest is managed as high forest or as coppice.

Country:

Reference period:

Ref.		Area (1000 ha)
4.1	**Forest available for wood supply**	(=3.6) 0
4.2	– High forest	
4.3	– Coppice and coppice with standards	
4.4	**Forest not available for wood supply**	(=3.11) 0
4.5	– High forest	
4.6	– Coppice and coppice with standards	

Check: (4.2) High forest + (4.3) Coppice and coppice with standards = (4.1) Forest available for wood supply OK
(4.5) High forest + (4.6) Coppice and coppice with standards = (4.4) Forest not available for wood supply OK

Data source and quality

Source:.....

Adjustment: Were source data for the following parameters adjusted to bring them into conformity with TBFRA-2000 definitions?

High forest: Yes/No
Coppice and coppice with standards: Yes/No

If adjusted, description of adjustment process: Attached/Not attached
Specifications of known deviations from TBFRA-2000 definitions: Attached/Not attached

Likely range: Taking account of errors due to measurement, sampling, and adjustment, please indicate the range within which the true value is likely to be, for the following parameters:

High forest: from..... to ..... thousand ha
Coppice and coppice with standards: from..... to ..... thousand ha

Comments:.....

TABLE 5

Ownership and management of forest

Purpose: To provide data on the distribution of forest by ownership categories and the extent of which it is under management, as both these factors strongly influence silvicultural treatment, if any, and wood supply potential. They are a crucial element in policy formulation.

Country:

Reference period:

Ref.		Total area	*Of which:* Managed
		(1000 ha)	
5.1	**Forest, total**	(=3.1) 0	
5.2	**– In public ownership**		
5.3	**– Ownership by indigenous or tribal peoples**		
5.4	**– In private ownership**		
	Of which :		
5.5	**Forest available for wood supply**	(=3.6) 0	
5.6	**– In public ownership**		
5.7	– State ownership		
5.8	– Owned by other public institutions		
5.9	**– Owned by indigenous or tribal peoples**		
5.10	**– In private ownership**		
5.11	– Owned by individuals		
5.12	– Owned by forest industries		
5.13	– Owned by other private institutions		
5.14	**Other wooded land**		
5.15	– In public ownership		
5.16	– Owned by indigenous or tribal peoples		
5.17	– In private ownership		

Note: This table refers to ***ownership***, wich may differ from ***use***, especially in the case of indigenous and tribal peoples. For forest use by indigenous and tribal peoples, see table 22.

Check:

Sum of (5.2+5.3-5.4) = (5.1) Forest, Total	OK
Sum of (5.6+5.9-5.10) = (5.5) Forest available for wood supply	OK
Sum of (5.7 and 5.8) = (5.6) In public ownership	OK
Sum of (5.11+5.12+5.13) = (5.10) In private ownership	OK
Sum of (5.15+5.16+5.17) = (5.14) Other wooded land	OK

Data source and quality

Source:.....

Adjustment: Were source data for the following parameters adjusted to bring them into conformity with TBFRA-2000 definitions?

In public ownership:	Yes/No
Owned by indigenous or tribal peoples:	Yes/No
In private ownership:	Yes/No

If adjusted, description of adjustment process: Attached/Not attached
Specifications of known deviations from TBFRA-2000 definitions: Attached/Not attached

Likely range: Taking account of errors due to measurement, sampling, and adjustment, please indicate the range within which the true value is likely to be, for the following parameters:

In public ownership:	from.....	to	thousand ha
Owned by indigenous or tribal peoples:	from.....	to	thousand ha
In private ownership:	from.....	to	thousand ha

Comments:.....

TABLE 6

Number and size of holdings of forest and other wooded land

Purpose: To provide information on the structure of holdings, which is useful for policy formulation relating to wood supply potential, nature conservation and the socio-economic functions of the forest.

Country:

Reference period:

Ref.		Total area (1000 ha)		Number of holdings
		Forest and other wooded land	*Of which:* Forest	Forest and other wooded land
6.1	**In public ownership**			
6.2	– Less than 3 ha			
6.3	– 3 to 5 ha			
6.4	– 6 to 10 ha			
6.5	– 11 to 20 ha			
6.6	– 21 to 50 ha			
6.7	– 51 to 100 ha			
6.8	– 101 to 500 ha			
6.9	– 501 to 10,000 ha			
6.10	– 10,001 to 100,000 ha			
6.11	– More than 100,000 ha			
6.12	**In private ownership**			
6.13	– Less than 3 ha			
6.14	– 3 to 5 ha			
6.15	– 6 to 10 ha			
6.16	– 11 to 20 ha			
6.17	– 21 to 50 ha			
6.18	– 51 to 100 ha			
6.19	– 101 to 500 ha			
6.20	– 501 to 10,000 ha			
6.21	– 10,001 to 100,000 ha			
6.22	– More than 100,000 ha			

Check: Sum of (6.2 to 6.11) = (6.1) In public ownership OK
Sum of (6.13 to 6.22) = (6.12) In private ownership OK

Comments: .....

TABLE 7

Changes in area of forest and other wooded land over time by main categories

Purpose: To provide information on changes over time for a few key parameters. (Because of changes in definitions, it is not possible to compare data for the TBFRA-2000 with those of FRA-1990 (temperate zones).

Country:

Previous reference period:

Latest reference period:

Ref.		Previous reference period	Latest reference period	Average annual change between reference periods
		(1000 ha)		
6.1	**Forest**		(=1.5) 0	
7.2	**– Forest available for wood supply**		(=3.6) 0	
7.3	**– Forest not available for wood supply**		(=4.4) 0	
7.4	**Other wooded land**			

Check: **Previous reference period**: (7.2) Forest available for wood supply + (7.3) Forest not available for wood supply = (7.1) Forest — OK

Latest reference period: (7.2) Forest available for wood supply + (7.3) Forest not available for wood supply = (7.1) Forest — OK

Comments: .....

Section II

Biological Diversity and Protection Status

(Tables 8 to 12)

It is now widely accepted that the conservation of biological diversity is a major function of forests, and that this aspect ought to be covered in quantitative assessments of the forest resource, at the national and international levels. However, this task is difficult, even from a conceptual point of view, as biological diversity as such is difficult to measure directly, except on a local scale and in the context of scientific research. Biological diversity as a concept may be applied at a number of different levels, notably the *ecosystem,* the *species,* and the *genetic* level. Naturally, species other than trees must also be considered. Even where promising concepts, such as biological diversity indices, are being developed they are often closely linked to a particular ecosystem type or region.

Furthermore, it is often difficult and expensive to capture the raw data necessary to construct the index. Therefore, in order to provide an indication of the status and trends for forest biological diversity at the international level, it is necessary at present to collect quantitative data on *proxies* for biological diversity, and on *actions* taken to preserve biological diversity. Furthermore, given the huge differences between regions and sub-regions, it appears desirable to concentrate on indicators of the *direction of change,* rather than attempting objective comparisons between forests in very different conditions. The parameters chosen to assess the situation and trends for forest biological diversity are as follows:

– ***protection status***, which is a rather objective indicator of action taken to protect biological diversity (although not necessarily of the need for or effectiveness of the protection measures);

– the simplest measure of richness of forest biological diversity is the ***number of tree species*** (although some areas, such as boreal or mountain ecosystems, have naturally less species than others). The balance between native and introduced species is also a preliminary indication of the extent to which natural or semi-natural ecosystems have been replaced by more intensely managed forests;

– the extent to which ***forest occurring species are at risk or endangered*** is an important indicator of biological diversity in forest and other wooded land as well as threats to it;

– the way in which ***forests are regenerated or extend to other land*** is an indicator, both of the intensity of management (a major influence on biological diversity) and of the genetic diversity of forest tree species;

– genetic diversity in managed forests can be measured to some extent by the ***provenance of genetic material used for planting***, with information by species: this gives a clear indication of the extent to which the forests being established coincide with the genetic material native to that region.

None of the above information has been requested in earlier forest resource assessments, and the concepts must of necessity be considered experimental. For that reason, correspondents are requested:

– to explore, if necessary new sources of information, notably academic research and environmental surveys;

– to make estimates if necessary, rather than providing no information at all;

– to comment on the format of the tables and questions asked, and to make suggestions for future international assessments of forest biological diversity.

TABLE 8

Protection status

Purpose: To provide information on how much forest and other wooded land is protected to conserve biological diversity and whether this area is increasing or not.

Country:

Reference period:

Ref.		Area (1000 ha)
8.1	**Forest**	(=1.5) 0
8.2	**– In IUCN categories I and II**	
8.3	**– In IUCN categories III to VI**	
8.4	**Other wooded land**	(=1.6) 0
8.5	**– In IUCN categories I and II**	
8.6	**– In IUCN categories III to VI**	

Check: Sum of (8.2 + 8.3) = (8.1) Forest OK
Sum of (8.5 + 8.6) = (8.4) Other wooded land OK

Please indicate trends over the laast 10-20 years in the area of forest and other wooded land in the IUCN protection categories with quantitative information, if possible.

Data source and quality

Source:.....

Adjustment: Were source data for the following parameters adjusted to bring them into conformity with TBFRA-2000 definitions?

Forest

In IUCN categories I and II: Yes/No
In IUCN categories III and VI: Yes/No

Other wooded land

In IUCN categories I and II: Yes/No
In IUCN categories III and VI: Yes/No

If adjusted, description of adjustment process: Attached/Not attached
Specifications of known deviations from TBFRA-2000 definitions: Attached/Not attached

Likely range: Taking account of errors due to measurement, sampling, and adjustment, please indicate the range within which the true value is likely to be, for the following parameters:

Forest

In IUCN categories I and II: from ..... to..... thousand ha
In IUCN categories I and II: from ..... to..... thousand ha

Other wooded land

In IUCN categories I and II: from ..... to..... thousand ha
In IUCN categories I and II: from ..... to..... thousand ha

IUCN categories (see attached "Terms and Definitions")

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

Comments:.....

TABLE 9

Tree species occurring on forest and other wooded land

Purpose: To provide an indication of how many species of trees occur on forest and other wooded land, and whether they are indigenous or introduced.

Country:

Reference period:

Please provide information on the tree species occurring on forest and other wooded land (scientific genus and species) on ***separate sheets*** under the following headings:

Country/Region* (to be decided by countries):

.....

Ref.		Species	Abundance**
9.1	Native (indigenous) tre species occurring on forest and other wooded land		
9.2	Introduced tree species on forest and other wooded land		

Note: * **largeur countries may wish to fill in this table separately for different geographic regions.**

** **e.g. "common", "rare", "at risk", "endangered".**

May any introduced species be considered as "domesticated"? Yes/No

If yes, please list them with the indication of the date of their introduction in the region (country):

.....

.....

.....

.....

Comments: .....

TABLE 10

Forest-occurring species at risk or endangered

Purpose: To provide information on the number of forest-occuring species (plants and animals) that are rare or endangered, therby giving an indication of the state of biological diversity in forest and other wooded land.

Country:

Reference period:

Ref.		All species in country				Foret occurring species		
		Total species	***Of which:* endangered**	**Endemic species**	***Of which:* endangered**	**Total species**	**Endemic species**	***Of which:* endangered**
10.1	Trees (coniferous and broadleaved species)							
10.2	Other vascular plants (flowers)							
10.3	Ferns							
10.4	Mosses							
10.5	Lichens							
10.6	Mammals							
10.7	Birds							
10.8	Other vertebrates (fish, amphibians, reptiles, snakes)							
10.9	Butterflies							

Problematic introduced species: (Please note any introduced species which create problems for particular forest ecosystems, and indicate the type of problems posed, e.g. invasive alien species preventing the other tree species regenerating, or an introduced exotic deer species that out-competing indigenous species and thus causing an imbalance in the forest ecosystem).

.....

.....

.....

Endangered status categories: Please use the attached sheet to calculate how many species in your country are endangered. Include all species which would be ranked in the pre-1994 IUCN ranks "Ex/E", "E", "V", "R" and "I", or in the new ranks "EW", "CR", "EN" and and "VU" (see annex to the table). The IUCN/WCMC publications "Threatened plants of the world" may be helpful, but many countries have national Red Lists which would be more appropriate.

Comments: .....

Definitions to Table 10

(New (post-1994) IUCN Endangerment Status Categories)

Extinct (Ex)

A species is ***Extinct*** when there is no reasonable doubt that the last individual has died.

Extinct in the Wild (EW)

A species ***is Extinct in the Wild*** when it is known only to survive in cultivation, in captivity or as a naturalised population (or populations) well outside the past range. A species is presumed extinct in the wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the species's life cycle and life form.

Critically Endangered (CR)

A species is ***Critically Endangered*** when it is facing an extremely high risk of extinction in the wild in the immediate future.

Endangered (EN)

A species is ***Endangered*** when it is not ***Critically Endangered*** but is facing a very high risk of extinction in the wild in the near future.

Vulnerable (VU)

A species is ***Vulnerable*** when it is not ***Critically Endangered*** or ***Endangered*** but is facing a high risk of extinction in the wild in the medium-term future.

Lower Risk (LR)

A species is ***Lower Risk*** when it has been evaluated, but does not satisfy the criteria for any of the categories ***Critically Endangered***, ***Endangered*** or ***Vulnerable***.

Data Deficient (DD)

A species is ***Data Deficient*** when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A species in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. ***Data Deficient*** is therefore not a category of threat or ***Lower Risk***. Listing of species in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases, great care should be exercised in choosing between DD and threatened status. If the range of a species is suspected to be relatively circumscribed, if a considerable period of time has elapsed since the last record of the species, threatened status may well be justified.

Not Evaluated (NE)

A species is ***Not Evaluated*** when it has not yet been assessed against the criteria.

For further information please write to: The Information Officer, World Conservation Monitoring Centre, 219 Huntingdon Road, Cambridge CB3 0DL, United Kingdom. Tel: + 44 1223 277 314; Fax: + 44 1223 277 136; **E-mail: info@wcmc.org.uk**

TABLE 11

Regeneration and extension of forest

Purpose: To provide information on the extent of regeneration and extension of forest over a recent 10-year period by natural or artificial means, in order to assess management methods and intensity and changes in genetic composition.

Country:

Ten-year period: 19..... to 19.....

Ref.		Annual average area over 10-year period	*Of which:* With introduced tree species
		(1000 ha)	
11.1	**A.** ***Regeneration of forest (reforestation), total***		
11.2	– Natural regeneration		
11.3	– Natural regeneration enhanced by planting		
11.4	– Coppice sprouting		
11.5	– Planting or seeding		
11.6	**B.** ***Extension of forest, including afforestation and reforestation of other wooded land, total***		
11.7	– Natural colonization of non-forest land to forest		
11.8	– Natural conversion of other wooded land to forest		
11.9	– Planting or seeding of non-forest land		
11.10	– Planting or seeding of other wooded land		
11.11	**C.** ***Natural colonization of non-forest land to other wooded land***		

Check: Sum of (11.2+11.3+11.4+11.5) = (11.1) Regeneration of forest (reforestation), total OK

Sum of (11.7+11.8+11.9+11.10) = (11.6) Exctension of forest, including afforestation and reforestation of other wooded land, total OK

Data source and quality

Source:.....

Adjustment: Were source data for the following parameters adjusted to bring them into conformity with TBFRA-2000 definitions?

Regeneration of forest (reforestation), total	***Yes/No***
Natural regeneration:	Yes/No
Natural regeneration enhanced by planting:	Yes/No
Coppice sprouting:	Yes/No
Planting or seeding:	Yes/No

If adjusted, description of adjustment process: Attached/Not attached
Specifications of known deviations from TBFRA-2000 definitions: Attached/Not attached

Likely range: Taking account of errors due to measurement, sampling, and adjustment, please indicate the range within which the true value is likely to be, for the following parameters:

Regeneration of forest (reforestation), total:	from	to	thousand ha
Natural regeneration:	from	to	thousand ha
Natural regeneration enhanced by planting:	from	to	thousand ha
Coppice sprouting:	from	to	thousand ha
Planting or seeding:	from	to	thousand ha

Comments:.....

TABLE 12

Species diversity and origin of planting material used in the forest

Purpose: To provide information on trends in species diversity and origin of planting material used in managed forests.

Country:

Ten-year period: 19..... to 19.....

Ref.		Total, *of which*	Known local provenance	Known non-local provenance	Unknown provenance
		(ha/year)			
	Indigenous species (specify)[1]				
12.1					
12.2					
12.3					
12.4					
12.5					
12.6					
12.7					
12.8					
	(add more species, if necessary)				
	Introduced species: (specify)[1]				
12.11					
12.12					
12.13					
12.14					
12.15					
12.16					
12.17					
12.18					
12.19					
12.20					
	(add more species, if necessary)				

Note: [1] Please provide local nad scientific names.

Comments: .....

Section III

Wood supply and carbon sequestration functions

(Tables 13 to 17)

The volume of wood likely to be available in the short and long term on a sustainable basis has always been at the centre of concerns of forest inventory at the national and international level. The importance of this topic has not diminished in any way, even though this concern has been joined by others. This section includes detailed questions on how much wood there is (growing stock), how much and how fast it is growing (increment), when it will reach maturity (age class structure) and how much and how fast it is being harvested (fellings and removals).

For growing stock and increment, a clear distinction is made between forests “available for wood supply” and others. Taken together this information makes it possible to assess the level of sustainable wood supply. However the biological processes which determine wood supply are the same as those which “sequester” carbon: storing it in vegetation, notably wood, through the process of photosynthesis. Thus, the same information as for wood supply, converted into different units (tons of oven dry biomass), is an essential input for the work of those investigating global climate change and carbon flows.

Correspondents’ attention is drawn to the fact that the definitions of growing stock and a number of other parameters have been changed, to include all trees, with no minimum diameter size. The data should be adjusted to the agreed definitions.

TABLE 13

Age-class distribution of high forest available for wood supply

Purpose: To provide information on the distribution by age-class and species groups of high forest available for wood supply as an indication of the extent and timing of future sustainable wood supply and of the structure of the forest.

Country:

Reference period:

Ref.		High forest available for wood supply (1000 ha)				
		Predominantly coniferous	**Predominantly broadleaved**	**Predominantly bamboos, palms, etc.**	**Mixed**	**Total**
13.1	Total					
13.2	– Uneven-aged					
13.3	– Even-aged					
13.4	– Under regeneration					
13.5	– 10 years or less					
13.6	– 11 to 20 years					
13.7	– 21 to 40 years					
13.8	– 41 to 60 year					
13.9	– 61 to 80 years					
13.10	– 81 to 100 years					
13.11	– 101 to 120 years					
13.12	– 121 to 140 years					
13.13	– Over 140 years					
13.14	– Unknown age					

Check: Sum of (13.4 to 13.13) = (13.3) Even-aged OK
(13.2) Uneven-aged + (13.3) Even-aged + (13.4) Unknown age = (13.1) Total OK

Note: The option to supply data on individual "commercial species" or species groups separately is open and would be welcomed.

Comments: .....

TABLE 14

Total woody biomass and the volume of growing stock

Purpose: To provide information on the mass and volume of tree and other woody biomass, thereby indicating the role played by forest resources in carbon storage; and the volume of growing stock as an indicator of the forest potential.

Country:

Reference period:

Ref.		Standing volume		Woody biomass
		Growing stock	Dead trees	
		(1000 m^3 overback)		(1000 m.t. oven-dry
		(A)	(B)	(C)
	Above-stump volume and biomass			
14.1	– Trees on forest, total			
14.2	– Coniferous			
14.3	– Broadleaved			
14.4	– Other (bamboos, palms, etc.)			
14.5	– Trees on forest available for wood supply			
14.6	– Coniferous			
14.7	– Broadleaved			
14.8	– Other (bamboos, palms, etc.)			
14.9	– Trees on forest not available for wood supply			
14.10	– Other trees (on other wooded land and trees outside the forest)			
14.11	– Other woody biomass (shrubs and bushes) on forest and other wooded land			
14.12	***Total above-stump volume and woody biomass***			
	Other woody biomass			
14.13	Stumps and roots			

Check:

Sum of (A:14.2 to A:14.4) = (A:14.1) Growing stock, Trees on forest, total	OK
Sum of (A:14.6 to A:14.8) = (A:14.5) Growing stock, Trees on forest vailable for woods su	OK
Sum of (C:14.2 to C:14.4) = (C:14.1) = Woody biomass, Trees on forest, total	OK
Sum of (C:14.1+C:14.10+C:14.11) = (C:14.12) Woody biomass, Total above-stump woody biomass	OK
Sum of (A:14.1+A:14.10) = (A:14.12) Growing stock, Total above-stump volume	OK

Data source and quality

Source: .....

Adjustment: Were source data for the following parameters adjusted to bring them into conformity with TBFRA-2000 definitions?

Growing stock of trees on forest, total: Yes/No
Growing stock of trees on forest available for wood supply: Yes/No
Woody biomass on forest and other wooded land: Yes/No

If adjusted, description of adjustment process: Attached/Not attached
Specifications of known deviations from TBFRA-2000 definitions: Attached/Not attached

Likely range: Taking account of errors due to measurement, sampling, and adjustment, please indicate the range within which the true value is likely to be, for the following parameters:

Growing stock of trees, total: from ..... to ..... thousand ha
Growing stock of trees on forest available for wood supply: from ..... to ..... thousand ha
Woody biomass, total above-stump: from ..... to ..... thousand ha

Comments: .....

TABLE 15

Increment

Purpose: To provide information on the increment, and natural losses as essential elements in the forest balance.

Country:

Reference period:

Ref.		Gross annual increment	Natural lossess	Net annual increment
		(1000 m^3 o.b.)		
		(A)	(B)	(C)
15.1	On forest, total			
15.2	– Coniferous			
15.3	– Broadleaved			
15.4	– Other			
15.5	– On forest available for wood supply			
15.6	– Coniferous			
15.7	– Broadleaved			
15.8	– Other			
15.9	– On forest not available for wood supply			
54.10	On other wooded land			
15.11	On trees outside the forest			
15.12	TOTAL INCREMENT			

Check:	(B) Natural losses + (C) Net annual increment = (A) Gross annual increment	OK
	Sum of (A:15.2+A:15.3+A:15.4) = (A:15.1) GAI on forest, total	OK
	Sum of (B.15.2+B:15.3+B:15.4) = (B:15.1) Natural losses on forest, total	OK
	Sum of (C:15.2+C:15.3+C:15.4) = C:15.1) NAI on forest, total	OK
	Sum of (A:15.5+A:15.9+A:15.10+A:15.11) = (A:15.12) Total gross annual increment	OK
	Sum of (C:15.5+C::15.9+C:15.10+C:15.11) = (C:15.12) Total net annual increment	OK
	Sum of (A:15.5+A:15.9) = (A:15.1) GAI on forest, total	OK
	Sum of (C:15.5+C:15.9) = (C:15.1) NAI on forest, total	OK
	Sum of (A:15.6+A:15.7+A:15.8) = (A:15.5) GAI on forest available for wood supply	OK
	Sum of (B:15.6+B15.7+B:15.8) = B:15.5) Natural losses on forest available for wood supply	OK
	Sum of (C:15.6+C15.7+C:15.8) = (C.15.5) NAI on forest available for wood supply	OK

Data source and quality

Source: .....

Adjustment: Were source data for the following parameters adjusted to bring them into conformity with TBFRA-2000 definitions?

Net annual increment on forest available for wood supply: Yes/No
Natural losses on forest available for wood supply: Yes/No

If adjusted, description of adjustment process: Attached/Not attached
Specifications of known deviations from TBFRA-2000 definitions: Attached/Not attached

Likely range: Taking account of errors due to measurement, sampling, and adjustment, please indicate the range within which the true value is likely to be, for the following parameters:

Net annual increment on forest available for wood supply: from ..... to ..... thousand ha
Natural losses on forest available for wood supply: from ..... to ..... thousand ha

Comments: .....

TABLE 16

Fellings and removals

Purpose: To provide information on the volume of wood being cut and harvested annually as essential elements in the forest balance.

Country:

Reference period:

Ref.		Annual fellings		Annual removals	
		Total	*Of which:* Fellings of natural losses*	Overback	Underback
		(Million m^3 o.b.)			(Million m^3 u.b.)
		(A)	(B)	(C)	(D)
16.1	On forest, total				
16.2	– Coniferous				
16.3	– Broadleaved				
16.4	– Other				
16.5	– On forest available for wood supply				
16.6	– Coniferous				
16.7	– For commercial use				
16.8	– Other				
16.9	– Broadleaved				
16.10	– For commercial use				
16.11	– Other				
16.12	– Other				
16.13	– For commercial use				
16.14	– Other				
16.15	– On forest available for wood supply				
16.16	On other wooded land				
16.17	On trees outside forest				
16.18	Total fellings and removals				

Note: * e.g., trees damaged by insects, pollution, fires, storms, avalanches

Check:
Sum of (A:16.2+A:16.3+A:16.4) = (A:16.1) Forest, total, Annual fellings OK
Sum of (D:16.2+D:16.3+D:16.4) = (D:16.1) Forest, total, Annual removals, underbark OK
Sum of (A:16.5+A:16.15+A:16.16+A:16.17) = (A:16.18) Total, Annual fellings OK
Sum of (D:16.5+D:16.15+D:16.16+D:16.17) = (D:16.18) Total Annual removals, underbark OK

Data source and quality

Source: .....

Adjustment: Were source data for the following parameters adjusted to bring them into conformity with TBFRA-2000 definitions?

Annual fellings: Yes/No
Annual removals: Yes/No

If adjusted, description of adjustment process: Attached/Not attached
Specifications of known deviations from TBFRA-2000 definitions: Attached/Not attached

Likely range: Taking account of errors due to measurement, sampling, and adjustment, please indicate the range within which the true value is likely to be, for the following parameters:

Annual fellings, total: from ..... to ..... thousand ha
Annual removals, total: from ..... to ..... thousand ha

Comments: .....

TABLE 17

Change in growing stock on forest available for wood supply

Purpose: To provide information on changes in growing stock, which give important indications of the extent to which the wood potential is being used.

Country:

Reference period: "1"

Reference period: "2"

Ref.		Reference period "1"	Reference period "2"	Average annual change
		(1000 m^3 over bark)		(1000 m^3 o.b./year)
17.1	Growing stock on "Forest", total			
	of which:			
17.2	Growing stock on "Forest available for wood supply"			
	of which:			
17.3	– Coniferous			
15.4	– Broadleaved			
15.5	– Other (bamboos, etc.)			

Check: Sum of (17.3+17.4+17.5) = (17.2) Reference period "1" OK
Sum of (17.3+17.4+17.5) = (17.2) Reference period "2" OK
Sum of (17.3+17.4+17.5) = (17.2) Average annual change OK

Note: The reference periods should correspond to those in tables 7 and 14

Comments: .....

Section IV

Forest Condition

(Tables 18 to 20)

Considerable concern has been expressed, especially since the 1980s, about damage to the temperate and boreal forest, from a wide variety of causes, including airborne pollution, fire and game damage. Although international data have been available for some time on forest fires and forest condition (defoliation), in the past this has not been included in the ECE/FAO assessments. It has been decided that, in the interests of presenting a complete picture of the forest resource, information on forest condition, notably fires and defoliation, should also be included in TBFRA-2000. The opportunity has been taken to collect data on a wider range of forest damage, to assess the whole range of damaging agents and their relative importance.

In this field, the agencies responsible for TBFRA-2000 are working closely with those who have been responsible for collecting these data in other fora. In particular, to the extent possible, common definitions and concepts are used, and in one case, data will be collected directly from the international organisation responsible, the Intergovernmental Co-operative Programme on Forests under the Convention on Long-range Transboundary Air Pollution.

TABLE 18

Damage to forest and other wooded land

Purpose: To assess the condition of the forest and other wooded land, and the extent to which the forest is under threat, to provide information on damage to the forest from different causes.

Country:

Ref.		Most recent 5-year period (19..... .to 19.....)	Year in most recent 10-year period in which the heaviest damage occurred	
		Annual average (100 ha)	Year	Extent of damage (1000 ha)
18.1	Total area of forest and other wooded land with damage by known causes			
18.2	– Primarily damaged by insects and disease			
18.3	– Primarily damaged by wildlife and grazing			
18.4	– Primarily damaged by fire			
18.5	– Primarily damaged from known local pollution sources			
18.6	– Primarily damaged by storm, wind, snow or other identifiable abiotic factors			
18.7	Total area of forest and other wooded land with damage from unidentified causes			

Check: Sum of (18.2 + 18.3 + 18.4+18.5 + 18.6) = (18.1)
Total area of forest and other wooded land with damage attributable to known causes. OK

Note: Where there have been major individual episode (e.g. a large wind blow, snow storm, etc.). Please provide information on date, extent, etc.

Other comments:.....

TABLE 19

Forest fire

Purpose: To provide information about the extent of fire damage and the average fire size, as well as about trends over time.

Country:

Ref.	Year	Total number of fires on forest and other wooded land	Area burned		
			Total	Area of forest burned	Area of other wooded land burned
			(1000 ha)		
19.1	1986				
19.2	1987				
19.3	1988				
19.4	1989				
19.5	1990				
19.6	1991				
19.7	1992				
19.8	1993				
19.9	1994				
19.10	1995				
19.11	1996				
19.12	1997				

Note: This table need be completed only by those countries which do not report annual data on fires in the UN ECE/FAO/Commission of European Communities questionnaire on forest fires (see Timber Bulletin, vol. ECE/TIM/BULL/48/4, (1995), Vol. XLVIII.

Other comments:.....

TABLE 20

Forest condition

Purpose: To provide information on defoliation as an indicator of the extent of tree damage from one or a combinaison of causes, including air pollution.

Country:

Ref.	Defoliation classes:	All species		Coniferous		Broadleaved	
		0 and 1	2, 3 and 4s	0 and 1	2, 3 and 4	0 and 1	2, 3 and 4
		(Percentage of sample trees)					
		(A)	(B)	(C)	(D)	(E)	(F)
20.1	1986						
20.2	1987						
20.3	1988						
20.4	1989						
20.5	1990						
20.6	1991						
20.7	1992						
20.8	1993						
20.9	1994						
20.10	1995						
20.11	1996						
20.12	1997						

Check: A + B = 100
C + D = 100
E + F = 100

Countries not able to provide information on forest condition in this form, i.e. countries not participating in the annual ICP surveys, are invited to describe the situation, provide relevant documentation and contact the secretariat.

Other comments:.....

Defoliation classes (UN/ECE and EU classification)

Class	Needle/leaf loss	Degree of defoliation
0	Up to 10 per cent	none
1	> 10-25 per cent	slight (warning stage)
2	> 25-60 per cent	moderate
3	> 60 per cent < 100 per cent	severe
4	100 per cent	dead

Section V

Protective and socio-economic functions

(Tables 21 to 25)

This section of the enquiry covers functions and benefits of the forest and other wooded land, which are widely recognized as extremely important and for which it is difficult to obtain reliable and internationally comparable data. These include soil protection, provision of non-wood goods and services, use by indigenous and tribal peoples, and access to forest, e.g. recreation.

The information to be provided by national correspondents in this section is to a great extent of a descriptive nature (*Enquiry Tables 22, 23* and *24*) and may well come from sources outside traditional forest inventory agencies. Some quantitative data are requested on changes in areas of forest and other wooded land managed primarily for soil protection (*Enquiry Table 21*), as well as on quantity and value of the main goods (wood and non-wood products), which have been collected or harvested (*Enquiry Table 25*).

The information to be provided in this section will probably be based on judgements of national correspondents, or even their estimates instead of hard figures. Still, it is considered useful to provide the best possible data on the importance and role of the forest in this area, provided sources and methods of estimation are clearly described.

TABLE 21

Protection

Purpose: To provide information on the situation and trends in management of forest and other wooded land for soil protection.

Country:

Previous reference period:

Latest reference period:

Ref.		Previous reference period	Latest reference period	Change
		(1000 ha)		
21.1	Area where forests and other wooded land are managed primarily for soil protection			
21.2	– Forest			
21.3	– Other wooded land			

Check: (21.2) Forest + (21.3) Other wooded land = (21.1) Area where FOWL are managed primarily for soil protection

Previous reference period	OK
Latest reference priod	OK
Change	OK

Other comments: .....

TABLE 22

Indigenous and tribals peoples

Purpose: In addition to ownership by indigenous or tribal peoples (table 5), it is useful to have information about the area of forest and other wooded land used by these peoples and the way they use it.

Country:

Reference period:

22.1 It is understood that not all responding countries have indigenous or tribal peoples. For those that do, please give an actual figure or estimate of the population number meeting the definition used in this enquiry: .....

22.2 Please give an estimate of the area of forest and other wooded land used by indigenous or tribal peoples for the collection and harvesting of wood and non-wood goods and the provision of services:

22.3 If the area used is either more or less than the combined figures in table 5 for forest owned by indigenous or tribal peoples, please give an explantion for the difference: ..... ,000 ha

22.4 What are the main uses of forest and other wooded land by indigenous or tribal peoples? If actual figures or estimates of the quantitites or values involved, please provide them:

Other comments:.....

TABLE 23

Access to, and use of, forest and other wooded land by public

Purpose: With increasing demand for non-wood goods and services, including recreation, it is important to know how much of the forest and other wooded land is legally accessible to the public for these purposes, and the trends in access and uses.

Country:

Reference period:

1. Please give an estimate of the area of forest and other wooded land to which the general public is legally NOT allowed access:

23.1	– Publicly owned forest and other wooded land	.....,000 ha
23.2	– Forest and other wooded land owned by indigenous or tribal peoples	.....,000 ha
23.3	– Privately owned forest and other wooded land	.....,000 ha

2. Has there been a long-term change in the area to which the public has legally had access:

23.4	– Yes*/No* If "YES", what has been the trend in the area to which the public is legally allowed access:	
23.5	– Publicly owned forest and other wooded land	INCREASING*/STABLE*/DECREASING*
23.6	– Forest and other wooded land owned by indigenous or tribal peoples	INCREASING*/STABLE*/DECREASING*
23.7	– Privately owned forest and other wooded land	INCREASING*/STABLE*/DECREASING*

* *Delete whichever are not applicable*

.....

.....

.....

3. What are the reasons for not allowing public access, and for the long-term change (if any) in the situation?:

.....

.....

4. For a recent year or period, please describe pattern of visitor use of different ownership categories of forest and provide any quantitative data you may have, e.g. give actual figures or estimates of areas of forests with high visitor intensity or the number of visitors/days by the public to forest and other wooded land (year/period:):

– State owned	.....
– Other publicly-owned	.....
– Owned by indigenous or tribal peoples	.....
– Owned by individuals	.....
– Owned by forest industries	.....
– Owned by other private institutions	.....

5. Please describe if appropriate, regimes of access to forest for non-wood goods (e.g. mushroom gathering/services/recreation/ hunting) when they differ from the general access regime.

.....

TABLE 24

Goods (wood and non-wood) and selected services provided by forest and other wooded land

Purpose: To provide qualitative and, where available, quantitative information on the importance of the role of forest and other wooded land in providing wood and non-wood goods and certain social, cultural and environment services

Country:

Reference period:

Please provide on separate pages **short description** (not more than 10 lines) of the most important types of goods and services provided by forest and other wooded land, whether demand for them is increasing, stable or decreasing; likewise their supply potential; and so on, under each of the following heading:

Goods (products)

24.1 Wood

24.2 Products for human consumption: food, beverages, medicinal plants and extracts (e.g. fruits, berries, nuts, honey, game meats, mushrooms, tec.)

24.3 Fodder and forage (grazing, range)

24.4 Other non-wood goods (products) (e.g. cork, resin, tannins, industrial extracts, wool and skins, hunting trophies, Christmas trees, decorative foliage, mosses and ferns, essential and cosmetic oils, etc.)

Services

24.5 Protection (against soil erosion by air or water, avalanches, mud and rock slides, flooding, air pollution, noise, etc.)

24.6 Social and economic values (e.g. hunting and fishing, other leisure activities, including recreation, sport and tourism)

24.7 Aesthetic, cultural, historical, spiritual and scientific values (including landscape and amenity)

Other comments:.....

TABLE 25

Quantity and values of goods (wood and non-wood products) collected or harvested from forest and other wooded land

Purpose: To provide quantitative information on the importance of the role of forest and other wooded land in providing wood and non-wood goods.

Country:

Reference period:

Please provide on separate page(s) factual information or estimates on the quantity and/or value of the main goods (products) collected or harvested from forest and other wooded land in a recent year (or annual average of a period of years). The focus of this table is on non-wood products, but information is also requested on the value of wood produced in order to estimate the relative importance of the different products.

Ref.	Goods (products)	Official data (OD) or estimate (EST) mark OD or EST	Quantity harvested/collected		Value (Please provide data to the extent possible)
			Unit:	Total	National currency (.....)
25.1	Wood				
25.2					
25.3					
25.4					
25.5					
25.6					
25.7					
25.8					
25.9					
	(add more goods, if necessary)				

Note: Please provide consistency in the list of major goods (products) with table 24.

Remarks: Please indicate for each product what the nature of the value estimate is: market price, or measured at roadside or at retail price, income to forest owners, etc., and how this information was obtained.

Other comments: .....

Appendix III

List of TBFRA-2000 National Correspondents[1]

ALBANIA

Mr. Spiro Karadumi
Institute of Forest and Pasture Researches
8367 Rruga Halil Bega
TR - Tirana
Tel. + 355 42 677 03
Fax + 355 42 677 03

ARMENIA

Mr. Karen Ter-Ghazaryan
Deputy Executive Director
Forest Research and Experimental Centre
Ministry of Nature Protection
15, Lusavorich Street, 4th floo
375015 Yerevan
Tel. + 3742 562 974 and/or 582172
Fax: + 1978 926 64 76
E-mail: frec@freenet.am

AUSTRALIA

Mr. Roger Hnatiuk
Senior Principal Research Scientist, Forest Section
Bureau of Resource Sciences, P.O. Box E11
Queen Victoria Terrace Parkes, A.C.T., 2600
Tel. + 61 06 272 3428 / 272 5790
Fax: + 61 06 272 3882
E-mail: rjh@mailpc.brs.gov.au

Ms. Claire Howell
Manager, Bureau of Rural Sciences
National Forest Inventory
P.O. Box E11, Kingston ACT 2604
Tel. + 61 2 6272 4299
Fax: + 61 2 6272 3882
E-mail: claire.howell@brs.gov.au
E-mail: chowell@brs.gov.au

Ms. Mellissa Wood
Database Manager, Bureau of Rural Sciences
National Forest Inventory
P.O. Box E11, Kingston ACT 2604
Tel. + 61 2 6272 4680
Fax: + 61 2 6272 5992
E-mail: mellissa.wood@brs.gov.au

AUSTRIA

Mr. Albert Knieling
Dr., Deputy Director, Forestry Department
International Forest Policy Division
Federal Ministry of Agriculture & Forestry
Ferdinandstrasse 4
A - 1020 Vienna
Tel. + 431 21 323 7304
Fax: + 431 21 323 7216
E-mail: albert.knieling@bmlf.gv.at

AZERBAIJAN

Mr. Faik Acad ogly Amirov
Director, Forestry Scientific, Research and Project Development Institute
Forestry and Industry Association, (AzerbLes)
Government Building, 13 Jusif-Zade str.
370 001 Baku-01
Tel. + 994 12 2 93 95 71 / 66 33 64
Fax: + 994 12 2 66 33 64
E-mail: amir@lan.ab.az

BELARUS

Mr. Mikhail V. Kuzmenkov
Head of the Forestry Department
Ministry for Forestry
Chkalov str. 6, 220039, Minsk
Tel. + 375 172 245 906
Fax: + 375 172 244 183

[1] The titles, addresses and contacts (telephone, fax, e-mail) of the experts on the list are those given in their capacity of National Correspondents for the TBFRA-2000.

BELGIUM

Mr. Christian Laurent
Attaché, Ministere de la Région Wallonne
Direction Générale des Ressources
Naturelles et de l'Environnement
Division de la Nature et des Forêts
Direction des Ressources Forestières,
Aménagement et Génie forestier
Avenue Prince de Liège, 15, 5100 Jambes (Namur)
Tel. + 32 81 33 58 42
Fax: +32 81 33 58 33
E-mail: c. laurent@mrw.wallonie.be

BOSNIA AND HERZEGOVINA

Mr. Faruk Melic (contact point)
Vice-Minister, Ministry of Agriculture,
Water Management and Forestry
Sarajevo
Tel. + 387 71 663 947 or 663 659
Fax: + 387 71 664 592 or 443 338

BULGARIA

Mr. Ilija Petrov Anguelov
Chief of Department of Forest Arrangement
Ministry for Agriculture, Forestry and Land Reform
ul. Antim I, 17, BG - 1303 Sofia
Tel. + 359 2 988 14 12 / 86 171 – 514
Fax: + 359 2 981 37 36 / 87 32 35

CANADA

Mr. David W.K. Boulter
Director, Economics & Statistical Services
Canadian Forest Service, 580 Booth Street, 7th Floor
CDN - Ottawa, Ontario K1A OE4
Tel. + 1 613 947 9076
Fax: + 1 613 947 9020
E-mail: dboulter@am.NCR.forestry.ca
E-mail: dboulter@ncran.gc.ca

Mr. Brian D. Haddon
Manager, National Forestry Database Programme
Economic and Statistical Services
Industry, Economics and Programs Branch
Canadian Forest Service, Natural Resources Canada
580 Booth Street, 7th Floor, Ottawa, Ontario K1A OE4
Tel. + 1 613 947 90 65
Fax: + 1 613 947 9020
E-mail: bhaddon@nrcan.gc.ca

CROATIA

Ms. Jela Bilandzija
World Bank Project Coordinator
Ministry of Agriculture and Forestry
Grada Vucovara 78; 10000 Zagreb
Tel. + 385 1 610 6618 / 385 1 610 6688
Fax: + 385 1 610 9203
E-mail: jela.bilandzija@zg.tel.hr

CYPRUS

Mr. L. Kourtellarides
Department of Forests
Ministry of Agriculture, Natural Resources
and Environment
CY - 1414 Nicosia
Tel. + 357 2 302 261
Fax: + 357 2 78 14 19

CZECH REPUBLIC

Mr. Vaclav Stransky
Ministry of Agriculture of the Czech Republic
Forestry Department
Tesnov 17, CZ - 117 05 Prague 1
Fax: + 420 2 2181 2988 (or 421 2 231 28 36)
Tel. + 420 2 2181 2245 (or 421 2 286 22 45)
E-mail: stransky@mze.cz

Mr. Jiri Skoblik
Dr., Researcher, Forestry and Game Management
Research Institute, VULHM
Jiloviste-Strnady 138
CZ - 156 04 Prague 516
Tel. + 420 2 579 21 643 / 28 591 612-7
Fax: + 420 2 579 21 444 / 591 240
E-mail: forinst@ms.anet.cz

DENMARK

Mr. Peter Munk Plum
Head of Section, Forest Management Planning Division
Ministry of Environment and Energy
National Forest & Nature Agency
Haraldsgade 53, DK - 2100 Copenhagen 0
Tel. + 45 39 472 505
Fax: + 45 39 472 662 / 27 98 99
E-mail: pmp@sns.dk

Mr. Kim Dralle
Head of Section, PhD
Ministry of Environment & Energy
National Forest & Nature Agency
Haraldsgade 53, DK - 2100 Copenhagen OE
Tel. + 45 39 47 25 16
Fax: + 45 39 47 26 62
E-mail: kdr@sns.dk

ESTONIA

Mr. Ulo Viilup
Director, Estonian Forest Survey Centre
Iva 12, EE - 0026 Tallinn
Tel. + 372 2 539 876
Fax: + 372 2 538 070
E-mail: emkk@online.ee

FINLAND

Mr. Erkki Tomppo
Ph.D.,Professor
Head of Finnish National Forest Inventory
Finnish Forest Research Institute
Unioninkatu 40A, FIN - 00170 Helsinki
Tel. + 00 358 9 857 05 340 / 358 9 857 051
Mobile phone: + 358 40 50 28 555
Fax: + 358 9 625 308
E-mail: erkki.tomppo@metla.fi

FRANCE

Mr. Jean-Marie Valdenaire
Ingénieur Chargé de la Communication à l'Inventaire Forestier National
(In charge of Communication, National Forest Inventory)
L'Inventaire Forestier National
Chateau (Domaine) des Barres
F – 45290 Nogent-sur-Vernisson
Tel. + 33 2 38 28 18 18 or 38 28 18 00
Fax: + 33 2 38 28 18 28
E-mail: jmvaldenaire@ifn.fr

Mr. François Wencelius
Director, National Forest Inventory (IFN)
Inventaire Forestier National
Château (Domaine) des Barres
F – 45290 Nogent-sur-Vernisson
Tel. + 332 3828 18 08
Fax: + 332 38 28 18 29
E-mail: fwencelius@ifn.fr

GEORGIA

Mr. Teimuraz E. Kandelaki
Doctor, Vice-Chairman of the State Department of Forest Management
9, Mindeli str.
380086 – Tbilisi
Tel. + 995 32 304 378
Fax: + 995 32 988 428 or 32 32 05 49
E-mail: tacisgeo@caucasus.net
E-mail: kattimet@geointer.net

GERMANY

Mr. Peter Lohner
Deputy Head, Section 531
Federal Ministry of Food, Agriculture and Forestry
Rochusstrasse 1, Postfach 140270
D – 53123 Bonn
Tel. + 49 228 529 43 42 / 529 43 18 / 41 46
Fax: + 49 228 529 43 42 / 529 43 14
E-mail: postatelle@bml.bund400.de
URL: Internet http://www.bml.de

GREECE

Mr. Stephanos Vogiatzis
Section of Forest Research
Ministry of Agriculture, General Secretariat of Forests and Natural Environment
3-5, Ippokratous Str., GR – 10164 Athens
Tel. + 30 1 36094 86
Fax: + 30 1 363 53 59

HUNGARY

Mr. Péter Csoka
Director General, State Forest Service
Ministry of Agriculture and Regional Development
Széchenyi utca 14, P.O.Box 10, H - 1054 Budapest V
Tel. + 36 1 37 43 203 / 37 43 200
Fax: + 36 1 31 26 112
E-mail: csoka.peter@aesz.hu
E-mail: aesz@aesz.hu

ICELAND

Mr. Thröstur Eysteinsson
Deputy Director, Iceland Forestry Service (IFS)
P.O.Box 98, IS - 700 Egilsstadar
Tel. + 354 471 2100
Fax: + 354 471 2172

IRELAND

Mr. Karl Coggins
Executive Officer, Forest Service
Department of Marine and Natural Resources
Marine House, Leeson Lane, IR – Dublin 2
Tel. + 353 1 607 29 02
Fax: + 353 1 676 89 80 / 661 13 26

ISRAEL

Mr. Gil Sapir
Forest Resources Unit
Research and Development Section
Forest Department, Land Development Authority
P.O. Box 45, Kiryat Haim 26 103
Tel. + 972 4 41 19 83 / 41 44 63/84 70 272
Fax: + 972 4 41 19 71 / 84 70 274
E-mail: johnw@kkl.org.il

ITALY

Mr. Alfonso Froncillo
President of the Italian Council for Forests and Forest Products
Italian Timber Trade Federation
Via Toscana, 10, I - 00187 Roma
Tel. + 39 06 42 00 68 30
Fax: + 39 06 42 01 22 36
E-Mail: fedecoml@tin.it

Mr. Roberto Cavalensi
Ispettore Forestale, Funzionario – Ufficio
Di Statistica Forestale (Div. III)-
Corpo Forestale Stato
Ministero delle Risorse Agricole
Alimentari e Forestali
Via G. Carducci 5, I – 00187 Roma
Tel. + 39 06 481 76 90
Fax: + 39 06 481 76 90
E-mail: cfs3@corpoforestale.it
URL: http:\\www.corpoforestale.it

JAPAN

Mr. Masahiro Amano
Director, Resource Planning Section
Forestry and Forest Product Research Institute (FFPRI
P.O Box 16, Tsukuba Norin Kenkyu Danchi-Nai
Ibaraki 305
Tel. + 81 298 73 32 11
Fax: + 81 298 73 37 99
E-mail: masahiro@ffpri.affrc.go.jp

KAZAKHSTAN

Mr. Murat Musataev (contact point)
Vice-Minister, Ministry of Nature Resources
and Environment Protection
475000, Kokshetau, K. Marks str. 81
Tel. + 7 327 (3162) 2 42 42
Fax: + 7 327 (3162) 5 06 20
E-mail: asp@kaznet.kz

Mr. T. Kosunov
Chairman, Forestry Committee
Ministry of Agriculture
15, pl. Respubliki, 480013 Almaty
Tel. + 7 327 2 6373 23

KYRGYZSTAN

Mr. Bronislav I. Venglovsky (contact point)
Director
Institute of Forestry and Nut-trees Management
Academy of Science of the Kyrghyz Republic
Bishkek
Tel. + 996 331 2 279 082
Fax: + 996 331 2 279 634

LATVIA

Mr. Janis Bisenieks
Senior Specialist, State Forest Service
Ministry of Agriculture
13 Janvara iela (str), 15, LV – 1932 Riga
Tel. + 371 721 52 03 / 2 22 47 56
Fax: + 371 721 11 76 / 2 21 11 76 / 371 78203 77
E-mail: janis@lsfs.gov.lv

Mr. Janis Birgelis
International Co-operation, Forestry Department
Ministry of Agriculture
13 Janvara Str., 15, LV -–1932 Riga
Tel. + 371 7 211 386
Fax: + 371 7 211 176
E-mail: janisb@lsfs.gov.lv

LIECHTENSTEIN

Mr. Felix Näscher
Landesforstamt (National Office for Forestry)
Ministry for Environment, St. Floringasse 3
Landesverwaltung, FL – 9490 Vaduz
Fürstentum Liechtenstein
(Principality of Liechtenstein)
Tel. + 075 236 64 00
Fax: + 075 236 64 11

LITHUANIA

Mr. Valdas Vaiciunas
Ministry of Forestry of the Republic of Lithuania
Gedimino ave 56, 2685 Vilnius
Tel. + 370 2 62 49 66 / 62 68 64 /
or 62 68 61 / 61 17 85
Fax: + 370 2 62 17 64 / 2 61 21 78
E-mail: valdas.v@zum.lt or valdas.v@is.lt

Mr. Andrius Kuliesis
Director, (Direktorius), Habil.dr.
Forest Inventory and Management Institute
Pramones pr. 11a, 3031 Kaunas
Tel. + 370 7 756 751 / 8-298 4 87 12
Fax: + 370 7 767 986
E-mail: sek@mp.is.lt

LUXEMBOURG

Mr. Marc Wagner
Ingenieur-Inspecteur, Le Chef du Service de
l'Aménagement des Bois et de l'Economie Forestière
49 Boulevard de la Pétrusse
Administration des Eaux et Forêts
B.P.411, L – 2014 Luxembourg-Ville
Tel. + 352 496 071
Fax: + 352 407 840
E-mail: marc.wagner@EF.etat.lu

THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA

Mr. Aleksandar Trendafilov (contact point)
Minister's Assistant, Ministry of Agriculture
Forestry and Water Economy, Forestry Department
Leninova str., 2,
91000 Skopje
Tel + 389 91 12 71 07 (or 13 44 77)
Fax: + 389 91 13 44 77 (or 12 71 07)

MALTA

Mr. Joseph Borg
Principal Agricultural Officer (PAO)
Programmes and Initiatives for Director of Agriculture
Department of Agriculture
Ministry of Agriculture and Fisheries
c/o Argotti Botanic Gardens, Floriana VLT 16
Tel. + 356 248 803 / 236 390 / 224 241/
or 224242 / 239 528
Fax: + 00 356 236 389 / 440 251/ 234 186

REPUBLIC OF MOLDOVA

Mr. Dimitru Galupa
Deputy Director General, State Forestry
Association (Asociatia de Stat pentru Silvicultura)
"MOLDSILVA", 124, Stefan cel Mare Bd.,
277001Chisinau
Tel. + 373 2 26 03 49 / 22 55 12 / 26 22 56;
Fax: + 373 2 22 32 51 / 23 38 06
E-mail: econdep@mfa.un.md

NETHERLANDS

Mr. Wim P. Daamen
Stichting Bosdata, Postbus 355
Bosrandweg 5a, 6703 EB Wageningen/
NL - 6700 AJ Wageningen
Tel. + 31 317 465 200
Fax: + 31 317 465 209
E-mail: mail@bosdata.nl

NORWAY

Mr. Stein Michael Tomter
Research Officer, Norwegian Institute of Land
Inventory (NIJOS), Radhuspl.
29, P.O. Box 115, N - 1430 AAS
Tel. + 47 64 94 9700 / 94 9771
Fax: + 47 64 94 9786
E-mail: stein.tomter@tor.nijos.no
E-mail: nijos@nijos.nlh.no

NEW ZEALAND

Mr. James P. Barton
Senior Policy Analyst
Agriculture and Forestry Statistical Information
Policy Information Team, MAF Policy
Ministry of Agriculture and Forestry
ASB Bank House, 101-103 The Terrace
P.O. Box 2526, Wellington
Tel. + 64 4 498 98 28 / 474 41 00
Fax: + 64 4 474 42 06
E-mail: bartonj@maf.govt.nz
E-mail: jpbarton@xtra.co.nz (home address)

POLAND

Mr. Jerzy Smykala
Dr., Deputy Director, Forest Research Institute
ul. Bitwy Warszawskiej 1920 r., Nr 3
PL - 00-973 Warsaw
Tel. + 48 22 822 49 38
Fax: + 48 22 822 49 35
E-mail: j.cichowska@ibles.waw.pl

Mr. Roman Michalak
Dr., Researcher
Department of Forest Management Planning
Forest Research Institute
ul. Bitwy Warszawskiej 1920 r., Nr 3
PL - 00-973 Warsaw
Tel. + 48 22 822 49 38
Fax. + 48 22 822 49 35
E-mail: r.michalak@ibles.waw.pl

PORTUGAL

Ms. Maria Odete Pinheiro Duarte
Head of National Forestry Inventory and
Statistics Division, Direccio Geral Das Florestas
Av. Joao Crisostomo 28-30, P - 1050 Lisboa
Tel. + 351 1 312 48 52 / 352 62 39 / 315 6132
Fax: + 351 1 312 49 83
E-mail: dgf.dgsi@mail.telepac.pt

ROMANIA

Mr. Claudiu Zaharescu
Expert, Ministry of Waters, Forests and
Environment Protection, Department of Forests
B-dul Libertatii 14, OP 42, Sector 5, Bucarest
Tel. + 40 1 410 65 90 / 410 02 18
Fax: + 40 1 411 04 03 / 312 04 03 (08)
or 410 62 95

RUSSIAN FEDERATION

Mr. Andrey N. Filiptchouk
Dr., Deputy Director, All-Russian Scientific, Research
and Information Centre for Forest Resources (ARICFR)
Novocheremushkinskaya str., 69
117 877, Moscow
Tel. + 7 095 332 53 42 / 332 53 38 / 332 53 45
Fax: + 7 095 331 05 33
E-mail: aricfr@aha.ru
E-mail: strakhov@aricfr.msk.su

SLOVAKIA

Mr. Jozef Vladovic
Dr., Researcher, Forest Research Institute (LVU)
ul T.G. Masaryka. 22, SK - 960 92 Zvolen
Tel. + 421 855 532 03 16 / 03 17 / 03 18
Fax: + 421 855 532 18 83
E-mail: jozef.vladovic@fris.sk

Mr. Miroslav Gecovic
Dr., Head of Department of Foreign Relations
and Information Technology
Forest Research Institute
T.G. Masaryka ul. 22, SK - 960 92 Zvolen
Tel. + 421 855 531 41 24 8
(or mobile + 421 905 497 684)
Fax: + 421 855532 18 83
E-mail: miroslav.gecovic@fris.sk

Mr. Roman Longauer
Dr., Researcher, Forest Research Institute (LVU)
T.G. Masaryka ul. 22
SK - 960 92 Zvolen
Tel. + 421 855 532 03 16 / 03 17 / 03 18
Fax: + 421 855 532 18 83
E-mail: roman.longauer@fris.sk

SLOVENIA

Mr. Milan Hocevar
Professor, Dr. Slovenian Forestry Institute
Vecna pot 2, 1000 Ljublijana
Tel. + 386 61 2007-8 / 20 78 00 / 20 78 34
Fax: + 386 61 273 589
E-mail: milan.hocevar@gozdis.si

SPAIN

Mr. Jose Solano Lopez
Direccion General
Conservacion de la Naturaleza
Ministero de Medio Ambiente
Gran Via de san Francisco 4
28071 – Madrid
Tel. + 34 91 597 56 00
Fax + 34 91 597 55 65
E-Mail jose.solano@gvsf.mma.es

SWEDEN

Mr. Sven A. Svensson
Head of the Forecasting Department
National Board of Forestry
S – 554 48 Jönköping
Tel. + 46 3615 5655
Fax: + 46 3616 6170
E-mail: sven.svensson@svo.se

Mr. Tomas Thuresson
Dr., Forest Analyst at the Analysis Department
National Board of Forestry
S – 551 83 Jönköping
Tel. + 46 36 155 572 (Mobile: + 46 70-3793324)
Fax: + 46 36 166 170 (Home: + 46 36-209 39)
E-mail: tomas.thuresson@svo.se

SWITZERLAND

Mr. Peter Brassel
Dr., Swiss Federal Institute for Forest, Snow and
Landscape Research
(Institut fédéral de recherches sur la forêt, la neige
et le paysage)
Zürcherstrasse 111
CH - 8903 Birmensdorf
Tel + 41 1 739 22 38 / 739 21 11
Fax: + 41 1 739 22 15
E-mail: peter.brassel@wsl.ch

Mr. Berthold Traub
Dr., Swiss Federal Institute for Forest Snow and
Landscape Research
(Institut fédéral de recherches sur la forêt, la neige
et le paysage)
Zürcherstrasse 111
CH - 8903 Birmensdorf
Tel + 41 1 739 22 10
Fax: + 41 1 739 22 15
E-mail: traub@wsl.ch

TAJIKISTAN

Mr. Gaidulo A. Avsalov
Director General, Forestry Production Association
“TAJIKLES”, Shota Rustaveli str., 22
734025, Dushanbe
Tel. + 7 377 2 22 69 52 / 27 80 37
Fax: + 7 377 2 27 80 37

TURKEY

Mr. Ulvi Us
Director of Statistical Division
Research Planning and Coordination Board
Ministry of Forestry
Atatürk Bulvary No: 153
Bakanlyklar / Ankara
Tel + 0090 312 417 77 23
Fax: + 0090 312 417 91 60
E-mail: ulvius@yahoo.com

TURKMENISTAN

Mr. Batyr Artykovitch Baigeldyev (contact point)
Head, Reforestation Department
Ministry of the Use of Natural Resources and
Environmental Protection
Azady kech., 81 (Machtumkuly Str. 54A)
744 000 Ashgabat
Tel. + 993 12 47 09 47; 47 17 53; 25 43 17
Fax: + 993 12 51 13 97; 29 20 62; 51 16 13

UKRAINE

Mr. Vladimir F. Romanovskiy
State Committee of Forestry of Ukraine
5 Khreshchatik Str., Kyiv 252601
Tel. + 380 44 228 76 67
Fax: + 380 44 228 77 94
E-mail: yyy@mlg.kiev.ua

Mr. Artijom S. Torosov
Dr., Deputy Director of Economy
Chief of Laboratory of Economy
Ukrainian Scientific Research Institute of Forestry & Forest Amelioration
Pushkinska str., 86
3100024, Kharkov, USFIR&FA
Tel. + 380 572 43 15 49
Fax: + 380 572 43 25 20
E-mail: effect@u-fri.kharkov.com
E-mail: zahist@u-fri.kharkov.com

UNITED KINGDOM

Mr. Simon Gillam
Head of Statistics, Forestry Commission
231 Corstorphine Road
UK - Edinburgh EH12 7AT, Scotland
Tel. +44 131 314 6280
Fax: + 44 131 314 6506
E-mail: simon.gillam@forestry.gov.uk

UNITED STATES OF AMERICA

Mr. Brad Smith
Associate Branch Chief, Forest Inventory Research
International Resource Assessment Liaison
USDA Forest Service, FIERR
1st Floor, S.W.m, Auditors Building
14th & Independence Ave., S.W.
P.O. Box 96 090, Washington D.C. 20250
Tel. + 1 202 205 0841
Fax: + 1 202 205 1551
E-mail: smith_brad/wo@fs.fed.us
E-mail: wbsmith/wo@fs.fed.us

UZBEKISTAN

Mr. Abdushukur A. Khanazarov (contact point)
Professor, Chairman of the State Committee on Forests
49A, Uzbekistanskaja str.
700063, Tashkent – 63
Tel. + 7 371 2 45 91 80
Fax: + 7 371 2 33 69 65

YUGOSLAVIA

Mr. Milan Medarevic
Associate Professor, Dr. Sc.,
Faculty of Forestry of Belgrade University
Kneza Viscslava 1, 11030 Belgrade
Tel. + 381 11 55 31 22
Fax: + 381 11 54 54 85
E-mail: sumeivode@sezampro.vu
E-mail: vgburcik@sezampro.yu

Appendix IV

List of Members of the Team of Specialists on TBFRA-2000[1]

Mr. Michael Köhl, (Leader of the Team)

PhD, Professor, Dresden University of Technology
Chair of Forest Biometrics and Computer Sciences
Wilsdruffer Str. 18
D – 01737, Tharandt
Tel. + 49 35203 381613/ -15
Fax: + 49 35203 381628
Private Phone: + 49-171-2852984
E- mail: koehl@forst.tu-dresden.de

AUSTRALIA

Mr. Ross Penny
Forest Resource Inventory Section
Department of Natural Resources and Environment
P.O.Box 41, East Melbourne, 3002, Victoria
Tel. + 61 03 965 14 074
Fax: + 61 03 965 14 073
E-mail: r.penny@dce.vic.gov.au

AUSTRIA

Mr. Albert Knieling
Dr., Deputy Director, Division of International Forest Policy,
Federal Ministry of Agriculture & Forestry
Ferdinandstrasse 4, A - 1020 Vienna
Tel. + 43 1 21 323 7304
Fax: + 43 1 21 323 7216
E-mail: albert.knieling@bmlf.gv.at

CANADA

Mr. Mark Gillis
National Forest Inventory Canada
Canadian Forest Service
506 W Burnside Road, Victoria, BC, V8Z 1M5
Tel. + 1 250 363 07 53
Fax: + 1 250 363 07 75
E-mail: magillis@PFC.Forestry.CA

CZECH REPUBLIC

Mr. Vladimir Henzlik
Head of the Department of the Forest Ecology
Forest Management Institute, (UHUL)
Nabrezni 1326, CZ – 254 44 Bandys Nad Labem
Tel. + 42 202 804 481 / 800137
Fax: + 42 202 802 434
E-mail: henzlik@uhul.cz

DENMARK

Mr. Henrik Hagen Olesen
Head of the Section, Forest Policy Division
The National Forest and Nature Agency
Ministry of the Environment
(Miljo-OG Energiministeriet)
Haraldsgade 53, DK – 2100 Copenhagen
Tel. + 45 39 47 20 00 / 45 39 27 20 00
Fax: + 45 39 27 98 99
E-mail: HHA@sns.dk

FINLAND

Mr. Erkki Tomppo
Ph.D., Professor
Head of Finnish National Forest Inventory
Finnish Forest Research Institute
Unioninkatu 40A, FIN - 00170 Helsinki
Tel. + 358 9 857 05 340 // 358 9 857 051
Mobile phone: + 358 40 50 28 555
Fax: + 358 9 625 308
E-mail: erkki.tomppo@metla.fi

FRANCE

Mr. Jean-Marie Valdenaire
Ingénieur Chargé de la Communication à
l'Inventaire Forestier National
(In charge of Communication, National Forest Inventory)
L'Inventaire Forestier National
Chateau (Domaine) des Barres
F – 45290 Nogent-sur-Vernisson
Tel. + 33 38 28 18 18 or 38 28 18 00
Fax: + 33 38 28 18 28
E-mail: jmvaldenaire @ifn.fr

[1] The titles, address and contacts (telephone, fax, e-mail) of the members of the Team of Specialists on the list those given in their capacity of the members of the Team of Specialists for the TBFRA-2000.

GERMANY

Mr. Friedrich Schmitz
Section 615, Federal Ministry of Food, Agriculture and Forestry
P.O. Box no. 140270
D - 53107 BONN
Tel. + 49 228 529 4167
Fax: + 49 228 529 4262
E-mail: BN4167@BML.bund400.de

HUNGARY

Mr. Péter Csoka
Director General, State Forest Service
Ministry of Agriculture and Regional Development
Széchenyi utca 14, P.O.Box 10
H - 1054 Budapest V
Tel. + 36 1 37 43 203 / 37 43 200
Fax: + 36 131 26 112
E-mail: csoka.peter@aesz.hu
E-mail: aesz@aesz.hu

NEW ZEALAND

Mr. James P. Barton
Senior Policy Analyst
Agriculture and Forestry Statistical Information
Policy Information Team, MAF Policy
Ministry of Agriculture and Forestry
ASB Bank House, 101-103 The Terrace
P.O. Box 2526, Wellington
Tel. + 64 4 498 98 28 // 474 41 00
Fax: + 64 4 474 42 06
E-mail: bartonj@maf.govt.nz
E-mail: jpbarton@xtra.co.nz (home address)

POLAND

Mr. Roman Michalak
Dr., Researcher
Department of Forest Management Planning
Forest Research Institute
ul. Bitwy Warszawskiej 1920 r., Nr. 3
PL – 00-973 Warsaw
Tel. + 48 22 822 49 38
Fax: + 48 22 822 49 35
E-mail: r.michalak@ibles.waw.pl

PORTUGAL

Ms. Maria Odete P. Duarte
Head of Forest Inventory Statistics Division
Direccao Geral Das Florestas
Av. Joao Crisostomo 28-50
P – 1050 Lisboa
Tel. + 351 1 312 4974
Fax: + 351 1 312 4983
E-mail: dgf.dgsi@mail.telepac.pt

RUSSIAN FEDERATION

Mr. Andrey N. Filiptchuk
Dr., Deputy Director, All-Russian Scientific, Research and Information Centre for Forest Resources (ARICFR)
Novocheremushkinskaya str., 69,
117 877 Moscow
Tel. + 7 095 332 53 42 or 332 53 38
Fax: + 7 095 331 05 33
E-mail: aricfr@aha.ru
E-mail: strakhov@aricfr.msk.su

SLOVAKIA

Mr. Jan Ilavsky
Dr., Director, Forest Research Institute (LVU)
ul. T.G. Masaryka 22, SK - 960 92 Zvolen
Tel. + 421 855 320 316 (- 318) / 321 961
Fax: + 421 855 233 97 / 321 883
E-mail: jan.ilavsky@fris.sk

SWEDEN

Mr. Sven A. Svensson
Head of the Department
National Board of Forestry
S – 554 48 Jönköping
Tel. + 46 36 15 5655
Fax: + 46 36 16 6170
E-mail: sven.svensson@svo.se

Mr. Erik Sollander
National Board of Forestry / WWF officer
S – 55448 Jörnköping
Tel. + 46 3615 5655
Fax: + 46 3616 6170
WWF-phone/Fax: + 46 392 123 99
E-mail: erik.sollander@telia.com
Home: Hasselgatan 22, 564 00 Mullsjö
Tel. + 46 392 129 55
E-mail: erik.sollander@mullsjo.mail.telia.com

SWITZERLAND

Mr. Peter Brassel
Dr., Swiss Federal Institute for Forest, Snow and Landscape Research
(Institut fédéral de recherches sur la forêt, la neige et le paysage)
Zürcherstrasse 111, CH – 8903 Birmensdorf
Tel. + 41 1 739 22 38 / 739 21 11
Fax: + 41 1 739 22 15
E-mail: peter.brassel@wsl.ch

UNITED STATES OF AMERICA

Mr. Brad Smith
Associate Branch Chief, Forest Inventory Research
International Resource Assessment Liaison
USDA Forest Service, FIERR
1st Floor, S.W.m., Auditors Building
14th Independence Ave., S.W.
P.O. Box 96 090, Washington D.C.20250

Tel. + 1 202 205 0841
Fax: + 1 202 205 1551
E-mail: smith_brad/wo@fs.fed.us
E-mail: wbsmith/wo@fs.fed.us

ORGANIZATIONS

FAO, Food and Agriculture Organization of the United Nations

Mr. Robert Davis
Senior Forestry Officer, FRA Programme
Forest Resources Division, Forestry Department
Food and Agriculture Organization of the United Nations
Viale delle Terme di Caracalla
00100 Rome, Italy
Tel. + 39 6 570 535 96
Fax: + 39 6 570 531 57
E-mail: robert.davis@fao.org

European Commission

Mr. Louis Du Breil De Pontbriand
DG VI-FII-2, European Commission
Directorate General VI Agriculture
Rue de la Loi 200, B - 1049 Brussels
Tel. + 32 2 295 45 16
Fax: + 32 2 296 62 55
E-mail: louis.du-breil-de-pontbriand"@cec.eu.int

JRC, Joint Research Centre

Dr. Pamela Kennedy
Sector for Forest and Catchment Studies
Environmernt and Geo-Information (EGEO) Unit
Space Applications Institute, Joint Research Centre
Commission of the European Communities
I – 21020 ISPRA (VA), Italy
Tel. + 39 332 78 59 78
Fax: + 39 332 78 94 69
E-mail: pamela.kennedy@jrc.it

Mr. Sten Folving
Environmental Mapping and Modelling Unit
Space Applications Institute
Joint Research Centre (JRC)
Commission of the European Communities
I – 21020 ISPRA (Va), Italy
Tel. + 39 332 785 009 (789 333)
Fax: + 39 332 789 4 69
E-mail: sten.folving@jrc.it

UNEP, United Nations Environment Programme

Mr. Sipi Jaakkola
Senior Scientific Officer, Regional Office for Europe
United Nations Environment Programme
15, Chemin des Anémones
CH - 1219 Châtelaine, Geneva, Switzerland
Tel. + 41 22 917 82 21
Fax: + 41 22 917 80 24
E-mail: sipi.jaakkola@unep.ch

WWF, World Wide Fund

Dr. Christopher Elliott
Director, Forests for Life Campaign
World Wide Fund for Nature
Avenue de Mont Blanc
CH - 1196 Gland, Switzerland
Tel. + 41 22 364 90 03
Fax: + 41 22 364 05 26
E-mail: celliott@wwfnet.org
URL: http://www.panda.org/forests4life

EFI, European Forest Institute

Mr. Tim Peck
2, chemin des Laurelles
CH – 1297 Founex, Vaud, Switzerland
Tel. + 41 22 776 10 69
Fax: + 41 22 776 10 69
E-mail: tpeck@worldcom.ch

WCMC, World Conservation and Monitoring Centre

Dr. Susan Iremonger
Senior Research Officer, Forest Programme
World Conservation Monitoring Centre (WCMC)
219 Huntingdon Road, Cambridge CB3 ODL
United Kingdom
Tel. + 44 1223 277 314
Fax: + 44 1223 277 136
E-mail: susan.iremonger@wcmc.org.uk
E-mail: susani@wcmc.org.uk
E-mail: s.iremonger@esatclear.ie (home in Ireland)

UN-ECE/FAO secretariat

Mr. Christopher F.L. Prins
Chief, Timber Section, UN/ECE Trade Division
Palais des Nations
1211 Geneva 10, Switzerland
Tel. + 41 22 917 28 74
Fax: + 4122 917 00 41
E-mail: christopher.prins@unece.org

Mr. Alexander V. Korotkov
Timber Section, UN/ECE Trade Division
Palais des Nations
1211 Geneva 10, Switzerland
Tel. + 41 22 917 28 79
Fax: + 41 22 917 00 41
E-mail: alexander.korotkov@unece.org

Appendix V

List of TBFRA-2000 Consultants

Mr. Péter Csoka

Director General, State Forest Service
Ministry of Agriculture and Regional Development
Széchenyi utca 14, POB 10
H - 1054 Budapest V, Hungary
Tel. + 36 1 37 43 203 / 37 43 200
Fax: + 36 131 26 112
E-mail: csoka.peter@aesz.hu
E-mail: aesz@aesz.hu

Mr. Nigel Dudley

Director, "EQUILIBRIUM"
Ecological and Policy Research
23 Bath Buildings, Montpelier
Bristol BS6 5PT, United Kingdom
Tel. + 44 117 942 86 74
Tel. + 44 165 4 703 808
Fax: + 44 117 942 86 74
E-mail: equilibrium@compuserve.com

Mr. John L. Innes

Professor, FRBC Chair of Forest Management
University of British Columbia
Forest Resources Management
2nd Floor, Forest Sciences Centre
2045, 2424 Main Mall, Vancouver BC, Canada V6T 1Z4
Tel. + 604 822 6761
Fax: + 604 822 9106, + 604 822 9106
E-mail: innes@interchg.ubc.ca

Mr. Pekka E. Kauppi

PhD, Finnish Forest Research Institute
Unioninkatu 40A
FIN - 00170 Helsinki, Finland
Tel. + 358 9 857 051
Fax: + 358 9 708 58 462, + 358 9 625 308
E-mail: pekka.kauppi@helsinki.fi

Mr. Kari T. Korhonen

PhD, Finnish National Forest Inventory
The Finnish Forest Research Institute
Unioninkatu 40 A
FIN - 00170 Helsinki, Finland
Tel. + 358 9 85 705 280
Fax: + 358 9 85 70 57 17
E-mail: kari.t.korhonen@metla.fi

Mr. Michael Köhl

PhD, Professor, Dresden University of Technology
Chair of Forest Biometrics and Computer Sciences
Wilsdruffer Str. 18, D - 01737, Tharandt, Germany
Tel. + 49 35203 381613/ -15
Fax: + 49 35203 381628
Private phone: + 49 171 2852984
E- mail: koehl@forst.tu-dresden.de

Ms. Linda Langner

PhD, USDA Forest Service
Strategic Planning and Resource Assessment
14th & Independence Ave., SW
Washington DC 20090-6090, USA
Tel. + 1 202 205 1370
Fax: + 1 202 205 1546
E-mail: llangner/wo@fs.fed.us

Mr. Jari Liski

PhD, European Forest Institute
Torikatu 34, FIN - 80100 Joensuu, Finland
Tel. + 358 13 252 020
Fax: + 358 13 124 393
E-mail: jari.liski@efi.fi
Office: Department of Forest Ecology
P.O. Box 24, 00014 University of Helsinki, Finland
Tel. + 358 9 191 7725
Fax: + 358 9 191 7605

Mr. Tim Peck

2, chemin des Laurelles
CH - 1297 Founex, Vaud, Switzerland
Tel. + 41 22 776 10 69
Fax: + 41 22 776 10 69
E-mail: tpeck@worldcom.ch

Mr. Erkki Tomppo

Ph.D., Professor
Head of Finnish National Forest Inventory
Finnish Forest Research Institute
Unioninkatu 40 A, FIN - 00170 Helsinki, Finland
Tel. + 358 9 85 705 340
Fax: + 358 9 625 308
Mobile Phone: + 358 - 40 - 50 28 555
E-mail: erkki.tomppo@metla.fi
URL: http://www.metla.fi/pp/ETom/index-en.html

SOME FACTS ABOUT THE TIMBER COMMITTEE

The Timber Committee is a principal subsidiary body of the ECE (UN Economic Commission for Europe) based in Geneva. It constitutes a forum for cooperation and consultation between member countries on forestry, forest industry and forest product matters. All countries of Europe; the former USSR; United States of America, Canada and Israel are members of the ECE and participate in its work.

The ECE Timber Committee shall, within the context of sustainable development, provide member countries with the information and services needed for policy- and decision-making regarding their forest and forest industry sector ("the sector"), including the trade and use of forest products and, when appropriate, formulate recommendations addressed to member Governments and interested organizations. To this end, it shall:

1. With the active participation of member countries, undertake short-, medium-and long-term analyses of developments in, and having an impact on, the sector, including those offering possibilities for the facilitation of international trade and for enhancing the protection of the environment;

2. In support of these analyses, collect, store and disseminate statistics relating to the sector, and carry out activities to improve their quality and comparability;

3. Provide the framework for cooperation e.g. by organizing seminars, workshops and *ad hoc* meetings and setting up time-limited *ad hoc* groups, for the exchange of economic, environmental and technical information between governments and other institutions of member countries that is needed for the development and implementation of policies leading to the sustainable development of the sector and to the protection of the environment in their respective countries;

4. Carry out tasks identified by the UN/ECE or the Timber Committee as being of priority, including the facilitation of subregional cooperation and activities in support of the economies in transition of central and eastern Europe and of the countries of the region that are developing from an economic point of view;

5. It should also keep under review its structure and priorities and cooperate with other international and intergovernmental organizations active in the sector, and in particular with the FAO (Food and Agriculture Organization of the United Nations) and its European Forestry Commission and with the ILO (International Labour Organisation), in order to ensure complementarity and to avoid duplication, thereby optimizing the use of resources.

More information about the Committee's work may be obtained by writing to:

Timber Section
UN/ECE Trade Division
Palais des Nations
CH - 1211 Geneva 10, Switzerland
Fax: + 41 22 917 0041
E-mail: info.timber@unece.org

WEB site address: http://www.unece.org/trade/timber

UN-ECE/FAO Publications

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Timber Bulletin Volume LII (1999)	ECE/TIM/BULL/52/...
Timber Bulletin Volume LIII (2000)	ECE/TIM/BULL/53/...

1 Forest Products Prices
2. Forest Products Statistics (database (chronological series, since 1964) also available on diskettes)
3. Forest Products Annual Market Review
4. Forest Fire Statistics
5. Forest Products Trade Flow Data
6. Forest Products Markets in *(current year)* and Prospects for *(forthcoming year)*

Geneva Timber and Forest Study Papers

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(Country profiles also exist on Albania, Armenia, Belarus, Bulgaria, former Czech and Slovak Federal Republic, Estonia, Hungary, Lithuania, Poland, Romania, Republic of Moldova, Slovenia and Ukraine)	
North American timber trends study	ECE/TIM/SP/9
Long-term historical changes in the forest resource	ECE/TIM/SP/10
European timber trends and prospects: into the 21st century (ETTS V)	ECE/TIM/SP/11
Forest and forest industries country fact sheets	ECE/TIM/SP/12
Non-wood goods and services of the forest	ECE/TIM/SP/15
State of European forests and forestry, 1999	ECE/TIM/SP/16
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Eronen, "Forest resources and consumption of forest products in countries in transition, 1990-2020"	ECE/TIM/DP/8
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Peck and Descargues, "The policy context for the development of the forest and forest industries sector in Europe"	ECE/TIM/DP/11

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- Seminar on "Exploring multiple use and ecosystem management: from policy to operational practice", Prince George, Canada, September 1995
- Workshop on "Wood--an environmentally friendly material", Jönköping, Sweden, April 1996
- Seminar on "Environmentally sound forest roads and wood transport", Sinaia, Romania, June 1996
- Seminar on "Safety and health in forestry are feasible!", Konolfingen, Switzerland, October 1996

International Forest Fire News ***(two issues per year)***

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United Nations
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CH - 1211 Geneva 10, Switzerland
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