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## World forest resources

Review of the world's forest resources in the early 1970:s.

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### Abstract

This report briefly describes the forest resources in practically all countries in Africa, Asia, Latin America and the Pacific. The country notes contain information about natural forest land, man-made forest and inventories. For the countries in Europe and North America only tabulated information about forest land and standing timber is presented. This tabulated information is also given for the countries for which country notes have been prepared.

Summarized, the information gives the areas of closed forest in the whole world as 2,800 million ha or 22 percent of land area while the area of open woodlands of different types is more than 1,000 million ha. The area of coniferous forest is estimated as 1,140 million ha or 40 percent of the total forest area.

The area of man-made forests in Africa, Asia (excluding China and Japan) the Pacific and Latin America is around 12 million ha. For the whole world the area may be around 100 million ha.

The total growing stock in the world's closed forests can not be estimated with accuracy but a very crude guess has given a total growing stock of 300,000 million m<sup>3</sup> (above 20-30 cm d.b.h. in broadleaved forests and above perhaps 5-10 cm d.b.h. in coniferous forests), of which 100,000 million m<sup>3</sup> is coniferous. Both these volume figures may be underestimates. The growing stock in areas outside closed forest may be around 50,000 million m<sup>3</sup>.



## Foreword

This report is a continuation of the so-called World Forest Inventories (WFI) which were earlier undertaken by FAO at five year intervals. The work on the fifth version of this series which started in 1968 was never finalized mainly due to the lack of resources. The information presented in this report is of a new type compared to earlier versions of the WFI, but it does replace the information given in the 1963 WFI and can be thought of as a fifth unofficial version of the WFI.

The author spent four years employed as an Associate Expert in the Forest Economics and Statistics Branch of FAO in Rome, working on the assembly of forest inventory material. In view of the lack of resources within FAO to prepare a publication, the material assembled since 1968 has been put at the disposal of the author to make publication of this version of WFI possible. Completion of the work has been made possible by an agreement of cooperation between FAO and The Royal College of Forestry in Stockholm.

Many colleagues have helped me in this work: I am in debt to all forestry officers at FAO's Forestry Department and especially to Messrs S. Pringle and M. de Backer. I should also like to thank Messrs J. P. Lanly, B. Steenberg, P. Vakomies and P. A. Wardle for valuable help.

At The Royal College of Forestry in Stockholm I owe a debt of gratitude to Professor N-E. Nilsson, who has supported me in my work for many years. Without his support it would have been impossible to finalize this work.

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I am also very grateful to all the forestry officers in different parts of the world, who during my visits, have given me information about the forests in their countries and helped me in so many ways.

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Last but not least I thank all the secretaries in Rome and Stockholm who have patiently interpreted my unreadable handwriting, especially Mrs M. Barr, Mrs K. Jordansson, Mrs G. Lindau and Mrs M. Lundgren who have done the final typing.

Stockholm, May 1974

Reidar Persson

<u>Table of contents</u>	Page
General notes	VII
Abbreviations and symbols	VII
1. Introduction .....	1
2. World Forest Inventory .....	2
2.1 General .....	2
2.2 Objectives of the WFI .....	2
2.3 Information in the WFI:s .....	2
2.4 Shortcomings of the previous WFI:s .....	3
2.5 The WFI 1968 .....	4
2.6 The new approach for WFI .....	5
2.7 Conclusions about the WFI .....	7
3. Background to this report .....	8
4. Objectives of this report .....	9
5. Results .....	10
5.1 Country notes .....	10
5.1.1 General about the country notes .....	10
Forest resources of Central America .....	13
Forest resources of South America .....	28
Forest resources of Africa .....	56
Forest resources of Asia .....	104
Near East .....	104
South and South-East Asia .....	114
Forest resources of the Pacific area .....	159
5.2 Summary tables .....	169
5.2.1 General about the tables .....	169
5.2.2 Comments on the tables .....	169
5.2.3 Judgement of accuracy .....	174
Table I Forest and Other Wooded areas .....	176
Table II Standing timber .....	198
Table III Man-made forests .....	215
6. Analyses of the results .....	220
6.1 General .....	220
6.2 Reliability of the data .....	220
6.3 Forest and Other Wooded areas .....	222
6.4 Coniferous forests .....	226
6.5 Ownership .....	226
6.6 Management status .....	227
6.7 Growing stock .....	228
6.8 Annual growth .....	232
6.9 Man-made forests .....	232
6.10 Crown-density .....	233
7. Conclusions and recommendations .....	233
Bibliography .....	238
Sammanfattning .....	243
Appendix I Definitions .....	245
Appendix II Glossary .....	253
Appendix III Main species commonly used in the text ....	260
Appendix IV Maps .....	263

## General notes

Regions are listed in geographical order from the "Date Line" eastwards. Within each region countries are given in English alphabetical order. In Asia the Near East countries are given first.

Whenever sufficient data was not available, estimates have been included in the regional and world totals. These may therefore not correspond with the arithmetical total of the country data. The terms used throughout the report are defined in the appendices "Definitions" and "Glossary".

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the author concerning the legal status of any country or territory or of its authorities, or concerning the delimitations of its frontiers.

As far as possible the countries are listed according to their "de facto" situation at the end of 1973.

## Abbreviations and symbols

-	Nil
..	Not available
0	Small areas. Not known exactly how much.
+	Known to exist. Not known exactly how much.
D	Dominating
()	Figure known to be incomplete or very uncertain.
cm	Centimetre (1 cm = 0.3907 inch)
m	Metre (1 m = 3.281 feet)
ha	Hectare (1 ha = 2.471 acres)
m <sup>3</sup>	Cubic metre of roundwood (1 m <sup>3</sup> = 35.31 cubic feet)
1 acre	= 0.4047 ha
1 foot	= 0.3048 m
1 inch	= 2.540 cm
CIDA	Canadian International Development Authority
CTFT	Centre Technique Forestier Tropical
d.b.h.	Diameter at breast height
d.r.h.	Diameter at reference height
FAO	Food and Agriculture Organisation of the United Nations
IBRD	International Bank for Reconstruction and Development
o.b.	Over bark
PY	FAO Production Yearbook
SF	United Nations Special Fund
SIDA	Swedish International Development Authority
Sp.	Species (singular)
Spp.	Species (plural)
u.b.	Under bark
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
WFI	World Forest Inventory
WW	World Wood (American magazine)

I urge anyone who finds some unclarities in this report or who knows about any report giving new and additional information to send this information to Reidar Persson, Royal College of Forestry, Fack, S-104 05 Stockholm 50, Sweden.

## 1 Introduction

This report tries to describe the forest resources of the world in the beginning of the 1970:s. The first known attempt to estimate the forest resources of the world was made by Dr Raphael Zon and Mr William A. Sparhawk from USA immediately after the first World War. The results of this inquiry were published in 1922 and served as a standard source of reference throughout the inter-war period. In the 1930:s further investigations were done by among others Professor Thorsten Streyffert from Sweden and the International Institute of Agriculture in Rome.

At the first session of the FAO conference in 1945 a recommendation was made that a world forest inventory should be undertaken as soon as possible (note that FAO was founded in 1945). The first so-called "World Forest Inventory" of FAO was carried out in 1947/48. Three more studies have been undertaken. The last one, "World Forest Inventory 1963", was published in 1966.

It may be of some interest to compare the results of some of these different studies:

Source	% forest of land area
Zon-Sparhawk 1922	23
WFI 1955	30
WFI 1963	29

The considerable differences between these estimates are mainly due to changed definitions of forest and of course changes in the state of knowledge of the forest area.

Underlying the preparation of FAO's appraisals has been a questionnaire circulated to all countries. On the basis of returns, information on areas, growing stock, increment etc. has been presented in tabulated form. These appraisals have been the basic source about the world's forests over a long period of years. These national totals often including low-quality forests and, based partially on crude estimates, have failed to reflect details which frequently have been available for the more accessible and valuable forests, as well as the more readily merchantable species and tree sizes.

This report tries to update the figures given in the last WFI. The information given is only in the case of Europe and Other Temperate regions based on information from a questionnaire or so-called official information. For other regions the information has been collected from all sorts of sources.

The report is - in some parts - written in a rather informal and personal style unusual for most "scientific reports". I find it easier to write in this way than to attempt a strained scientific English: some parts e.g. chapter 3 are self-biographical and, finally, this report is a reference book rather than an academic thesis.

## 2 World Forest Inventory

### 2.1 General

Since I will repeatedly refer to the World Forest Inventory (WFI) it seems appropriate to start by explaining what the World Forest Inventory really is (or rather was). The WFI is not an inventory in the sense of a forest inventory, but rather an assessment of the forest resources in different countries. The figures are based on national estimates and these are not always based on proper forest inventories. FAO has recently adopted the name (World) Forest Resource Appraisal for this project which is a more suitable name than WFI.

### 2.2 Objectives of the WFI

The objectives of the previous WFI:s have been somewhat unclear. FAO certainly needs this information for its own studies and outside users are greatly interested in receiving information about the world's forests but no clearly stipulated written objective can be found.

The four previous World Forest Inventories have tried to provide a general picture of the nature and extent of the world's forest and, to some degree, information on how they are being used to supply wood. This has been done in the hope that this information would be useful in satisfying the question of whether or not the world's forest resources are sufficient in extent and productive capacity to meet the need for wood products and to provide basic data for the formulation of national forest policy. Actually, this generalized information has been used more in analyzing world forest resource trends and capabilities than for national forest policy formulation or forestry planning on a regional or national scale.

The most important task for which resource information is necessary are the Timber Trends Studies undertaken by FAO. These balance-studies simply cannot be done without proper information about the world's forest resources. When such balance studies are undertaken at the national level it is also necessary to take into account the forest resources of other countries.

### 2.3 Information in the WFI:s

The information shown in FAO's WFI:s have been obtained by sending questionnaires to individual countries and then compiling the resulting contributed data. In those cases where insufficient or no information was provided, best estimates were made by FAO personnel. The fact that these world inventories were based on data supplied by individual countries means that their accuracy and reliability varied according to the quality of the information available to the respondent.

The questionnaires have been changing all the time in a search for the most important information that was available. The standard questionnaire has been sent to the whole world so some questions are only relevant for certain parts. Generally one can say that the previous questionnaires have been based on forest conditions occurring in Europe but of minor importance in other regions.



The main items presented in the 1963 WFI are shown in the list below:

- Forest land
  - Forest
    - In use
    - Unproductive
  - Unstocked forest land
- Ownership
- Management control
- Sylvicultural treatment
  - High forest
  - Coppice
- Permanent reserves
  - Protection reserves
- Crown-density
- Composition (Coniferous and Broadleaved)
- Volume per hectar (area distribution)
- Growing stock
- Increment

#### 2.4 Shortcomings of the previous WFI:s

It is known that the information presented in the WFI contains many mistakes. Many of these mistakes are actually prompted by the questionnaire approach. The most important difficulties when using a questionnaire in a forest resource appraisal can be summarized as follows:

- a) It is difficult to formulate the most important questions in a questionnaire.
- b) One may usefully only ask questions to which one can hope to get a reply.
- c) Questions are not relevant in all countries.
- d) It is almost impossible to make watertight definitions.
- e) With a questionnaire one may only collect a part of the available information.
- f) The Government Agencies receive so many questionnaires from different International Agencies that they may not take sufficient care
- g) It is often impossible to recalculate the national statistics according to the standardized definitions used by FAO.
- h) The definitions are not always read by the respondent.
- i) The measurement units often differ in the reporting countries. This often causes confusion.

Many of the difficulties mentioned above are the same for all questionnaires and not only those used for the WFI. Questionnaires can and unfortunately also must, be used for items which are collected yearly. On items like production and trade some form of records are also kept in nearly all countries.

## 2.5 The WFI 1968

According to a FAO Conference decision in 1951 a WFI should be undertaken every fifth year. This decision was probably based on the belief that it would be possible to check up on changes in forest resources by repeating the inventory. It has however proved impossible to compare figures between consequent inventories. This is because changed figures are mainly caused by new definitions, new inventories, new estimates and so on and not by any identifiable change in the forest resource. In these days with our increased concern for the environment the task to check up on changes in forest resources is becoming still more important. What has been said so far concerns the WFI:s that have been published. These past four inventories have been carried out on a global basis each time. This had, as has already been mentioned, the disadvantage that it is difficult to prepare a questionnaire which is applicable to such different forest conditions and then to interpret the widely disparate replies. In addition, a world inventory every five years concentrates the work to the time of the inventory with periods in between, when no information is collected.

The suggestion was made in 1966 that these disadvantages could be alleviated by a regional approach. Inventories would be carried out for one region at a time and on a continuing basis. The latest World Forest Inventory which started in 1968 was in this way planned to cover one region at a time. Over a five year period the whole world would be covered. Each region would have a specially tailored questionnaire taking into account the different forestry conditions occurring in each region.

The questionnaire for Europe was dispatched in 1968 and the results were more or less ready for publication at the end of 1969. Due to a lot of different reasons, the results have not yet been published. The questionnaire which was sent to the European countries (and slightly modified, to countries in "Other Temperate regions") was largely a copy of the 1963 questionnaire. The basic difference was that the definition of forest was changed. The results are, in the case of Europe, quite similar to those given in the 1963 version.

The questionnaire for Africa was prepared with great care during 1968 and differed greatly from previous questionnaires. It was an honest attempt to answer the questions of importance in Africa and it tried to take into account the form in which the information is available. The definitions were carefully prepared and reasons why the different types of information was needed were given. This approach proved to be the main difficulty. The questionnaire became too complicated. Questionnaires of a similar type were also prepared for Asia and Latin America.

Few countries answered the African questionnaire, some of the replies were incomplete and there were clearly misunderstandings. The main conclusion which could be drawn from the work with the regional questionnaires was that standardized questionnaires are an unsuitable method of collecting information on forest resources, at least in tropical regions. The questionnaires for Asia and Latin America were therefore never sent out.



The first trials with the questionnaires were acceptable as they gave a first broad summary of the forest conditions in the world. Nowadays no additional information can be collected in this way. It is also a fact that so little information is available in most countries concerning the forest resources that all this material must be utilized in a forest resource appraisal. It simply cannot be accepted that any of this information gets lost. In a questionnaire approach it definitely does.

## 2.6 The new approach for WFI

The approach with regional questionnaires was dropped long before the whole world was covered by the 1968 WFI. The reason for this was not only that the questionnaire approach proved difficult (or impossible) but also that the resources available were inadequate.

As has been mentioned it seemed necessary to collect new information and improve the existing information about the world's forest resources. A new method which gave better information than the questionnaires and which was relatively cheap, had therefore to be worked out. Otherwise the whole idea of the WFI would have to be dropped until considerably larger resources were made available.

In discussing a new method for data collection it may be advisable to see which information really is available concerning forest resources.

The table below shows the approximate percentage of the forest in different regions that is covered with any inventory. (Note that this table is based on the original estimates from 1971):

Region	Approximate percentage of closed forest area inventoried
North America	60
Latin America	10
Africa	15
Europe	74
USSR	40+
Asia	35
Pacific area	20
World	35

One conclusion can easily be drawn from this table and that is that a World Forest Inventory cannot exclusively be based on inventory results. As only one third of the world's forests have been covered by any form of inventory, other sources of information have to be used. In tropical countries (Africa, Asia, Latin America) information of the following types are available in most countries:

- a) Vegetation maps
- b) Land-use maps
- c) Forest maps
- d) Topographic maps:  
Such maps have been prepared for many countries. Sometimes they show the areas covered by forest (normally closed forest).

6.

- e) Inventories:  
Inventories of at least selected areas are to be found in most countries. Summaries of the result from these inventories may give valuable information. An inventory may sometimes be used as an example of the volume of a certain vegetation type.
- f) Result from logging operations:  
Statistics from such operations can give some information about the volume that is extracted per ha in different areas.
- g) Botanical descriptions:  
A great amount of botanical work has been done in most countries. This work can sometimes be used for practical purposes. This is especially the case when the vegetation is described for large areas. From the description of vegetation types can be gleaned information about main species, density of vegetation, height of trees etc.

A World Forest Inventory must be based on the information that really is available in the countries and not on the data that ought to be available. Consequently information of all kinds must be utilized in trying to make the best possible inventory. That few inventories have been carried out must not mislead us in believing that it is completely impossible to undertake a World Forest Inventory (or World Forest Resource Appraisal)

Put together in a suitable form the information available ought to give quite a clear picture of the forest resources in most countries.

At an early stage in the preparation of the Forest Resource Appraisal for Africa the outlook of the final publication was outlined as follows:

#### A. Tables

The tables should show some of the main features like forest areas, ownership, management plans etc. This material can come from a questionnaire but it is more probable that the data will come from other sources. Actually this part will try to give the same information as previous WFI:s.

#### B. Maps

A map must be prepared for each of the important forestry countries. This map should show:

- a) Location of the forests
- b) Different types of forests (vegetation types)
- c) Location of inventories undertaken
- d) Location of forest reserves (when applicable)
- e) Exploited areas and/or areas under concessions (when applicable).
- f) Transport system (this at present being the only practical way to say something about accessibility)
- g) Location of plantations

If all this information is available it will probably be necessary to prepare more than one map.

### C. Country notes

A note must be prepared for each country. This being mainly an explanatory note to the map and the tables. Index numbers put on different inventories and/or forest regions relate to the same numbers in the text. These notes should at least contain the following points:

- a) A general description of the forests. To some extent a description of the vegetation
- b) Summary of inventory results
- c) Description of accessibility
- d) Information about plantations: areas, species etc.
- e) List with most important species and their possible use. This is normally given in connection with inventories
- f) Some notes about exploitation and concessions
- g) Other information of interest

None of these country reports will be like the other, the result depending completely on information available.

The best way to collect this information is to visit each separate country. As this probably will prove to be impossible for economic reasons the information must be collected from reports, interviews, correspondence etc. This is a cheaper way of collecting the information but it does not give the same opportunity to check the reliability of the information.

It must be said here that this so-called method or approach was by no means new. Methods of similar types had been discussed several times over the years but the aspirations had been too high and the costs consequently unacceptable. The outline described above has been reached after a trial and error period where a lot of other ideas had to be tried out and discarded.

The previous questionnaire approach is much more exciting and scientific than the "new method" with its boring search for information from all possible sources.

It must be mentioned that the questionnaire method has not the same disadvantage in many of the countries in the temperate regions. The figures on forest resources in these countries are often based on some form of inventory. These national figures based on inventories are, on the other hand, not necessary of good quality.

### 2.7 Conclusions about the WFI

It may be of interest to mention what will be the result of the work with the 1968 WFI and the so-called "new approach". The following reports will be published in addition to this report:

- a) A report of the traditional WFI type will be published for the Temperate regions by FAO. Certain maps will be included in this report but not any country notes.

- b) A Forest Resource Appraisal for Africa will be published by myself in cooperation with FAO. This report which is already drafted follows the proposals for the so-called new approach for Regional Forest Resource Appraisals. The information given will be quite detailed. Maps will be included.
- c) A Forest Resource Appraisal for the Asia-Pacific region will be published in connection with the Asia-Pacific Timber Trends Study. This report contains very detailed country notes.
- d) A report discussing the need for a WFI and the methods that can be used in collecting forest resource statistics at an international level will be published by myself in cooperation with FAO.

What will happen after these reports have been published depends on the interest for forest resource information inside and outside FAO.

### 3 Background to this report

In clarifying the objectives of this specific report and the method used it is necessary to give certain background facts. I will start by describing how I got involved.

I joined FAO's Forestry Department in November 1968 and began, more or less immediately, with the analysis of the answers to the questionnaire especially tailored for European countries which had been sent out some months earlier. The analysis of these questionnaires meant - in addition to checking figures - comparisons with all possible other sources of information that could be traced. This work gave me quite a detailed view of the forest resources in Europe.

During the spring of 1969 I undertook a study trip to seven countries in Asia. The basic aim of the trip was to prepare a WFI questionnaire for Asia. During the autumn of 1969 I finalized this work although the questionnaire was not cleared until one year later. The autumn of 1969 and the spring 1970 I also finalized the work on a questionnaire for Africa and another for the Temperate regions outside Europe and USSR. The basic work had been done before I arrived at FAO. The questionnaires for Africa and Other Temperate regions were dispatched during the summer of 1970.

During the spring of 1970 I started to work out a new approach for the WFI. The main thing as I saw it, was to get rid of the questionnaire as the basic tool in collecting the data and to present the information in a more suitable form than in tables. During the summer of 1970 I visited seven countries in South America. My main interest was in collecting as much information as possible about the forest resources in these countries and I also wanted to draft a questionnaire for Latin America. The pilot work done for Latin America proved quite successful. It proved to be possible to collect much better information by checking reports, interviews with FAO field experts, travels and so on than from any questionnaire however well-designed. Maps also proved to be a very suitable tool for presenting incomplete information about forest resources in the best possible way. The plans I had to prepare a complete Forest Resource Appraisal for Latin America were unfortunately not realised due to the lack of time. In the winter of 1971 I had instead to try to do something about the Forest Resource Appraisal for Africa for which the questionnaire had already been sent.

The response to the questionnaire was very disappointing. One year after the dispatch only 20 countries had sent any answer. Many of the answers were also of a rather low quality. Money was made available by SIDA so I travelled to eight African countries to collect information during the summer of 1971. Not until autumn 1971 did it become clear to me that a pilot study for the African region should really be undertaken and that something substantial would come out of all my work in the field of Forest Resource Appraisals. It was then agreed between FAO and the Royal College of Forestry that I should be given time to finalize the work on the African region.

I have provided this rather long story to explain that - during my four years at FAO Headquarters - I worked intensively with the forest resources in all parts of the world. During this work I gained a great deal of knowledge of the world's forest resources and built up files about the forest resources in different countries.

The idea of making a summary of the forest resources of the world came to me during my last months at FAO. I repeatedly noticed the great interest from outside for the traditional WFI. I realised too that the country files started to become rather complete. During my last weeks at FAO I summarized the material in the country files.

After my return to Sweden in the autumn 1972 I started to finalize the work with a Forest Resource Appraisal for Africa. This work proved to be much more time-consuming than was expected. The methodological discussions especially caused trouble. In sparetime I worked on preparing short forest resource notes for all countries in the tropics and summary tables for all countries in the world.

What is published here is a summary of the knowledge I have gathered over the years. To a great extent it is a summary of the files built up during my stay with FAO. Over the last year I have made several attempts to finalize the report but no really concentrated effort. I left my handwritten drafts for occasional over-capacity in typing during summer and autumn 1973. And suddenly, I discovered that the report was more or less finished. It was then only a question of writing an introduction and a few concluding chapters. During a trip to FAO Headquarters in November 1973 I collected a considerable amount of new information which had to be fed into the already written country notes. This delayed the publishing of the report somewhat but means also that the report is relatively up-to-date.

#### 4 Objectives of this report

It is necessary to explain clearly the limited objective of this report to avoid being misunderstood by critical readers.

The aim in this report is to use available information to answer questions about the size of the forest resource - how much wood is there? It is hoped that it will provide adequate international forest resource data for national and international forest and forest industries policy making.



The objective in this specific report is to give country-by-country a description of the forest resource (Chapter 5). In the case of countries in the tropical or subtropical regions the information is mainly given in the form of short country notes. This information has as far as possible also been tabulated in summary tables. In the case of countries in Europe and North America the information is only given in the form of tables. The intention with these country descriptions is largely as was given for Africa on pages 6 and 7. It is only that I did not have the means to prepare the necessary maps. Maps will hopefully occur in a future version of this world report or in future regional reports.

An important subordinate objective is to analyse the accuracy of information about forest resources. In this way gaps in existing knowledge about forest resources can be identified.

## 5 Results

### 5.1 Country notes

#### 5.1.1 General about the country notes

The country notes describe country-by-country the forest land, man-made forests, and inventory results. Other information considered to be of interest is given under "other".

In the case of Africa, the country notes are summaries of more detailed country notes in the Forest Resource Appraisal of Africa. Some scattered figures have been taken from the questionnaire which in 1970 were sent to the African countries. For some of the countries in Asia and Pacific information in country notes prepared by Mr. H. Koivisto for the Asia-Pacific Timber Trends Study have been utilized. For Latin America I have mainly used material collected during my travel in the region or drawn from information held at FAO Headquarters.

Country notes have only exceptionally been prepared for countries in the temperate regions. The simple fact is that I had no time to search for this information. Information of the pure descriptive type is of minor importance in countries in the temperate regions where forest resource statistics of acceptable accuracy are normally to be found. Furthermore, I have written a report which shows my own interest. From my Stockholm horizon it is more interesting to describe the forest resources in Bolivia than in Finland or Belgium. In the case of the last two countries statistics by themselves give most of the necessary information. Most readers already have some background information about the forest conditions in European countries. If more detailed information for these countries is needed it is also rather easy to find published material for most European countries and for USA and Canada.

The country notes are not always complete and consistent. This is because they have been compiled from sources that are themselves incomplete or it was impossible to trace or understand all the necessary background facts. Some of the inventory figures or other volume estimates should perhaps not have been included in this report as

they are so unreliable. They have however been included in the hope that they might be completed or corrected in a later version of this report.

A main reason for deficiencies in the presented material is the incompleteness of the information available about forest resources and the fact that it is difficult to get hold of all basic sources and check the information. It is then quite natural that a summary of such unsecure information is not without its deficiencies.

The forestry conditions may also change but the information sources do not. The present drought in West Africa can be cited as a case. This drought probably makes part of the description out of date.

It has not proved possible to find all the words necessary to describe the quality of the information. The attempt to explain different degrees of uncertainty have anyhow made certain words very common. The judgement given in the summary tables about the accuracy of the information about natural closed forest (Table I) standing timber (Table II) and man-made forest (Table III) could also be used as a rough indication of the quality of the information in the country notes.

The country notes are of a somewhat variable depth. This depends partly on the information available and partly on when they were written. The intention has changed somewhat while writing the report and it seems as if the first and last country notes are the most detailed. It did not seem worthwhile to re-write simply to achieve a standard form.

In summary, the country notes should ideally give the same information as a short visit to the country. Some of the lack of clarity in the country notes would be resolved after a visit but much would remain. All of this means that the country notes must not be accepted uncritically as the absolute truth. Most country notes give certainly an acceptable picture of forest resources though some may, due to the working method used, give a wrong and/or misleading picture.

The country notes must often be read with a map in hand as the information given often refers to a certain area, district or place. The World Forestry Atlas, prepared by The Federal Research Organization for Forestry and Forest Products in Reinbek, is excellent and can be recommended.

That concludes the general discussion of country notes. I now tabulate some further points.

- a) The scientific names of species are not always clear. "Dalbergia" for instance may not always mean "Dalbergia spp". It may in fact refer to a single species.
- b) The terms and expressions commonly used in different countries have often been used also in the country notes. It has not always been possible to find out precisely what is meant by the different expressions. The same term used in two different countries may mean different things. Terms like "savanna", "commercial volumes" and so on have caused some trouble.

- c) Terms like "forest", "open woodlands", "commercial volume" etc. ought to be discussed in detail. These basic concepts would require more space than I have been prepared to allow here. In the country notes these do not always correspond with the rather tidy description in Appendix I.
- d) It has proved impossible to provide a good bibliographic list in this paper. This is because most information given in the country notes has been collected from unpublished material, through interviews and so on. Where the information is based on published materials the reports were rarely available to me when finalizing this report. Time-consuming library checks would be necessary in order to find the complete names of all usable sources. One of the main tasks of the next version of this report will be to present a detailed bibliography.
- e) When information for one reason or another has been available short country notes have been prepared even for small islands. No attempt has been made to complete this information.
- f) Some figures given in this report have been found repeated in different reports year after year. In the absence of more recent information these figures have been repeated here but the year of estimate has always been given.
- g) It must be pointed out that the sources used in preparing the country notes are not always national. Information has for instance been collected from articles in forestry journals, mission reports or from interviews with forestry officers visiting FAO Headquarters. This is the main reason why there are discrepancies in the information presented. The sources used by me are perhaps not always the best ones available.
- h) When a figure refers to "present time" it normally means 1972-1973.
- i) "Utilized volume" often means the volume that can be utilized for timber (at least in tropical countries). Undefined volume figures often means the utilizable volume of all trees of sawtimber size. (For definitions of different volume concepts see the Glossary).
- j) Quite often the country notes contain conflicting information from estimates made at different times or from different sources. Unfortunately this makes it sometimes more or less impossible to be sure where the probable truth lies. The information in the summary tables is in my own judgement of the probable truth.
- k) The figures found in the different sources have only rarely been rounded in spite of their unreliability.



## FOREST RESOURCES OF CENTRAL AMERICA

### Barbados

Of the total land area of 43,000 ha only 350 ha are covered with forest and woodland. In all only 20 ha of original forests remain and these contain 20 indigenous species.

### Belize

#### Natural forest land

Of the total area of 2.26 million ha about 2 million is said to be forest land. Closed forest is reported to cover 1.63 million ha and woodland and pine land 150,000 ha. One estimate gives the area of "productive forest" as 1.22 million ha. Of this area 1.11 million ha should be accessible.

The forests are mainly moist deciduous. 1.9 million ha is given as broadleaved. A lot of swamp and savanna is included in this area. Along the coast there is also quite a lot of mangrove.

Mahogany (*Swietenia* spp), cedrela (*Cedrela* spp) and pine are the main species.

#### Man-made forests

At the end of 1967 2,500 ha were planted. Of this area 1,900 ha was coniferous. The main species were *Pinus caribaea* and *Swietenia macrophylla*. A later source (W.W. 1973) gives the total area planted as 2,900 ha. In 1971 around 100 ha should have been planted.

#### Inventories

Considerable areas seem to have been covered by inventories. One report gives an area of 400,000 ha as inventoried.

#### Other

- 1) Forest reserves occupy 22.5 percent of the land area for the time being. It is planned that 45 percent should be kept as forest reserves.
- 2) Considerable forest areas are in private ownership. The state forests are situated in the more mountainous parts.
- 3) Exploitation is said to occur in an area of about one million ha. Licences are given for 3-5 years and sawmills take care of all timber. The exploitation in the broadleaved forests is selective. The pine forests are reported to have been overcut.
- 4) Shifting cultivation is quite common.

Costa RicaNatural forest land

In 1967 the forest area was estimated at around 2.2 million ha. The following breakdown was found:

Land category	Area, ha
Area suitable for agriculture	484,000
Area where timber may be exploited	844,000
Protection zones	565,100
Potential reserves	122,500
Forests for combined use	188,200
Total	2,206,200

Of the above area 364,400 ha have already been turned over to agriculture. According to some studies an area of 33,000 ha is lost for forestry each year.

Evergreen rainforest is the most extensively distributed type. Where there are dry and wet seasons on the west coast there are deciduous forests. Cloud forests cover higher parts in the mountains. Along the Atlantic coast there are some areas with palm swamps. Mangrove swamps are of very little importance.

In the evergreen rainforest the most important species are caoba (*Swietenia* spp), cedro (*Cedrela* spp), cativo (*Prioria copaifera*), Santa Maria (*Calophyllum brasiliense*), fruta do-rada (*Virola koschnyi*), laurel (*Cordia alliodora*) and roble (*Tabebuia pentaphylla*).

In the deciduous forest the most important species are coco-bolo (*Dalbergia retusa*), mora (*Chlorophora tinctoria*), pochote (*Bombacopsis quinatum*), cenizaro (*Pithecolobium saman*), cortez (*Tabebuia chrysantha*).

In all there should be 3,500 species in Costa Rica.

Man-made forest

The total area planted is 200 ha. In 1972 around 80 ha should have been planted (W.W.).

Inventories

An area of 30,400 ha in the Zone of Rio Macho is covered by a field inventory. The number of trees per ha was 108 and the gross volume per ha 256 m<sup>3</sup> o.b. (minimum diameter 30 cm d.b.h., all species included). The total commercial volume in Costa Rica has been estimated as 82 million m<sup>3</sup> (W.W.).

Other

Seventy percent of the forest is estimated to be publicly owned.

CubaNatural forest land

The natural forest area is given as 1.6 million ha but large parts are degraded. Only 500,000 ha can give industrial wood. Another 400,000 ha can provide wood of small dimension. The rest is protective forests (200,000 ha) or degraded forests (500,000 ha).

Cuba has four indigenous pines. They are *Pinus caribaea*, *P. tropicalis*, *P. occidentalis*, and *P. cubensis*. The area covered by pines is not known, but the WFI 1963 gave a figure of 400,000 ha.

The broadleaved forests have been described as:

- a) Rainforest or semi-evergreen seasonal forest (semi-deciduous forest!)
- b) Scrub
- c) Mangrove

The area once covered by mangrove is 400,000 ha. The present area is not known.

Man-made forests

For the past 10-15 years 215,000 ha have been planted in total. No breakdown in species has been given for this area.

The species distribution for the 118,000 ha established at the end of 1965 was as follows:

Species	Area, 1000 ha
Pines	15
Other coniferous	10
Eucalyptus	53
Other broadleaved	40
Total	118

Main species planted: *P. caribaea*, *P. tropicalis*, *P. cubensis*, *P. occidentalis*, *Swietenia mahogany*, *S. macrophylla*, *Khaya nyasica*, *K. senegalensis*, *Cedrela mexicana*, *Eucalyptus saligna*, *Casuarina equisetifolia*.

Dominica

The total area of this island is 75,000 ha. The area of forest land is 35,000 ha and the area of commercial forest 29,000 ha. The man-made forest covers 120 ha of which 10 ha was planted in 1972. (W.W.).

Domenican RepublicNatural forest land

A distribution of the total land area according to the so-called Holdridge system gives the following areas:

Life zone	Area, ha
Subtropical thorn woodland	100,100
Dry subtropical forest	996,200
Moist subtropical forest	2,279,400
Wet subtropical forest	683,400
Subtropical rainforest	5,600
Low montane moist forest	348,000
Low montane wet forest	357,700
Low montane rainforest	3,600
Montane wet forest	300,300
Total land area	5,074,300 a)

a) 4,873,000 ha according to FAO Production Yearbook 1971.

The total forest area is given as 1.1 million ha. Of the 2,355,800 ha covered by a FAO forest inventory, 994,700 ha was classified as forest and 101,900 ha as other forested area. Several different breakdowns of the forest area have been done. They do not always cover exactly the same area.

The breakdown in vegetation types is as follows:

Vegetation type	Area, 1000 ha
Pine ( <i>P. occidentalis</i> )	206
Mixed	128
Humid broadleaved	480
Dry broadleaved	166
Mangrove	9
Total	990

The area with productive forest is given as 784,000 ha of which 99,000 ha has already been exploited.

Man-made forests

At the end of 1965 1,500 ha were planted. In 1972 the area was said to be 4,200 ha of which 1,200 ha should have been planted in 1972. (W.W.).

## Inventories

The FAO inventory gave the following information about standing volumes:

Type of wood	Standing volume, 1000 m <sup>3</sup>
Industrial wood	11,860
Pine	4,860
Broadleaved	7,000
Charcoal wood (broadleaved)	10,300
Total	22,160

It is not known exactly to which area these volumes refer. The industrial volume seems to be given for an area of 480,000 ha of accessible forests. Fuelwood may have been calculated for an additional area of 188,000 ha. The volume of industrial wood is probably given for trees above 20 cm d.b.h.

The figures show that the forests are low stocked - about 30-40 m<sup>3</sup>/ha. This probably means that at least parts of the forest are degraded.

## El Salvador

### Natural forest land

Of the total land area of 2,031,000 ha about 0.26mill.ha is given as forest. An evaluation of the forests undertaken around 1960 gave the following result:

Woodland type	Area 1000 ha	Standing volume, 1000 m <sup>3</sup>
Pine	28	1,450
Peobles a) mixtas con pin- ares (mixed with pine)	-	175
Saline forests	29	2,800
Other forests	148	27,500
Coffee forests	140	6,900
Natural grasslands with trees	950	11,875
Total	1,295	50,700

a) May be roble (oak).

Important species in the north are *Pinus occarpa*, *P. pseudostrobus*, *P. rudis*, and *Cypressus lusitanica*.

Along the coast is found *Rhizophora mangle*, *Langucularia racemosa*, *Avicennia nitida* and *Conocarpus erecta*.

It is not known whether any plantations exist.

### Inventories

Some minor inventories have been undertaken. A FAO project has recently inventoried an area of 11,850 ha. The commercial volume in the closed forest in this area was 18 m<sup>3</sup>/ha (volume above 15 cm d.b.h.). Of this volume 73 percent was coniferous.

### Guadeloupe

The total area is 178,000 ha and the area of forest land 60,000 ha. The commercial forest covers 30,000 ha. Man-made forest covers 2,800 ha of which 150 ha was planted in 1972. (W.W.) The main species are *Dacryodes excelsa*, *Amanoa caribaea*, *Licanjia ternatensis* and *Simuraba amara*.

A large part of the forest is xerophyte or, at higher altitudes, a stunted forest without commercial value.

### Guatemala

#### Natural forest land

An area of 5,350,000 ha is reported to be forested, another 1.2 million ha given as brush land. Of the total forest area one million ha is said to be coniferous forest. The volume in these pine forests is estimated to be 30 million m<sup>3</sup>. The pine species are *Pinus occarpa*, *P. caribaea*, *P. pseudostrobus*, *P. montezumae* and *P. ayacahuite*.

It is evident that very little is known about the forests in many parts of Guatemala.

The area of man-made forest was about 1,000 ha in 1965.

### Inventories

#### A. Inventory in El Petén:

The inventory covered 3,739,900 ha. Of this area 3.6 million ha is forest. The total gross volume in this area is 468 million m<sup>3</sup>. Gross volume per ha for all species is estimated to be 45-155 m<sup>3</sup> and of known merchantable species 5-25 m<sup>3</sup>/ha. The volumes given include bark and all species above 10 cm d.b.h.

## B. Inventory of De Salama:

The inventory covered 45,000 ha of pine forests. Total volume without bark above the minimum diameter 10 cm d.b.h. was 3,336,000 m<sup>3</sup>.

C. Certain other inventories have been undertaken by private companies.

## Haiti

### Forest land

A twenty year old estimate gives the following information about the area of different types of forests:

Vegetation type	Area, 1000 ha
Pine forest ( <i>P. occidentalis</i> )	75
Broadleaved humid forest	25
Broadleaved dry forest	100
Total	200

According to a forestry expert who has recently visited Haiti nearly all of these natural forests have disappeared. Only some scattered stands remain. His "guesstimate" was that only 10,000 ha of forest was left.

The area covered by man-made forest is reported to be 300 ha.

## Honduras

### Forest land

An area of 7,049,000 ha is covered with forest. This area is composed of the following types:

Forest type	Area, ha
Pine forests. Low density	802,300 a)
Pine forests. High density	1,936,500
Broadleaved forests	4,072,200
Mangrove and swamp forests	297,800
Total	7,108,000

a) Certain areas unstocked.



Two main pine species occur. *P. caribaea* from sea level to 900 m. and *P. occarpa* as the most common from 600 - 1,700 m. The pine forests include everything from pine savanna to dense stands and from pure pine to pine forests mixed with broadleaved. The broadleaved forests are found mainly in the eastern part of the country while the pine forests are concentrated in the west.

Existing plantations are very small.

### Inventories

An inventory of 2,150,000 ha of pine forests has been undertaken. Total gross volume is 134 million m<sup>3</sup> without bark (volume of all trees above 15 cm d.b.h.). The maximum annual yield should be 6 million m<sup>3</sup>.

### Jamaica

#### Natural forest land

The area of forest land is given as 267,000 ha. Well-stocked broadleaved natural forest occupies 77,000 ha while "temporarily unstocked forest" occupies 186,000 ha. In addition there are 230,000 ha of other wooded land (scrub forest). The forest reserves cover 109,000 ha.

The following forest types can be identified:

- a) Dry limestone scrub forest: This type has little forest potential.
- b) Wet limestone forest: Still fairly well-stocked stands of important hardwood species.
- c) Lower montane forest: Potentially most productive for forest plantations.
- d) Montane sclerophyll forest: Consists of scrub species.

#### Man-made forests

The total area of plantations is (or was) around 6,000 ha. *Pinus caribaea*, *Hibiscus elatus*, and *Swietenia macrophylla* being the main species. On the whole of the island there should be another 47,000 ha suitable for planting.

A more recent estimate of unknown accuracy gives the total area planted as 11,500 ha. Of this area 7,800 ha should be teak and 3,200 ha pine.

### Inventories

A forest inventory of certain areas has been undertaken by



the UNDP/SF Project No. 307/Jam 5.

Result:

Area (natural forest)	40,604 ha
Volume (sawlog)	2,386,000 m <sup>3</sup>
Gross volume (natural forest)	5,196,000 m <sup>3</sup>
Gross volume (man-made forest)	230,000 m <sup>3</sup>

The increment in plantations is calculated as follows:

Species	m <sup>3</sup> /ha/year
Pinus patula	11
Pinus caribaea	11
Eucalyptus saligna	9

## Mexico

### Natural forest land

The forest cover of Mexico is closely associated with the topography. At sea level along the coasts, and on the peninsula of Yucatan, tropical broadleaved forests are found. In the tropical forests 300 species are found. The main species are caoba (*Swietenia macrophylla*), cedro (*Cedrela mexicana*), bari (*Calophyllum brasiliense*), chacá (*Bursera simaruba*). The Yucatan peninsula has a very high concentration of caoba and cedro.

The Cordillera or mountainous region is covered by open stands of many species of pine. In the pine forests 42 species and 8 varieties have been found. The Cordillera has pure pine above 2,000 m and a mixture of oak, pine, and juniper below 2,000 m.

Most of the country is an arid and semi-arid plateau with typical xerophytic vegetation (Chapparal). Chapparal is the name for "Chaparillo" (low thorn scrub), grasslands with shrubs, and grasslands with oak and juniper.

The total wooded area is 40 million ha. Of this 29 million ha can be useful. The breakdown in vegetation types is as follows:

Vegetation type	Area, million ha
Coniferous forests	15
Temperate broadleaved forests	3
Tropical broadleaved forests	11
Chapparal	10
Total	39

Man-made forests

At the end of 1967 the following areas of plantations were reported:

Species	Area, 1000 ha
Pines	10
Eucalyptus	20
Other broadleaved species	20
Total	50 <sup>a)</sup>

a) In 1973 World Wood reported the planted area to be only 5,700 ha.

The main species are Eucalyptus spp, Pinus spp, Acacia spp, Fraxinus spp, Jacaranda mimosifolia.

Inventories

## A. Inventory in Chichuahya, Durango, Sonora.

The total area mapped was 19.6 million ha of which 16.5 million ha was forest. The coniferous area of 8.6 million ha was covered by an inventory. The total gross volume in this area was 540 million m<sup>3</sup> (volume with bark, all trees above 12.5 cm d.b.h.).

## B. Inventory in Baja California.

The total area studied was 605,000 ha. Of this area 86,550<sub>3</sub> ha were coniferous. The total gross volume was 8 million m<sup>3</sup> (volume with bark, all trees above 12.5 cm d.b.h.).

## C. Inventory in Michoacán.

Of the 2,173,102 ha studied around 914,000 ha was forest. The total gross volume in this area was 83 million m<sup>3</sup>.

## D. In 1973 the first National forest inventory will be finalized.

## National estimates:

In coniferous forests the average volume is 75 m<sup>3</sup>/ha. Most trees are found in the size class 30-60 cm d.b.h. The annual cutting capacity in coniferous forests is 21 million m<sup>3</sup>.

In broadleaved forests the annual cutting capacity has been estimated to be 3 million m<sup>3</sup>. In these forests only 20 of about 300 species are utilized.

NicaraguaNatural forest land

The total forest area is given as 6.4 million ha. The following types seem to be important:

Forest type	Area, million ha
Tropical rainforests	5
Forest area east of central mountain	0.75
Pine forests	0.65
Total	6.4

The Pacific region has relatively dry forests where the reserves of workable timber are nearing exhaustion. The north central region contains low mountain forest including stands of *P. occarpa*. The pine forests are mainly situated in the north-eastern part of the country. It is a savanna area with more or less open stands of pine (*Pinus caribaea*). This area has been heavily exploited. Ninety percent of the savanna is burned every year.

Inventories

A. Inventory of pine forest in north-east covered 300,000 ha. Total gross volume of pine is 5.6 million m<sup>3</sup> (volume without bark, minimum diameter 14 cm d.b.h.).

B. Broadleaved forests cover one million ha in the area of FAO/SF Project Nicaragua 2. Small inventories have been undertaken in this area. More than 130 species have been identified. Average volume per ha is 40-170 m<sup>3</sup> (volume without bark, all species above 10 cm d.b.h.).

Area distribution:

Forest type	Area 1000 ha	Commercial volume m <sup>3</sup> /ha
Mountain forest	200	150
Lowland forest	500	100
Gallery forest	100	60
Transition to savanna	9	35
Secondary forest	80	..

C. A recent inventory of 100,556 ha with broadleaved forest showed a gross volume of 17.3 million m<sup>3</sup> (all trees above 40 cm d.b.h.) of which 2,685,000 m<sup>3</sup> is of commercial value (18 species).

Other

- 1) Lots of shifting cultivation seems to occur in the country.
- 2) Mahogany is the most valuable timber.
- 3) The plantations are very small.

PanamaNatural forest land

The total forest area is 4,081,600 ha. The following forest regions can be identified:

## A. The Atlantic forest region:

This region of tropical rainforest occupies 1/3 of the land area. It covers the entire Caribbean slope up to the ridge and from Costa Rica to the Colombian border.

## B. The Pacific forest region:

This region covers 50 percent of the land area. Large areas are covered by savanna. In the mountains forests vary from evergreen to deciduous. Almost complete conversion of the forests to agriculture has occurred.

## C. The tropical highlands forest region:

This is found near the Costa Rica border and in higher mountains close to Colombia. The forest is evergreen.

The present forest area is classified as follows (groups according to the Holdridge system):

Life zone	Area, ha
1. Dry tropical forest and dry premontane forest	18,000
2. Moist tropical forests and wet premontane forest	1,951,900
3. Wet tropical forests	1,339,200
4. Moist premontane forest	18,800
5. Premontane rainforest	577,400
6. Low montane moist forest	-
7. Low montane wet forest	5,500
8. Low montane rainforest	150,100
9. Montane wet forest	-
10. Montane rainforest	20,700
Total	4,081,600

Man-made forests

The area of man-made forests is reported to be 4,000 ha. The total gross volume is given as 230,000 m<sup>3</sup>. This is distributed between the following species:

Species	% of volume
Pinus caribaea	37
Mahoe	34
Pinus patula	9
Eucalyptus saligna	6
Tectona grandis	5
Total	91

Inventories

A. Inventory of all forests east of the Canal Zone. The area covered was 2.7 million ha, of which 80 percent was forest. The gross volume was 350 million m<sup>3</sup> (volume without bark, all trees above 45 cm d.b.h.). Thirteen species with 15 percent of the volume are utilized. 114 species make up 51 percent of the volume.

B. UNDP/SF No. 234 PAN 6 has done an inventory of 187,000 ha in the Donoso district. Of this area 153,000 ha was forest. Total standing timber per ha was 127 m<sup>3</sup> and the number of trees per ha 486 (all species above 10 cm d.b.h., volume without bark).

C. The same project has done an inventory of 129,610 ha in Azuero:

Dense stands	250-300 m <sup>3</sup> /ha
Stands with low density	100-150 "

28 million m<sup>3</sup> of sawnwood is to be found in this area.

D. An evaluation of the volume in all the forests has been done. In this study the forests in Azuero, Donoso, Camarca de San Blas, Canal zone, and The isle of Coiba have been excluded.

The results are summarized below. Note that the numbers refer to the same Holdridge life zones as described before.

Life zone	Area ha	Mean volume, m <sup>3</sup> /ha a)	Total volume 1000 m <sup>3</sup> a)
1	17,960	74.0	1,329
2	1,923,661	129.3	248,723
3	1,117,950	107.6	120,272

Life zone	Area ha	Mean volume, m <sup>3</sup> /ha a)	Total volume 1000 m <sup>3</sup> a)
4	18,850	94.9	1,789
5	545,550	66.2	36,122
7	5,400	41.1	222
8	149,200	86.6	12,925
10	20,700	84.7	1,754
Total	3,799,271	111.4	423,136

a) Minimum diameter 40 cm d.b.h.

### Other

The total number of tree species in Panama is estimated to be 2,000.

### Puerto Rico

Of a total of 890,000 ha an area of 155,000 ha is covered by forest. The commercial forest area is 24,000 ha and the area of reserved forest is 36,000 ha. Man-made forests cover an area of 9,600 ha. In 1972 155 ha was planted. (W.W.).

### St Lucia

Of the total area of 61,000 ha about 13,000 ha is classified as forest land. The commercial forest area is 6,600 ha. The area of man-made forests is 400 ha. In 1972 an area of 20 ha had been planted. (W.W.).

### St Vincent

Of a total area of 34,000 ha about 14,000 ha is given as forest land. The commercial forest area is estimated to be 1,200 ha. The area of man-made forest is 85 ha. (W.W.)

### Trinidad and Tobago

#### Natural forest land

Of the total land area of 513,000 ha about 235,000 ha is state - owned forest.

On Trinidad forest reserves occupy	139,000 ha
" Tobago           "           "           "	4,000 "

Forest areas that are not reserved are decreasing rapidly.

In the lowland centre and south the forests vary from evergreen to semideciduous. On the northern hills evergreen rainforest predominates.

#### Man-made forests

According to the 1971 annual report teak plantations cover 7,650 ha, pines (*Pinus caribaea*) 3,450 ha, and local species 530 ha. Another source (W.W.) gives the area planted in 1972 as 485 ha.

## FOREST RESOURCES OF SOUTH AMERICA

### Argentina

#### Natural forest land

The natural vegetation (of forestry interest) can briefly be described as follows:

##### A. Eastern subtropical region (Selva misionera):

This is a subtropical rainforest covering about 2,150,000 ha. Outstanding for the number and value of its tree species, it supplies nearly half of the domestic timber, although only 20 percent of its tree species are logged. The stands are heterogeneous and up to 100 species have been counted per ha.

##### B. Western subtropical region (Selva Tucumano - Boliviano):

This is a narrow strip stretching through the province of Tucuman - an area of approximately 2.6 million ha. It is a mountainous region with trees reaching up to 2,000-2,500 m above sea level. The physiognomy is very similar to that described above. An UNDP/FAO Project are just now investigating the potential of this region.

##### C. Sub-antarctic region (Bosques Sub-Antarcticos):

These forests are found in the Andean mountains from the Fire land halfway up the country. Nothofagus and Araucaria are among the main genera. The productive area is reported to be 2.25 million ha (of which 1.6 million ha is timber forest).

##### D. Gallery forest:

This type is mainly found along the rivers Paraná, Uruguay and Paraguay. It consists of evergreen trees normally with a height of 15-20 m, but it has probably disappeared to a large extent.

##### E. Gran Chaco Woodlands (Parque Chaqueño):

The total area is around 27 million ha. The eastern part is humid while the western is arid. The vegetation is consequently different in these two parts. It is a dry forest although quite varied, certain parts have blocks of forest surrounded by large open areas where grasses dominate. The trees reach a height of about 20 m.

##### F. Open woodland types of some forestry interest are:

Northern Mesopotamic forest park	1.5 million ha
Southern Mesopotamic forest park	1.87 " "
Western mountain region (Monte Occidental)	1.96 " "



According to an estimate from 1956 the following areas of some forestry interest should exist:

Type of forest land	Area million ha
Productive forests	39
Forests with sawtimber	27
Forests with fuelwood	12
Unproductive forests	21
Total	60

The "productive" forests can be described as follows:

Vegetation types	Area million ha	Gross volume m <sup>3</sup> /ha
<u>Forest:</u>		
Eastern subtropical	2.15	250
Western subtropical	2.6	200
Sub-antarctic	2.25	150
Gallery forest	..	..
<u>Open woodland</u>		
Gran Chaco woodlands	27.0	30
Mesopotamic forest park, north	1.5	25
Mesopotanic forest park, south	1.87	20
Monte Occidental	1.95	10

According to one estimate (W.W.) the total commercial volume should be 450 million m<sup>3</sup>.

#### Man-made forests

Plantations were started in the 1940:s and now (1972) the planted areas are:

Species	Area, 1000 ha
Populus	75
Salix	75
Eucalyptus	75
Araucaria angustifolia	33
Pinus	62
Other spp.	5
Total	325

The total volume in Eucalyptus plantations is estimated to be 5.6 million m<sup>3</sup>.

The plans are to plant 30 - 35,000 ha annually between 1970 and 1974, mostly coniferous. In 1971 45,000 ha should, according to World Wood, have been planted.

### Inventories

- A. Management plan inventories cover about 500,000 ha in different parts of the country. In all 300 - 350 inventories have been carried out.
- B. 100,000 ha of plantations have been inventoried by photo interpretation in the Paraná delta. Inventory work of this type has also been undertaken in the province of Entre Rios.
- C. An UNDP/FAO Project is presently making inventories of extensive areas in the Western subtropical region. The only result available so far is from an inventory of 295,000 ha "productive forest" in the Chaco. The number of trees above 10 cm d.b.h. is 167 per ha. The commercial volume per ha is 34.8 m<sup>3</sup> (above 10 cm d.b.h.). Of this volume 23.2 m<sup>3</sup>/ha is quebracho.

### Other

- 1) Fifty percent of the forests are privately owned and 50 percent publicly owned. Public means that the forests belong to the provinces. For historical reasons most forests in the "old states" in the north-west have private forests while the "new states" in the north-east mostly have public forests. In the south all forests are publicly owned.
- 2) There are about 500,000 ha of concessions in public forests.
- 3) Tannin from quebracho (*Schinopsis balansae*) makes up 95 percent of the export of forestry products. This tree grows in Gran Chaco.

## Bolivia

### Natural forest land

The prevalent figure available concerning the area of forest is an estimate from 1938 which states that the forest area is 47.3 million ha. A more recent figure found in World Wood gives the "commercial forest area" as 10.2 million ha.

A recent map showing distribution of commercial forests gives - after a crude dot counting - the following area for the different forest types. Note that the forest types are described according to the main commercial species:

Forest type	Area, 1000 ha
1. Genuine mahogany, Spanish cedar, Cordia alliodora	27,350
2. True walnut, Podocarpus spp.	3,950
3. Guayacan, Tabebuia	4,060
4. Quebracho blanco, Piptadenia spp, Astronium urundeuva	6,150
5. Hura crepitans, Ocotea spp, Nec- tandra spp, Calophyllum spp.	4,940
6. Schinopsis lorentzii	3,190
7. Coulteria tinctoria	550
Total	(50,000)

Some information has been found concerning certain different vegetation types (the names refer to a phytogeographic map by Lucio Arce):

- A. Evergreen tropical rainforest (Hylea Amazonica) occupies an area of approximately 17.9 million ha in the northern part of the country. Gross volume per ha estimated to be 107-143 m<sup>3</sup>.
- B. Yungas is a subtropical to subhumid formation situated on the eastern part of the Andes. Gross volume per ha is 99-165 m<sup>3</sup>.
- C. Chaco has a dry tropical climate. The vegetation is xerophytic or semi-xerophytic and composed of trees and shrubs.
- D. Valles mesotermicos has a dry temperate climate.
- E. Sabanas de Santa Cruz is a subhumid formation.
- F. Pampas aluviales de mojos is a formation of subhumid to humid tropical savanna having large areas covered with grass vegetation interrupted by islands of semi-xerophytic tree vegetation. The area is estimated to be 13.5 million ha.
- G. Formation Guaraya Chiquitera consists of subtropical and subhumid savanna formations. Most forests do not form islands but are associated with Grammineous. Moreover there are considerable areas covered with grass.
- H. Grassland of San Matias is natural grasslands interrupted only by islands of palms which generally occupy the higher parts.
- I. Hylea del Alto Paraguay has a dry tropical climate. Gross volume per ha is 26-41 m<sup>3</sup>.

#### Man-made forests

Foresters with local experience have given a "guesstimate" of 5-7,000 ha, other sources give as much as 24,000 ha. These plantations are situated around La Paz and in the Andean valleys.

Small areas are also to be found on the Altiplano. Most of these plantations are *Eucalyptus globulus*.

There are plans to plant another 8,000 ha around La Paz. Re-forestations are also planned in the Santa Cruz and Cochabamba area.

### Inventories

13 different inventories cover in all 900,000 ha in different parts of the country. The volume figures reported seem to be very low.

### Other

- 1) The main exploitation at present is around Santa Cruz, where there are 350,000 ha under contract for cutting. In these licenced areas there is estimated to be 950,000 m<sup>3</sup> of exploitable wood - mainly mahogany.
- 2) Perhaps 200-240,000 m<sup>3</sup> of timber is exploited each year.
- 3) One estimate gives the commercial forest volume as 600 million m<sup>3</sup> (W.W.).

### Brazil

#### Natural forest land

Brazil has enormous resources of natural forests but their composition and extent are evidently not known.

The Amazon basin is covered by enormous areas of tropical rain-forest. There are also rainforests along the south-eastern coast. Araucaria-forests are still found in the south - mainly in the Parana-state. The remaining parts of the country are mainly covered by open woodland (cerrado) and grasslands. In the north-east there are dry scrub areas (caatingas).

The area of these different "forest" types have been estimated as follows:

Forest type	Forest area Estimate 1972 million ha	Growing stock Estimate 1972 million m <sup>3</sup>	Forest area Estimate 1970 million ha
Amazon basin rain-forest	260	65,000	(350)
Araucaria Class I	0.2	(	(
" " II	6.6	( 215	( (3)
East coast rain-forest	30	7,500	(5)
Cerrado (open woodland)	80	1,600	(175)
Total	358	74,315	(358) <sup>a)</sup>

a) This was the area given as forest.

A very recent estimate gives the area of pure forest in the Amazon as 200 million ha (275 million ha if including water etc). Total growing stock above 40 cm d.b.h. should be roughly 40,000 million m<sup>3</sup> of which 8,000 million m<sup>3</sup> commercial (commercial volume is the volume of species which are now or, in the near future can be expected to be marketable).

#### Man-made forest

A very intense planting activity is presently going on in Brazil. In 1972 the following plantations were reported to exist:

State	Species	
	Pine 1000 ha	Eucalyptus
São Paulo	123	520
Paraná, Santa Catarina	175	186
Rio Grande do Sul	45	135 <sup>a)</sup>
Minas Gerais-Belgo-Mineira	-	85
-Triangulo Mineira	25	28
Espirito Santo	-	25
Amapá	-	10 <sup>b)</sup>
Total	368	983

a) Acacia  
b) Gmelina

#### Planting schedule:

250,000 ha in 1972  
300,000 ha in 1973

Half a million ha shall have been planted since the present planting programme started (around 1965). Half of this area is pine, the rest Eucalyptus.

#### Inventories

A lot of inventory work has gone on in Brazil over the years. Certain results and other estimates for different regions are given below. The figures do not always correspond with the ones given under Natural forest land.

#### A. Paraná pine region:

##### General estimates for the whole region:

Original forest area	7 million ha
Present forest area (1963)	3 million ha
Estimated gross volume	240 million m <sup>3</sup>
" " "	80 m <sup>3</sup> /ha
Estimated volume of sawtimber	90 million m <sup>3</sup>
" " " "	30 m <sup>3</sup> /ha

## Inventory results:

An area of 7 million ha was inventoried in 1963. The main results are given below:

Forest type	Area, ha	Gross volume <sup>a)</sup> m <sup>3</sup> /ha	Number of trees per ha	Increment m <sup>3</sup> /ha/year
Araucaria forest type 1b)	216,110	251	48 <sup>±</sup> 7	2.13
Araucaria forest type 2 <sup>c)</sup>	1,351,650	74	19 <sup>±</sup> 7	0.77
Tropical and subtropical forest	1,082,753	..	..	..

a) Gross volume without bark. All trees above 20 cm d.b.h.

b) Untouched forest

c) Exploited forest

In 1963 the annual cut was 4 million m<sup>3</sup> while total increment was calculated to 1.4 million m<sup>3</sup>. As exploitation was going on - mainly in Araucaria forest type 1 - it is unlikely that there is much left of this type.

## B. Inventory of Parana pine in Santa Catarina

The forest area inventoried was 61,000 ha. Four different forest types were recognised. The volume per ha was 132 m<sup>3</sup> in the best forest type while in the most poorly stocked type it was 18 m<sup>3</sup> (gross volume without bark, minimum diameter 20 cm d.b.h.).

## C. East coast:

The forests in this region should cover 5 million ha (30 million ha according to 1972 estimate). These forests are reported to be just about completely logged for valuable species. They are now mainly necessary for protection. Many different types of forests are found in this region. Different rainforest types developed due to differences in altitude and rainfall. In rain shelters behind the mountains dry forest and Campos Cerrados (open woodland) are found with gallery forest along the rivers. Along the coast mangrove is found. The table below give the percentage of forest cover in the different states.

State	Forest cover, %	
	In 1965	Original coverage
Rio Grande do Norte	12	25
Paraiba	1	40
Pernambuco	14	35
Alagoas	10	35
Sergipe	9	40



An inventory of 20,000 ha gave a gross volume of  $187 \text{ m}^3$  without bark per ha (all species above 20 cm d.b.h.).

Brazilian estimates give a total gross volume of  $300 \text{ m}^3/\text{ha}$  while the sawtimber volume is given as  $200 \text{ m}^3/\text{ha}$ . The latter figure sounds very high.

#### D. Amazonas:

General information for the whole region:

Mangrove forest is found along the coast. Marshland forest, which is periodically flooded, occurs along rivers. Dry land forest grows on relatively high land beyond the reach of the floods. Swamp forest grows on land which is generally subject to inundation, but it also grows on firm land which, being lower than the adjacent land, retains the water of the tides or rains owing to lack of drainage. A lot of sub-types of tropical rainforest can be identified.

Total area in the so-called Amazon region is 490 million ha. The forest area has recently been estimated from 200 million ha to 350 million ha (a very rough estimate).

Brazilian estimates give a gross volume of  $350 \text{ m}^3/\text{ha}$  (of which  $280 \text{ m}^3/\text{ha}$  could be used for sawnwood). This latter figure must be too high.

Knowles, who has written a FAO report dealing with the utilization of the Amazon forest, provides the following information which he has gleaned from different sources:

- a) Equatorial forests are said to cover 260 million ha.
- b) There are about 1,000 trees of 5 cm d.b.h. or over at breast height per ha, representing about 100 individual species. Above 25 cm d.b.h. there are 100-200 trees per ha.
- c) About 40 trees of commercial size (45 cm d.b.h. or over) with a standing volume of roughly  $150 \text{ m}^3$  are found per ha: of these, only 10 trees with a standing volume of about  $45 \text{ m}^3$  per ha are of the "presently commercial" species.
- d) The standing volume of timber in all trees of all species of 25 cm d.b.h. and over is conservatively calculated at  $200 \text{ m}^3$  per ha.
- e) The forest as a whole is a mosaic of many individual forest "types", varying in composition even within comparatively short distances.
- f) 400 species with a diameter above 25 cm d.b.h. have been identified in inventories.

#### Inventory results:

Inventories of in all 20 million ha have been undertaken in the lower Amazon valley. 24 forest types were distinguished in these inventories. The types are characterized by the number

of certain species. These forest types are given in the table to show the variation in different types of forest. The names of the different inventory regions have been underlined in the table.

Forest type (and inventory region)	Gross volume <sup>a)</sup> m <sup>3</sup> /ha	Area ha		No. of trees per ha
		Total area	Forest area	
<u>Tapajos - Rio Madeira</u>		4,335,500	3,500,000	
Canhuma	164	..	..	..
Manés	169	..	..	..
Arapiums	146	..	..	..
<u>Tapajos - Rio Xingue</u>		2,000,000	1,500,000	
Planalto I	227	..	..	..
Flanco I	111-167	..	..	..
Planalto II	233	..	..	..
Planalto II Baixo	104	..	..	..
Planalto II Baixo Ci- poal	104	..	..	..
Flanco II	148	..	..	..
<u>Xingu - Rio Tocantins</u>		3,009,000	1,800,000	
Caxuana	271	..	..	..
Portal	228	..	..	..
Cameta-oeste	192	..	..	..
<u>Tocantins Guana-Capim</u>		4,629,600	3,300,000	
Belém-sul	210	..	..	..
Acarã	217	..	..	..
Capim	124	..	..	..
<u>Belem - Brasilia</u>				
Sant'Anna	153	..	..	106
Candira	192	..	..	124
Médio Guamã	161	..	..	108
Alto Guamã	121	..	..	94
Ligaçao	138	..	..	101
<u>Rio Cacte - Rio Mara- cassume</u>		..	444,800	
Piriá	161	..	..	..
Curupá	131	..	..	..
Maracassumê	122	..	..	..
<u>Belem - Brasilia</u>				
Aqailândia	62	..	..	51

a) Gross volume without bark and for all species above 25 cm d.b.h.

ChileForest land

The WFI 1963 gives an area of 20,686,000 ha as forest land. Figures of about this order are also found in many other publications. The area includes all types of land. How much really is forest is not exactly known and several different estimates have been done. One estimate is that 5-6 million ha has some form of wooded cover but that only one million ha of this would be worth exploiting, and of this one million ha only a minor part is thought to be accessible. Most of the accessible natural forest has already been overcut.

A recent report says however that 4,705,563<sub>3</sub> ha is potentially productive with a volume of 1,000 million m<sup>3</sup> without bark (200 m<sup>3</sup>/ha). A second paper gives the following figures:

Type of forest land	Area, 1000 ha	Gross volume <sup>a)</sup> million m <sup>3</sup>
Forest land:	20,443	..
A. Accessible	10,077	..
of which forest	5,742	..
1. Exploitable	4,742	..
a) Coniferous	532	136
i. Plantations	290	(60)
ii. Natural	242	(76)
b) Broadleaved	1,119	1,102
c) Mixed	3,055	..
2. Inexploitable	1,010	..
B. Inaccessible	10,366	..
of which forest	800	..

a) All trees above 12.5 cm d.b.h. in natural forests and above 10 cm d.b.h. in plantations.

b) The gross volumes given for an area of 4,641,000 ha (exploitable forests).

c) Included in coniferous and broadleaved.

It is difficult to give a good description of the natural forests in Chile as the vegetation is rather heterogeneous and difficult to classify.

Hueck gives the following types in his book "Die Wälder Süd-amerikas":

- a) Subtropical "hardleaf" and dry forests
- b) Valdivia rainforests
- c) Nothofagus obliqua and Nothofagus procera forest
- d) Araucaria and Libocedrus forest
- e) Evergreen forests in Patagonia and Magalhaes
- f) Deciduous forests in Patagonia and Magalhaes
- g) Subantarctic tundra

The main species are *Nothofagus dombeyi*, *N. obliqua*, *N. procera*, *Laurelia philippiana*, *L. sempervirens*, *Eucryptia cordifolia*, *Weinmannia trichosperma*, *Persea lingue*, *Fitzroya cupressoides*, *N. alpina*, and *Araucaria araucana*.

### Man-made forests

The following different estimates have been found:

Year of estimate	Area, 1000 ha
1966	331
1970	336
1972	440

The present (1970) planting rate reported to be 10 - 12,000 ha annually. There are plans to plant 3 million ha in a 20 year period.

### Result of the 1966 inventory of plantations:

#### A. Area and volume per province:

Province	Area planted, ha	Gross volume <sup>a)</sup> , m <sup>3</sup>
Arauco	35,574	9,301,133
Bio-Bio	37,699	6,853,447
Cautin	7,821	1,913,921
Concepción	87,642	20,708,854
Linares	4,716	1,059,710
Malleco	24,368	4,776,408
Maule	50,503	10,923,406
Nuble	29,621	6,630,008
Coquimbo	620	-
Aconcagua	715	26,867
Valparaiso	15,847	1,367,790
Santiago	9,870	227,737
O'Higgins	2,617	-
Colchagua	4,627	348,902
Curicó	4,710	240,223
Talca	4,035	225,668
Valdivia	8,681	2,009,836
Osorno	1,291	315,015
Llanquihue	448	138,351
Total	331,405	67,067,306

a) Gross volume given without bark. All trees above 10 cm d.b.h.

## B. Species distribution:

Species	Area, ha
Pinus radiata	293,642
Eucalyptus spp.	31,052
Populus spp.	2,562
Other spp.	4,149
Total	311,405

## C. Age classes of Pinus radiata:

Age class, years	Area, ha
1-5	24,172
6-10	63,103
11-15	96,252
16-20	75,556
21-25	29,138
26-30	4,500
31+	921

Inventories

In Chile 13 relatively small inventories have been undertaken (in 1970). These inventories are mostly of plantations, while only relatively small inventories have been undertaken in the native forests. In all, 520,000 ha have been inventoried.

ColombiaNatural forest land

According to one estimate 45 percent of the land area is covered by forests. The breakdown of forest land in different categories looks as follows:

Type of forest land <sup>a)</sup>	Area, million ha
Area of natural forests and forest land	78
Area declared as reserved forests	70
Area covered by forests	50
Tropical forests	40
of which commercial forests	25
" " accessible forests	10

a) The definitions of the terms are unclear.

It is estimated by one source that 6,000 million  $m^3$  of commercial wood exists of which 2,000 million  $m^3$  is commercial at present (another source gives only 300 million  $m^3$ )

The actual forestry vegetation is shown on "Mapa Forestal de Bosques" from 1967. This map is largely based on aerial photographs. The map gives the following areas for different types:

Type of land	Area, ha
Primary forest	64,599,340
Secondary forest	2,982,490
Primary forest under destruction	2,549,300
Cardonal (Half desert vegetation)	521,700
Desert vegetation	506,000
Without trees	40,937,600
Eroded zones	1,018,900
Mangrove	501,300
Total	113,616,630

The area marked as forest on this map certainly include scattered areas of open land. Some of the areas shown as forest have actually been cleared.

The vegetation in different regions (or vegetation types) can be described as follows:

#### A. Amazonas:

The Amazonas region is covered by tropical broadleaved evergreen forests. This region is estimated to have an area of 38 million ha of forest. 13.5 million ha reported to be "commercial". The area is rather inaccessible at present and very little is actually known about the forests. There are estimated to be 2,500 different species of trees. The forest is dense and composed of large trees. The estimates of merchantable volume variates from 45 to 80  $m^3$ /ha.

#### B. The Pacific region:

This region of roughly 9 million ha along the Pacific coast and the Panamá border is covered by tropical broadleaved evergreen forests. It is the main productive area with an estimated 8 million ha of "commercial forest".

The area has high temperature, high humidity and high precipitation. The estimates of merchantable volume per ha variate from 90 to 190  $m^3$ /ha.

#### C. Middle Magdalena:

Tropical broadleaved evergreen forest cover this region. It is a heterogeneous forest with up to 80 species per ha.



The total forest area is estimated to be 1,760,000 ha, one million ha of which is reported to be commercial with an estimated 110 m<sup>3</sup>/ha of merchantable wood.

#### D. Serrania de los Motilones:

This too is a heterogeneous forest-mainly tropical broadleaved evergreen forest. The total forest area is estimated to be 3,590,000 ha, with an estimated 140 m<sup>3</sup>/ha of merchantable wood.

#### E. Temperate broadleaved evergreen forest:

This occupies the mountain slopes from 1,000 to 3,600 m. Many of its species are the same as in the tropical broadleaved evergreen forest. (Amazonas and Pacific). In addition there are Podocarpus, Quercus, Alnus and Salix. Large parts of this forest have been cleared.

This type is found in the Central Cordillera, Sierra Nevada de Santa Marta and Santa Nevada del Cocuy. The total area of this type is estimated to be 7-800,000 ha<sub>3</sub> and the merchantable volume per ha between 60 and 120 m<sup>3</sup>. In Sierra Nevada de Santa Marta (a mountain area) all vegetation types are found. A lot of destruction has occurred in the lower parts so that accessible forest is normally secondary and composed of non-merchantable species. There are still some relicts of Podocarpus.

#### F. Tropical broadleaved deciduous:

The remains of this type of forest is mainly situated within the Sinu San Jorge area and on the great plains of the Caribbean Sea and including the lower part of the Magdalena and Sinu rivers. It is found where there are distinct wet and dry seasons. The forests are usually open. The trees are usually shortboled but of large diameter. Although much of this forest type has been cleared, there is reported to remain an area of 700,000 ha.

#### G. Mangrove forest:

This forest occurs both along the Pacific and the Caribbean coast of Colombia.

#### H. Tropical dry scrub:

This type covers the north eastern corner of Colombia, especially the Guajiro Peninsula. The climate is dry throughout the year with a mean annual precipitation of 300-800 mm distributed in 18-56 days. The mean temperature is 29°C. The soil is sandy and arid with a vegetation of coarse grasses, bushy scrub or "deciduous thorn forest".

#### I. Grassland forests:

Between the rivers Guaviare, Arauca and Meta exist enormous areas of prairies or savannas. This is the so-called "llanos". Many channels, rivers, swamps and lagoons are found

in this area. Along the sides of the rivers and natural channels more or less broad belts of forest exist (gallery forests). The llanos is partly used for grazing.

#### J. Subtropical evergreen forests:

This type is very similar to the rainforest type and is found at the base of the Andes at 300-1000 m and in Sierra Nevada de Santa Marta. The density is lower than in the rainforest.

#### Man-made forests

Most of the plantations are situated in the Antioquia area. In all, around 40,000 ha is reported to have been planted. The plantations are mostly pines (*Pinus elliotti*, *P. radiata*, *P. taeda* and *P. caribaea*), *Cypressus*, *Eucalyptus* and *Tectona grandis*. According to the plans there will be 200,000 ha of mostly coniferous plantations by 1980. In 1972 5,000 ha should have been planted (W.W.).

#### Inventories

Several inventories have been carried out in different parts of Colombia. The following have been identified (in 1970):

Inventory	Area, ha
Serrania de San Lucas	576,010
Barbacoas	100,000
Terecita	50,000
Rio Carare	36,500
Norte del Departamento del Choco	861,500
Rio San Juan	290,690
Inventories in concession	500,000

#### Results from inventories:

##### A. Rio San Juan:

Inventory of 275,830 ha of forest. Volume information is given for 256,760 ha of exploitable forests. Gross volume in exploitable forests is 41.8 million m<sup>3</sup> (volume of 52 species, minimum diameter 30 cm d.b.h., bark excluded). Mean value of sawnwood 80.8 m<sup>3</sup>/ha.

##### B. North of Choco Department:

Inventory of 817,500 ha of forest.

Type of wood	Gross volume <sup>a)</sup> 1000 m <sup>3</sup>
Sawnwood	142,967
Pulpwood <sup>b)</sup>	28,767
Total	171,695

- a) Volume given for all species above 30 cm d.b.h. Bark probably excluded.  
 b) All species not suitable for sawnwood (?).

C. Serrania de San Lucas:

Total area inventoried	1,017,293 ha
Forest area	920,192 "
Commercial forest	576,010 "
Gross volume	65,114,000 m <sup>3</sup>
Industrial volume	38,399,000 "
Commercial volume	18,848,000 "

An attempt has been made to evaluate the areas of forests and the merchantable volume per ha in different regions. These results are given below:

Region	Forest area, 1000 ha	Merchantable volume, m <sup>3</sup> /ha
Caquetá <sup>a)</sup>	10,537	50
Amazonas <sup>a)</sup>	9,562	80
West Vaupés <sup>a)</sup>	12,412	45
East Vaupés <sup>a)</sup>	4,987	45
Rio Atrato <sup>b)</sup>	3,294	188
Pacífico <sup>b)</sup>	3,618	120
Nariño <sup>b)</sup>	2,088	90
Carare <sup>c)</sup>	1,760	110
Motilones	3,590	137
Central Cordillera	150	..
Sierra Nevada de Santa Marta	400	123
Sierra Nevada del Cocuy	200	60

a) Situated in the Amazonas region.

b) Situated in the Pacific region.

c) Situated in middle Magdalena.

Other

1) Shifting cultivation is a serious problem in many parts of the country. It has e.g. been estimated that 2.5 million ha disappeared over a 10 year period along the railroad Bogotá - Santa-Ana.

2) More than 90 percent of the forest area is publicly owned. For the time being some 100,000 ha/year are exploited in Colombia with a gross production of three million m<sup>3</sup>.

EcuadorNatural forest land

The total forest area is 18 million ha. Sometimes an area of 34.7 million ha is given as forest. In this is included 16.7 million ha in the so called "Region Oriental" which has been annexed by Peru but is still under dispute.

The mountains were once forested up to 4,000 m but are now deforested. The present forest is situated on both sides of the Andes.

The distribution between basic types is as follows:

Forest region	Area, million ha
Coastal	2.7
Mountainous	6.6
Amazonian	8.7
Total	18.0

A. The coastal forest mainly consists of wet tropical forests. There are also some areas with mangrove and dry tropical forest (sometimes savanna). The area of "yield forest" is said to be 1.7 million ha.

B. In the mountainous forests on the Andean slopes the area of "yield forests" is estimated to be 3.4 million ha. The remaining part of this forest is considered to be necessary for protective purposes. Shifting cultivation is a serious problem. In the low mountain forest the timber volume seldom exceeds 115 m<sup>3</sup>/ha. In the high mountain forest the volume per ha is low.

C. Very little is known about the Amazonian forests. Exploitation has recently started in the accessible areas along the eastern slopes of the Andes. At the present time there are only four roads to the Region Orientale. A large area along the Colombian border will be inventoried and opened up for exploitation. Two small reconnaissance surveys gave around 50 m<sup>3</sup> of "commercial wood" per ha (minimum diameter 30 cm d.b.h.)

Man-made forests

The estimated area of Eucalyptus was 45,000 ha in 1970. These plantations are mainly situated between Quito and Latacunga. The main species is E. globulus. From 1964-70 it was estimated that 9,000 ha had been planted. Trial plantations of Pinus radiata have been established on the slopes of Cotopaxi. In coming years 50,000 ha of pine plantations are planned to be established in this area. These plantations should give the raw material for a pulp mill.

### Inventories

A. Inventory of 822,663 ha have been undertaken in Esmeralda. The gross volume without bark of all trees above 10 cm d.b.h. was 104 million m<sup>3</sup>. In all, 500 species were identified. The number of trees per ha is, as a mean, 186.

B. Inventory in Guyas:

1) Eastern zone: In this zone 101,000 ha of forest have been inventoried. The total gross volume was 15 million m<sup>3</sup> (volume without bark, all species above 17.6 cm d.b.h.). The number of trees per ha was 142. In all 110 species were identified.

2) Western zone: In this zone 176,000 ha of forest have been inventoried. The total gross volume was 16 million m<sup>3</sup> (volume without bark, all species above 17.6 cm d.b.h.) The number of trees per ha was 172.

### Other

In 1970 13 concessions with an area of 581,367 ha existed in the coast region.

### French Guyana

#### Natural forest land

The total forest area is 8,646,000 ha. No detailed description of the vegetation types is available. 70,000 ha of mangrove along the coast and some savanna areas are reported to exist. Most of the rest of the country is occupied by tropical rain-forests, probably intermingled with certain areas of swamp forests. As the population density is very small the forests are quite undisturbed by human activities. Exploitation is quite difficult due to the lack of labour.

#### Man-made forests

In 1967 plantations in French Guyana and Antilles were reported to cover 2,650 ha, probably mostly on the islands. *Swietenia macrophylla* seems to be the most common species planted. In 1972 the planted area was said to be 160 ha (W.W.).

### Inventories

A 100 km wide zone along the coast has been inventoried. 1.5 million ha of forest is inventoried.

## Inventory results (volume above 40 cm d.b.h.):

Mineral grounds (Forest type)	Total gross volume, m <sup>3</sup> /ha	Commercial volume, m <sup>3</sup> /ha	Number of trees per ha
Paramaca	177	104	120
Ocapin-on poor soils	82	33	134
Granite Guyanese	113	36	..
Granite Cairbes	135	57	..

The volume above 60 cm d.b.h. of 6-7 commercial species is 10-45 m<sup>3</sup>/ha.

GuyanaNatural forest land

The forest area given as 18,230,000 ha. In FAO report No. 1762 the area of different vegetation types and regions are given as follows (cover total land area):

Vegetation type	Area, 1000 ha
Coastal strips	570
Swamp and marsh forest <sup>a)</sup>	530
Rainforest	7,600
Evergreen seasonal forest	1,530
Dry evergreen forest	4,270
Montane forest	4,750
Savanna	2,250
Total	21,500

a) Swamp forest occurs along rivers or in undrained sites which are usually waterlogged. Marsh forest occurs on sites subjected to seasonal drying.

The rainforest is very heterogeneous and has trees of small size.

Greenheart is the most important species and constitutes some 60 percent of the volume harvested. It will be exhausted within fifteen years. (?) Other important species are wallaba (*Eperua* spp) and purpleheart (*Peltogyne* spp).

Man-made forest

An area of 250 ha should be covered with plantations. In 1971 25 ha have been planted (W.W.).



## Inventories

Recently the whole country has been covered by reconnaissance surveys. The inventories identified are:

A. Reconnaissance survey of the more accessible forest areas in the northern part of the country: The inventory covered 4,920,000 ha. Thirty to forty percent of volumes are defective due to heart rot. Ten percent should be deducted as bark. Half of volume may consist of sound wood.

The average volume per ha of trees with d.b.h. above 25 cm is as follows:

Zone	Species groups, m <sup>3</sup> /ha		
	Dominant <sup>a)</sup> species	Other species	All species
1	98	119	217
2	77	105	182
3	119	77	196
4	98	91	189
5	56	77	133

a) 2.5 trees per ha (one tree per acre) with a diameter exceeding 40 cm d.b.h. over bark.

B. Reconnaissance survey of the southern part of Guyana: The inventory covered 10,100,000 ha. No volume information is given.

C. Inventory of the Ebini-Itaki area: The inventory covered 127,000 ha. The gross volume without bark was estimated to be 28,230,000 m<sup>3</sup> (all species above 25 cm d.b.h.).

D. Inventory of a selected area in the north-west districts: The inventory covered 73,800 ha. The volume of 5 enumerated species was 3,960,000 m<sup>3</sup> (volume without bark, minimum diameter 25 cm d.b.h.).

E. Inventory of 8,360,000 ha in Great Fall: Total gross volume of all species was estimated to be 183 m<sup>3</sup>/ha. Of this volume 12 m<sup>3</sup>/ha is greenheart.

## Other

Guyana timber companies take out only around 9 m<sup>3</sup>/ha in their exploitations. The situation tends to worsen as the most accessible stands become exploited. At the end of 1969 leases on state forest land covered 1,580,000 ha.

ParaguayNatural forest land

The forest area is often given as 21 million ha. In the eastern region there are around 8 million ha with tropical and subtropical forests. This region has a high rainfall and consists of gently rolling hills and flat plains between 300-600 m above sea level. The heterogeneity of these forests is a problem for exploitation. The most valuable species are *Cedrela fissilis*, *Cordia trichotoma*, *Mycocarpus frondosus*, *Tabebuia ipe* and *Pterogyne nitens*. Fellings have so far been concentrated on these species but the number of these species in virgin forests is low, about 3-4 per ha have a diameter of over 50 cm d.b.h. Only about one percent of the total growing stock is being used so far.

The region west of the River Paraguay is occupied by the Chaco. The Chaco area is said to have 13 million ha of forest. Part of the area seems to be occupied by savannas (forest-savanna mosaic), gallery forests and other dry vegetation types. It has therefore here been classified as open woodland, although part of it may be closed forests. Certain parts of the forests on the eastern part of the River Paraguay are also reported to be of open woodland type.

From the Chaco originates the quebracho (*Schinopsis balansae*), which provides tannin and a hard resistant wood used for sleepers, poles and posts. In areas where it is exploited this species has a volume of 3-15 m<sup>3</sup> per ha (of a total volume of 80-150 m<sup>3</sup>/ha).

Man-made forests

About 21,000 ha of plantations, mainly of *Eucalyptus*, were established up to 1967. Another source gives only 3,000 ha.

Inventories

A. An inventory of 720,000 ha has been undertaken in the south-east. Gross volume per ha was 200 m<sup>3</sup>, (volume without bark, all species above 15 cm d.b.h.). Defects, waste etc. made up 50 percent of the volume. The usable volume per ha is therefore around 100 m<sup>3</sup>. Approximate total volume of usable wood is 60 million m<sup>3</sup>. As a mean there are 300 trees per ha.

B. UNDP/SF No. 220 PAR 15 has undertaken an inventory of 6,401,000 ha. The total volume in this area is - according to the drafted report - 105,421,000 m<sup>3</sup> (all trees above 35 cm d.b.h.). As this gives only 16.5 m<sup>3</sup>/ha, something must be wrong. The total volume is probably 1,054,210,000 m<sup>3</sup>. This would give 165 m<sup>3</sup>/ha. The commercial volume is 32.3 m<sup>3</sup>/ha.

C. The forestry faculty in Curitiba (Brazil) has undertaken an inventory of 100,000 ha.

### Other

Ninety-three percent of the forests are privately owned.

### Peru

#### Natural forest land

The forest area is often given as 87 million ha but included in this figure is 22 million ha of unstocked forest land. Of the stocked forest land 53.7 million ha is classified as broadleaved while 11.6 million ha is classified as mixed forests since they include a generous sprinkling of Podocarpus. These provide good coniferous sawnwood and in many cases are superior to most other species for plywood production.

Practically all the forests are situated east of the Andes.

#### Man-made forests

The area of Eucalyptus plantations is estimated to be 20,000 ha. There may also be some small areas with pine plantations. The plantations have been established mainly for fuelwood production and for supplying pit props to the mining industry.

### Inventories

A. Inventory of Central Huallaga, Chiriyacu, and Nievas River Basins: Reconnaissance survey of 3,360,000 ha. Of this area 2.7 million ha was forest. The forest of highly exploitable and commercial value is estimated to be 780,000 ha. Volume information has been given for only 40,000 ha. Gross volume in this area is 4,890,000 m<sup>3</sup> (all species above 26 cm d.b.h., bark included). There are 67 - 98 stems per ha. The number of species identified was 264.

B. The Forest Service undertakes inventories of four types. The intensity of the inventories increases from point 1 to point 4.

1. General reconnaissance
2. Exploitation reconnaissance
3. Preliminary study
4. Definitive study

In all 60 inventories are reported to have been carried out. Of the 12 million ha that have been inventoried around 90 percent is of the reconnaissance type.

SurinamNatural forest land

The total forest area is 14.8 million ha. This area can be subdivided as follows:

Forest type	Area, 1000 ha					
	Total	Unproductive		Productive		
		Physically a)	Economically b)	Total	Partly exploited	Unexploited
Mangrove forest	115	8	107	-	-	-
Low swamp forest	240	240	-	-	-	-
Triplaris swamp forest	210	-	210	-	-	-
Virola mixed swamp forest	275	-	178	97	80	17
Marsh forest	470	-	220	250	120	130
Ridge forest	35	7	-	28	20	8
Xerophytic forest	150	70	15	65	20	45
Submesophytic forest	510	-	510	-	-	-
Mesophytic forest	12,842	-	12,282	560	200	360
Total	14,847	325	13,522	1,000	440	560

a) Poor composition

b) Distance, access

High tropical lowland forest is the climax vegetation for most of Surinam. Soil and drainage conditions lead to edaphic climax vegetation types with several successive stages: hydrophytic vegetation in areas with impeded drainage, xerophytic vegetation on freely draining or shallow soils.

Periodic burning has tended to maintain and expand the areas under low forms of hydrophytic and xerophytic vegetation at the expense of higher forest.

The high forest contains hundreds of tree species but only about 10 percent of the stand possesses commercial value at the present stage of utilization.

Man-made forests

In all 4,650 ha have been planted (in 1970). Of this area 2,800 ha are coniferous. Main species are *Pinus caribaea*, *Virola surinamensis* and *Simuraba amara*.

### Inventories

The total area inventoried is 260,700 ha. These inventories have been undertaken in the coast region. Another 250,000 ha planned to be inventoried.

#### Inventory results:

Inventory region	Area, ha	Presently commercial volume m <sup>3</sup> /ha
Cossewijne	75,100	49
Mapane	36,900	44
Commewijne	54,300	49

The total gross volume above 25 cm d.b.h. reported to be 140-210 m<sup>3</sup>/ha. Mangrove forest reported to have 125 - 200 m<sup>3</sup>/ha.

### Other

- 1) Practically all forest is state-owned.
- 2) An estimated 17,000 ha is occupied by shifting cultivation at any one time. Total area involved in migratory agriculture is estimated at 170,000 ha.
- 3) In 1969 1,235,000 ha were under cutting permits or concessions.
- 4) The rivers are navigable up to 60 - 80 km from the sea but mudbanks in front of wide estuaries restrict tonnage.
- 5) Important species: *Virola surinamensis*, *Triplaris surinamensis*, *Pterocarpus officinalis*, *Symphonia globulifera*.

### Uruguay

#### Natural forest land

Natural forest land occupies around 456,000 ha. The forests are widely scattered along the banks of streams, in poorly drained areas, and on rock ridges and slopes. Indigenous forests have been useful as sources for fence posts, fuelwood, charcoal and, to a more limited extent, for lumber. The native trees which are found today are usually small and crooked. The wood volume is low due to uncontrolled exploitation. It should also be noted that the country was originally without a widespread forest cover. 220 species are reported to be found in the natural forest.

Man-made forests

At the end of 1966 the total extent of plantations was estimated to be 154,500 ha. Of this area 13,500 ha was government-owned.

## Species distribution:

Species	Area, ha
Pines	25,000
Other coniferous	500
Eucalyptus	105,000
Poplars and willows	8,000
Other broadleaved species	16,000
Total	154,500

A figure giving the total area of man-made forest as 183,000 ha has been found from 1972 (W.W.). This would have required a yearly planting average of 6,000 ha. In 1971 2,000 ha should have been planted.

Main pines are *Pinus pinaster* (17,000 ha), *Pinus radiata* (4,000 ha) *P. elliottii*, *P. taeda*, and *P. halepensis*. Other coniferous are *Cupressus sempervirens* and *C. macrocarpa*. Main broadleaved species are *Eucalyptus globulus* (30,000 ha), *E. rostrata* (30,000) and *E. tereticornis* (70,000), *Populus deltoides*, *Melia azadirach*, *Acacia melaxylon* and *Fraxinus americana*.

## Estimated volume in 1966 (rough estimates):

Species	Volume	
	million m <sup>3</sup>	m <sup>3</sup> /ha
Eucalyptus	13.1	10
Coniferous	2.5	5
Poplars and willows	0.4	10
Other spp.	0.3	..
Total	16.3	..

Most Eucalyptus are in small livestock shelters, windbreaks, roadside and homestead planting. Relatively large blocks of 50 - 1,400 ha of pine have been planted for wood production. These blocks are scattered. Most of the coniferous are planted along the coast (16,000 ha).

Part of the plantations are for windbreaks and sand dune fixation. Poplars and willows are chiefly planted to produce fuelwood. 6 - 7,000 ha is estimated to be available for industrial use.



The distribution on age classes is as follows:

Age class, (years)	Area, 1000 ha
11 - 20	90
31 - 40	21
40+	4

### Inventories

No real inventories have been undertaken. The figures given above come from an aerial survey based on aerial photographs undertaken in 1965.

### Other

1) In the total forest area the density has been estimated as follows:

Type of stand	% of forest area
Dense	66
Average stocked	27
Lightly stocked	7

2) About 98 percent of all forests are privately owned.

## Venezuela

### Natural forest land

The forest area is normally given as 48 million ha. 11.7 million ha should be reserved for forest exploitation.

Different sources give different information about the extension of different vegetation types. One recent source gives half of the forest area as dry savanna.

In a botanical study the following information was given:

Vegetation types	Area, 1000 ha	No. of trees per ha	Total gross volume m <sup>3</sup> /ha	Commercial volume
Xerophytic	1,658	84	22	1
Tropophytic	11,082	129	107	21
Pluvial	35,231	162	188	26

Another breakdown gives the following result (total forest area given as 30 million ha):

Vegetation type	Area, million ha
Deciduous rainforest	9.4
Rainforest	16.7
Dry forest	1.7
Mountain forest	2.0
Mangrove forest	0.2
Total	30.0

The area of "loggable" forest has recently been estimated to 17.5 million ha. The following breakdown have been done for this area:

Type of forest	Area, million ha
Forest reserves	7.5
Presently accessible	2.5
Presently inaccessible	5.0
Private land and vacant govt. land	10.0
Total	17.5

Seventy-four percent of the forest area is situated in the eastern part of the country (Guyana). In western and central Venezuela a lot of exploitation has occurred. At least in central Venezuela not much is left. The best accessible forests are situated in the Venezuelan Guyana. The Amazonas region is unknown and inaccessible at present. Some reports state that the forest here is bad and that the terrain is often difficult.

In summary little seems to be known about the real extent of forests in Venezuela.

#### Man-made forests

A plantation scheme for 25,000 ha exists. Up to 1970 3,000 ha were planted. In 1971 4,000 ha was planned to be planted. In a recent report the planted area was given as 7,000 ha.

#### Inventories

In Venezuelan Guyana a reconnaissance survey of 2,429,000 ha has been undertaken. A detailed inventory covered 600,000 ha.

## Results:

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Gross volume industrial wood <sup>a)</sup>	122,600,000 <sup>b)</sup> m <sup>3</sup>
Gross volume above 20 cm d.b.h.	130-170 m <sup>3</sup> /ha (without bark)
"Usable volume"	100 m <sup>3</sup> /ha
No. of species above 10 cm d.b.h.	600
No. of species above 40 cm d.b.h.	300

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a) Volume without bark. Minimum diameter 40 cm d.b.h.

b) This figure is probably given for 2,429,000 ha.

A recent crude estimate gives total growing stock in the whole of Venezuela as 5,630 m<sup>3</sup>.

Other

Eighty-one percent of the forest area is state owned.

FOREST RESOURCES OF AFRICAAlgeriaNatural forest land

Forest remnants are found in the two ranges of the Atlas mountains. It is estimated that the total area of productive forests, scrub and brushland today cover around 2.4 million ha. At the end of the nineteenth century the productive forests covered 4 million ha. The climax vegetation is mainly formed by *Quercus ilex*, *Cedrus atlantica*, *Abies numidica*, *Pinus* spp, *Juniperus* spp, and *Callitris articulata*. A large part of the area shown as forest and forest land on different maps is degraded. A recent estimate of the potential commercial forest land gave the following figures:

Species	Area, 1000 ha
<i>Pinus halepensis</i>	400
<i>Pinus maritima</i>	10
<i>Cedrus atlantica</i>	20
<i>Quercus suber</i>	60
Total	490

It is unknown how much of this forest land is covered by exploitable forest at present.

Man-made forests

The total area of plantations in Algeria is unknown. In 1955 it was reported that a total area of 100,000 ha of plantations existed. A recent FAO paper gives the total area of plantations as 72,000 ha. According to the same paper 43,000 ha were planted during the years 1965-1970 of which around 35,000 ha were reafforested. The species distribution of these plantations were reported to be as follows:

Species	% of total area
<i>Pinus halepensis</i>	60
<i>Cypressus</i> spp.	13
<i>Pinus pinea</i> , <i>P. maritima</i>	5
<i>Eucalyptus</i> spp.	7
<i>Acacia</i> spp.	4
<i>Cedrus atlantica</i>	2
Other spp.	9

The present plan for planting was, according to the same paper, around 10,000 ha a year. Another source claims considerably more intensive planting efforts. Between 1945 and 1969 an area of 163,000 ha should have been afforested - 145,500 ha between 1963 and 1969. An area of 27,600 ha was planted in the 1971-1972 season while an area of 45,000 ha was planned to be planted 1972-1973.

Some of the differences between sources may be caused by the fact that considerable areas of protection plantations (or areas under protection measures) are included in some of the figures but not in others.

### Inventories

The UNDP project Alg 15 has carried out a reconnaissance of 106,300 ha of natural forests in the Aurès mountains south of Constantine. Of this area 93,500 ha is covered with *Pinus halepensis* and 12,500 ha with cedar. Thirty percent of the pine forests have 75-175 trees/ha and a standing volume of 50-125 m<sup>3</sup>/ha. The pine forests in this area are over-mature; eighty percent of trees being 90-120 years old. In the project area 18,000 ha has been covered by a detailed inventory.

### Other

- 1) In 1969 50,000 m<sup>3</sup> of industrial wood was exploited. A sustained yield of 400,000 m<sup>3</sup> of sawtimber and other wood products is calculated to be possible.
- 2) On the high plateau between the mountain ranges alfa grass (*Stipa tenacissima*) is to be found.

## Angola

### Natural forest land

Land under tree cover makes up about two thirds of the land area. An area of 250,000 ha with tropical rainforest is to be found in the Cabinda enclave and small parts of the north of the province. Another 750,000 ha of riparian and mangrove forests are reported to occur. According to one basic source an area of 2,760,000 ha is covered with moist semideciduous forest (coffee forest). The "Vegetation map of Africa" classifies these areas as woodlands of relatively moist type.

Miombo is the dominating vegetation type and covers close to 60 million ha. Mopane and *Adonsonia* woodlands cover over 10 million ha.

### Man-made forests

In 1970 an area of 120,000 ha was covered by man-made forests. These plantations were distributed as follows:

- a) 38,000 ha are found along the railroad Benguela-Dilolo. The main species are *Eucalyptus saligna* and *E. camaldulensis*.
- b) Ultramar Cellulose Company has 20,500 ha of *Eucalyptus* plantations (*E. saligna* and *E. grandis*) and 7,500 ha with *Pinus patula*.
- c) Different private plantations occupy 41,450 ha. The main species is *E. saligna*. These plantations supply light construction timber, posts, poles, fuel and other domestic needs.
- d) Plantations established by the Forest Service cover 12,400 ha (mainly *Eucalyptus*).

#### Plans:

- a) Ultramar Cellulose Company plans to plant 12,000 ha per year of *Eucalyptus saligna* and *E. grandis*. In 1974 the total area will be 72,000 ha.
- b) There are plans to plant 16,500 ha per year from 1974 up to 1981. The area established will then be 132,000 ha.
- c) Along the Benguela-Dilolo railroad there are plans to plant 5,000 ha of *Eucalyptus* and 2,000 ha of *Pinus patula* each year. These areas may eventually be included in some of the earlier mentioned plans.

#### Inventories

In 1970 it was reported that 8,910,000 ha were covered by extensive inventories. From a reconnaissance survey in the Miombo in the south it was reported that the two main species gave 3-5 m<sup>3</sup>/ha. The total growing stock per ha was 8-45 m<sup>3</sup>/ha. Commercial and potentially commercial species show a volume of 11 m<sup>3</sup>/ha. In an inventory in the moist evergreen forest a volume of 55 m<sup>3</sup>/ha above 50 cm d.b.h. was found for the 55 different species enumerated. The ten most frequent species enumerated had a volume of 39 m<sup>3</sup>/ha.

#### Botswana

##### Natural forest land

A crude land classification gave 24 million ha in the central and western part of the country as shrub or bush savanna (wooded steppe with abundant *Acacia* and *Commiphora*). Roughly the same area in the eastern part should be covered by dry savanna woodland (partly *Acacia* and *Mopaneshrub*). Around one million ha in the Chobe district in the north is covered by dry deciduous forest. This is a continuation of the same formation as in Rhodesia and Zambia. In this forest can be found the timber called Rhodesian teak (*Baikiaea plurijuga*).



### Man-made forests

In the south-eastern part of the country there exist some small plantations, mainly of Eucalyptus.

### Inventories

The Chobe district has been covered by an enumeration survey. In an enumerated area of 518,000 ha 55 percent of the area was classified as productive. In this area was found only 260,000 m<sup>3</sup> o.b. of timber. Of this volume *Baikiaea plurijuga* made up 56 percent and *Pterocarpus angolensis* 41 percent. Since this inventory (1967) there has been no exploitation of indigenous species.

### Burundi

#### Natural forest land

The major part of the country is an undulating plateau with an elevation of between 1,500 and 2,000 m. The mountainous Congo-Nile divide crosses the country from north to south. This region was once forested but nearly all of this forest has disappeared. Only about 100,000 ha of closed forest remains. Most of these forests are at high altitudes, rather inaccessible, and mainly needed for protection purposes. Since 1968 all exploitation in natural forests has been forbidden.

In the eastern and southern parts of the country open woodlands are also to be found.

### Man-made forests

There exist at present around 25,000 ha of plantations. At the end of 1967 the species distribution was as follows:

Species	Area, ha
Eucalyptus	15,787
Cypressus	2,422
Grevillea	939
Acacia	2,445
Other spp.	2,098
Total	23,691

These plantations are scattered in small blocks all over the country.

The present planting rate is around 250 ha per year. In 1972 200 ha were planted. It has been estimated that it will be necessary to establish around 50,000 ha with plantations to

meet the need for wood in the year 2000. Another 50,000 ha ought to be planted for protection purposes.

### Inventories

No forest inventories have been undertaken so far.

### Other

The lack of forest causes enormous erosion problems in this mountainous country. The most serious erosion takes place on the Congo-Nile divide. This erosion is the cause of inundation in the lowlying areas down to the Tanganyika Lake.

## Cameroon

### Natural forest land

The whole southern part of Cameroon is covered by tropical rainforest. North of the dense forest zone are zones with forest-savannamosaic, open woodlands, savannas and steppes. Parts of the naturally forested zone have been cleared. A recent estimate gives the total forest area as 17.5 million ha. The main forest types are: dense forest on solid soils, forest on marshy soils, degraded and second-growth forest. Only dense forest on solid soil is of interest for forest exploitation nowadays. It is not known how much of the total forest area really is covered with forest of this type but it is thought to be the main part.

Approximately 100,000 ha with mangrove is to be found.

### Man-made forests

At present the total area planted is 6,000 ha. The main species planted is okoumé (*Aucoumea klaineana*) which covers 3,000 ha. Pines and Eucalyptus have also been planted, mainly on a trial basis. No large blocks of plantations exist. For the period 1972-1976 it is planned to plant 6,500 ha.

### Inventories

A. Inventory in Haute Nyong and Boumba - Ngoko: An area of 2.2 million ha was inventoried in 1966 - 67.

Result: (volumes above 62 cm d.b.h.)

Species group	Gross volume, m <sup>3</sup> /ha
Limba + Ayous	50.6
12 other principal species	16.7
16 secondary species	34.2

B. In 1965 300,000 ha was inventoried in the Deng Deng forest in East Cameroon (the Departments Lom and Kadei).

Result: (volumes above 62 cm d.b.h.)

Species groups	Gross volume, m <sup>3</sup> /ha
Ayous	20
Limba	10
9 other principal species	8
16 secondary species	32

FAO has undertaken a complementary inventory of 76,000 ha in the Deng Deng forest. The gross volume over bark of the 25 species of greatest commercial importance was 8,280,000 m<sup>3</sup>.

C. An inventory of 100,000 ha have been undertaken in the neighbourhood of Edea. All species (in all 342) above 15 cm d.b.h. were enumerated. The total available volume was 41,283,000 m<sup>3</sup> of which 35,558,000 m<sup>3</sup> utilizable in the form of logs.

In dense forest the following information was found per ha:

Total available volume	396 m <sup>3</sup> /ha
Utilizable in form of logs	341 "
No. of stems per ha	253

#### Other

1) The exploitation goes now up to Yaoundé - Sangmelina. Of the total forest area 3 million ha have been exploited. In recent years concessions have been sold on another 6 million ha. Forest areas are often reserved and closed to exploitation pending the development of suitable plans.

2) At present 16 species are exploited.

### Central African Republic

#### Natural forest land

In the southern part of the country there are 3 million ha of closed forest. Some parts of this forest appear to be exceptionally rich. The forests are almost untouched and still rich with exploitable species. North of the closed forest zone there is a belt of derived Guinea savanna with gallery forests containing *Khaya senegalensis* and *Chlorophora excelsa*. One quarter of the country is covered by this type of association (the more densely populated areas). One quarter lies under woodlands of *Isoberlinia* and *Anogeissus* (Guinea savanna). In the northern part there is Sudan savanna. The

savanna areas supply fuel, poles and so on for local consumption.

### Man-made forests

The total area of plantations is around 1,000 ha. The main species are limba, Cassia and Eucalyptus.

### Inventories

Around half of the closed forest zone has been covered by inventories. These inventories have given a mean total gross volume above 20 cm d.b.h. of 275 - 300 m<sup>3</sup>/ha.

Main commercial species: (gross volume above 62 cm d.b.h.)

Species	m <sup>3</sup> /ha	Volume total country, 1000 m <sup>3</sup>
Ayous	13.3	39,750
Limba	16.0	48,000
Sapelli	10.9	32,760
Sipo	1.1	3,330
Tiama	1.3	3,810
Kosipo	1.2	3,480
Acajou	0.5	1,350
Dibétou	1.1	3,360
Mukulungu	-	-
Doussié	0.5	1,560
Iroko	1.3	3,870
Beté	1.8	5,520

### Other

At present all forest products for overseas export have to be transported on rivers to Brazzaville and by rail from Brazzaville to the harbour Pointe-Noire. The main rivers penetrate the forest only peripherally.

### Chad

#### Natural forest land

The northern half of the country is covered with desert and sub-desert, while the southern half of the country is mainly covered with wooded steppe with abundant Acacia and Commiphora (Sahel), and relatively dry types of woodlands and savannas (Sudan savanna). A small part of the southern corner of the country is covered with Guinea savanna.

Wooded areas are exploited for firewood, building poles, canoe logs. It is unlikely that Chad will become a producer of sawnwood.

### Man-made forests

There are some afforestations with *Khaya senegalensis* around Fort Lamy. Trials with *Eucalyptus* and *Dalbergia* have not been too successful. Afforestation with natural *Acacia* species has also been tried, but these species grow very slowly.

### Congo

#### Natural forest land

All forests of any importance are - according to most vegetation maps - classified as dense tropical forests. The remaining part of the country is classified as forest-savanna mosaic. The area of closed forest is given as 17 million ha (of which 5 million ha is classified as unproductive).

The most extensive areas of closed forest are situated in the northern part of the country. These areas are difficult to reach. A considerable part of this region is also covered with swamp forest. These swamp forests are considered impossible to exploit. The areas of main interest for present exploitation are situated in the Mayombe region along the coast and in the region around Mossendjo and Zanaga. The Mayombe region is nearby exhausted of its commercial species.

### Man-made forests

The total area planted with pines (mainly *P. caribaea*) and *Eucalyptus* is reported to be at least 6,000 ha. The main area planted is situated at Loudima. In this area 100,000 ha will be available for planting. According to the present plans 800 - 1,000 ha of *Eucalyptus* and 100 - 200 ha of pines will be planted every year in this region. Later information give the planting programme as 2,200 ha/year of pine during a ten year period and 5,500 ha/year of *Eucalyptus platyphylla* during 5 years.

There are also considerable areas available for planting in the region north and north-west of Pointe Noire. 6,000 ha of limba have been planted west of Dolisie. From 1974 and onwards 1,000 ha per year will be planted with limba in the Niari region. This planting programme is scheduled to last for 35 years.

### Inventories

A. CTFT has recently undertaken an inventory of 1,100,000 ha in the Ouesso region in northern Congo.

## Results:

Species groups	Gross volume above 60 cm d.b.h. m <sup>3</sup> /ha	Total gross volume 1000 m <sup>3</sup>	Commercial volume above 60 cm d.b.h.	No. of stems per ha above 60 cm d.b.h.
Principal species (17 spp)	24.5	28,756	17,805	2.3
- Red woods (8 spp)	11.6	13,565	9,306	0.9
- Other principal spp (9 spp)	12.9	15,191	8,499	1.4
Secondary species (16 spp)	33.7	39,340	..	4.5
Complementary species	75.4	88,224	..	10.5

B. The UNDP/SF Project No. 542 has done an inventory of 976,650 ha in the Sibiti-Zanaga region. Of this area 148,050 ha were eliminated from the inventory. Okoumé is found in an area of 551,200 ha.

## Results:

Species groups	Mean gross volume per ha above 20 cm d.b.h.    above 60 cm d.b.h. m <sup>3</sup> /ha		Total gross volume above 60 cm d.b.h. 1000 m <sup>3</sup>	Total commercial volume above 60 cm d.b.h.
Okoumé	12.1	7.9	6,567	3,658
Principal species 1x) (17 spp)	15.9	10.2	8,448	4,912
Principal species 2 (12 spp)	16.1	5.9	4,858	2,674
Secondary species (11 spp)	21.8	9.7	8,074	-
Complementary species	..	30.1	24,897	-

C. The Forest Service has carried out several smaller inventories of blocks of 10 to 20,000 ha in the southern Congo.

x) Okoumé included



D. FAO will undertake an inventory of a large part of the northern region

### Other

1. In 1969 the total production of sawlogs was 817,000 m<sup>3</sup>. Of this, okoumé made up 384,000 m<sup>3</sup>, and limba 155,000 m<sup>3</sup>.
2. The total volume of exploitable wood have been crudely estimated to be 70 million m<sup>3</sup>.
3. In all 20 species are exploited.

### Dahomey

#### Natural forest land

The vegetation consists mainly of savanna and savanna woodland. Altogether around 60 percent of the land area is wooded in some form. At most 250,000 ha (two percent) is covered with islands of sub-equatorial forest, riverine forest or dry tropical forests. An area of 2,144,000 ha is "classified forest" (foret classée) in Dahomey.

The total reserve of merchantable timber (suitable for sawlogs) has been estimated to be around 5 million m<sup>3</sup>.

#### Man-made forests

At present there are 18,375 ha of plantations, nearly all of them on classified forest land. The following breakdown can be given:

Ownership and species	Area, ha
State-owned plantations. Teak and other timber species	6,954
State-owned plantations. Casuarina, Cassia, Hymenea etc. <sup>a)</sup>	2,955
State-owned plantations. Anacardium	4,495
Private plantations. Anacardium	3,971

a) These species are used mainly for fuelwood and roundwood.

### Egypt

The small plots classified as forest today are all man-made. The total forest area is often given as 600 ha. There should also be 10,000 km of linear tree plantations of Casuarina and Eucalyptus in the Nile valley and the Delta.

Equatorial GuineaNatural forest land

This country is completely situated within the rainforest zone. No detailed information is available about the present forest resources. It is estimated that one million ha is covered with closed forest. Of this area 0.7 million ha should be undegraded and unexploited. It is not known exactly how much is worth exploiting. The country is rather mountainous and 10 percent of it is considered to be inaccessible.

Secondary forests and bush is estimated to cover around 1.1 million ha. The nonforested parts of the land area is in one way or another agricultural land. Along the coast there are also some areas with savanna.

It is not known whether any plantations exist.

Inventories

A considerable part of the forest area was, until 3 years after Independence, covered by concessions. Many of these concessions were inventoried. These inventories showed a commercial cut of 25-45 m<sup>3</sup>/ha. In the southern part of the country okoumé makes up around 25 percent of the volume.

Other

1) The main commercial species are okoumé, limba, *Pycnanthus angolensis*, and *Tetraberlinia bifoliata*. Nearly a hundred species are utilized in one way or another but only 34 are of real importance.

2) At the end of 1968 232,000 ha had been exploited and concessions issued on another 295,000 ha. Another 30,000 ha of concessions were logged after 1968 until all the large forest companies left Equatorial Guinea and their concessions reverted to the state.

Fernando Poo

The total area is 200,000 ha. The forests occupy roughly 120,000 ha. The forest is nearly unexploited due to difficult terrain.

EthiopiaNatural forest land

The estimates concerning the area covered by closed forests vary considerably. The currently accepted figure is 4 mil-

lion ha. Another one million ha thought to be covered with bamboo. One estimate gives 850,000 ha with coniferous and 3,150,000 ha with broadleaved forests (including 630,000 ha with an admixture of coniferous).

Open forests in the lowlands cover perhaps 3 million ha while 25-30 million ha of savanna woodland is estimated to remain.

At present only 10 indigenous species are utilized as timber.

#### Man-made forests

a) Privately-owned Eucalyptus plantations (mainly *E. globulus*) around Addis Ababa cover 15,000 ha.

b) Privately-owned Eucalyptus plantations (mainly *E. globulus* and *E. camaldulensis*) forming scattered blocks elsewhere cover 20-25,000 ha.

c) Government plantations (various species) cover around 850 ha.

The latest estimate (W.W.) gives the total area of plantations as 56,000 ha, (of this area 12,000 ha should have been planted in 1972.)

#### Inventories

No forest inventories have been undertaken. The following estimated yields of merchantable logs have been used in calculations:

Coniferous forest:	40-100 m <sup>3</sup> per ha
Broadleaved forest:	20-40 " " "

A recent estimate (W.W.) gives the total "commercial volume" as 158 million m<sup>3</sup>.

#### Other

Forests which contain usable wood are restricted to inaccessible or hardly accessible locations. Centuries of intensive agriculture have almost completely destroyed the indigenous forests in the populated parts of the country and this to such an extent that fuelwood is so scarce that cow dung is used as fuel in the rural areas.

#### French Territory of Afars and Issas

This is a country with a very dry climate. A few remnants of forests totalling about 6,000 ha are said to exist. An area of 100,000 ha of poor tree vegetation good only for fuelwood and low-quality poles is also to be found. The dominant vegetation is composed of *Acacia* species.

GabonNatural forest land

Gabon is a very low populated country and the forest resources are quite undisturbed by human influence. Roughly 21.5 million ha is covered with dense forest. Of this area around 6 million ha in the eastern part of the country is described as an intermediate type between evergreen forests and semideciduous forests. The basic difference between this type and the evergreen forest found in the remaining part of the country is that okoumé, which is the principal species in Gabon, is lacking in the eastern part. In the southern part of the country relatively large areas are marked as savanna on existing vegetation maps. These areas are normally a forest-savanna mosaic with the savanna pre-dominating. Scattered areas of savanna are also found in areas marked as closed forest on the map.

Man-made forests

25,000 ha of okoumé have been planted in some blocks in the neighbourhood of Libreville. These plantations are estimated to give 300 m<sup>3</sup>/ha. Trial plantations have also been established with Eucalyptus and pine.

Inventories

A. 8.08 million ha are or have been under concessions. Most concessions have been inventoried but the results are normally not available. Scattered results have been used to estimate the volumes in Forest Zone 1 (3,365,000 ha along the coast) and Forest Zone 2 (11,420,000 ha).

## Results:

Species	Volume <sup>a)</sup> , 1000 m <sup>3</sup>	
	Zone 1	Zone 2
Okoumé	13,350-13,650	40,700-41,200
Ozigo	6,800	13,740-14,440
Ayous	-	500-2,000
Limba	-	2,000-5,000
Ilomba	1,920	14,900-18,600
Azobé, padouk	2,970	3,559
All species (over 45 species)	62,000	124,000

a) See under "results" for the 3rd zone.

B. In 1962 and 1972 CTFT undertook inventories of together 150,000 ha in the Kango area to investigate the possibility of locating a pulp mill in this area. The total wood volume (including branches above 7 cm) is 300-350 m<sup>3</sup>/ha. The volume utilizable for pulp should be 180 m<sup>3</sup>/ha.

C. UNDP/SF Project GAB 6 has done an extensive inventory of 3.3 million ha in the eastern part of the country (3rd zone).

D. GAB 6 has done an intensive inventory of 1.2 million ha (3rd zone).

E. GAB 6 will make an inventory of another 550,000 ha, and will probably also make a complementary inventory of another 1.5 million ha (3rd zone).

Result of inventories in the 3rd zone:

Species group	Volume <sup>a)</sup> , 1000 m <sup>3</sup>	
	Intensive inventory (about 1,200,000 ha)	Extensive inventory (about 3,300,000 ha)
Okoumé	3,400	0
Other principal species	7,410	19,600
Secondary species	9,720	22,000
Other utilizable species	18,550	50,220
Total	39,080	91,820

a) m<sup>3</sup> over bark. Minimum d.b.h. 50 cm. Volume utilizable after removal of waste. The same definition may apply to the table giving volumes in Zone 1 and Zone 2.

### Other

At present 10 m<sup>3</sup>/ha is extracted in logging operations. Of the total wood volume (350 m<sup>3</sup>/ha) around 50 m<sup>3</sup>/ha is extracted or destroyed (by roadbuilding - waste etc.) in logging operations. It is a selective cutting of trees above 70 cm d.b.h. Eighty-five percent extracted volume is okoumé.

1st cut gives 10 m<sup>3</sup>/ha )  
 2nd cut (20 years later) gives 5 m<sup>3</sup>/ha ) crude mean values  
 3rd cut (20 years later) gives 3 m<sup>3</sup>/ha )

### Gambia

#### Natural forest land

The natural vegetation of lower and middle Gambia is Guinea savanna which changes to Sudan savanna in the upper basin. It is a light canopy with a height of 7-20 m. Closed forest does not exist. The wooded vegetation is used for fuelwood and charcoal. Scattered timbertrees occur where there is more water. Along the coast there is 25,000 ha with mangrove. Shifting cultivation is the normal agricultural pattern. The area

under bush fallow have been estimated as between 200,000 and 360,000 ha. The fallow period becomes shorter and shorter.

### Man-made forests

Planting of *Gmelina arborea*, *Tectona grandis* and *Eucalyptus citriodora* started in Nyambi around 1960. The present planted area is 800 ha.

## Ghana

### Natural forest land

The closed forest zone covers around 8 million ha. Of this area roughly 1.8 million ha have been formally constituted as forest reserves (of which around 1.5 million ha are considered as productive). Some years ago it was estimated that there remained an area of 5-600,000 ha of closed forest outside the reserves, but that 50,000 ha of this area disappears each year.

According to exploitation statistics as much as 50 percent does still come from "forests" outside the forest reserves. As scattered timbertrees occur practically everywhere it is certain that a large amount of the volume comes from areas classified as agricultural land. It is probable anyhow, that in a few years time the exploitation of commercial species will come only from the reserved areas. Marketing of new species will allow exploitation in unreserved areas. From the planning point of view only the reserves seem to be of real interest.

Of the savanna areas 10 million ha is classified as forest land. They have no value as a timber producer but they supply fuel and poles as well as charcoal for local consumption.

### Man-made forests

At the end of 1969 in all around 14,000 ha were planted. 1970-71 7,700 ha (or 4,600 ha) was planted. In 1971 the goal was 6,000 ha. From 1972 onwards it is planned to plant around 6,000 ha per year. In 1972 7,900 ha should have been planted. (W.W.)

The planting is mainly of indigenous species. The policy is that poorly productive natural forests should be made into plantations - a total area of 647,500 ha.

The total area of man-made forests is 21,500 ha (Oct. 72) which means that some of the yearly planting figures above must be too high.

### Inventories

Almost all forest reserves in the high forest zone have been inventoried. This inventory normally covers only a defined set of "valuable" species. It is unknown which percentage of



the total volume standing timber these species represent.

The present timber resources from the productive areas are summarized in the table below (all species seem to be included in these figures):

Yield class	Volume, million m <sup>3</sup>		
	Immature stock d.b.h. 10-69 cm	Mature stock d.b.h. 69+cm	Total
Class I <sup>a)</sup>	12	50	63
Class II <sup>b)</sup>	18	33	51
Other species <sup>c)</sup>	154	60	214
Total	184	143	328

a) Class I: Primary redwoods. (Khaya spp, Entandophragma spp, Afrormosia etc.)

b) Class II: Other commercial species

c) Other spp: Secondary species numbering about 310

### Other

1) Of 360 recorded timber species only 40 have a market. Twelve are regularly exploited but 8 of them make up about 90 percent of the production. Twenty-eight species are exported.

2) Nearly all forest reserves are under concessions or licenses. There are also large areas outside the reserves which are covered by concessions.

3) The forests are owned by the "stools" (tribal ownership). The Forest Service manage the forests on behalf of the "stools".

### Guinea

#### Natural forest land

A recent estimate gave the total forest area as 1.2 million ha, of which 6-700,000 ha should be exploitable. Of the latter area dense forest should cover 200,000 ha, open forest 400,000 ha and an intermediate category 100,000 ha. A somewhat older estimate gave the area of dense forest as only 80,000 ha of which 50,000 ha was already in degradation. According to the same source 6 million ha were covered by disturbed savanna, and 10 million ha by savanna where degradation was in progress. A more recent estimate gives the area of savannas with some woodcover as 14.2 million ha.

Man-made forests

Present species distribution:

Species	Area, ha
Gmelina	500
Teak	700
Pines	600
Fraké-Framiré <sup>a)</sup>	150
Bamboo	60

a) Terminalia spp.

To cover future requirements it has been estimated necessary to afforest 300 ha/year. The present afforestation programme is 700 ha/year; to rise to 1,800 ha/year.

Inventories

Certain inventories seem to have been executed in connexion with bilateral assistance.

The total exploitable volume (sawnwood) is estimated to 10 million m<sup>3</sup>. Of this volume one million m<sup>3</sup>, is estimated to be of export quality.

Ivory CoastNatural forest land

The southern part, roughly 16 million ha, is covered by the high forest zone. At present an area of 9 million ha is still classified as forest. The table below shows how difficult it is to estimate the present forest area. It gives the result from the 15.7 million ha inventoried in 1966.

Type of land	Area, 1000 ha
Forest area (blocks > 500 ha)	8,357
Small forest blocks (blocks 10-500 ha)	626
Degraded forest (blocks 5-10 ha)	5,701
Unforested areas	988

The degradation of the above tree covered areas are probably continuing at a fast rate. In the 13.1 million ha covered by the CTFT inventory the forest area had decreased by 3 million ha from 1956 to 1966. This degradation probably continues. The vast areas covered by blocks of 5 to 500 ha do certainly contain considerable volumes of valuable species. It is pro-

bable that these "forest areas" will more or less disappear in a few years time. The savanna areas in the north also contain a large amount of wood but this only covers the needs of the local population.

### Man-made forests

The present area of planting is reported to be 42,000 ha of which probably 14,000 ha is enrichment planting. Of this area, 10,000 ha is estimated to be teak. Most of these plantations have been made in recent years, but 2,000 ha are old teak plantations. Around 26,000 ha of the plantations are in the high forest region.

The plans are now to plant 4,000 ha/year (as a maximum).

### Inventories

The whole high forest region has been inventoried between 1965 and 1967.

A. CTFT has inventoried 13.1 million ha.

Results (volume of 43 commercial or potentially commercial species):

- a) Trees of middle size (36-62 cm d.b.h.) 227 million m<sup>3</sup>
- b) Big trees (trees above 62 cm d.b.h.) 433 " "
- c) In degraded forests was found 46 million m<sup>3</sup> (above 60 cm d.b.h.) of the four most frequent species

B. Development and Resources Corporation has inventoried 2.6 million ha in the south-western part of the country.

Results:

a) Gross volumes per ha:

No. of species and minimum diameter				Gross volume, m <sup>3</sup> /ha
All species above 10 cm d.b.h.				174.7
All " " 43 cm d.b.h.				136
30	"	"	10 cm d.b.h. a)	73.8
30	"	"	43 cm d.b.h. a)	68.8
11	"	"	43 cm d.b.h. b)	19.3

a) 3 commercial categories.

b) Category I

b) Volume distribution:

m <sup>3</sup> /ha	% of forest area
300+	18
200-300	26
150-199	18
100-149	17

cont.

$m^3/ha$	% of forest area
50-99	14
0-49	8

## C. Summary for the whole country:

Species groups		Gross volume <sup>a)</sup> , 1000 $m^3$	
		In forest	In degraded forest
Group I	Main redwoods	51,106	1,260
Group II	Secondary red-woods	17,149	820
Group III	Species used for slicing	20,875	980
Group IV	Samba	123,745	21,080
Group V	Iroko	14,826	5,760
Group VI	Asaméla	714	60
Group VII	White woods other than samba	131,042	25,750

a) Over bark. Trees above 60 cm d.b.h.

KenyaNatural forest land

Around 1.7 million ha is covered by forest reserves. Roughly 1.1 million ha of these are closed forests, (of which 700,000 ha classified as productive). The montane conifer forest is the largest area and the most important commercially. Podocarpus is an important species in these forests. Below 1,800 m whenever rainfall and aspect permit semi-tropical and low-land forests may occur. The principal forest areas are concentrated on Mount Kenya and on the Aberdare mountains east of the Rift Valley and on the Mau Range, Kaptagat-Elgeyo and Mount Elgon to the west. Few large blocks remain below 1,800 m.

The forest used to be much more widely distributed than at present, but cultivation and burning for grazing have taken their toll.

The mangrove forests are estimated to occupy around 45,000 ha. It is probable that practically no closed forests are to be found outside the forest reserves.

There also exist areas of open woodlands. No information as to the extent of these areas is available but they are thought to be small.

Man-made forests

Planted area at 31/12 1967 (same information given at end of 1970):

Species groups	Area, ha
Indigenous softwood	4,600
Indigenous hardwood	4,500
Indigenous Subtotal	9,100
Exotic cypress	54,300
Exotic pine <sup>a)</sup>	54,600
Other exotic softwoods	9,100
Exotic softwoods Subtotal	118,000
Timber	2,900
Fuelwood	7,800
Exotic hardwoods Subtotal	10,700
Total	137,800

a) Mainly *P. patula* and *P. radiata*.

The Government plantation programme has lately been running at a rate of 6,000 ha a year (of which 45 percent pines and 45 percent cypress). For 1971 a figure of 4,600 ha has been quoted.

Target for 1980:

Utilization	Area, 1000 ha
Pulpwood	20
Sawlog	142
Total	162

Private plantations on farms have about 141,000 ha to cover local needs (fuelwood etc).

Inventories

Inventories have been undertaken by CIDA in both the indigenous forest and in the plantations. In all, the inventory covers a land area of 8.6 million ha.

Results for natural forest:

Species groups	Volume, million m <sup>3</sup>
Softwoods	30
Hardwoods Commercial volume	23
Hardwoods Non-commercial volume	56
Total	109

The above information is from 1,264,000 ha. The volume of at present commercially important species above 33 cm d.b.h. within the productive forest types is an average of 140 m<sup>3</sup> per ha or more.

### Other

The indigenous high forests offer little promise. The recent inventory has, however, shown a growing stock much in excess of earlier estimates. The logging and transport difficulties are serious for a major part of indigenous hardwoods, which grow mostly on mountain slopes.

### Lesotho

Practically the whole land area is classified as agricultural land. The natural vegetation is temperate and subtropical grasslands. There is a complete absence of naturally occurring tree growth. At present only uneatable shrubs can survive due to the high grazing pressure.

There are some small trial plantations.

### Liberia

#### Natural forest land

Forestry is the natural vegetation in Liberia but a large part of this has disappeared. At present around 2.5 million ha is still classified as closed forest. Of this area 1.6 million ha is declared as forest reserves (National forests). Existing forest resources are quite inaccessible. An area of 1.2 million ha is classified as exploitable.

The forest area is larger if different definition is chosen. Extensive areas of young forest have not been included in the forest area given above as they are mainly used for shifting cultivation. The rotation period for shifting cultivation is now only 15-25 years, and this means that these young forests are of no importance as timber producers.

#### Man-made forests

Little is known about the total area of man-made forests. In 1971 500 ha were planted with *Gmelina arborea*. The plan is that 6,500 ha should be planted between 1972 and 1976.

#### Inventory

The National forests have been inventoried in recent years. The results are difficult to summarize, but the volume per ha



in  $m^3$  over bark of all trees above 40 cm d.b.h. seems, in the inventoried areas, to vary between 86 and 112  $m^3/ha$ .

The species distribution of different species groups vary as follows:

Species group	Variation in districts	
	% of total volume	$m^3/ha$
Export timber	8-25	8-26
Export timber but low prices	5-12	2-11
Sawn timber - at least suitable for home market	15-50	11-73
Heavy construction work	10-20	9-23
Non marketable species	8-25	17-37

### Libyan Arab Republic

#### Natural forest land

It is estimated that 460,000 ha of mixed coniferous-broad-leaved scrub forest exist. The vegetation is degraded to a large extent. The indigenous woodlands are almost exclusively located on the two plateaus of the Cyrenaica. Tripolitana has no natural forest and no traces of its existence in the past can be found.

In the higher, subhumid zones (rainfall 450-600 mm) there are some fair stands of *Cypressus sempervirens*, *Quercus coccifera*, and *Juniperus phoenicea*. This type of woodland is estimated to cover around 70,000 ha.

In the semi-arid parts of the two plateaus (rainfall 300-400 mm) an open type of woodland composed of *Juniperus phoenicea*, *Olea oleaster*, *Pistacia lentiscus*, *Arbutus pavarii*, and *Ceratonia siliqua* is found. The area is estimated as around 230,000 ha. *Pinus halepensis* grows in isolated clumps in this type of woodland.

Towards the south of the plateau the climate turns arid (150-300 mm rainfall) and the woodlands change into very open scrub with *Juniperus phoenicea*, *Zizyphus lotus* and *Thymelaea hirsuta*, on perhaps 160,000 ha.

This description is from somewhat outdated sources and it is probable that the vegetation now is still more degraded.

#### Man-made forests

In 1972 the planted area was reported to be 75,000 ha. Most of these plantations are situated in the western region.

The most common species are Eucalyptus and pine. In 1971/1972 the total area planted by the state was 3,600 ha. 1972/1973 - 1974/1975 the plans are to afforest 15,000 ha.

## Madagascar

### Natural forest land

Several estimates as to the extension of forest of different types have been made. Such estimates are difficult to make because large areas of forest have been degraded. The 12.5 million ha normally given as forest may be correct but this figure says practically nothing about the productive potential of these forests.

A CTFT estimate based on old photographs reported 12.5 million ha to be undegraded and 4 million ha to be degraded. It is probable that larger areas must be classified as degraded nowadays. In the eastern forests for instance only the most inaccessible areas are untouched.

The rainforest in the east is reported to cover 6.5 million ha. This forest is very heterogeneous without dominating species. Practically all species are exploited.

The dry deciduous forest in the west is easily destroyed by fire. Much of this type of forest has disappeared completely and only a few major blocks are left. The survival of this forest is due to the sparse population. The present area of this type is given as 3.5 million ha.

The bush forest in the south is estimated at about 2 million ha. It is reported to be degraded to a large extent.

The table below summarizes the information concerning the forest resource in different regions. These figures taken from a CTFT report do not completely correspond with figures given in other places.

#### Forest land:

Vegetation type	Area, 1000 ha		
	Undegraded	Degraded	Economically exploitable
Eastern rainforest	6,100	3,600	..
Western forest	2,000	540	..
Bush forest	2,900	80	..
Other types <sup>a)</sup>	1,500	110	..
Total	12,500 <sup>b)</sup>	4,300	700

a) Mangrove, riverine etc.

b) Another source gives 5 million ha.

### Man-made forests

a) A lot of Eucalyptus plantations (mainly E. robusta) are found in the central part of the country. The plantations are scattered in small blocks here and there. The estimates of the total area vary from 160 - 240,000 ha.

b) Pine plantations cover in all 40,000 - 45,000 ha. The species planted are mainly Pinus patula and P. kesiya.

Main plantation areas:

Haut Matsiatra: 22 - 30,000 ha is planted in this area. The plantations are 7 - 16 years old. The planting target is 3,000 ha/year. Areas available for additional planting are limited.

Haut Mangoro: 100,000 ha is available for planting. Planting target 3 - 4,000 ha/year. The plans are to reach 60,000 ha.

Antsirabe: 10,000 ha of pine plantations have been established.

The information concerning planting rate etc. vary from source to source.

### Inventories

A. Inventory of 100,000 ha in Fierenana.

Result:

33 trees/ha above 40 cm d.b.h.

56 m<sup>3</sup>/ha of trees above 40 cm d.b.h.

81 m<sup>3</sup>/ha of trees above 30 cm d.b.h. (variation from 14 to 113 m<sup>3</sup>/ha)

104 different essences (species groups) were found

37 percent of volume (above 30 cm d.b.h.?) can be used for sawnwood

B. Inventory of 12,000 ha with pine plantations.

Result:

Increment 5 - 16 m<sup>3</sup>/ha/year. Meanvalue 10 m<sup>3</sup>/ha/year.

C. Inventory of Eucalyptus plantations around Tananarive. The area covered was 180,000 ha.

D. Inventory of 100,000 ha on the west coast (Morandava).

Result:

4 - 5 m<sup>3</sup>/ha of trees above 30 cm d.b.h.

27 trees/ha (above 30 cm d.b.h.)

80 percent of the trees have a d.b.h. of 30 - 40 cm.

### E. Biological inventories.

Inventory of 25 blocks of 40 ha each. In these blocks enumeration of all trees above 20 cm girth. The blocks were spread in all forest regions.

Based mainly on these biological inventories a FAO project has tried to estimate the total volume of all species above 30 cm d.b.h. in unexploited forests. The results are shown in the table below:

Region	Area		Gross volume <sup>a)</sup>	
	Total	Unexpl. and rather dense	m <sup>3</sup> /ha	million m <sup>3</sup>
East-north-east				
> 800 m	2000	1500	140	210
East-north-east				
> 800 m	2500	2000	80	160
East-south-east	2000	1500	80	120
North-west	1500	1000	50	50
West	2000	1000	25	25
South	2000	1000	10	10
Total	12000	8000		575

a) All species above 30 cm d.b.h.

### Malawi

#### Natural forest land

Relicts of closed forests are found in the high mountains from 1,500 - 2,400m in altitude. Only very small areas are thought to remain. The dominating vegetation type is the Miombo which covers approximately 60 percent of the land area. This type has a very poor sawlog content.

Two other open woodland types (Pterocarpus-Oxytenanthera and Combretum-Afrormosia-Acacia woodlands) cover around 30 - 40 percent of the land area. They are of little economic significance from the forestry point of view.

#### Man-made forests

Information from 31 March 1971:

Species	Area, ha
<u>Timber plantations:</u>	
Pinus patula, P. taeda, P. elliotii, P. kesiya	12,950

Cont.

Species	Area, ha
Eucalyptus saligna, E. cloeziana, Gmelina, Chlorophora excelsa	1,247
Total timber plantations	14,197
<u>Pulpwood plantations:</u>	
P. patula, P. taeda	21,020
E. saligna	1,855
Total pulpwood plantations	22,875
Total area planted	37,072

Some 4,000 ha of private plantations (Eucalyptus and Gmelina) do also exist.

The plans for plantations are as follows:

Plans	Area, ha
In 2000 timber plantations will cover	18,500
In 1980 pulpwood plantations " "	27,900
of which Pines	21,850
" " Eucalyptus	6,050

### Inventories

One inventory of 10,400 ha has been undertaken in the ever-green forests in the Balaka - Blantyre area. Brachystegia and Sterculia were the most common species.

### Other

An area of 2 million ha has been reserved. This is mainly for protection.

### Mali

#### Natural forest land

The northern and central part of the country is in order from the north covered by desert, subdesert, Sahel and Sudan savanna. The latter two types give fuelwood. In the extreme south there are areas of Guinea savanna ("dry dense forest") which could be exploited. These areas are thought to be very limited. CTFT is going to make an inventory of 6 million ha in the Guinea zone.

Man-made forests

There are some plantations of teak around Bamako.

Mauritania

This is more or less a desert country. In the southern part some thorn and dry savanna (Sahel) are to be found. These areas can give fuelwood.

MauritiusNatural forest land

Very little natural forest remains. The main part of this is situated in the south-west of the island.

In 1967 the following breakdown was given:

Type of forest	Area, ha
Closed natural tropical evergreen forest	2,000
Mixed natural forest and secondary exotic scrub	25,050
Predominantly secondary exotic forest scrub	
Used for non-forestry purposes	4,000

Man-made forests

There is an area of around 9,000 ha with exotic plantations. About one half of this area consists of conifers (pines, Cryptomeria) the remainder largely of Eucalyptus.

MoroccoNatural forest land

Around 5 million ha is given as forest land of which 4 million ha seems to be considered as closed forest. Most of these forests are situated in the mountains.

The so - called forest area includes considerable areas of very poor forest. According to a recent estimate 435,000 ha is of strong interest for exploitation - 1,906,000 ha of mean interest and - 2,541,000 ha of low interest.

The following statements can be made for the species in different interest groups. Most species are found in more than one interest group.

**Strong interest:**

Cedar: This is the most valuable species and it covers an area of 100 - 140,000 ha. It gives excellent sawtimber. The cedar forests are overmature.

Pine: (*P. pinaster* and *P. halepensis*). Pine covers around 70 - 80,000 ha. It gives mainly sleepers, pitprops and poles.

Quercus ilex: In this interest group this species covers around 215,000 ha. It is used mainly for firewood and charcoal.

**Mean interest:**

Quercus suber: (cork oak) 200,000 ha are covered by more than 100 stems/ha.

Callitris articulata: Around 900,000 ha are covered by this species. Most of this is more maquis than true forest. It is mainly of value for protection.

Quercus ilex: In this interest group are found around 715,000 ha.

**Low interest:**

Argania spinosa: Around Agadir this species covers more than 700,000 ha. It gives good fodder, oil, and firewood for the local population.

Quercus ilex: This species covers around 715,000 ha in this interest group.

This description indicates that there exists around 400,000 ha of really valuable timber forests in Morocco. Of this area around 100,000 ha are covered by cork oak. The remainder produces fuelwood, poles and is useful for protection.

Man-made forests

Species distribution 31 March 1971:

Species	Area, ha
Eucalyptus	168,770
Other broadleaved	21,659
Pinus halepensis	70,995
Other coniferous	32,841
Total	294,265

The present planting rate is 25-30,000 ha/year.



## Plantations planned 1968 - 2000:

Species	Area, 1000 ha
Coniferous	540
Broadleaved	115
Others	7
Total	662

Inventories

In 1970 it was reported that 75,000 ha had been inventoried. For the time being a National inventory is planned.

A crude estimate gives the following information about standing timber on the total area of forest land:

Species	Volume, <sup>a)</sup> million m <sup>3</sup>
Cedar	11
Pines	4
Eucalyptus	8
Others	130

a) Bark and all diameters should be included.

Other

Grazing is a major ecological problem which restricts the number of species that can be established in North Africa. The main species in Morocco, *Quercus ilex*, *Callitris*, *Argania* are those which can most easily regenerate even under heavy browsing. More intensive forestry can only be developed in areas where grazing is excluded.

Present policy is to accept the indigenous species in the natural forest and seek to regenerate them naturally. No rapid departure from this tradition is considered to be possible in this erosion-prone country.

MozambiqueNatural forest land

Of the land area in Mozambique four-fifth is under tree cover. Closed forests are more or less negligible. Riparian and mangrove forests cover an area of 1.5 million ha.

The dominating vegetation type is the Miombo which covers around 60 million ha. This type is reported to be very luxurious in

certain areas. Another 5 million ha is covered by Mopane and Adonsonia woodlands.

### Man-made forests

In december 1971 an area of about 21,000 ha was covered by plantations.

### Inventories

No information concerning inventories is available.

### Other

- 1) The total area covered by concessions is 800,000 ha. The concessions vary in size from 100 to 55,000 ha.
- 2) All forest land is owned by the state.

## Namibia

At least 90 percent of the land area is covered by desert, subdesert and steppe. In the extreme north perhaps 10 million ha of Mopane woodlands is found.

There are practically no plantations.

## Niger

The northern half of the country is covered by desert and tropical subdesert steppe. The remainder is mainly covered with wooded steppe (Sahel). On the southern frontier with Nigeria some woodlands of Sudan type are found. Niger is considered to be practically devoid of sawtimber trees.

Trials are going on to find suitable species for planting.

## Nigeria

### Natural forest land

The area of forest is often given as 31 million ha. This area includes any land suitable for the practice of forestry but excludes farm land on which agriculture is practised and other non-forested land.

Due to the strong influence by man in the high forest zone in Nigeria it is very difficult to estimate how much real forest is left. In the future probably only the reserved forests

will remain. In the high forest zone these reserves cover - according to one source - 1.9 million ha (3.9 million ha according to another). It is also estimated that 2.5 million ha of non-reserved forest exists. Perhaps 7 million ha or more is covered by a forest cover but used for shifting cultivation under a rotation (10 - 30 years) too short to produce useful timber. It has been estimated that for the time being 50 percent of the exploited commercial volume comes from unreserved forest.

In the savanna zone firewood represents the major wood product. Savanna areas also contain short boled timber tree species. In this zone 7.7 million ha have been gazetted as forest reserves.

#### Man-made forests

Species distribution at the end of 1967:

Species	Area, ha
Pines	12
Other coniferous	10
Eucalyptus	3,480
Teak	7,490
Other broadleaved	24,600
Total	35,592

In 1970 the planted area was given as 69,630 ha. Of this area 54,930 ha is situated in the high forest zone and 14,700 ha in the savanna zone.

In the years 1971 - 1974 it was planned to plant 56,500 ha. Whether the plans can be carried out or not depends on the budgetary situation. Considerable areas have been reported to be planted in the seventies but this does not affect the total area planted.

#### Inventories

A number of enumerations have been undertaken in Nigeria but only a few selected species have been counted. The results are unsuitable for any statistical analysis.

In the eastern region an area of 400,000 ha has been inventoried near the Cameroon border.

Result:

150 hardwood species were identified. Total volume above 15 cm d.b.h. is 74 million m<sup>3</sup>. Of this volume 30 percent is considered to be commercial at present.

A forest inventory of all national forest resources has been planned for the period 1971 - 1985.

A recent very crude estimate gave the total volume of all commercial species in the closed forest as 71 million m<sup>3</sup>. For the closed forest zone as a whole it is estimated that there is 10-25 m<sup>3</sup>/ha of commercial species.

### Other

Six hundred species attain a height of at least 12 m or a diameter at breast height of 10 cm. Only 24 of these are utilized at present but 100 of them could be utilized.

## Portuguese Guinea (Guinea Bissau)

### Natural forest land

Very little information exists about the forest resources. To the WFI 1963 forest land was given as one million ha. To the WFI 1970 forest and other wooded areas has been given as 2.3 million ha. The great discrepancy is probably caused by different definitions. According to a detailed vegetation map, roughly 10 years old, the vegetation cover is as follows:

Vegetation types	Area, 1000 ha
Forest cleared for agriculture	1,291
Rice fields	213
Forest	294
Palms	182
Mangrove	465
Grass savanna	162
Tree savanna	126
Sandbanks	67
Total	2,800

### Man-made forests

In 1970 the area of man-made forests was reported to be 300 ha.

## Reunion

### Natural forest land

Indigenous forests cover around 100,000 ha in the mountains and less accessible areas of the central part of the island. A large part of the forests consists of degraded formations.

### Man-made forests

The total area of plantations is reported to be 9,000 ha. Of

this area 3,000 ha is Casuarina, in the lowlands, and 3,000 ha of Acacia plantations in the higher elevations.

## Rhodesia

### Natural forest land

There remain a few negligible relics of montane forest along the eastern border. The characteristic woody vegetation comprises several types of open deciduous woodlands with occasional fringes of riverine forest along the major water courses. Around two-thirds of the land area is covered by such open woodland types. The most important of these woodlands is the dry deciduous forest rich in Rhodesian teak (*Baikiaea plurijuga*) which occurs in over 800,000 ha in the western corner of the country.

The other woodlands are mainly of the Miombo type and to some extent of the Mopane type. These woodlands are very low-productive.

### Man-made forests

The plantation of pines and wattle are concentrated in the eastern districts. Eucalyptus plantations are scattered over most of the settled areas.

In April 1967 the following areas were planted:

Species	Ownership	
	State	Private
	1000 ha	
Coniferous	12	24
Wattle	-	30
Other broadleaved	1.2	27
Total	13.2	81

## Rwanda

### Natural forest land

The natural forests that remain are found in the more remote areas in the northern and southern part of the Congo-Nile divide which crosses the country from north to south. They are estimated to cover 180,000 ha in the north and 120,000 ha in the south. These forest areas are diminishing quite rapidly.

There are also open woodland areas in the eastern part of the country.

Man-made forests

In all there are 29,000 ha of plantations. These plantations are scattered in small blocks here and there. The plantations are mainly Eucalyptus.

In 1968 the communal plantations had the following species distribution:

Species	Area, ha
Eucalyptus <sup>a)</sup>	19,099
Acacia mollissima	2,889
Grevillia robusta	561
Cypressus	723
Pinus	643
Others	1,657
Total	25,572

a) Mainly E. maideni, E. saligna and E. grandis.

The present planting rate is 250 ha/year

Other

Erosion is a severe problem in this mountainous country. The natural forests are officially protected but at least the more accessible parts of them may disappear in the near future due to the pressure for more agricultural land.

SenegalNatural forest land

The natural vegetation in Senegal is open woodland, savannas and steppes. The main part of the country is in the Sahel and Sudan zone. These areas mainly supply fuelwood. In the southern part, especially in the Casamance region, there exist areas with "dry dense forest" (dense Guinea woodland to dry deciduous forest). In the Casamance region there is estimated to be 210,000 ha of "valuable woodlands" (which have sawtimber in "acceptable" qualities). Along the coast there are also 200,000 ha of mangrove of which 80,000 ha is exploitable. In the interior there is according to one source about 20,000 ha of bamboo.

Man-made forests

In 1970 the total area planted was 13,700 ha.

## Species distribution:

Species	Area, ha
Teak	1,714
Gmelina	574
Casuarina spp <sup>a)</sup>	311
Acacia albida <sup>b)</sup>	1,000
Anacardium occidentale <sup>b)</sup>	9,233
Total	12,832

a) Dunefixation  
b) Windbreaks

Inventories

An inventory in the lower Casamance region will be published in 1974. No preliminary results are available.

The following estimates concerning total volumes (probably sawtimber volume) have been given to the WFI 1970:

Species	Volume, 1000 m <sup>3</sup>
Tectona grandis (Teak)	348
Gmelina arborea	121
Acacia scorpioides var. pubescens	6,000
Borassus flabellifer	2,800
Daniella olivieri	14,400
Combretum spp.	12,000
Rhizophora racemosa and Avicennia nitida	8,000
Total	43,000

Seychelles

Seychelles consists of 25 islands of which the total area is about 23,000 ha. Originally the islands were covered with forest but most of it has been cleared. At present 4,500 ha is classified as forest land. Of this area 1,100 ha are plantations created after 1950.

Sierra LeoneNatural forest land

Sierra Leone is, to a large extent, situated within the rain-forest region. Only a small area remains as closed forest.



The area of closed forest is normally given as 290,000 ha. Mangrove which earlier covered the whole coast region has now more or less disappeared.

Of the 290,000 ha remaining as closed forest only 110,000 ha is classified as productive. 250,000 ha closed forest has been reserved. When cleared the rainforest gives place to fallow bush. As shifting cultivation is the normal agricultural system a large part of the area classified as agricultural is actually under a wooded cover.

#### Man-made forests

In 1970 the area of man-made forests was reported as 6,500 ha. The main plantations are situated in the southern and eastern provinces. Indigenous species are the main ones planted.

#### Inventories

An inventory of 107,000 ha (or 121,000 ha) has been done in the main forest reserves (Gola, Tama and Tonkali). Total (commercial?) volume available in this area is given as 3 million m<sup>3</sup>.

A recent inventory of 52,000 ha has been undertaken in the Gola forest reserve. The productive forest area is given as 25,540 ha. In the productive forests the net volume of commercial wood is 46 m<sup>3</sup>/ha while the total net volume of all species is 115 m<sup>3</sup>/ha (volume under bark of trees above 38 cm d.b.h.).

A recent estimate gave the total (commercial) volume in all forests as 6.4 million m<sup>3</sup> of which 0.6 million m<sup>3</sup> is in man-made forests. Of this volume 2 percent could be used for furniture, 45 percent for utility and the rest for other uses. In areas outside forest was estimated to be 5 million m<sup>3</sup>. These volumes include all exploitable trees above 46 cm d.b.h. bark included.

In all 45 species are exploited. The volume normally exploited ranges from 17-49 m<sup>3</sup>/ha with a mean value of 23 m<sup>3</sup>/ha.

#### Other

1) 92,000 ha of the closed forest is under working plans. There are plans to increase the forest estate but increasing competition for land makes progress slow.

2) The forest estate is, to a large extent, situated in remote areas, accessibility and terrain makes exploitation difficult or uneconomic.

SomaliaNatural forest land

Some vegetation types which deserve the name forest may exist. Different sources give very different information as to the extent of these areas. The dominating vegetation type at present is semi-desert. It is a low bushy country with Acacias as the main species.

There are said to be some stands of African pencil cedar (*Juniperus procera*) in the high altitude areas of the Golis range in the north. The area is estimated to be 130,000 ha.

There are also thought to be some potentially productive forests in the southern region of Somalia, along the rivers Juba and Scebelli and south-west of Chisimaio. The area of this forest is estimated to be 70,000 ha.

The mangrove on the coast between the river Juba and the Kenya border has been heavily overcut.

Man-made forests

There are some small patches of plantations here and there. One source (WW) gives the total area as 25 ha.

Inventories

No inventories have been undertaken. It is estimated that the natural riverine forests in the lower Juba valley contain a growing stock of 400-450 m<sup>3</sup> per ha. This figure is reduced to 200-250 m<sup>3</sup> in the degraded stands.

Other

- 1) Destruction of the natural forests occurs due to over-grazing, and - in some localities - to uncontrolled charcoal burning.
- 2) The existing natural forests do not meet the requirements of the country.

South AfricaNatural forest land

The natural forest is estimated to cover around 255,000 ha. These remaining forest patches are found in the mountains and in certain coastal areas. Open savanna forests and scrub covers around 2,686,000 ha. The rest of the country is covered by grass-savannas, subdesert and desert.

The indigenous forests have no economic importance. Some exploitation does take place.

Man-made forests

The planted area, according to information from 1969, is 959,000 ha.

Species distribution:

Species	Area, 1000 ha
Pines and other coniferous	471
Eucalyptus	290
Wattle	191
Other broadleaved	7
Total	959

Of these plantations around half are privately-owned and half publicly.

In 1971 the total area of plantations was 1,025,000 ha. In the same year 23,000 ha had been planted.

Inventories

The plantations are covered by some form of inventory practically every year. The reports give information mainly about species and areas. The total commercial volume in natural forest and plantations is - according to one source (WW) - 149 million m<sup>3</sup>. (110 million ha according to another.)

Spanish Sahara

According to the "Vegetation map of Africa" the whole country is covered with desert.

It is not known whether there are any forest plantations.

SudanNatural forest land

Roughly half of the land area is covered by desert and sub-desert types. In the central part of the country there are extensive areas of Sahel (part of the low rainfall savanna). One fifth of the land area - the southern part - is covered with open woodlands. In the mountains in the south, west and east there are half a million ha of closed forest. In the open woodland around the Nile as much as 25 million ha is estimated to be covered by inundated areas.

The areas of different vegetation types were given as follows in 1962:

Zone	Area 1000 ha	
	Productive	Total
Woodland savanna (Low rainfall)	23,400	69,100
Woodland savanna (High rainfall)	16,400	34,700
Flood region	1,200	24,600
Montane vegetation	300	600
Total	45,500 <sup>a)</sup>	250,680

a) In the total are also included certain subdesert types and special areas which have been classified as productive but which are not shown separately.

The "forest area" was earlier often given as 58.5 million ha. Since then (1958) a total of 16.5 million ha is estimated to have been lost to other uses. The present "forest area" is therefore given as 42 million ha (39.8 million ha according to another recent estimate). The area with gazetted forest reserves is 1,190,000 ha.

#### Man-made forests

The species distribution of the area planted to the end of 1969 was as follows:

Species	Area ha
Pines	210
Other coniferous	1,580
Total coniferous	1,790
Eucalyptus	7,560
Teak	9,210
Other broadleaved	62,300
Total broadleaved	79,070
Total	80,860

Another source from 1970 (WFI) gave the planted area as 26,000 ha (probably an underestimate).

Estimated annual planting 1970-74 is 4,500 ha. This is mainly other broadleaved species.

#### Inventories

The WFI 1970 reports 10,619,000 ha to have been inventoried. This means mainly reconnaissance surveys. The following inventories have been identified:

- a) Dow Palm Survey - Eastern Sudan:  
Area covered 3.6 million ha
- b) Jebel Mara Survey - Western Sudan:  
Photointerpretation of 3.1 million ha
- c) Yei - Loka area - Southern Sudan:  
Area covered 1.9 million ha
- d) Yirol area - Bahr El Ghazal Province:  
Aerial reconnaissance survey of 310,000 ha
- e) Imatong Mountains - Equatoria Province:  
Area covered 38,000 ha
- f) Reconnaissance of the area between Raga and Wan:  
Area covered 1.7 million ha
- g) Acacia senegal - Kordofan Province:  
Type mapping of 4.2 million ha
- h) Air reconnaissance in Bahr El Ghazal Province:  
Aerial survey of 450,000 ha.

No summary of results is available.

This table gives the estimated annual yields of sawn timber from all potential sources:

Species	Estimated annual yield, m <sup>3</sup>
<u>North Sudan:</u>	
Acacia nilotica	7,200
Acacia albida	5,000
Anogeissus schimperi, Khaya senegalensis, Cordia abyssinica etc.	5,000
<u>South Sudan:</u>	
Khaya senegalensis	2,500
Daniellia oliveri	1,250
Isoberlinia spp.	128,000
Khaya grandifolia etc.	800
Montane forests	1,000
Other species (approximate)	4,000
Total	154,760

A rough estimate gives the total growing stock as 1,500 million m<sup>3</sup>.

### Swaziland

#### Natural forest land

There are 40,000 ha of savanna forest in the low-lying eastern part of the country. The higher parts of the country are covered by temperate and subtropical grasslands.

Man-made forests

Total area planted in 1970 was 76,494 ha.

Species distribution:

Species	Area, ha
Pines and other coniferous	68,381
Eucalyptus	7,569
Wattle	542
Other broadleaved	2
Total	76,494

All these plantations are privately owned and are used for pulp production.

TanzaniaNatural forest land

Up to 50 percent of Tanzania is estimated to be covered by forest and other wooded areas. Of this area closed forest (montane forest) covers 1,360,000 ha, another 80,000 ha is covered by mangrove. Woodlands - mainly Miombo - cover around 37.6 million ha. Remaining "wooded areas" are covered by open areas, grasslands, scrub and brushlands. The closed forest is reserved to 65 percent while the open woodlands are reserved to 30 percent. It is expected that a large part of these unreserved woodlands will disappear. These unreserved forests and open woodlands supply a lot of sawtimber. In 1968 45 percent of the sawlog production was estimated to come from these areas. This proportion seems to be decreasing.

Man-made forest

The area planted at the end of 1969 was 28,555 ha.

Species distribution:

Species	Area, ha
Cypress	4,900
Pines	19,100
Cedar	260
Maesopsis, teak, loli- ondo, mvule	2,425
Others	1,870
Total	28,555 <sup>a)</sup>

a) In addition, certain sources give 30,000 ha as wattle plantations.

The present planting rate is around 4,000 ha/year.

### Inventories

- 1) The softwood plantations have been investigated.
- 2) An inventory of selected areas of reserved and unreserved forest land has been carried out with assistance from CIDA. Results not yet published. The total area covered was 8.5 million ha.

### Togo

#### Natural forest land

There are some scattered stands of closed forests in the south, but most of the country is covered with savannas and open woodlands. A recent inventory in the south gave 380,000 ha with closed forests 70,000 ha with dry dense forests (Guinea savanna) and 116,000 ha with secondary growth. The forest land situated in the north is wooded savannas.

#### Man-made forests

There are 6-8,000 ha of teak plantations - small and scattered village plantations which have suffered from damagable extraction. The real area of utilizable teak plantations is now estimated to be 3,000 ha.

### Inventories

A reconnaissance survey of 2,555,000 ha has been undertaken in the southern half of the country.

Result:

Species	Standing gross volume million m <sup>3</sup>
Fromager	7
Ako	3

These two species make up 2/3 of the potential of known commercial species. Redwoods are not common.



Potential volume (minimum diameter 62 cm d.b.h.):

Species group	Vegetation type			
	Dense semi-deciduous forest	Dry dense forest	Wooded savanna	Low dense forests on slopes
	1000 m <sup>3</sup>			
Principal spp.	2,695	165	600	1,075
Secondary spp.	5,870	810	1,170	3,165
Complementary spp.	9,195	1,280	2,590	3,240
All species	17,760	2,255	4,360	7,480
Area (1000 ha)	293	70	1,292	86

## Tunisia

### Natural forest land

Tunisia is reported to have 253,000 ha of natural forests. These are found in the two parallel chains running from south-west to north-east. Another area of 323,000 ha is classified as scrub and brushlands.

The forest of the northern massif is dominated by cork oak (*Quercus suber*) either pure or in a mixture with *Q. zeen* or *Pinus pinaster*. This type of forest has been well managed for a long time.

The forest of the southern massif consists mostly of *Pinus halepensis*, or *Quercus ilex*. The pines are slow-growing and of poor form and have never been properly managed.

One estimate says that 180,000 ha of the total forest area are dense enough for utilization, of which 80,000 ha covered by *Pinus halepensis*, the rest by *Quercus suber* and *Q. faginea*.

### Man-made forests

The planted area is said to be 114,000 ha (1971). These plantations are mainly *Pinus maritima*, *Pinus radiata*, *P. halepensis*, and *Eucalyptus*.

The present plans are to plant 18,000 ha per year. The actual planting rate is reported to be 11-14,000 ha/year. In 1971 anyhow the planted area was reported to be 7,000 (WW). Of the annual plantings 5-6,000 ha are for production, the rest are protective.

### Inventories

The whole area of closed forest is reported to be covered by an extensive inventory. To the WFI 1970 the following

volume information was given:

Species	Volume <sup>a)</sup> , 1000 m <sup>3</sup>
Quercus suber - Q. mirbechi	4,750
Pinus halepensis, P. pinaster, P. pinea	2,531
Eucalyptus camaldulensis, E. gompho- cephala, E. occidentalis, Acacia cy- clopis, A. cyanophylla	445
Cypressus sempervirens, C. macro- carpa, Casuarina glauca	50
Total	7,776

a) With bark, all diameters. The breakdown is given for 90 percent of the total volume.

### Other

The crown-density was given as follows to the WFI 1970:

Crown-density <sup>a)</sup>	Area, ha	
	Natural forest	Man-made forests
1.0-0.7	70,000	22,800
0.69-0.4	60,000	57,000
0.4-0.20	113,637	34,200
Temporarily un- stocked	9,700	-

a) A ratio of the area of vertical projections of the crowns to the total area of the stand.

## Uganda

### Natural forest land

Uganda has rainforest of both montane and lowland type. Within the forest reserves are found 720,000 ha of closed forests. It has also been estimated that minor areas of closed forest exist outside the reserves. Of the reserved closed forest area only around 400,000 ha are of immediate interest for exploitation.

Around 870,000 ha of open woodlands has been declared forest reserves. Open woodlands situated outside these reserves have quite often been strongly influenced by man. If one accepts the recent figure of 2.8 million ha of forest land, the unreserved open woodlands should cover only 1.2 million ha. An area of 6.5 million has recently been transformed from forest land to land for agricultural development. It is

clear that a large amount of wood is to be found outside the areas classified as forest land.

### Man-made forests

Situation on September 1st, 1971.

Species	Area, ha
Eucalyptus (fuel and poles)	7,598
Fire breaks	291
Softwood plantations	9,050
Hardwood plantations	2,080
Total	19,019 <sup>a)</sup>

a) There is also reported to exist around 6,900 ha of private fuel and pole plantations.

The annual planting target for softwood is 2,000 ha.

An investigation gave an area of 276,000 ha as potentially available and suitable for plantations within the savanna areas.

### Inventories

The situation in reserved natural closed forest can be summarized as follows:

a) Approximately 20 percent is not type-mapped but half of this is montane forest with a mainly protective function at present;

b) Approximately 30 percent (including (a) above) has not been enumerated but some volume estimates have been made from data obtained in the ground sampling during type mapping;

c) Approximately 70 percent has been enumerated (exploratory sampled) at 1-2 or 3 percent, though one-third of this was only sampled by representative blocks.

No short summary of the results can be made. Possible volume from forest under exploitation at present is as follows:

Species group	Year of exploitation	
	1972	1987
	m <sup>3</sup>	
Mvule and mahogany	41,300	10,900
Other compulsory <sup>a)</sup>	131,200	72,300
Optionals	41,000	36,100
Total	213,500	119,300

- a) Certain species are compulsory to cut in exploitations, others are optionals.

### Upper Volta

#### Natural forest land

Upper Volta is mainly covered by Sudan savanna. The present forest products are mainly firewood and poles. In the south-western corner there are areas of Guinea savanna. The area of this is estimated to be one million ha. The so called "forest reserves" cover about 3.5 million ha.

#### Man-made forests

Some forest plantations of an experimental nature have been started in three different areas, mainly in the south-west. The area planted amounts to 2,000 ha, the main species are teak and Anacardium.

### Zaire

#### Natural forest land

Zaire has around 50 percent of the closed forest area in Africa. Available information about these forests are very unreliable. The estimates of the area of closed forest range from 90-110 million ha. These figures are over 10 years old so the lower figure which has been accepted here may still be an overestimate.

Wooded savannas were - according to an old estimate - 90 million ha.

#### Man-made forests

There are 50-60,000 ha of plantations in Zaire. Of these conifers accounted for 2,000 ha and limba for the main part of the other plantations. Most of the plantations have been established in the Mayumbe area. Plantations of limba in the Mayumbe go back to 1941. Since 1960 the plantations have been badly neglected.

### Inventories

No inventories have been made so far but it has now been decided that CIDA will undertake an inventory of around 3 million ha in the area of Lake Albert II. These 3 million ha will be selected in an area of 30 million ha. There should be 10 m<sup>3</sup> of commercial wood per ha in this area.

Other

- 1) Out of a total of 80-100 m<sup>3</sup> of exploitable volume per ha, an average of 20-25 m<sup>3</sup> is extracted in areas under industrial exploitation.
- 2) In the best Miombo stands the available sawlog volume averages around 5 m<sup>3</sup> per ha.
- 3) In 1969 500,000 m<sup>3</sup> was exploited in the whole of Zaire.

ZambiaNatural forest land

According to the "Vegetation map of Africa" the whole country is covered with different open woodland types. As in most parts of East Africa the Miombo is the dominating type. This type varies very much in quality. There are open woodlands of still more open and drier types. It is thought that around 50 percent of the land area is still covered with different open woodland types. The forest reserves cover 5.9 million ha. The Miombo has an important role in providing raw material for most of the needs of the rural population.

The Rhodesian (or Zambesian) teak forest is said to cover 650,000 ha in Barotseland north of the Zambesi river. It is reported that a large part of the productive areas of this forest have been exploited.

Man-made forests

Plantations started already in 1935. Originally they were planned to supply timber to the mining industry. They are located in the Copperbelt, west of Kitwe city and between Kitwe and Ndola. Over 40,000 ha are available for plantations.

Planted areas (1973):

Species	Area, ha
Pinus kesiya	12,800
Eucalyptus (mainly E. grandis)	5,800
Total	18,000

In 1972 the area planted was reported to be 2,600 ha. The present planting programme aims at planting 800 ha of Eucalyptus and 1,300 ha of pine annually.

Plans for 1985 (total area):

Species	Area, 1000 ha
Pine	26
Eucalyptus	15
Total	41

### Inventories

A district by district survey of Zambia's forest resources begun fifteen years ago was completed 1967. No summarized results are available.

The best Miombo areas give 15 m<sup>3</sup>/ha of sawnwood. The normal yield from the Miombo is 2-5 m<sup>3</sup>/ha of sawnwood and 50 m<sup>3</sup> of fuelwood per ha.

The stocking in the Rhodesian teak forest rarely exceeds 70 m<sup>3</sup>/ha of exploitable timber (another source gives 20 m<sup>3</sup>/ha). The total quantity of exploitable teak is estimated at 2.3 million m<sup>3</sup>.

FOREST RESOURCES OF ASIAAfganistanNatural forest land

The forest is situated in the eastern border provinces Paktia, Nangahar, Laghman and Kunar. Total forest area (including scrub and brushland and degraded forest) is 700,000 ha.

## a) Paktia (Inventory by German mission 1968/69):

Type of forest	Area, 1000 ha	Volume, 1000 m <sup>3</sup>
Closed forest	20	900
Degraded forest	165	900
Protection forest (Mandaher)	5	330
Scrub forest	210	-
Total	400	2,130

## b) Laghman - Kunar (Nuristan):

An evaluation has been carried out by a french mission (ASMIC-CINAM). According to this, an area of 166,000 ha should be covered by exploitable coniferous forest. An area of 160,000 ha should also be able to supply fuelwood.

An USAID inventory in this area gave 150 m<sup>3</sup>/ha (25 million m<sup>3</sup>).

## c) Nangahar:

This is a protected forest. The area is not known but the volume is given as 170,000 m<sup>3</sup>. In addition to the above mentioned volumes there are 1 - 2 million m<sup>3</sup> of poplarwood and "bunthölzern" (trees with highly coloured wood)

## Species distribution of valuable forest (around 200,000 ha):

Species	% of area
Cedrus deodara	70
Picea morinda	10
Pinus excelsa	10
Abies webbiana	10

Broadleaved species are mainly found as bushformation. They are of no importance for timber production.



Man-made forests

In the middle of the 1960 an area of 800 ha was covered with poplar plantations.

Other

Ownership conditions of the forests are very complicated.

CyprusForest land

The forests of Cyprus are classified in the following way:

Administrative type	Area, ha
Main state forests	137,970
Minor " "	21,907
Private "	13,508
Total	173,385

Of the Main state forests - which are the productive forests - there is an area of 51,300 ha which is temporarily unstocked. This area includes maquis, empties (destroyed through fire) etc. Minor state forests are found on low lands and are mainly under cultivation. Private forests are well stocked.

Stocked forests therefore cover 95,300 ha while 73,300 ha are temporarily unstocked.

The productive forests are concentrated on the south-western part of the island on the Troodos mountain massif. These forests are mostly state-owned and cover the altitudinal zone from some 200 m in the north of the Paphos to 1,940 m on Mt Olympus.

The forest terrain is mountainous and steep (with slopes of 60 degrees not uncommon), deeply dissected topography drained by streams leading mainly to the north-east and south-west of the massif whose main ridge has a north-west to south-east general direction.

Large parts of the forests have been declared National forest parks. The net potential source of raw material consists of the permanent forest reserves of the Paphos, Troodos and A-delphi forests.

The areas are as follows:

Permanent forest reserve	Area, ha
Paphos	49,014
Troodos	2,461
Adelphi	10,245
Total	61,720

The main species of the permanent forest reserves is *Pinus brutia* which grows in natural pure stands, intermixed with artificially established plantations of the same species. In many parts of the Troodos massif *Quercus alnifolia* and *Arbutus adrachne* grow as understorey of pine or in pure patches. *Platanus orientalis* and *Alnus orientalis* grow along streams and on riverine sites. *Pinus nigra* grows over 1,400 m in elevation on Troodos and occupies some 2,414 ha of the Troodos National forest park. *Cedrus brevifolia* occupies 175 ha of the Tripylos Nature reserve and in the Paphos forest.

#### Man-made forests

All plantations are government-owned. During the last years 1,000 ha or more have been planted per year.

Forest plantations at the end of 1969 were as follows:

Species	Area, ha
Pines	13,174
Other coniferous	219
Total coniferous	13,393
Eucalyptus	895
Poplars	3
Other broadleaved	1,055
Total broadleaved	1,953
Total area planted	15,346

The estimated annual planting program 1970-74 was 500 ha each of pines and Eucalyptus.

#### Inventories

All the productive forests have been stockmapped by photogrammetric methods and inventoried.

Some results are summarized in the table below:

Forest reserve	Area ha	Average per ha		Increment <sup>a)</sup>		Total volume <sup>a)</sup> o.b. m <sup>3</sup>
		No. of trees	m <sup>3</sup>	/year m <sup>3</sup>	m <sup>3</sup> /ha	
Northern part of Paphos	25,223	67	36	17,076	0,68	902,248
Southern part of Paphos	23,791	72	37	18,528	0,78	889,487
Troodos	2,461	84	31	1,850	0,75	76,021
Adelphi	10,245	96	36	8,670	0,85	369,348
Total	61,720	75	36	46,124	0,75	2,237,104

a) For trees 16 cm d.b.h. and over.

Most of the trees are in the size class 16 to 45 cm d.b.h.  
The volume consists mainly of trees 36 to 65 cm d.b.h.

## Iran

### Natural forest land

Degradation of the vegetative cover due to over-grazing and excessive cutting of fuelwood and charcoal wood is common in the whole country. Most of the vegetative formations which ecologists include in the forest formations are largely degraded to semi-deserts, or to scrublands which produce nuts and other valuable fruits, but whose value for soil protection or wood supply is insignificant.

Only two areas with some forestry importance remain - the Caspian area, where temperate forests dominated by *Carpinus betulus* and *Fagus orientalis* grow on the northern slopes of the Elburs mountains, and the Zagros mountains, with open forests of various types.

The only real forest area is that of the Caspian, which covers a total of approximately 3.4 million ha. Only one million ha of "good forest" is reported to be left. The total volume (including branches above 7 cm) is reported to be 250 m<sup>3</sup> per ha. The total volume of growing stock in 1.6 million ha of forest land covered by an inventory was 381 million m<sup>3</sup>. The Caspian forest is decreasing at about one percent a year.

In the Zagros area several vegetative formations are distinguishable. Characteristic genera are *Quercus*, *Amygdalis*, and *Pistacia*. Patches of dense forest exist only as relicts and most of the area has now a cover that appears as scrubland of varying density. Large areas do not even carry any shrubs. One estimate gives the whole area of "Zagros forest" as 5 million ha of which about one million ha represents a more or less forestry vegetation under heavy pasture. One optimistic estimate gave the growing stock as 100-150 m<sup>3</sup> per ha, but it is doubtful if the Zagros area contains any real forest vegetation.

Man-made forests

Poplars are planted by farmers in single lines, parallel lines or in patches of different shapes.

The total area of all plantations have been estimated at 100,000 ha. Another estimate (WW) gives the total area of plantations as 14,000 ha in 1972. Around 700 ha should have been planted in 1972.

Inventories

An area of 3.4 million ha in the Caspian region has been covered by the Caspian Forest Survey carried out in 1958 with the assistance of USAID. Of this area 1.63 million ha was classified as forest land. For results, see under Natural forest land.

IraqNatural forest land

The main part of the country is classified as desert and semi-desert. Only in the mountains on the northern border are there any forest relicts.

1,500,000 million ha is classified as forest land. Forty percent of this is bare land while 60 percent is covered by scrub oak. 22,000 ha is reported to be covered by closed forest (*Pinus brutia*). Certain reports mention 20,000 ha of forest growing on the river banks in the north and south of the country.

An old report gave around one million ha with dense forest. The total growing stock was then estimated at 36-38 million m<sup>3</sup>. In more recent reports the volume is given as considerably lower.

Man-made forests

In the middle of the sixties it was reported that 3,500 ha of poplar plantations existed. More recent estimates vary from 4,000 ha to 7,500 ha. Some of the plantations are irrigated, the rest are situated in the mountains.

Other

Of the area classified as forest 1,250,000 ha is publicly owned.

IsraelForest land

In 1972 the forest was reported to cover 84,700 ha of which 49,700 ha was man-made and the remaining area consisting of natural oak scrub stands. The forests are scattered all over the country - the planted stands in 400 blocks ranging from 5 to 3,000 ha each. Almost all the natural forests are in small areas in the north.

Afforestation and reforestation are still the main objectives of forestry in Israel. 2,000-3,000 ha seem to be planted every year. In 1972 1,200 ha should have been planted. Of the planted forest area 63 percent are conifers, 25 percent Eucalyptus, and 12 percent other species (mainly Acacia and tamarisk).

### Inventories

Only a relatively small part of the forest area seems to be covered by any inventory.

The standing timber in the whole forest area was estimated for the WFI 1968 as follows:

Species	Gross volume <sup>a)</sup> , m <sup>3</sup>
Pinus	831,100
Cupressus	21,600
Tamarix	32,800
Eucalyptus	776,200
Others	32,800
Total	1,694,500

a) All diameters included.

Outside the forest area is found 25,000 m<sup>3</sup> of wood.

### Other

Ninety-six percent of all forest is publicly owned.

### Jordan

#### Natural forest land

The declared forest area in Jordan totals about 121,500 ha, but more than three-quarters of it is treeless. The forests have been exploited and overcut for many centuries, and they are all in need of effective protection against misuse.

The West Bank has been completely denuded of forests. The Jordan valley and the deserts of the east and south are devoid of natural forests, except in some narrow river flats with high water tables where a luxurious woody vegetation can be found.

The East Bank Uplands is the only region where forests are found.

Results from an inventory in 1965:

Area:

Vegetation type	Area, ha
Broadleaved evergreen (mainly oak)	20,985
" deciduous ( " )	3,980
Pinus halepensis	142
Juniperus phoenicea	7,773
Mixed forests	3,027
Wild olive	106
Total	36,013
In north	22,193
In south	13,820

Standing volume:

Vegetation type	Volume, m <sup>3</sup> /ha
Broadleaved evergreen	23.3
" deciduous	10
Conifers	33.6
Mixed	25.4
Total volume in north	311,000 m <sup>3</sup>
Total volume of fuelwood in whole country	459,000 "

#### Man-made forests

In the middle of the sixties 3,500 ha of plantations, mainly pines, acacias, and Eucalyptus was reported to exist. At the end of 1967 the area of pine plantations was given as 7,000 ha. In 1972 the total area of plantations was reported as 7,400 ha. Of this area 1,400 ha should have been planted in 1972. According to one source 10,000 ha were planted 1966/67.

Plans exist to create 23,740 ha with government plantations and 575 ha of private plantations between 1970 and 1979. Now the private plantations are restricted to occasional row plantings.

## Kuwait

Kuwait is situated in the desert region of the Near East. An area of 5,200 ha has been declared as forest reserves. In 1967 a total area of 370 ha had been planted. This is probably the only real forest area.

## Lebanon

### Natural forest land

Very little forestry vegetation remains. One report gives the area of forest more or less degraded and coppice with a crown-cover of more than 10 percent as 70,000 ha. Degraded forests (crown-cover less than 10 percent) cover 65,000 ha. Another report gives total forest land as 80,000 ha of which 30,000 ha is closed. Of the total forested area 21,000 ha should be covered by coniferous, 54,000 ha by broadleaved and 5,000 ha by mixed forest.

### Man-made forests

At least 3,200 ha of mainly pine plantations was reported to exist in 1966. The result of the planting is reported to be rather poor.

### Other

- 1) Of the forest area (80,000 ha) 46,000 ha belongs to the state, 16,000 ha to communes, and 18,000 ha to private owners.
- 2) The production of industrial wood is around 50,000 m<sup>3</sup> while 300,000 m<sup>3</sup> of fuelwood is produced.

## Saudi Arabia

### Natural forest land (woodlands)

So-called woodlands cover 1.2 million ha in the mountains of Hijaz and Aseer province. Another 0.8 million ha is available for plantation and reafforestation. These woodlands are situated between 1,200 and 1,800 m above sea level where the rainfall is 400 - 600 mm annually. Main species are Juniperus spp. (especially J. procera), Olea spp., Acacia spp., Tamarix spp., and Zizyphus spinachristi.

The species show poor performance. The most valuable stands, composed of Juniperus spp. and Acacia spp. usually form open stands and only in favoured places are forests dense. Large parts of the so-called woodlands are probably scrub.



Syrian Arab RepublicNatural forest land

The area recorded as forest is 470,000 ha. Of this area only 15 - 20 percent is tree covered. The most important forests are found in the Lattakia district (40 percent of total area).

The area effectively covered by trees in Syria is 60 - 70,000 ha. Of which perhaps 40,000 ha can be classified as closed forest with around 40 m<sup>3</sup>/ha.

Main species: Pine (North Lattakia)  
Fir-cedar (upper zone of Ausariyeh mountains)

Man-made forests

In 1965 it was reported that 10,000 ha of poplar and willow plantations existed. These plantations are situated in the Ghonta valley near Damascus and in the Aleppo district.

TurkeyForest land

The following breakdown of the forest area has been made (to the WFI 1968):

Type of Forest and Other Wooded areas	Area, 1000 ha
Forest	7,046
Forest with growing stock	6,933
Normal high forest <sup>a)</sup>	4,826
Normal coppice forest <sup>a)</sup>	1,850
Private forests	17
National parks	240
Forests temporarily unstocked	113
Normal coppice forest <sup>a)</sup>	109
Burned forest area	4
Other wooded areas	11,189
Open woodlands and scrub	11,184
Degraded high forest	4,389
Degraded coppice and scrub	6,795
Forest tree nurseries	2
Areas occupied by trees in lines	3

a) Normal high forest and normal coppice forests include tree cover from 11 percent upwards.

The best site qualities are found in the Black Sea region where soils are rich and climate favourable. There the forests are luxurious and quite heavily stocked. Broadleaved species, mainly beech, dominate, but there are also considerable stands of spruce and fir (*Picea orientalis*, *Abies bornmülleriana*, *A. nordmannia*). In the Aegan and Mediterranean regions pines are the most common species and site qualities are generally lower and the climate drier. In east and middle Anatolia, the forests are rather scattered. Principal species are *Pinus brutia*, *P. nigra*, *P. pinea*, *P. silvestris*, *Cedrus libani*, and *Abies equitrojani*. Main broadleaved genera are *Quercus* and *Fagus*.

Age class data indicates that the high forests are mainly mature and overmature. Current annual increment is low and does not match the potential of the sites.

The degraded forests are those which have been subject to uncontrolled removals or grazing so that their volume and composition has been affected.

### Inventories

To the WFI 1968 an area of 2,761,000 ha reported to be inventoried.

Management plan inventories are said to cover all Turkish forests, including non-productive and remote areas. These inventories have been carried out from 1938 to 1963. New management plan inventories are at present under way. In 1969 less than half of the 23 regions had been resurveyed.

The following information about standing timber in high forest has been given:

Species	Gross volume <sup>a)</sup> , 1000 m <sup>3</sup>
Pine	414,017
Fir	64,235
Spruce	32,387
Cedar	17,813
Other conifers	11,335
Total conifers	539,787 <sup>b)</sup>
Oak	43,793
Beech	112,554
Other broadleaved	41,812
Total broadleaved	198,159 <sup>c)</sup>

a) All trees above 10 cm d.b.h.

b) Of which 64,500,000 m<sup>3</sup> in degraded forest

c) Of which 23,143,000 m<sup>3</sup> in degraded forest

The volume in coppice is given as 138,033,000 steres (one stere is 0,65 m<sup>3</sup> solid volume without bark).

Yemen Arab RepublicNatural woodlands

Yemen is situated in a very dry region and has very little treegrowth. The total area of the country is 19 million ha.

In the coastal zone there is no tree vegetation. On the high plateau (600 - 3,000 m above sea level) there is intensive agriculture. In the eastern part of the country there is desert. Visiting foresters have only seen scattered trees. One report says that there is 2,000 ha of solid Acacia forest in Wadi-Surdont. Another source gives the main species as *Dobera roxburghii*. One report gives an area of one million ha covered with open Acacia forest. This is probably scrub.

BangladeshNatural forest land

The area of forest land is given as 2,324,000 ha. Of this area 1,419,000 ha is covered with stocked forest. The area of permanent forest reserves cover 1.15 million ha. A minor part of the forest reserves are unstocked. The following basic vegetation types are to be found:

## A. Tropical evergreen and moist deciduous forest:

These types are situated in the Chittagong Hill Tracts. The total forest area is given as 600,000 ha. Of this area 540,000 ha is classified as ecologically productive. Most of this area is reserved for timber production. In addition there is also an area of around 900,000 of unclassed forests (unstocked forests). This area is subject to shifting cultivation. The main species are garjan (*Dipterocarpus* spp) and civit (*Swin-tonia floribunda*). Abundant bamboo occurs in the understorey. It is reported to be the main crop on about 130,000 ha. Due to steep hills and deep ravines only a limited part of the bamboo could be extracted at reasonable cost. Several investigations show that the bamboo forests can be used for pulp. Estimated annual allowable cut is one million tons.

## B. Tidal forests of Sunderbans (mainly mangrove):

The area of this type is 0.6 million ha. The productive area is given as 380,000 ha. This forest is relatively well-managed. It is used for fuel, newsprint, pulp, matches, poles, boat building and tannin for fishing nets. In recent years this forest has been badly damaged by cyclones. The main species are sundri (*Haritiera minor*) and gewa (*Excaecaria ag-allocha*).

## C. Alluvial forests of low level plains (in Dacca, Mymensingh and north Bengal):

The area covered by this type has been estimated as 100,000 ha. The dominating species is sal (*Shorea robusta*) which is treated as coppice. It is mainly used for poles and for boat building. The forests have been overcut in the past and are generally low stocked. Shifting cultivation occur frequently.

#### D. Other wood resources:

The unclassified state forests have a sparse growth of trees. Considerable areas of bamboo is available from these areas. *Albizia* spp. are the main timber species.

Clungs of trees and bamboo, are scattered over the central farming delta. These are maintained and harvested by individual owners, villages and the government.

#### Man-made forests

In 1968 it was reported that plantations through replacement of natural forests amounted to about 68,000 ha. Three-quarters of these plantations were teak.

#### Inventories

The Chittagong Hill Tracts were covered by a forest inventory in 1961-63 and by a soil and land use survey in 1964-66, both under the Colombo Plan. The area covered was 235,000 ha.

The mangrove forests have been covered by inventories. The Colombo Plan and USAID have given assistance.

The main results from these inventories are given below:

Species	Standing timber <sup>a)</sup>	
	million m <sup>3</sup>	m <sup>3</sup> /ha
I. <u>Sunderbans</u> (97,230 ha) <sup>b)</sup>		
Gewa	3.95	33.7
Sundri	14.72	157.3
Others	2.40	25.7
Total	21.07	216.7
II. <u>Chittagong Hill Tracts</u> (235,000 ha)		
Garjan	2.77	11.8
Civit	1.79	7.6
Rest of commercial volume (21 species)	4.98	21.2
Non-commercial	8.36	35.6
Total	17.90	76.2

- a) Gives volume of trees 12.5 cm d.b.h. and above for Sunderbans and of trees 25 cm d.b.h. and above for Chittagong Hill Tracts. Bark, 0.6 m stump, and top volume below 10 cm are excluded.
- b) In all 380,000 ha should have been inventoried. Included here are the two largest reserves.

### Other

- 1) About 95 percent of the forest area is publicly owned.
- 2) There is a rapid depletion of the forests especially in the central and northern part where they are estimated to be reduced by 8,000 ha annually. One may assume that the stock of village trees is being depleted.
- 3) The annual recorded output of timber and fuelwood is 1.6 million m<sup>3</sup>. The output from village sources plus non-recorded fellings may increase the figure two or three times.

### Bhutan

Of the total area of 4.7 million ha about 3 million ha are occupied by forests. Half of these forests are tropical or subtropical mixed broadleaved forests in the southern foothills and one half is coniferous forests in the middle Himalayas.

The proximity of the tropical forests to India has helped to secure a market for several species and increasing volumes are logged. The southern forests have been under working plans of an extremely general nature, for ten years.

In the coniferous areas, until recently, the forests have not been logged except to supply local needs of timber and firewood. The absence of roads, of an export-oriented industry and of labour prevented any intensive use of these forests.

### Brunei

#### Natural forest land

Of the total land area of 576,500 ha about 435,000 ha is covered by forest, 117,000 ha by secondary forest and 25,000 ha by cultivated and settled land.

The forest consists of the following types:

Vegetation type	Area, 1000 ha
Mangrove forests	11
Other coastal forests	1
Peat swamp forests	99
Kerangas forests	4
Dipterocarps forests	315
Montane forests	5
Total	435

### Man-made forests

Practically no plantations exist, but plans to plant do. Certain trial plantations have been undertaken.

### Inventories

No inventories are known to have been undertaken.

### Other

Exploitation occur mainly in state land forests (132,000 ha). The existing forest reserves (212,000 ha) are rather inaccessible. In 1967 70,000 ha were under licences for exploitation.

## Burma

### Natural forest land

Very little is known about the actual state of the forests in Burma. The description below is probably quite outdated.

In 1955 the forest area was given as 38,982,000 ha. Another 5.6 million ha should be covered by bushland. In 1957 9 million ha was reported to be reserved.

The following types are recognised:

- A. Coastal forest:  
Mangrove, beach and dune forests, swamp forest. These forests supply fuelwood and cover 4 percent of forest area.
- B. Evergreen forest:  
Cover 15 percent of forest area.
- C. Mixed deciduous forest:  
Cover 40 percent of forest area. Part of this type contain teak.

## D. Dry forest:

Cover 10 percent of forest area. The trees are small and are only useful for fuelwood. In this report this type is classified as open woodland.

## E. Deciduous Dipterocarps forest:

Cover 5 percent of the forest area. The greater part is on dry or exposed sites and produces only shrubs. In this report this type is classified as open woodland.

## F. Hill forest:

Cover 26 percent of forest area.

a) Hill evergreen forest

b) Dry hill forest

c) Pine forest

*Pinus kesiya* and *P. merkusii* are found in large stands in mountainous parts of Shan State (East), Shin division (West) and Kachin State (North). Around 5 percent of the forest area was once estimated to be covered by pine.

## G. Bamboo:

The bamboo forests potential as a source of raw material for pulp has been investigated and found to be enormous. The area is sometimes given as 9 million ha. It is not known whether this area is included in the forest area, whether it is in understorey etc.

Man-made forests

The area is not known. One source gives the area of teak plantations as 100,000 ha. The annual planting rate should be 7,000 ha.

Inventories

The country is divided into 30-35 forest districts. Working plans are prepared for each forest district. The working plans are based on total enumerations of all trees above 30 cm d.b.h. The plans are revised each 5-10 years.

ChinaNatural forest resources

Most information concerning forestry in China comes from the publications by Richardsson. In summary he states that in south and east China, the natural forest distribution is determined by soil type; in the arid west and north-west steppe, semi-desert and desert dominate the vegetation types. In the mountain and plateau regions, vertical zonation of soils and vegetation is marked.

The greater part of China's natural forest has been destroyed over the years, resulting in acute soil-erosion problems and



serious shortage of forest produce. In the north-east only forest in the horseshoe formed by the east margin of the Mongolian plateau, the Greater and Lesser Khingan Mountains and the Changpaishan massif in Manchuria is left. This region contains some 60 percent of China's total timber reserves. Significant, though generally inaccessible areas of natural forests are to be found also in the provinces of Kwangtung (on the island of Hainan), Kiangsi, Fukien, Kweichow and Szechuan in the Tsinling mountains; and on the eastern edge of the Tibetan Plateau. Over most parts of China, however, the primary forest vegetation is indicated only by groves surrounding the Buddhist temples and shrines. Kiangsu, Shantung, Hopek, Shansi, Western Inner Mongolia, Chensi, Kansu, Tsinghai, Singkiang are devoid of forest. The forest area has variously been estimated as covering from 46 to 100 million ha with the volume ranging from 4,615 million  $m^3$  to over 7,000 million  $m^3$ . In 1963 the forest area was given as 96 million ha (plantations included). Of this area 72 million ha was classified as accessible (or accessible sometime in the future). Growing stock of all species was estimated at 7,000 to 7,460 million  $m^3$ . Of this volume around 5,600 million  $m^3$  was classed as accessible. These figures have later been adjusted downwards. In a recent report Richardsson accepts a figure of 80 million ha as the total area of natural forest, of which 60 million ha will eventually prove to be accessible. The total volume is estimated to be 6,000 million  $m^3$ .

No estimates as to the total area of conifers are found in Richardsson's reports. A very crude utilization of different information indicates that an area of around 25 million ha should be covered by conifers. These coniferous forests are mainly situated along the Mongolian and USSR borders in north-west Manchuria. There are also extensive areas with mixed forests. The main species seem to be *Larix dahurica*, *Pinus silvestris*, *Picea obovata*, and *P. microsperma*.

The country is said to have 2,800 species of trees of which more than 1,000 are economically important.

#### Man-made forests

The plans and programmes for plantations are enormous. A programme in 1956 set a target of 105 million ha to be replanted by 1968, notwithstanding the windbreaks, shelterbelts and tree rows along roads, river banks etc. At present the annual afforested area is reported to be 10 million ha (including replanting because of previous failure). In 1971 the total forest area was given as 207 million ha. (This should mean a planted area of 127 million ha.)

It seems that a large part of these plantations have been failures. In 1963 Richardsson estimated that only 10 percent of the plantations were successful. The total area of man-made forests in China must therefore be considered as unknown. It seems probable, however, that at least an area of 15-20 million ha of plantation has been successfully established.

Among planted species can be mentioned *Pinus yunnanensis*, *Pinus massoniana*, *P. korsiensis*, *P. silvestris* var. *mongolica*, *Euca-*

lyptus spp, Larix dahurica, Cunninghamia lanceolata.

### Inventories

Something of a National forest inventory seems to have been completed for at least the 32 million ha for which detailed statistics are available (in 1963). It seems probable that most forests have been surveyed by now.

### India

#### Natural forest land

The extent of "forest area" in India is 75 million ha which is 22 percent of total land area. According to some sources a great part of this so-called forest is denuded to barren land and of the remaining part large areas have a very low volume per hectare.

The estimates for the actual area covered by closed forests vary very much and is sometimes as low as 40 million ha. A very provisional estimate would be that the stocked forest area is about 57 million ha of which only 25 - 30 million ha would contain good raw material for industries.

Champion has described the vegetation in detail. The main forest types are as follows:

Forest type	Area, mil- lion ha	Gross volume m <sup>3</sup> /ha <sup>a)</sup>
Tropical wet evergreen forest	4,503	393
Tropical semi-evergreen forest	1,854	286
Tropical moist deciduous forest	23,303	177
Littoral and swamp forest	0,671	40
Tropical dry deciduous forest	29,154	60
Tropical thorn forest	5,236	20
Tropical dry evergreen forest	0,075	10
Sub-tropical broadleaved (hill forest)	0,287	80
Sub-tropical pine forest	3,740	200
Sub-tropical dry evergreen forest	0,173	200
Montane wet temperate forest	1,613	200
Himalayan dry temperate forest	0,227	200
Himalayan moist temperate forest	2,725	200
Sub-alpine forest		
Moist alpine scrub	1,790	30
Dry alpine scrub		
Total	75,351	136

a) This gives the gross volume under bark in undegraded stands. All trees above 5 cm d.b.h.

A. Temperate coniferous and broadleaved types extend from Kashmir to Assam, covering the whole Himalayan range. The most important species are deodar (*Cedrus deodara*), chir pine (*P. roxburghii*), blue pine (*P. excelsa*), khasi pine (*P. kesiya*), spruce (*P. smithiana*) and fir (*Abies pindrow* and *A. spectabilis*) and from broadleaved species various oaks and walnuts.

B. The wet evergreen forests occur in parts of Western Ghats, Andamans and Assam region. These formations are dense, high forest comprising a large number of species in a mixture. Various bamboo species are common as well.

C. The moist deciduous type is found as a strip along the western slopes of the Western Ghats and along the foothills of the Himalayas. It also covers parts of Madhya Pradesh and the Ghota Nagpur plain. The main tree species are teak (*Tectona grandis*), sal (*Shorea robusta*), rosewood (*Dalbergia latifolia*) and lamel (*Terminalia tomentosa*). Bamboo is also common.

D. Dry deciduous forests occupy parts of the central Indian peninsular from Cape Comorin in the south to the foothills of the Himalayas merging through Rajasthan to West Pakistan. The main species are sandalwood (*Santalum album*), acacias and albizzas.

It must be noted that "forest" in India includes areas which are classified as reserved forests, protected forests, village forests, unclassified forests, forests in the charge of the Revenue Department and some other types.

The forests of India are to 97 percent publicly owned. The main legal classes of forest, as defined by the Indian Forest Act, are in the following proportions:

Legal class of forest	% of total forest area
Reserved forest	45
Protected forest	31
Unclassified forest	24

Only the first category should be considered reasonably well protected in practice.

#### Man-made forests

In 1972 the total area of plantations in India has been given as 1.1 million ha.

Between 1961/62 and 1966/67 the following areas were planted:

Species	Area, 1000 ha
Eucalyptus	132.2
Teak	100.7
Bombax ceiba (matchwood)	22.1
Other spp. (i. a. sal)	174.8
Total	429.8

One of the long term objectives is to extend the forest area to cover 33 percent of the total area. It is very doubtful if enough land suitable for planting is available.

The present yearly planting rate is 40,000 ha of Eucalyptus and 40,000 ha of teak, sal etc.

There are sizeable concentrations of Eucalyptus plantations in Uttar Pradesh, Kerala and Mysore.

World Wood reports the total area of plantations in 1972 as 1,708,090 ha. An area of 128,300 ha should have been planted in 1972.

### Inventories

4.7 million ha of forests in three different parts of India have been covered by an inventory which was initiated in 1965 (Pre-Investment Survey of Forest Resources). The Government of India has continued the inventory work.

#### Results:

##### A. Pre-Investment Survey of Forest Resources.

##### a) Central Zone (dry area, rainfall 1.250 mm/year, managed forest)

Forest type	Area 1000 ha	Growing stock <sup>a)</sup>	
		million m <sup>3</sup>	m <sup>3</sup> /ha
Sal	48	4.7	98
Teak	11	0.7	63
Miscellaneous	1,439	77.8	54
Miscellaneous with sal	175	16.6	95
Miscellaneous with teak	316	23.1	73
Unstocked	19	0	0
Total	2,008	122.9	61

a) Volume under bark. Minimum diameter 5 cm d.b.h. over bark.

The area covered by bamboo is 531,000 ha of which 234,000 ha is pure, dense or fairly dense. The estimated annual growth is

466,000 tons (dry weight).

b) Southern Zone (Tropical rainforests)

Forest type	Area 1000 ha	Growing stock	
		million m <sup>3</sup>	m <sup>3</sup> /ha
Evergreen	97	38.2	393
Moist deciduous	104	18.3	177
Semi-evergreen	72	20.6	286
Evergreen and deciduous mixed with reeds	125	30.5	245
Dry deciduous	21	1.4	68
Plantations	40	1.0	25
Total	459	110.0	220

c) Northern Zone (Himalayan coniferous forests)

Forest type	Area 1000 ha	Growing stock	
		million m <sup>3</sup>	m <sup>3</sup> /ha
Lowland hardwoods	57	2.0	35
Sal	33	5.6	171
Chir pine	61	8.8	144
Blue pine	56	11.9	214
Deodar	28	7.1	249
Spruce, fir	67	25.6	379
Mixed conifers	33	10.3	316
Upland hardwoods	77	11.5	148
Total	412	82.8	200

B. Government of India Surveys

a) Chenab Valley (Himalayan coniferous forests)

Forest type	Area 1000 ha	Growing stock	
		million m <sup>3</sup>	m <sup>3</sup> /ha
Fir	132	46.5	351
Blue pine	73	15.0	205
Deodar	66	24.9	379
Chir pine	19	2.8	128
Broadleaved species	83	12.9	154
Total	374	101.9	272

## b) Chanda Priority II (dry area, rainfall 1.250 mm/year)

Forest type	Area 1000 ha	Growing stock
		m <sup>3</sup> /ha
Teak	48	69
Miscellaneous	604	68
Miscellaneous with teak	151	87
Blank	8	16
Total	811	71

## c) Mahaboognagar Forest Division (very dry area, rainfall 600 mm/year)

Forest type	Area 1000 ha	Growing stock	
		million m <sup>3</sup>	m <sup>3</sup> /ha
Teak and mixed teak	45	1.4	31
Yeppa	68	1.2	18
Rest	81	1.8	22
Total	194	4.5	23

About half of the forest area is under working plans and some statistics are available from this area. Surveying and mapping is necessary for the preparation of these working plans but the procedure seems to be very different from state to state.

The total volume in all forests (the 75 million ha mentioned) has been estimated to be 10,178 million m<sup>3</sup>. This estimate is based on the area and m<sup>3</sup>/ha figures given under "Natural forest land". If part of the "forest land" has been degraded this figure is too high. An estimate from 1960-61 gave e.g. the total growing stock as only 2,100 million m<sup>3</sup>.

IndonesiaNatural forest land

The most recent information gives an estimate of 124.7 million ha as forested land. This has been designated by the forest authorities as follows:

Type of forest land	Area, million ha
Production forest	48.7
Protection forest	47.0
Game reserves forest	3.6



cont.

Type of forest land	Area, million ha
Forest land not yet designated	25.4
Total	124.7

This total is reported to be located as follows:

Region (Island)	Total land area million ha	Forested land
Sumatra	51.3	29.5
Kalimantan	54.1	42.5
Sulawesi	18.9	10.9
Maluku	7.5	6.0
West Irian	42.2	31.0
Java and Madura	12.8	2.9
Bali and Nusa Tenggara	7.4	1.8
Total	194.2	124.6

The area that has been devastated by shifting cultivation and settlement is around 30 million ha (estimates vary from 25 - 37 million ha) and the area currently being depleted is about 2 million ha, a quarter of which is assumed to be the amount of virgin forest touched. The largest areas damaged by shifting cultivation are situated in Kalimantan, Sumatra and Sulawesi. West Irian has not been affected by this practice at all due to low population.

About 18 million ha of forested land will be alienated to agriculture, of which around 14 million ha has already been earmarked for prompt exploitation.

It is assumed that approximately 9 million ha of forested land are bare or at best sparsely forested.

Considering the above it would seem that a realistic distribution of the forested area might be as follows:

Type of forest	Area, million ha
Operable forest	42
- Permanent production forest <sup>a)</sup>	24
- Managed forests	3
- Plantations	0.8
- Forest to be alienated to agriculture	18
Protection forest <sup>b)</sup>	43
Devastated by shifting cultivation	30
Bare or sparsely forested	9
Total	124



- a) Most of the production forest (22.5 million ha) are situated in Kalimantan and Sumatra. These areas have currently desirable species and are considered accessible (or potentially accessible).
- b) Coincide with inaccessible areas and with forests with unattractive species.

A breakdown of the area of forest land into vegetation types gives the following results:

Vegetation type	Area, 1000 ha
Evergreen rainforest	89,180
Secondary	(15,000)
Tidal forest (mangrove)	1,060
Swamp forest	13,000
Mixed deciduous	1,400
Teak (mainly plantations)	640
Deciduous	990
Coniferous	295
Other	385
Total	121,950

#### Man-made forests

The area of plantations established at the end of 1967 was reported to be 1,193,000 ha while it was reported as 1,203,000 ha in 1972. The species breakdown was reported to be as follows:

Species	Area, 1000 ha	
	Year of estimate	
	1967	1972
Pines	117	298
Other coniferous spp.	22	
Teak	576	774
Eucalyptus	1	131
Other broadleaved spp.	477	
Total	1,193	1,203

The above figures are anyhow most uncertain. Most estimates give lower figures.

It is reported that 30 - 50,000 ha of pine plantations exist in the Lake Tobo area (Sumatra). If natural stands are included the total area covered with pine may be 150,000 - 200,000 ha. The species is *Pinus merkusii*.

In Java the teak plantations may total 600,000 ha.

Some sources give the total area of conifers in Java as 145,000

ha, of which about 100,000 ha would be pine (mainly *P. merkusii*) and the rest *Agathis loranthifolia*.

The annual planting area is not known, but in 1968 about 3,500 ha of bare land were afforested with conifers in Java.

### Inventories

Inventories seem to cover the forest areas for which concessions have either been granted or applied for. The area covered was around 29 million ha at the end of 1971. Analysis of these inventory reports show volumes in excess of 100 m<sup>3</sup> per ha of which half generally consists of species currently considered merchantable.

The Indonesian authorities estimate the growing stock at 100 m<sup>3</sup> per ha for the timber in excess of 35 cm d.b.h. as an average for the whole country. Thus the total size of the timber resource would be the following:

- operable forests: 42 million ha (of which 1 - 4 million ha is estimated to have already been cut over) at 100 m<sup>3</sup> per ha-3,800 to 4,100 million m<sup>3</sup>.
- protection forests: 43 million ha at 100 m<sup>3</sup> per ha-4,300 million m<sup>3</sup>.

Practically all the hardwood species established on the world market belong to the family Dipterocarpaceae. Accessible forests are mainly located in regions noticeably rich in valuable species.

Kalimantan and Sumatra are known to have extensive Dipterocarp forests. Sulawesi and Maluku also have these species but in lesser concentrations. Further east, Dipterocarps fade out and are replaced by a greater number of other species. West Irian, for instance, is known to be a non-Dipterocarp region with a mixture of species. So far only a few of these are in demand on the world market.

A National forest inventory will be completed within five years.

### Other

1) Logging is mainly carried out by private Indonesian enterprises, state forest enterprise (Perhutani) or jointly by Perhutani and foreign investors.

2) The following table show the rapid rise in log exports and removals:

Year	Log exports, million m <sup>3</sup>	Log removals, million m <sup>3</sup>
1967	0.5	4.1
1969	5.0	8.1
1970	6.7	12.4

cont.

Year	Log exports, million m <sup>3</sup>	Log removals, million m <sup>3</sup>
1971	10.0	16.0
1975	17.0 <sup>a)</sup>	..
1977	17.0 <sup>a)</sup>	28.0 <sup>a)</sup>

a) Anticipated

Volumes extracted range from 20 to 100 m<sup>3</sup> per ha with an average of 50 to 60 m<sup>3</sup>. Approximately 250,000 ha can be assumed to have been harvested in 1971. The total area so far exploited is between one and 4 million ha.

- 3) Practically all forest land is owned by the state.
- 4) For the time being 9.7 million ha is covered by concessions.
- 5) In about 1976-77 all granted concessions (29 million ha) are expected to be actually operating and producing about 28 million<sup>3</sup> of industrial wood.
- 6) The density of road and river networks is as follows:

Island	Area forest (ha) per km road
Sumatra	600
Java	100
Kalimantan	3,000
Sulawesi	120
Bali and Nusa	350
Tengera islands	

- 7) An estimated 6 million m<sup>3</sup> of wood is burnt each year due to shifting cultivation.

## Japan

### Forest land

The total forest area in Japan is 25,206,000 ha. This area is distributed between the following main vegetation types.

A. Subtropical forests cover 37 percent of the total forest area. These forests are broadleaved, mostly evergreen and composed mainly of oaks and *Shiia* spp. In transition to the temperate zones part of this type is deciduous, composed primarily of *Quercus serrate*, *Q. acutissima*, *Carpinus* spp, *Pinus densiflora*, *P. thunbergii* and *Cryptomeria japonica*.

B. The temperate forests cover 41 percent of the forest area. These forests are mainly broadleaved and deciduous. The most common species is *Fagus cremata*. Other important species are *Quercus mongolica*, *Betula* spp, *Magnolia obovata*, *Tilia japonica*, *Cercidiphyllum japonicum*, *Aesculus turbinata*. Occasionally conifers like *Cryptomeria japonica*, *Chamaecyparis obtusa* and *Pinus densiflora* are found.

C. Subfrigid forests cover 22 percent of the forest area. Among typical species can be mentioned *Abies sachalinensis*, *Picea jezoensis*, *Taxus cuspidata*, *Abies firma*, and *Tsuga sieboldii*. Broadleaved genera like *Betula*, *Alnus*, and *Populus* occur as natural regrowth on clear-cut forest lands.

Based on inventory results available in 1969, Japan's forest resources can be summarized as follows:

Ownership	Area, 1000 ha				Total
	Man-made forest	Natural forest	Unstocked land and others	Bamboo grove	
National forest	1,694	5,493	879	0	8,066
Private forest	6,453	9,774	736	177	17,149
Total	8,147	15,267	1,615	177	25,206

The overall species composition of the country's natural and man-made forests is as follows:

Species	% of forest area
<u>Conifers</u>	50
<i>Cryptomeria japonica</i>	17
<i>Chamaecyparis obtusa</i>	7
<i>Pinus</i> spp. <sup>a)</sup>	9
<i>Larix</i> spp. <sup>b)</sup>	1
<i>Picea jezoensis</i>	3
<i>Abies firma</i>	6
Others	7
<u>Broadleaved</u>	50
Beech	8
Others	42

a) Mostly *P. densiflora*

b) Mainly *L. leptolepis*

Ninety-four percent of all forests in the country are considered readily or easily accessible. In a considerable part of the accessible forests, logging has been restricted by legislation as shown below:

Type of restriction	Ownership		
	National	Private	Total
	forest 1000 ha	forest	
Total protection forests	3,555	3,274	6,829
- limited logging allowed	..	..	5,350
- logging prohibited	1,479	-	1,479

The total area of productive forests should therefore be 16,860,000 ha.

### Man-made forests

The total area of plantations at the end of 1972 was 8,863,000 ha. Most information has been given under forest land although these figures refer to 1969.

Most of the plantations are still fairly young. The age structure is as follows:

Age, years	% of total area
- 20	76
21 - 40	15
41 -	9
All	100

Past and repeated planting is shown below:

Year	Area, 1000 ha		
	Total annual planting	Reforestation, blanking	Expansion of area planted
1965	372	86	286
1966	368	86	282
1967	362	72	290
1972	354	..	..
1965-75 <sup>a)</sup>	300	..	..
1975-85 <sup>a)</sup>	200	..	..

a) Plans

At present planting corresponds to 60 percent of the annually exploited area. *Crytomeria japonica* and *Chamaecyparis obtusa* account for 66 percent of all planting in the country. *Larix leptolepis* ranks third in areas planted.

### Inventories

Forest surveys are now carried out at five-year intervals em-

playing both aerial photographs and ground sampling. The third National inventory was completed in 1971. The figures given in the table below are however from 1967/68:

Type of land	Growing stock	
	1000 m <sup>3</sup>	m <sup>3</sup> /ha
Man-made forests	559,231	69
Natural forest	1,325,536	87
Unstocked land & others	5,538	
Total	1,890,305	75

#### Other

- 1) The annually exploited area is around 550,000 ha.
- 2) The present removals are roughly 45 million m<sup>3</sup>. In 1976 it is forecasted to be 52 million m<sup>3</sup>, in 1981 59 million m<sup>3</sup>, in 1986 66 million m<sup>3</sup>, and in 1991 72 million m<sup>3</sup>.

#### Khmer Republic

##### Natural forest land

According to a USAID inventory undertaken 1960-62 the total forest area is 13,173,486 ha or 73 percent of the total land area. Of this area 9.6 million ha should contain commercially exploitable forests. The main types can briefly be described as follows:

- A. Dry Dipterocarp: This type occupies 40 percent of the forest area and is found on sandy soils. The forest is mostly open due to the fact that the grass is burned nearly every dry season.
- B. Tropical humid forest: This type occupies 30 percent of the forest area and is a dense forest with a high volume per ha.
- C. Tropical semihumid forest: This type occupies 19 percent of the forest area and grows on deep soil which retains water during the dry season.
- D. Pine forest: Pine occupies areas above 600 m. The most important species being *Pinus merkusii*. The area covered is 10,000 ha.
- E. Mangrove forest and rear mangrove forest: These types occupy small areas along the coast. The area covered is around 90,000 ha.

F. Dwarf evergreen forest: This occupies around 2 percent of the forest area. It grows on thin soil in rainy regions.

G. Flooded forest: This occupies 5 percent of the forest area. This forest is situated around the Lake Tonle-Sap. It is a scrub forest flooded during some months of the year.

H. Bamboo forest: This occupies 3 percent of the forest area.

#### Man-made forests

In 1967 5,860 ha was planted. Of this area 240 ha was pines, 2,010 ha teak and 3,610 ha of other broadleaved species.

#### Inventories

A. A forest inventory covering the whole country was started in 1960 with the assistance of USAID. Only one report covering around 20 percent of the land area has been published. Data for the whole country was said to be compiled at the Forest Headquarters.

##### Results:

Area of exploitable forest: 3,357,600 ha.

Standing net volume: 270 million m<sup>3</sup>.

Volume of sawnwood (minimum diameter 20 cm d.b.h.): 176 million m<sup>3</sup>.

B. In 1962 FAO undertook an inventory of 5,520,000 ha east of Mekong. Of this area 3,875,000 ha was forest:

##### Results:

Type of forest	Area ha	Volume above 20 cm d.b.h.	Volume above 60 cm d.b.h.
		m <sup>3</sup> /ha	million m <sup>3</sup>
Dense forest	622,500	200	66.8
Secondary forest	770,600	75	..
Semi-dense forest	360,700	230	45.4
Intermediate	182,600	120	..
Open forest	1,938,600	52	16.1

C. A FAO Project has undertaken an inventory of 487,000 ha in the lowlands west of the Cardamomes Mountains. The forest area was 422,000 ha of which 337,000 ha was inventoried.

##### Results:

Type of volume included	Volume, 1000 m <sup>3</sup>
Total volume above 10 cm d.b.h. All species	24,839
" " " 30 cm " " "	17,857



Cont.

Type of volume included	Volume, 1000 m <sup>3</sup>
Total volume above 45 cm d.b.h. All species	10,328
" " " 60 cm " " "	6,442
Volume commercial species above 45 cm d.b.h.	4,567
" " " " 60 cm "	3,698

Korea North

Of the total area of 12,054,000 ha an area of 8,970,000 ha was given as forest land in the 1958 WFI. No later information is available.

The main species should be *Quercus* spp., *Abies* spp., *Betula* spp., *Pinus* spp., *Larix* spp., and *Picea* spp.

Korea SouthForest land

At the end of 1970 the area of stocked forest land was given as 5,748,153 ha. Unstocked forest land was said to be 866,111 ha. At the end of 1972 these figures had been changed to 5,779,395 ha and 828,689 ha.

The main vegetation types in Korea can be briefly described as follows:

A. Fir/oak type: This is a high altitude virgin forest and is now only found in zones above 700 m in the more inaccessible parts of the National forests. It covers quite large areas and is the only existing reserve of large dimension and mature timber in Korea. The two principal species are *Quercus crispula* and *Abies holophylla*. Some *Pinus koraiensis* and *Betula schmidtii* also occur.

B. Moist (mixed) hardwood type: This occurs in lower and usually in cooler and damper localities than the previous type. It is composed of about 12 to 15 commercially important hardwood species. The main genera are *Fraxinus*, *Carpinus*, *Ulmus*, *Quercus*, *Betula*, *Tilia*, *Acer*, *Cornus*, *Kalopana*, *Populus*, *Prunus*, and *Mackia*.

C. Dry hardwood type (or mixed *Quercus* type): This type occurs on relatively infertile granite soils. It is a hardwood forest of poor quality, volume and tree form, and its main value is for protection of soils. The main species are a range of *Quercus* species. *Pinus densiflora* occurs whenever dry conditions dominate.

D. Pinus densiflora type: This type occurs in the northern temperate hardwood forests wherever soil conditions become too dry for hardwoods. Pine is a pioneer species where the hardwood forest has been cleared.

The distribution of stocked forest land according to type is as follows:

Forest type	Area, ha	
	year of estimate	
	1970	1972
Coniferous	3,295,111	3,333,224
Hardwood	1,216,813	1,218,305
Mixed	1,229,265	1,220,350
Bamboo stand	6,964	7,516
Total	5,748,153	5,779,395

Distribution according to age-classes is as follows:

Age class, years	Area, ha
0 - 30	5,426,371
31 - 50	290,363
51 +	24,435

The main part of the area recorded as forest land has extremely low stocking. This is explained partly by the large amount of young forests partly by the forest conditions in Korea. Three fairly distinct forest conditions can be identified:

- 1) Overmature hardwood forests without large or valuable trees.
- 2) Even-aged but under-stocked coniferous forest mixed in blocks with immature and low-value hardwood forests.
- 3) Logged-over hardwood forests that are in a very under-stocked state.

Note: Plantations are included in the above figures.

#### Man-made forests

The total area of plantations was reported as 2,025,000 ha at the end of 1971.

The species distribution was as follows:

Species	Area, 1000 ha
Pines	617
Other conifers	215
Poplars and willows	188
Other broadleaved species	1,005
Total	2,025

The main species planted are *Pinus densiflora*, *P. koraiensis*, *Robinia pseudoacacia*, *Alnus* spp. and *Larix leptolepis*.

During the years 1962 - 71 an area of 1,527,681 ha should have been planted. The very extensive planting programme has not been fully effective as the recorded percentage of failure is high. One very crude guess is that the reasonably productive plantation area should be around one million ha.

The planned future planting rate, including afforestation, reforestation and supplementary planting, is 495,000 ha for the years 1970-74. During the period 1975-2004 it is planned to plant 3 million ha. This programme means an annual planting rate of around 100,000 ha.

The absolute latest figures give an area of 531,000 ha to be planted between 1972 and 1976. In 1980 the total area of plantations should be 3,050,000 ha. The vast majority of the plantations are for fuelwood but large areas are also established for timber production.

### Inventories

In 1960-64 the whole forest area was covered by some sort of a forest inventory. The results are reported to be somewhat unreliable, but the inventory seems to be updated each year or at least now and then.

The information concerning growing stock is summarized below:

Forest type	Growing stock		
	Year of estimate		
	1970		1972
	million m <sup>3</sup>	m <sup>3</sup> /ha	million m <sup>3</sup>
Coniferous	32.3	9.8	33.6
Broadleaved	24.1	19.8	25.7
Mixed	12.3	10.0	13.4
Total	68.8	12.0	72.7
<u>Age class, years</u>			
0-30	48.7	8.9	..
31-50	18.0	62.3	..
51 +	2.0	80.1	..

This gives an average stock per ha of  $10.3 \text{ m}^3$ . Average stocking in 1.3 million ha of National forest is higher-about  $30 \text{ m}^3/\text{ha}$ .

In a recent UNDP/FAO inventory covering 1,027,800 ha the total growing stock was 37,291,000  $\text{m}^3$ . In a more detailed inventory of 300,000 ha the mean volume per ha was around  $60 \text{ m}^3$ .

The FAO Project has now made an inventory (reconnaissance survey) of 2.4 million ha. The new results from 1972 may be caused by this new inventory.

### Other

National forest covers 1,287,708 ha, public forest 501,380 ha and private forest 4,852,521 ha.

### Laos

#### Natural forest land

Information about the forest resources in Laos is naturally scarce. The war during the last years may have changed conditions drastically.

An area of 15 million ha is given as forested land. The following breakdowns of this area has been found:

Type of forest	Area, 1000 ha	
	Year of estimate	
	1962	1969
Open forest	9,000	9,000
Semi-dense forest	2,500	) 5,500
Dense forest	2,500	
Coniferous forest	1,000	300
Total	15,000	14,800
<u>of which exploitable:</u>		
Open forest	3,600	3,600
Dense forest	2,280	2,280
Coniferous forest	120	120

*Pinus merkusii* is found up to 800 m while *Pinus kesiya* is found at higher elevations. In the southern zone estimated to be 120,000 ha of pine of which 100,000 ha of *Pinus kesiya*. The stands are (or were) poorly stocked, overmature and much damaged by fire. *P. merkusii* mixed with hardwoods cover around 20,000 ha. These stands are accessible and said to have  $300 \text{ m}^3/\text{ha}$ . Conifers of no economic importance are found in the northern part of the country.

300,000 ha of forest is estimated to be destroyed per year. The area under shifting cultivation is given as 750,000 ha while 7,250,000 ha is said to be fallow land.

### Man-made forests

In 1960 the area of plantations was given as 740 ha.

### Inventories

A CIDA - USAID team has undertaken a forest inventory of 880,000 ha in three selected areas in Vientiane, Savannakhet, and Pakse. Of this area 616,000 ha was forest. The loggable volume was given as 11.1 million m<sup>3</sup> (volume above 60 cm d.b.h.) and the total volume as 67 million m<sup>3</sup> (volume above 10 cm d.b.h.).

## Malaysia

### A. Sabah

#### Natural forest land

Of the total land area of 7.61 million ha around 6 million ha is classified as forest. One source classifies 2.6 million ha of this forest area as commercially exploitable.

The distribution of forest types is as follows:

Forest type	Area, million ha
<u>Currently exploitable</u>	
Exploitable Dipterocarp	2.59
Exploitable fresh-water swamps	0.06
<u>Potentially exploitable</u>	
Mangrove	0.28
Inaccessible Dipterocarp	2.07
<u>Unexploitable</u>	
Montane	0.39
Secondary	0.65

Most of the commercial Dipterocarp and mangrove forests are on the east coast of Sabah. The fresh water swamps are principally on the west coast.

### Man-made forests

The total area of plantations reported as 500 ha in 1972. Of this area around 60 ha were planted in 1972. (WW).

Inventories

Over the last years CIDA has undertaken an inventory of extensive forest areas. The average volume per ha of all trees above 50 cm d.b.h. is probably above 100 m<sup>3</sup>.

Other

Most of the commercially exploitable forests are included in forest reserves (in all 2,175,000 ha).

B. SarawakNatural forest land

The forest covers about 9.5 million ha. Three million ha have been incorporated into forest reserves. The area of different vegetation types is as follows:

Vegetation type	Area, 1000 ha
Dipterocarp forests	7,785
Swamp forests	1,474
Mangrove	174
Other (montane, secondary)	77
Total	9,510

A large proportion of the Dipterocarp forest is located in areas hitherto economically inaccessible. The Dipterocarp forest contains a lot of different species, only a few of which are of importance as timber producers. Up to 450 m above sea level Shorea, Dipterocarpus and Dryobalanops predominate, above this altitude the Dipterocarpus species decrease until they disappear at an altitude of 1,200 m, when they are replaced by oaks, chestnuts and conifers like Agathis, Dacrydium and Phyllocladus. The stocking is estimated at 70-110 m<sup>3</sup>/ha. Swamp forest is found on flat land. The most important genera are Gonystylus, Dactylocladus and Shorea. Commercial swamp forest (585,000 ha) has a volume of around 45 m<sup>3</sup> per ha of commercial timber.

Inventories

A. A FAO/UNDP project has undertaken an inventory of selected areas covering in all 1,293,323 ha of mainly Dipterocarp forest.

## Result:

Stratum	Area 1000 ha	Volume <sup>a)</sup> m <sup>3</sup> /ha
Mixed Dipterocarp forest of medium density	269	94
" " " " high "		
" " " " Flat terrain	317	148
" " " " high density		
" " " " Mountain terrain	474	145

a) The net industrial stem wood for trees above 46 cm d.b.h.

B. A considerable portion of the peat swamp forests seems to have been inventoried by the Forest Service. One source gives as much as one million ha to be inventoried. No results are available.

Other

1) Of the Dipterocarp forest only 2 million ha are or expected to become accessible within the next 20 years. In addition 0.6 million ha of accessible swamp forest exists.

2) It is estimated that 250 - 350,000 ha of Dipterocarp forests are affected by shifting cultivation.

C. West MalaysiaNatural forest land

Of the total land area of 13.1 million ha forest covered 9,486,000 ha in 1969. This area was distributed as follows:

Type of forest	Area, 1000 ha
Reserved forest	3,480
- for production	2,350
- for protection	1,130
Game reserves and National parks	666
Other state forest	3,950
Total (non-alienated forest)	8,096
Alienated forest <sup>a)</sup>	1,390

a) Not yet put in crop but not classified as forest any longer.

Four distinct forest types are recognised. The table below gives a breakdown for 8.4 million ha of forest:



Forest type	Area, 1000 ha
Lowland and Hill Dipterocarp forests	7,110
Peat swamp forests (mainly on the west coast)	500
Mangrove forests (mainly on the west coast)	145
Montane forests, above 1,200 m elevation	654
Total	8,400

The three first types are of commercial value but up to date the mangrove has been exploited only as fuelwood and charcoal.

The Dipterocarps are the most important species in West Malaysia. Especially the light density Shorea species (merantis) are of importance. In 1967 they made up 39 percent of the log production while the Dipterocarps as a total made up 71 percent.

The West Malaysian Forest Inventory 1970-72 gave the following information about different classes of forest. Note that this inventory did not cover the entire country. (Roughly 1.1 million ha of forest excluded).

Forest type	Area, ha
Unexploited Hill	3,413,645
Recently partly-exploited Hill	1,267,520
Disturbed Hill including eroding	1,713,905
Hill with shifting cultivation	260,222
Poor Edaphic and Upperhill	700,940
Swamp, un- and partly exploited	814,661
Mangrove	149,739
Total	8,320,632

The same inventory has also given the following classification of the forests:

Class of forest	Area, 1000 ha
Unexploited accessible commercial forest	2,360
Selectively logged-over forest	3,990
Forest currently classed as inaccessible or not available for harvesting	630
Non-commercial forest (unproductive)	1,370
Total (non-alienated forest)	8,350

### Man-made forest

In 1970 the conifer plantations were reported to cover about 1,090 ha mainly in the Selangor area. The principal species recommended for planting is *Pinus caribaea* var. *hondurensis*.

The Forestry Department has plans to establish 100,000 ha of pine plantations over a 15-year period to create the resource base for a planned newsprint mill. Whether the plans will be effected or not depends on the budgetary situation.

Malaysia also has 1,816,000 ha of rubber plantations.

### Inventories

#### A. Forest Resource Reconnaissance Survey:

This inventory - which was started in 1961 - has a rather limited value as the work was not done in a standardised way for the whole country.

#### B. West Malaysian Forest Inventory 1970-72:

This inventory covered a forest area of 8.3 million ha. The main results are shown in the table below:

Forest type	Gross volume <sup>a)</sup>					Total	Total <sup>a)</sup>
	Mer <sup>b)</sup>	O.Dip <sup>c)</sup>	Mar <sup>d)</sup>	Pot <sup>e)</sup>	Res <sup>f)</sup>		
	m <sup>3</sup> /ha						mill.m <sup>3</sup>
Unexploited Hill	47.2	28.2	44.7	25.0	66.7	211.8	531
Recently partly-exploited Hill	27.7	24.0	41.8	17.0	54.9	165.3	148
Disturbed Hill							
incl. eroding and							
Hill with shifting							
cultivation	17.3	10.6	27.7	13.6	41.3	110.5	140
Poor Edaphic and							
Upperhill	11.6	8.6	20.5	24.5	50.4	115.9	50
Swamp, un- and							
partly exploited	4.7	1.7	29.9	14.1	23.5	73.9	31
Total <sup>g)</sup> (million							
m <sup>3</sup> )	215	130	215	94	244	-	900

a) All trees above 30.5 cm d.b.h. (12")

b) Mer = all Merantis

c) O.Dip = all Non-Merantis Dipterocarps

d) Mar = all Non-Dipterocarps presently fully on the market

e) Pot = all Non-Dipterocarps partly on the market and with future market potential

f) Res = all Non-Dipterocarps not at present on the market

g) All trees above 45.7 cm d.b.h. (18")

Estimates of the amount of timber in alienated land not yet converted to agriculture are not available.

Other

1) A FAO Project based on a soil suitability classification has estimated that around 2.5 million ha of forest in West Malaysia is suitable for agriculture. It is further estimated that about 1.2 million ha of these forests will be alienated and converted to agriculture over the next 20 year period. In 20 years time the size of the forest estate will therefore be about 7.1 million ha of which some will be unproductive (perhaps 1.4 million ha) and some reserved for protection.

2) Assuming an average exploited volume of  $40 \text{ m}^3$  per ha and an annual exploitation of 6.4 million  $\text{m}^3$  the annual coupe would be around 150,000 ha. Half of this area is alienated land below 1,000 m in elevation.

MongoliaNatural forest land

The total area is 156,500,000 ha. It is a rather mountainous country which - in the west - reaches up to 4,653 m. There is a relatively flat eastern plateau and some lowlands in the centre with the eastern and southern parts of the country being generally lower than the western and northern parts.

Five different vegetation zones are recognised: They can briefly be described as follows:

A. The forest zone is the southern extension of the Siberian taiga and covers 15 percent of the land area (23.5 million ha).

B. The mountain steppes cover 17 percent of the land area.

C. The grassy and arid steppes cover 26 and 27 percent respectively.

D. The desert lying to the extreme south of the country and including the south Altai mountains, covers about 15 percent of the land area.

The most extensive areas of forest are in the north and central part of the country and particularly in the mountain regions Khangai, Khentei, and round Khubsugal Lake.

The dry continental climate with a wide temperature range results in rapid changes in the density of timber stands decreasing from north to south and from the mountains to their foot-hills. The forests change quite rapidly from pure coniferous through mixed broadleaved to the typical steppe and semi-desert vegetation.

Inventories

The first forest inventory was carried out in 1955-1957 by

the Selanga Complex Expedition of the USSR. The Bureau "Lesoprojekt" surveyed 9.4 million ha of forest area and classified this according to the dominant species. The main results are given in the table below:

Species	Area by species, 1000 ha	Percentage mature and overmature stands	Volume m <sup>3</sup> /ha
Pinus silverstris	655	65	152
Larix sibirica	6,810	80	130
Pinus cembra var. sibirica	1,104	90	163
Picea obovata	11	..	..
Total coniferous	8,581	80	..
Betula spp.	887	45	50
Populus spp.	0.4	100	50
Total broadleaved	887	..	..
Total	9,467	..	..

The total volume of all inventoried stands was 1,261 million m<sup>3</sup>.

The volume by species in the commercial forest (2,970,000 ha) is as follows:

Species	Volume million m <sup>3</sup>
Pinus silvestris	21.9
Pinus cembra	37.5
Larix sibirica	225.0
Fir and spruce	0.4
Poplar and aspen	0.2
Birch	28.2

#### Other

1) In 1969 the recorded removal of roundwood for the whole country was 1.97 million m<sup>3</sup> of which 0.8 million was timber and the rest fuelwood.

2) The area of National parks is 165,000 ha.

#### Nepal

##### Natural forest land

The forest area is estimated to cover about 4.66 million ha.

The forests may be divided into four zones:

A. The Terai and Bhabar forests of the plains are found at altitudes below 300 m on a strip of level alluvial terrain between the Indo-Nepal border and the main hill regions. They occupy about 1.3 million ha. The main species are *Terminalia tomentosa*, *Acacia catechu*, *Shorea robusta*, *Salmalia malabarica* and *Dalbergia sissoo*. The Terai forests constitute Nepal's principal commercial forest area.

B. The forests of the Siwalik hills and the lower valleys of the Mahabharat range run east to west between the Terai and the main central mountain mass. They cover about 0.8 million ha. The upper altitudinal limit is about 1,200 m. The forest cover is characterized by *Shorea robusta* and *Pinus roxburghii*. The terrain in this zone is extremely steep and rugged.

C. The forest cover of the upper Mahabharat to an elevation of 2,500 m is generally patchy, particularly in the east and centre of Nepal. Much of the forest has been cleared in these areas. In other areas the stocking is relatively high. The area has been estimated as 2.1 million ha. The characteristic species are *Quercus semicarpifolia*, *Q. incana*, *Q. glauca*, *Schima wallichii*, *Alnus nepalensis* and *Pinus roxburghii*. *Pinus wallichiana*, *Tsuga dumosa* and *Rhododendron arboreum* occur at higher altitudes.

D. The forests in the valleys on the southern side of the Himalaya at an elevation of over 2,500 m are composed of *Abies pindrow*, *Tsuga dumosa*, *Picea smithiana*, *Cupressus torulosa*, *Pinus wallichiana*, *Juniperus recurva*, and *Cedrus deodara*. At present these forests are rather inaccessible but their commercial potential is considerable. The area of this type is around 0.5 million ha.

#### Man-made forests

In 1970 4,000 ha of forest plantations were said to exist. The main species are *Eucalyptus* spp, *Pinus patula*, *P. radiata*, *P. taeda*, *P. longifolia*, *Tectona grandis*, *Alnus nepalensis*, *Michelia champeca*, and *Schima wallichii*.

#### Inventories

A considerable part of the forested areas have been inventoried. USAID and FAO have been the main executing agencies. The following results can be given:

A. Inventory of the Terai, Siwalik Range and the southern Mahabharat Range.

There exists 1.67 million ha of forest land of which 1.25 million ha are classified as commercial forests (i.e. land capable of providing a commercial crop of wood). Sawtimber stands occupy 1.05 million ha of the commercial forest area. The gross volume to 10 cm top of all species on commercial forests is estimated at 102 million m<sup>3</sup>. Nearly 50 percent of the volume is *Shorea robusta*. Ninety percent of the growing stock is suitable now or in the future for conversion into industrial

wood products. The net sawlog volume (volume to 20 cm top with deductions for defects) of the commercial forests is 66 million m<sup>3</sup>.

B. Of the 276,000 ha inventoried in the Bheri-Karnali watershed 84 percent is under forests. Fifty-seven percent of the forest land is capable of producing commercial timber products. The total net volume of timber on commercial forest land in the area is 9.1 million m<sup>3</sup>; pine forests account for 1.8 million m<sup>3</sup> of this total.

## Pakistan

### Natural forest land

The forest area is given as 2.6 million ha. "Productive forest" area estimated to be 1.9 million ha. The natural forests can be described according to the following types:

A. Conifer forest occurs in the north and north-west part of the country in the foothills of the Himalayas between 900 and 4,000 metres. The area covered is around 0.9 million ha (sometimes given as 1.3 million ha).

Species: (2,500 m - 4,000 m) *Pinus longifolia*  
(900 m - 3,000 m) *Cedrus deodara*, *Pinus excelsa*, *P. gerardiana*, *Abies pindrow*, and *Picea morinda*

Most coniferous forest are overmature and mature. Average stocking is as high as 500 m<sup>3</sup>/ha in certain parts despite low average density (60 percent). Six percent of the trees have a diameter below 40 cm. Over 80 percent of the timber is of very good quality. These forests are growing on steep slopes and are only partly accessible.

B. There are some scattered stands of *Juniperus macrocarpa* and *Pinus gerardiana* in an area of 100,000 ha in Baluchistan. Outside these stands it is mainly scrub.

C. Riverine forests cover around 300,000 ha along major rivers in the arid parts of central and southern Pakistan. The main species are *Acacia arabica* and *Prosopis specigera*. These forests give fuelwood and mining poles.

D. Mangrove forest cover 300 - 350,000 ha. It is poorly-stocked and is composed of less valuable species. This forest provides fuelwood for Karachi.

E. Submontane scrub forest grows below the conifer forest of the Himalaya foothills. The area covered is around 0.8 million ha. This forest is quite often degraded. The main species are *Acacia modesta* and *Olea cuspidata*. The main produce is fuelwood.

The area figures given above are, according to some sources, overestimates. In 1967 the area of stocked forests was estimated as follows:



Type of forest	Area	Estimated volume	
	1000 ha	million m <sup>3</sup>	m <sup>3</sup> /ha
Coniferous	347	55	160
Riverine	219	..	..
Irrigated plantations	155	..	..

### Man-made forests

a) Roadside plantations cover around 100,000 ha. The main species are *Dalbergia sissoo* and *Acacia arabica*. They are predominantly used for fuelwood though *Dalbergia* is sometimes used for furniture.

b) Irrigated forests along the river Indus in the arid zones cover around 200,000 ha. The main species are *Dalbergia sissoo*, *Acacia arabica* and *Morus alba*. An effort is being made to introduce *Eucalyptus* and *Populus* species to increase productivity and the share of industrial wood. They are presently mainly used for fuelwood and for some tools and turnery.

c) Unrecorded resource: The term is used for tree plantations on private agricultural land. Plantations of this type in lines and groups of mainly *Populus* and *Salix* species are of a certain importance in the Peshawar region.

### Inventories

A. In 1965 a team was charged with the inventory of 13 million ha non-inventoried area in the north and north-west of which about 10 - 15 percent is forest. The purpose was to establish management plans for all ownership categories. According to the plans 40 percent of the area should be covered by 1973, and the remainder in the following 3 - 4 years.

B. Management plan inventories cover the whole area of state owned forests outside the northern Himalayan zone and a part of this zone as well. In all 1.6 million ha is covered.

### Other

1) The total area under control of the Forestry Department is 7.5 million ha. Included in this figure is 4.95 million ha with range lands. Forest reserves cover 1.47 million ha.

2) Private forests cover 700,000 ha.

## The Philippines

### Natural forest land

Forests are reported to cover 15.4 million ha of the total



of 30 million ha of land in the Philippines. However 2.6 million ha of these forests have already been lost to forestry through alienation to agriculture, shifting cultivation and encroachment. The total forest area is made up as follows: (within brackets are given updated figures from 1971. The other figures are from 1969)

Location	Forest type						
	<u>Dipterocarps</u>				Pine	Other	Total
	Unprod- uctive <sup>a)</sup>	<u>Productive</u>					
		Virgin	Cut-over	Total			
	1000 ha						
Mindanao	326	2,667	3,541	6,208	-	105	6,639
N. Luzon	849	1,509	2,058	3,567	221	6	4,643
Other islands	1,616	..	..	..	..	..	4,124
Total	2,791	..	..	..	..	..	15,406
	(1,728)	..	..	(13,589)	(214)	(286)	(15,875)
Lost to for- estry	..	..	..	..	..	..	2,600
	(56)	..	..	(3,026)	(8)	(47)	(3,138)
Total Phili- pines	..	..	..	9,287	280 <sup>b)</sup>	448	12,806
	..	..	..	(10,562)	(205)	(239)	(12,736)

a) Forests of poor site quality. Trees averaging less than 5 m of merchantable sawlogs at maturity.

b) Includes 40,000 ha with plantations.

Practically all of the reduction is reported to occur in the productive forests. Practically all unproductive forests will be reserved for protection purposes. The following information has been found concerning various forest types.

A. Dipterocarp forest: This type occurs in all parts of the Philippines up to 1,000 m. It is the most important type in area, volume and commercial value. Members of the Dipterocarp family are the dominant species and they usually constitute about 75 percent of the volume of the stand. The Dipterocarp forest is of the mature to overmature type, averaging about 100 to 200 m<sup>3</sup> per ha in timber volume. The area covered is 13,589 million ha.

B. Molave type: This type occurs mainly in Northern Luzon in areas having a distinct wet and dry season. It is of a more open character than the Dipterocarp type, and its average volume of timber is only 30 m<sup>3</sup> per ha. The area covered is 1.25 million ha. (The areas under B, D, E and F seem to be too high.)

C. Pine: Pine is found in the high altitude region in Northern Luzon and Mindoro. The species is *Pinus kesiya* (insularis). The area covered amounts to about 0.24 million ha.

D. Mangrove and marsh: Mangrove usually grows in tidal flat-

lands at the mouth of streams and on the shores of protected bays. The species are mainly used for firewood and charcoal and the bark for tanning and dying. The area covered is around 0.45 million ha.

E. Mountain and mossy types: These types are composed of shortboled trees whose branches are generally covered with moss. Usually found in high and very rough mountainous regions these forests are essentially for protection. The area covered is around 0.33 million ha.

F. Other forest types cover around 1.6 million ha.

### Man-made forests

At the end of 1968 the area of plantations was officially 146,000 ha. It is more likely that the actual area planted was around 100,000 ha. Forty percent of which is *Pinus kesiya* and the rest non-coniferous species.

The area of new planting has been decreasing steadily during the years (less than 2,000 ha in 1968). In the same year replanting amounted to 9,800 ha. There is a considerable need for replanting since it is estimated that not more than one third of annual planting is successful at first trial. Most of the existing plantations have been established in scattered locations - primarily for protection purposes.

There is said to be 5 million ha of open grassland in the country. Large parts of these lands would be suitable for the establishment of plantations.

World Wood gives total area planted in 1972 as 177,000 ha. In 1972 an area of 12,800 ha should have been planted. These figures do not correspond with the earlier given figures.

### Inventories

In 1962 the Bureau of Forestry, with the assistance of USAID started a nation-wide inventory. Fieldwork for the whole country was completed in the late 60's and final data has been published for the Philippines as a whole. The table below gives the basic results:

	Volume <sup>a)</sup> , million m <sup>3</sup>				
	Type of forest				
Location	Productive	Mangrove	Pine	Unproductive	Total
Mindanao	1,010	4	-	21	1,035
Palawan	127	4	-	23	154
Luzon	505	1	15	29	550
Visayas	247	1	-	6	254
Total	1,888	10	15	79	1,992
m <sup>3</sup> /ha	134	34	70	44	124

a) Volume above bark of sound trees, all species above 20 cm d.b.h.

Other

1) Shifting cultivation is a serious problem. Rough estimates say that 40 - 170,000 ha are destroyed annually. On Mindanao for instance the timber drain resulting from land clearings and shifting cultivation was calculated to an average of 15.3 million per year, whilst only an average yearly drain of 4.8 million m<sup>3</sup> came from authorized logging. (in 1962)

Shifting cultivation and legal conversions of forest land to other purposes will reduce the forest area by 200,000 ha per year. This would reduce the productive forest to 7 million ha in 20 years time.

2) The present log removals amount to about 17 million m<sup>3</sup> (industrial wood, unrecorded portion estimated).

3) The estimated annual rate of utilization is as follows:

- |  |                           |
|--|---------------------------|
| - commercial logging                       | 110,000 - 170,000 ha/year |
| - transfer of forest land<br>to other uses | 50,000 ha/year            |

4) Ninety-seven percent of the forests in the Philippines are owned by the Government.

5) The area of National parks and Game parks is 1,996,000 ha.

Sabah

See under Malaysia

Sarawak

See under Malaysia

Sri LankaNatural forest land

The total land area is 6.4 million ha. Of this area 2.44 million ha is classified as forest. Another one million ha is under shifting cultivation and 240,000 ha under grass, fern or scrub. The area of "forest" decreased by 400,000 ha between 1961 and 1968. The distribution of the forest in vegetation types is as follows:

Vegetation type	Area, 1000 ha
Tropical evergreen rainforest	159
Montane forest	67
Intermediate zone	129
Dry zone (low quality forest)	2,086
Total	2,441

#### Man-made forests

The estimates of the area of man-made forests vary considerably. In 1970 the area of pure plantations was given as 41,000 ha and the area of natural forests enriched with mahogany planting was given as 12,000 ha.

The species distribution in pure stands was as follows:

Species	Area, ha
Teak	26,300
Eucalyptus	7,000
Pines	600
Jak/mahogany	4,850
Others	2,500
Total	41,250

Most plantations are situated in the dry zone. The species planted there is mainly teak.

Since 1966 the annual planting target is 5,665 ha of pure plantations and 810 ha of enrichment planting of degraded wet-zone forest with *Swietenia macrophylla*. In pure plantations teak is the main species. In 1966 the total area of plantations was planned to be 44,000 ha by the end of 1974.

The absolute latest figure (WW) gives the total area of plantations as 65,000 ha. In 1971 5,000 ha should have been planted.

#### Inventories

Between 1956 and 1961 an inventory of practically all forest resources on Sri Lanka was carried out under the Canadian Colombo Plan.

The main results were the following:

Type of forest	Wet Zone		Intermediate Zone		Dry Zone	
	Area Volume <sup>a)</sup>		Area Volume <sup>a)</sup>		Area Volume <sup>a)</sup>	
	1000 ha	1000 m <sup>3</sup>	1000 ha	1000 m <sup>3</sup>	1000 ha	1000 m <sup>3</sup>
High Yield	12	3,000	-	-	-	-
Medium Yield	47	7,800	8	620	152	11,700
Low Yield	105	10,700	53	2,950	1,267	62,100
Non Productive	64	2,750	69	2,500	1,089	23,600
Montane	14	660	-	-	-	-
Plantation	9	-	5	-	6	-
Total	251	24,910	132	6,070	2,514	97,400

a) Probably gross volume of all species above 9.6 cm d.b.h.  
(1 foot girth)

In 1966 these results were adjusted to allow for changes in the forest area. The adjusted table is as follows:

Type of forest	Wet Zone		Intermediate Zone		Dry Zone	
	Area Volume		Area Volume		Area Volume	
	1000 ha	1000 m <sup>3</sup>	1000 ha	1000 m <sup>3</sup>	1000 ha	1000 m <sup>3</sup>
High Yield	46	7,986	7	595	125	9,629
Medium Yield						
Low Yield	73	7,448	51	2,804	1,101	54,091
Non-Productive	37	1,586	66	2,407	947	20,475
Montane	4	170	-	-	-	-
Plantations	1.2	-	5.3	-	12.5	-
Total	161	17,190	130	5,806	2,185	84,195

About 30 percent of these volumes is of species already established on the world market. About 70-80 percent is used locally.

### Other

Practically all forest land is owned by the state. In 1969 356 forest reserves comprising 1.17 million ha were established or proposed.

### Taiwan

#### Natural forest land

According to the latest available statistics the natural forests of Taiwan cover an area of 1.96 million ha or 55 percent of the total land area. Of this forest area, conifers cover 18.9 percent, mixed stands 2.8 percent, hardwoods 72.5 per-

cent and bamboo 5.8 percent.

The forest types vary according to elevation. The hardwood types mostly occupy the lower elevations, whilst conifers dominate the higher altitudes. The main types are as follows:

A. Bamboo type: These forests are mostly cultivated and are widely spread throughout the island. Bamboo forests cover a total of 113,900 ha, and consist mostly of *Sinocalamus latiflorus*, *Phyllostachys makinoi* and *Phyllostachys edulis*.

B. Hardwood type: This type is distributed from the sea level up to 2,000 m. It occupies an area of 1,427,300 ha, and can be subdivided into tropical, subtropical and temperate groups. As this type lies in the easiest accessible areas it has been heavily overcut and badly managed. For this reason large areas have a very low volume per ha.

C. Conifer - hardwood type: This type occupies 55,300 ha and is the dominant type between the temperate hardwood and the upper conifer types. It forms a narrow belt at elevations ranging from 1,500 to 2,000 m. Where logging has taken place, the conifers have been removed, leaving many old and decadent hardwoods.

D. Conifer type: This type occupies an area of 373,000 ha, above 2,000 m, within which the following sub-types may be recognized:

- a) Cypress - *Chamaecyparis taiwanensis* and *Chamaecyparis formosensis*;
- b) Hemlock - *Tsuga chinensis* is the dominant species and is found at elevations of 2,000 to 3,000 m;
- c) Fir - spruce type - the most important species here are *Abies kawamii* and *Picea morrisonicola*;
- d) Pine type - the pine type consists of four native species - *Pinus armandi*, *Pinus taiwanensis*, *Pinus morrisonicola* and *Pinus massoniana*.
- e) Other conifer type - this type appears in different elevations ranging from 300 - 2,700 m. The most important species are *Libocedrus formosana*, *Taiwania cryptomerioides*, *Cunninghamia konishii*, *Pseudotsuga wilsoniana*, *Cunninghamia lanceolata* and *Cryptomeria japonica*.

The figures given above are from an islandwide inventory undertaken in 1955. A classification undertaken in 1969 and based on the most recent information gave the following breakdown:

Type of forest	Area, ha
Productive natural forest	574
- Conifer	163
- Hardwood	412



cont.

Type of forest	Area, ha
Bare forest land	414
Protection	354
Other non commercial	621
Total	1,960

Man-made forests

Excluding bamboo there were, in 1968, a total of some 235,000 ha of plantations. Of this area 97,000 ha are conifers and 139,000 ha hardwoods (mainly *Acacia confusa*). In addition there are 78,000 ha of bamboo plantations.

The mean annual planting area during 1960 - 1965 was about 25,000 ha, while the planned planting rate at present is somewhat above 15,000 ha.

Inventories

A Forest resource survey of the entire country was undertaken 1954 - 1956. In recent years the National forests have been completely covered by management plan inventories. No complete National inventory has anyhow been undertaken since 1956. In 1969 the following estimate of the total standing volume was done:

Standing volume (all trees above 10 cm d.b.h.):

Type of forest	Productive forest land				Total	Protection for-est	Other non commer- cial forest	Total forest land
	Natural forest		Plantation					
	Conifer	Broad-leaved	Conifer	Broad-leaved				
million m <sup>3</sup>								
National Forests	44.4	30.7	3.3	1.0	79.3	47.6	57.2	184.1/ f
Other forests	-	4.6	0.7	2.5	7.9	0.3	0.7	8.9
Total	44.4	35.3	4.1	3.5	87.2	47.9	57.8	193.0

Other

1) The area affected by shifting cultivation within the National forests is estimated to be 100,000 ha.

2) It is estimated that around 75,000 ha will be released from National forest over the next 20 years.



ThailandNatural forest land

More than 50 percent of the total land area is still covered by forest. Part of this area is covered by degraded poorly-stocked forests. The forest may be broadly divided into the following categories:

A. Tropical evergreen forests: This forest type is found throughout Thailand but reaches its greatest development in those parts of the country with a tropical rainforest climate, for instance in eastern Thailand and on the Peninsula. The most dominate species in this type belongs to the family Dipterocarpaceae.

B. Coniferous forests: Coniferous forests are found all over northern and north-eastern Thailand at elevation ranging from 700 m and upwards. The species are *Pinus kesiya* (insularis) and *P. merkusii*, the latter descending to much lower altitudes than *Pinus kesiya*. The area of pine is estimated at 136,000 ha.

C. Mangrove forests: In Thailand mangrove forests occur on thick muddy tidal swamps at the mouth of the rivers, along the sea coast in the Gulf of Thailand, and on the east and west coasts of the Peninsula. The total area of mangrove forest is calculated to be about 368,100 ha, of which about half are along the shore of the Gulf of Thailand and the rest on the west coast of the Peninsula.

D. Mixed deciduous forests (mostly with teak): This type forms extensive tracts throughout northern Thailand. The general characteristic of the teak forests is their open nature with teak growing singly here and there or in small groups mixed with other deciduous trees. On alluvial grounds and in suitable localities the teak sometimes forms pure stands. Forest fires usually sweep through the whole teak forests every dry season, around March and April, but they are not of great intensity and cause comparatively little damage to sound standing trees. Mixed deciduous forests without teak are found scattered in central Thailand and in the northern part of the Peninsula.

The total standing volume of teak has been estimated as 30 million m<sup>3</sup>.

E. Deciduous Dipterocarp forests: These forests occupy large stretches of the forest areas in northern, central and north-eastern Thailand. The occurrence of this forest is mostly due to edaphic rather than climatic factors. This type of forest is found on porous, well drained soil which is generally formed by the decomposition of laterite. The general appearance of these forests is of an open grassy type, often approaching that of the savanna forest. The trees are scattered and as a general rule of medium or small size both in height and girth. The forests are burnt over regularly each year.

F. Savanna forests: The savanna forest is found in some scattered areas in north-eastern Thailand and on the Peninsula. This type occupies a very small area.

According to the National inventory the land distribution is as follows:

Type of land	Area, 1000 ha
Forest area	29,002
Teak plantations	21
Other plantations	14
Tropical evergreen	10,816
Mixed deciduous	5,849
Dry Dipterocarps	10,349
Pine	136
Mangrove	368
Scrub	433
Swamp	79
Shifting cultivation	4,799
Agricultural land and other land	17,610
Total area	81,491

The area of permanent productive forest has been estimated to 15 million ha. The area of stocked forest is - according to one source - around 21 million ha (degraded areas are included in some of the vegetation types above).

#### Man-made forests

At the end of 1972 the area planted was given as 57,000 ha. The species distribution was as follows:

Species	Area, ha
Pines	2,200
Teak	34,400
Eucalyptus	125
Other broadleaved	20,300
Total	57,025

It should be noted that only some of these plantations have been successful (80 percent teak and 30 percent of others).

The estimated annual planting over the next five years is 17,500 ha most of which is teak. In 1975 the planted area should be 90,000 ha while it should be 189,000 ha in 1985.

Another source gives the present area planted annually as 4,800 ha. This source says that the plans are to increase the planted area to 9,600 ha in 1974 and eventually to 16,000 ha in 1975.

## Inventories

The first National inventory was started in 1961 in the north-eastern region. The whole country has been covered by regional inventories. All trees with a diameter of more than 30 cm d.b.h. were measured.

In 1968 a new National forest inventory was started. This time the whole country will be covered each year, but to complete the inventory, the results of six years must be added together.

The information given in the table below has been found summarized in a recent Timber Trends Study.

Vegetation type	Volume <sup>a)</sup>	
	million m <sup>3</sup>	m <sup>3</sup> /ha
Evergreen forest	660	61
Mixed deciduous forest	310	53
Dry Dipterocarp forest	319	27
Pine	6	..
Total	1,295	48

a) All sound trees above 30 cm d.b.h. Volume under bark.

Another summary of the results from the National inventory have been received from the Forest Service. This summary gave the following results:

Vegetation type	Volume million m <sup>3</sup>
Evergreen forest	831
Mixed deciduous forest	226
Dry Dipterocarp forest	220
Pine	6
Total	1,283

It is not possible to judge which summary is correct but the first one ought to be the more reliable as it is the latest.

## Other

1) It is estimated by one source that 250,000 ha is cleared annually for shifting cultivation. The same source estimates the total area destroyed as 500,000 ha. Another source gives the total area destroyed annually as 100,000 ha.

2) A recent land classification gave 23,810,900 ha as permanent commercial forest area. Another 1,537,100 ha of forest covered land is set aside for National parks and wildlife management. The total forested area will be 25,328,200 ha. 3,674,000 ha of forested land will be set aside for farming etc.

West Malaysia

See under Malaysia.

Viet-Nam NorthNatural forest land

A. Broadleaved forests cover about 1.4 million ha. They are mainly situated in the southern part of the country and in the mountainous regions towards the Laos frontier. Most broadleaved forests are rather inaccessible.

B. Bamboo forests cover around 500,000 ha according to one source. These forests are reported to be rather accessible. Bamboo does not grow well at altitudes exceeding 500 m above sea level.

Others

- 1) One source reports as much as 6 million ha to be available (and suitable) for planting. Included in this figure is probably not only bare land but also considerable areas covered with grass- and bush as well as certain areas under bush fallow.
- 2) Nothing is known about the establishment of any plantations.
- 3) Nothing is known about any undertaken inventories.
- 4) Shifting cultivation seems to be rather common.

Vietnam SouthNatural forest land

The terrible war that has taken place over the last years makes it almost impossible to describe the forests. Forests existing some years ago have probably to a great extent been destroyed.

The information given below is from 1966 - 1967. Of the total area of 17,146,000 ha around 5,620,000 ha was then considered as forest, it was divided on the following types:

Forest type	Area, 1000 ha
Pines	125
Hardwood	5,015
Mangrove	280
Other aquatic plants	200
Total	5,620

The main part of the hardwood forest was occupied by open forests (forêt claire).

The pine species are mainly *Pinus merkusii* and *P. kesiya*, *P. armandii*, *P. krempfii* and *P. griffithi* are also reported to exist.

#### Man-made forests

Up to the end of 1966 an area of 17,468 ha were planted. Pines, teak and *Casuarina* were the most commonly planted species.

#### Inventories

A forest inventory was planned to start in 1974.

## FOREST RESOURCES OF THE PACIFIC AREA

### Australia

#### Natural forest land

The total area of forest depends on the chosen definition. The latest figure given for closed forest is 42,475,000 ha while the area of forest and other woodlands is 138 million ha.

The native forest of Australia can be classified into three main categories - rainforests, sclerophyll forests, and cypress pine forests. In addition there are extensive open woodland areas.

A. The rainforest occupy around 750,000 ha. This type is found in scattered locations along the east coast where climatic conditions vary from tropical to temperate. Different types of rainforest have therefore developed.

a) Tropical rainforest occurs in the wettest parts of northern Queensland. Main species are Queensland walnut (*Endiandra palmerstonii*) and Queensland maple (*Flindersia brayleyana*). In certain places the coniferous species *Agathis palmerstonii* and *Araucaria cunninghamii* occur.

b) Subtropical rainforest is found in southern Queensland and northern New South Wales. Main broadleaved species are *Flindersia* spp., *Argyrodendron* spp., *Ceratopetalum apetalum* and *Doryphora sassafras*. Scattered *Araucaria cunninghamii* and *Araucaria bidwillii* are found.

c) Temperate rainforest is found in Tasmania. The main species are *Nothofagus cunninghamii* and *Atherosperma moschatum*. Three endemic conifers, *Phyllocladus aspleniifolius*, *Dacrydium franklinii* and *Athrotaxis selaginoides* occur in small quantities.

B. Sclerophyll forest occupy the main part of the closed forest in Australia. This forest consists mainly of *Eucalyptus* species of which there are more than 500 endemic species. The sclerophyll forest covers a wide range of climates and is subdivided into wet and dry formations. The wet sclerophyll forest occupies 30-40 percent of the area of this type but produces the main part of broadleaved sawlogs.

C. Cypress pine forests occur as a discontinuous belt west of the Great Dividing Range in New South Wales and southern Queensland. Much of it has been cleared but the remaining scattered stands are of importance locally. The main species are *Callitris glauca* and *C. calcarata*.

D. Open woodlands occur inland from the forest areas and in large parts of northern Australia. Many different species of *Eucalyptus* are to be found.

The most recent complete estimates of the forest resources are shown in the table below:

Type of Forest and Other Wooded areas	Area, million ha
Forests	37.9
- Forests with growing stock	37.3
- Forests temporarily unstocked	0.4
Open woodland, scrub and brushland	99.8
Total	137.8

A more accurate recent survey has given the forest area as 42.5 million ha.

A breakdown of the natural forest area in vegetation types gives the following result:

Vegetation types	Area <sup>a)</sup> , million ha
Coniferous	6.95
Sclerophyll type	27.8
Rainforest	0.75
Total	35.5

a) Forests excluded from exploitation by law are not included in these figures.

#### Man-made forests

At the end of 1972 plantations covered 482,000 ha. Of this area 455,000 ha was coniferous and the rest broadleaved.

At 31/3 1972 the species distribution was as follows:

Species (on ownership categories)	Area, ha
<u>Government plantations:</u>	
Native conifer	36,504
Pinus radiata	229,182
Other pines	78,984
Other exotic conifers	2,743
Total	347,413
<u>Private plantations:</u>	
Pinus radiata	90,493
Other conifers	30,000
Total	120,493
Grand total	467,906



It is planned that 31,000 ha per year should be planted over the next five years.

The ultimate target is 1,215,000 ha of conifers, and the intermediate targets are 548,000 ha of conifers by 1975 and 750,000 ha by 1985.

The main coniferous species planted are *Pinus radiata* with smaller areas of *P. pinaster*, *P. elliottii*, *P. caribaea*, and *Araucaria* spp.

Among broadleaved species *Eucalyptus* dominate but there are also some areas with poplars.

### Inventories

According to a WFI questionnaire roughly 19 million ha have been covered by some form of inventory. This inventory covers the better-stocked state and federal forests and all plantations regardless of ownership. Information on the remaining government-owned forests is inadequate, and that on private indigenous resource is non-existent. The estimates given for growing stock are therefore most unreliable. In 1970 the following estimates have been prepared for all forests except those excluded from exploitation by law:

Type of forest	Growing stock		
	Inventoried forests	Total (inventoried and non-inventoried)	Total
	million m <sup>3</sup>		m <sup>3</sup> /ha
Plantations <sup>a)</sup>	57	58	148
Cypress <sup>b)</sup> (indigenous)	8	21	3
Total conifers	65.3	79	11
Eucalyptus <sup>c)</sup>	476	974	
Rainforest <sup>c)</sup>	11		
Total broadleaved <sup>c)</sup>	486	974	34
Total all forests	555	1053	29

a) All ages and size classes

b) Volume of all trees down to 10-18 cm (d.b.h., u.b.)

c) Commercial wood down to 30-39 cm (d.b.h., u.b.)

The net increment is estimated to be 5.6 million m<sup>3</sup> for coniferous and 12.2 million m<sup>3</sup> for broadleaved.

British Solomon IslandsNatural forest land

The total forest area (including man-made) is 2,563,400 ha. The area of forest capable of large scale exploitation has, due to a cyclone, been reduced from 259,000 ha to 168,350 ha. The remainder is on very steep and rugged terrain, is second growth forest, or in agricultural areas.

Practically all the forests are broadleaved, but about 6,000 ha of *Agathis* exists.

Relatively few species made up the bulk of the growing stock. A single species sometimes accounts for 80 percent of the volume (*Campnosperma brevipetiolata*), and *Terminalia brassii* growing in swamp forests forms almost completely pure stands.

The main species are *Calophyllum kajewskii*, *C. vitiense*, *Campnosperma brevipetiolata*, *Pometia* spp, *Dillenia* spp, *Terminalia brassii*, *T. calamansanai*.

Man-made forests

The area of man-made forests was 4,400 ha at the end of 1972. The target is to plant 2,000 ha per year but this has not been reached. In 1972 around 500 ha were planted. All the plantations are broadleaved. To meet the demand for wood 130,000 ha of plantations would be necessary.

Inventories

It is not known if any inventories have been undertaken. Some information about volumes has been traced.

The total exploitable volume is (or was) probably around 20 million m<sup>3</sup> in trees larger than 50 cm d.b.h. Due to a recent cyclone this volume may have been reduced to 10-15 million m<sup>3</sup>.

FijiNatural forest land

The total area of closed forest is about 500,000 ha, including non-commercial forest and protection forest. The commercial forest amounts to roughly 200,000 ha. There are also 390,000 ha of open woodlands and 362,000 ha of brushland and grassland.

The closed forest is a mixed tropical forest of non-Dipterocarp type. Over 40 species are exploited but four of them, *Agathis vitiensis*, *Endospermum macrophyllum*, *Calophyllum* sp. and *Myristica* sp. - account for over 60 percent of production. Tropical conifers (*Agathis*, *Podocarpus*, and *Dacrydium*) are of importance in Fiji. They are found throughout the islands, but are present in greater abundance at higher elevations.

Man-made forests

The actual planted area at the end of 1971 was as follows:

Species	Area, ha
Pines	6,840
Mahogany	7,760
Eucalyptus	162
Total	14,762

About 80 percent of pine is *P. caribaea* var. *hondurensis* and the rest *P. elliottii*. Mahogany is all *Swietenia macrophylla* and Eucalyptus is mostly *E. citriodora* and *E. deglupta*.

The plans are to plant 2,945 ha of pine each year until the total area of pines is 30,500 ha. In 1971 2,150 ha were planted. At the end of 1972 the area planted should be 16,000 ha.

Inventories

All forests of any commercial importance (405,000 ha) were inventoried in 1967-68. The main results are the following:

Type of volume	Volume <sup>a)</sup> , 1000 m <sup>3</sup>		
	Total inventoried forests	Non-inventoried forests (estimate)	Grand total
Volume of commercial <sup>b)</sup> species	15,299	2,784	18,083
Volume of non-commercial species	4,939	910	5,849
Volume of all species	20,238	3,694	23,932
m <sup>3</sup> /ha (all species)	50.0	38.9	47.9

a) Volume of trees above 35 cm d.b.h.

b) The 31 most important species.

New Hebrides

Of the total land area, 1,476,000 ha, 16,000 ha is given as "commercial forest area". The two main species are *Agathis robusta* and *Calophyllum* sp.

Trial plantations cover around 30 ha.

New ZealandNatural forest land

The total area of natural forest is 5,780,000 ha and the total area of open woodland, scrub and brush land is 2.3 million ha.

The main types of natural forests can be described as follows:

A. Beech forests cover about 21 percent of natural forest area. They are mainly situated in the South Island, but are also found in the higher mountains of the North Island. Five species of *Nothofagus* are represented. These forests have their greatest importance as protective forests.

B. Coniferous forests cover 70 percent of the natural forest area and are fairly evenly divided between the main islands. Podocarpus forests (*P. specatus*, *P. totara*) are found in inland regions of the North Island. Forests where *Dacrydium cupressinum* is dominant are found in the Podocarpus forests of the coastal hills and plains. This type is very difficult to regenerate. In a couple of small areas on the North Island forests of *Agathis australis* are found. These forests are no longer of any economic significance.

C. Mixed broadleaved forests lie in the North Island and cover about 9 percent of the land area.

If man-made forests are included, the total area of forests is 6,185,000 ha. In 1968 the following breakdown was given for this area:

Type of forest	Area, 1000 ha		
	Stocked	Temporarily unstocked	Total
Currently or potentially accessible	..	..	930
- exotic	405	-	405
- indigenous	..	..	525
Inaccessible and/or unproductive	..	..	1,535
Excluded from exploitation by law	..	..	3,720
Total	5,580	605	6,185

Man-made forests

In 1968 the total area of plantations was 405,000 ha. No breakdown for different species is available. The breakdown of the volume in species groups is as follows:

Species	% of Total volume
Pines <sup>a)</sup>	78.5
Other conifers <sup>b)</sup>	16.8
Broadleaved <sup>c)</sup>	4.7
All species	100.0

a) Mainly *P. radiata*, but to some extent also *P. nigra*, *P. patula* and *P. elliotii*.  
 b) Mostly Douglas fir, but also *Cryptomeria japonica*, *Cupressus* spp., and *Larix decidua*.  
 c) Mainly *Eucalyptus*.

For the years 1971-74 the plans are to plant 20,000 ha per year and 18,000 ha per year for the years 1975-85. In this planting programme 75 percent of the area planted should be *Pinus radiata*. If these planting figures are realised the area planted should be 509,000 ha by March 1973.

The man-made forests are concentrated in the central North Island.

World Wood has given the total area planted as 587,000 ha at end of 1972 of which 29,000 should have been planted in 1972.

### Inventories

A National inventory of natural forests was carried out in 1955 and in 1959-63 for exotic plantations. Results from these inventories have been updated.

In 1970 the growing stock was estimated as follows:

Forest type	Growing stock <sup>a)</sup> million m <sup>3</sup>
Exotic conifers <sup>b)</sup>	212
Indigenous conifers <sup>c)</sup>	46
Subtotal conifers	258
Exotic hardwoods <sup>b)</sup>	0
Indigenous hardwoods <sup>c)</sup>	14
Subtotal hardwoods	14
Total	272

a) Growing stock in all forests, except those excluded from exploitation by law are included.

b) Volume to 10 cm top diameter under bark.

c) Volume of indigenous timber given only for sawtimber quality above 15-20 cm top diameter under bark.

In the natural forest the main species occupy the following proportions of the total volume:

Species	% of Total Volume
Podocarpus <sup>a)</sup>	70.0
Kauri <sup>b)</sup>	0.5
Beech	20.9
Tawa and other hardwoods <sup>c)</sup>	8.6
All species	100.0

a) Podocarpus dacrydioides, P. spicatus, P. ferrugineus, P. totara, and P. hallii.

b) Agathis australis.

c) Mainly Beilschmiedia tawa (tawa), but also Knithia excelsa, Beilschmiedia farairi, Vitex lucens and Lancelia novaezealandiae.

### Other

The ownership conditions are as follows:

Ownership	Area, 1000 ha		
	Plantations	Natural forests	Total
Public	208	4,482	4,690
Private	197	1,298	1,495
Total	405	5,780	6,185

### Niue

The total land area is 25,900 ha. High forest in scattered blocks is reported to cover 5,500 ha while secondary forests cover 14,000 ha.

### Papua and New Guinea

#### Natural forest land

Of the total land area of 47.5 million ha about 36.4 million ha is covered with forest. Of the forest area 14.8 million ha are classified as exploitable while the rest have been classified as not exploitable. There is also an area of 4 million ha of open woodlands.

The types of natural forest vary from mangroves to lowland evergreen rainforests and Eucalyptus savanna on the coastal plains, to midmontane forests occurring between 900 and 2,000 m above sea level, and finally to alpine vegetation covering the mountains from 3,000 to 4,600 m in elevation.

The table below shows the occurrence of coniferous in commercial forests:

Species	Area, 1000 ha
Mainly coniferous (Agathis spp.)	50
Mainly broadleaved	13,830
Mixed <sup>a)</sup>	530
Commercial forest	14,400

a) The conifers are stated to account for 20 percent of stand volume.

#### Man-made forests

Around 7,000 ha are covered with Araucaria and pines. Hardwoods (Teak, Eucalyptus deglupta etc.) cover 4,000 ha. Estimated annual planting will be 1,500 ha. In 1975 20,000 ha and in 1985 48,000 ha will be planted if the plans are followed.

#### Inventories

In 1970 an area of 6.8 million ha was reported to have been covered by inventories. Of this area 2 million ha were covered by rather extensive inventories. No detailed results from these inventories are available. It is estimated that 60-70 percent of the volume consists of medium-heavy hardwoods. The rest consists of light-density hardwoods.

An inventory of 290,000 ha in the Vanimo area gave an average net merchantable volume per ha of 26 m<sup>3</sup> (in trees above 68 cm d.b.h.). The average net merchantable volume was 36 m<sup>3</sup>/ha in lowlands and 51 m<sup>3</sup>/ha in hilltracts (minimum diameter not known).

#### Other

- 1) The area under permits and licences is 800,000 ha.
- 2) 200,000 ha of regrowth and virgin forests are cleared every year for shifting cultivation. One tenth of this is in mature rainforest within the exploitable forest area. The result of shifting cultivation is the 4 million ha of open woodland and grassland and still larger areas of secondary forests.
- 3) Most of the forests are owned by the indigenous people. (95%)



Western Samoa

Of the total land area of 284,000 ha an area of 184,000 ha is given as forest land. The "commercial forest area" is supposed to be 52,000 ha.

Plantations cover in all 50 ha.

## 5.2 Summary tables

### 5.2.1 General about the tables

The data given in the summary tables has (except for Europe and Other Temperate regions) been extracted from the country notes. The limitations of the information given in the country notes discussed in 5.1.1 are therefore also valid for the summary tables.

Furthermore the data is not available in the same form in all the different countries so it has been necessary to interpret the data that is available. This means that the tables are full of compromises. Very often it is impossible to put a meaningful figure under one heading although information of this sort may be available. The same tables filled in at different times often show discrepancies between certain figures because basic information in the country notes has been interpreted differently.

It is obvious that many readers need summary tables of the sort presented here even if a lot of mistakes are hidden. These tables will probably become the most studied part of this report in spite of the fact that much of the data in the country notes is actually fuller and better. Readers must use judgement and common sense in interpreting the tables.

The definitions of the terms used in the tables are given in Appendix I. These definitions together with the scattered comments on the different tables and regions given in 5.2.2 below should give a relatively clear understanding of the tables.

### 5.2.2 Comments on the tables

#### Table I Forest and Other Wooded areas

##### General

The main effort has been put into identifying the area of closed forest in the respective countries. Outside Europe and Other Temperate regions I have consequently tried to show natural forest and man-made forest separately because man-made forests are normally so specific in these regions. But man-made forests may sometimes have been included in the natural forests without my knowing. In reality it makes very little difference as the figures for total forest area are so uncertain and the area of man-made forest relatively so small. Often exclusion of the man-made forests from the total forest area would make figures for the area of natural forests look more exact than they actually are. The last sentence explains why I have not included a category showing total forest area in Table I.

##### Central America

Many of the figures giving closed forest area are probably quite unreliable. The human influence on the natural vegetation is considerable in many areas. The forests in such areas are decreasing rapidly.

Information on the area of open woodland, scrub and brushland is rather poor for this region. The scrub and brushland areas are investigated mainly in order to separate them from more valuable woodland areas (the same in all regions).

The areas of mangrove (in tropical regions) and bamboo (in Asia) are shown separately not because these areas are especially valuable but rather because it is important to separate them from other types.

### South America

Some of the figures for closed forest are very uncertain. The area under any form of open woodland cover is rarely reported. Such woodlands cover considerable areas but are not as extensive as for example open woodland areas in Africa nor are they as important for wood production. Scrub and brushland areas are not recorded at all though they certainly exist.

It should be noted that the Chaco forests found in Argentina, Paraguay and Bolivia are here shown as open woodlands. This vegetation type is normally classified as forest in the countries concerned.

### Africa

The information in this table has been taken from a drafted report called "Forest Resources of Africa". Some of the information given in this table (as well as in Tables II and III) cannot be traced in the country notes as they have been calculated from detailed background facts in the report mentioned.

The closed forest area is quite well known for most countries. The area of open woodlands is better known in Africa than in other regions but the information is still incomplete.

The mangrove and swamp forests which cover a considerable portion of the forest area are far from completely known. Bush fallow areas are also very widespread but their extent is poorly known.

### Europe (Including USSR, Cyprus, Israel and Turkey)

These figures are taken from the answers to the 1968 WFI questionnaire for the European region. More details about the forests in these countries will be published by FAO. The area of coniferous and broadleaved forests do not always add up to the area of all forests. This is because the area excluded from exploitation by law is not included in the area for which a breakdown in coniferous and broadleaved has been given. In Europe open woodlands, scrub and brushland have consequently been included in forest and other wooded areas (this is not always the case in other regions).

### Other Temperate regions

More or less the same questionnaire as the one sent to European countries was later sent to a few other countries in the Other Temperate regions. These results are given here.

### Near East (Asia)

The basic information given in this table is the area of closed forests.

It is probable that considerable areas of degraded forests are still shown as closed forests. The areas of open woodlands are quite poorly known - if they exist at all - while the scrub and brushland areas which cover considerable areas in this region are practically not shown at all.

When part of the closed forest area is covered by coniferous forest this area is shown separately. The information is certainly incomplete and uncertain.

### Asia

The human influence on forestry vegetation is strong in most Asian countries. It is probable that many of the figures giving closed forest are overestimates. It is also probable that considerable areas of open woodlands are either not shown at all or are included in the forest areas.

The area of dry deciduous forest has as far as possible been shown separately. This vegetation type is in Asia always considered as closed forest while it would probably be classified as open woodland in other parts of the world. It becomes very easily degraded to more open types.

When information about the area of bush fallow is available it is given. In many countries large areas of this class are included in the forest area.

### Pacific area

For Australia, New Zealand, Papua and New Guinea information has been received from the questionnaire that was sent to the temperate regions outside Europe. For some of the other countries the information has been taken from the 1963 WFI, for others information comes partly from country notes prepared for the recent Asia-Pacific Timber Trends Study.

## Table II: Standing timber

### General

This table gives results for the main inventories that have taken place (e.g. National inventories) but also certain crude estimates covering whole countries or main regions. The definitions of different volume concepts in the different countries are rarely the same. As far as possible this has been explained in the footnotes.

The information about standing timber is given either as total (million m<sup>3</sup>) or per ha (m<sup>3</sup>/ha). No consistent attempt has been made to give both. This is because it is not always possible to say exactly to which area a volume figure refers.

### Central and South America

As can be seen from many of the per ha figures, the estimates presented here hardly mean the same thing. Total volume per ha in tropical rain-forest (the dominating type in Latin America) is more or less the same all over the world (around 350 m<sup>3</sup>/ha).

The trials to give a breakdown of total volume in commercial volume etc. have not been especially successful.

The information is presented here to give a first crude picture of the forest resource. Future work will have to adjust many of these figures.

### Africa

The information about standing timber in Africa is scarce. Most volume figures show commercial volume. Even when all species are enumerated (which are rare) the minimum diameter measured are normally quite high.

Information about standing timber in open woodlands is practically completely missing, in spite of the fact that these areas are so extensive.

### Europe

Here the information is based on a questionnaire which was dispatched in 1968 (and partly updated in 1971). It is not always based on inventories. It is probable that many of the results based on bad or unsuitable inventories give underestimates.

In many countries in Europe inventories are mainly made for the purpose of management plans and not for national statistics. For the assessment of volume and increment, the use of yield tables is common. This implies that a forest is classified as belonging to a group for which a yield table shows a "normal" development under fixed management conditions. The forest is then assumed to have the volume and increment shown in the table for the relevant group and age. In forests with a high volume per ha the volume is more frequently measured. National statistics are compiled by adding the district results, usually with an intermediate accumulation at the provincial level.

The system has many sources of error. Experience shows that it often leads to considerable underestimations. The following two examples can illustrate this.

In 1952-56 Austria undertook an inventory based on the "classical system" while in 1960 it started a modern continuous sampling inventory. The result of the latter showed that growing stock had increased by 55 percent and annual increment by 100 percent between the two inventories. (The figures change somewhat depending on how many years have been included in the estimate from the continuous inventory).

A recent inventory in Bavaria using statistical methods gave a mean value of 280 m<sup>3</sup>/ha. The earlier calculation based on a "classical inventory" gave 150 to 180 m<sup>3</sup>/ha.

There is reason to doubt whether the "classical system" leads to more accurate results in other European countries: the figures shown give a very interesting idea of possible underestimations.

The results from different countries are not fully comparable as the volume units differ somewhat from country to country. The volume should normally show the volume of all species with bark and branches excluded but exceptions from this do certainly occur by mistake. The minimum diameters measured differ somewhat from country to country. Certain additional information on these points is given in the footnotes.

The information about increment is based on the same questionnaire as mentioned above under standing timber. Many of the figures are uncertain. The increment is given with bark.

#### Other Temperate regions

The information for these countries comes from the 1970 WFI questionnaire for Other Temperate regions. The same comments as for Europe apply.

#### Asia

The figures given should refer to the volume of all species with bark. The minimum d.b.h. is probably around 20-30 cm.

When commercial volume is given this does not mean the same thing from country to country.

#### Pacific area

Information is given only for Australia and New Zealand. This information is found under Other Temperate regions.

### Table III: Man-made forests

#### General

Information about man-made forests are not given for Europe and North America. The reason is that plantations in these countries do not have the same meaning as in tropical countries. The plantations of fastgrowing species in the latter countries differ normally completely from the natural forests, while the plantations in most countries in Europe and North America are a replacement of the exploited forest with the same species as before. Recent information about man-made forests for most countries in Europe is in any case not available. (Note that figures have been included at the very end.)

Estimates of the total area planted are often overestimates. This is caused by the fact that the area planted is calculated from the number of plants that have been sold. Since a lot of plants never get planted and a lot of them die there is an error. Enrichment planting is probably sometimes included in the figures. On the other hand figures for man-made forests valid in one year often quickly become outdated due to new plantings.

Information about man-made forests is rarely consistent. For instance one may compare the total area planted for 1968 and the planted areas given for 1969-1972, with the total area of plantations given at the end of 1972. These different figures rarely work out consistently.



The accuracy of man-made forest figures can be judged from the country notes as contradictory quantities from different sources and dates are quite often given there.

Information about the annual planting rate quite often seems to be of doubtful value while information about the total area seems to come closer to the truth. This is especially the case when the plantations are concentrated in large blocks. Statements about the accuracy refer to the year of estimate.

The country notes often give plantation figures that have been quoted from World Wood (WW). As these figures often differ considerably from other sources they have not always rarely been included in the tables.

#### Central America

The rather incomplete information comes from FAO questionnaires intended to collect information about man-made forests and from World Wood.

#### South America

Part of the information was collected by myself during a trip to South America in 1970. This information has been completed and updated from various sources. The information is relatively accurate.

#### Africa

The information in this table has been traced from the best available sources. It is relatively accurate.

#### Asia

In the case of the Near East countries the information is rather incomplete and outdated. Information for the other Asian countries is often incomplete and uncertain too. It often originates from different progress reports that have been prepared to the FAO Regional Forestry Conferences.

#### Pacific area

Most of the plantations in this region are situated in Australia and New Zealand. The information for these two countries must be judged as being rather accurate. Even the information for the other countries is based on relatively secure sources.

### 5.2.3 Judgement of accuracy

The accuracy of the information presented in the tables as well as in the country notes quite naturally vary very much. I have tried to evaluate the accuracy of the information presented for different countries. The evaluation has been done for each country for the three different types of tables: Forest and Other Wooded areas (Table I), Standing timber (Table II) and Man-made forests (Table III). In Table I and Table III the evaluation is done basically for the area of closed forest and the total area planted respectively. In Table II it is basically done for the total volume of standing timber.



The accuracy has been classified in five crude classes ranging from very good to very bad. These classes can be described as follows:

Accuracy Class	Rough estimate of accuracy level Percentage
1. Well known. Information based on good inventories	-5 to +5
2. Relatively well known	-10 to +10
3. Rather unreliable information. Partly based on inventories	-20 to +20
4. Poorly known	-40 to +40
5. Practically unknown. Information close to a guess	-50 to +100

It must be clearly stated that this classification is my own most subjective judgement. It is perhaps as much a judgement of the quality of the sources as of the quality of the figures but I believe these are normally the same thing. My classification is naturally very crude - a country might be moved up or down one or even two classes but hardly more.

Often the definitions of terms differ between a country and this report so it is not only a judgement whether the figures are correct or not. This will naturally cause a down-grading of an otherwise exact figure but this will be explained in the country notes.

In the case of Forest and Other Wooded areas (Table I) and Standing timber (Table II) the classification refers to the present day situation (1973). If the figures were accurate some years ago does not matter. In the case of Man-made forests (Table III) the figures are practically always some years out of date and therefore often rather inaccurate. The judgement is therefore done for the year of estimate as due to new plantings and so on it is quite impossible to make a meaningful classification of the present day situation. In the case of Standing timber the judgement has been done as if the area figures were correct. Otherwise most countries would have been placed in accuracy class 5.

It must also be noted that the area of natural forests and man-made forests far more often is overestimated than underestimated. The minus-signs in the accuracy classification are therefore more often valid than the plus-signs.

Inventories for European countries have not been studied so the classification for many of these is not very accurate. The accuracy of the figures is actually relatively better known for other regions.

Finally it must be said that this very crude and subjective classification of accuracy must be seen as an attempt to show in a simple form something very complicated. It has not always been possible to follow all the rules set. The judgement of large countries has, for instance, probably been more critical than that for small countries.

Table I. Forest and Other Wooded areas. Central and South America

Country	Accuracy class	Year of estimate	Forest and Other Wooded areas (natural)				Man-made forest
			Total	Closed forest	Open woodland	Scrub and brushland	
			1000 ha				
CENTRAL AMERICA							
Antigua	..	1968 (PY)	7	..	..	..	..
Bahamas	..	1962 (WFI)	324	324 <sup>1)</sup>	..	..	..
Barbados	..	1961 (WFI)	0.4	0.4	..	..	..
Bermuda	..	1970 (PY)	0.4	..	..	..	..
Belize	3-4	..	2 000	1 630	(150) <sup>2)</sup>	..	(3)
Cayman Islands	..	1965 (PY)	6.5	..	..	..	..
Costa Rica	3	1967	2 200	1 800	..	..	0
Cuba	3-4	..	1 600	1 100	500 <sup>3)</sup>	..	215
Dominica	..	1968 (PY)	35	..	..	..	0
Dominican Republic	2	1970	1 100	990 <sup>4)</sup>	..	..	2
El Salvador	3-4	1961	..	200	950	..	-
Grenada	..	1967 (PY)	4	..	..	..	..
Guadeloupe	..	1962 (WFI)	68	68 <sup>1)</sup>	..	..	(3)
Guatemala	4	..	6 500	5 000	..	1 200	(1)
Haiti	5	..	..	(200)	..	..	0
Honduras	3	1966	..	7 049 <sup>6)</sup>	..	..	..
Jamaica	2	1968	490	77	186 <sup>7)</sup>	230	(12)
Martinique	..	1958 (WFI)	27	27 <sup>1)</sup>	..	..	..
Mexico	3	..	40 000	30 000	..	10 000	(50)
Montserrat	..	1965 (PY)	1	..	..	..	..
Netherlands Antilles	..	1951 (PY)	..	..	..	..	..
Nicaragua	3-4	..	6 400	6 400 <sup>8)</sup>	..	..	0
Panama	2	..	4 080	4 080	..	..	4
Panama Canal Zone	..	1951 (PY)	56	..	..	..	..
Puerto Rico	..	1962 (WFI)	155	118 <sup>1)</sup>	..	..	10
St. Kitts-Nevis-Anguilla	..	1970 (PY)	7	..	..	..	..
St. Lucia	..	1966 (PY)	13	..	..	..	0
St. Pierre and Miquelon	..	1946 (PY)	1	..	..	..	..
St. Vincent	..	1970 (PY)	14	..	..	..	0
Trinidad and Tobago	3	..	..	235	..	..	12
Turks and Caicos Islands	..	1970 (PY)	..	..	..	..	..
Virgin Islands (UK)	..	1955 (PY)	1	..	..	..	..
Virgin Islands (US)	..	1970 (PY)	2	..	..	..	..
SOUTH AMERICA							
Argentina	5	1972	60 300	7 000	32 300	..	325
Bolivia	5	1970	..	(47 300)	..	..	5-25
Brazil	5	1972	320 000	240 000	80 000	..	1 350
Chile	4	1970	..	5 000	..	..	440
Colombia	4	1970	78 000	50 000	..	..	40

Total area	Special types of closed forest		Inventoried area	Closed forest in percent of land	Closed forest per caput	Probable change in closed forest area	Country
	Mangrove	Coniferous					
1000 ha				%	ha		
44	..	..	..	..	..	..	Antigua
1 140	..	..	..	28	2.1	..	Bahamas
43	..	..	..	0.9	0	..	Barbados
5	..	..	..	..	..	..	Bermuda
2 296	..	100	400	72	13.2	d	Belize
26	..	..	..	..	..	..	Cayman Islands
5 070	..	-	30	36	1.0	d	Costa Rica
11 452	..	(400)	..	11	0.16	d	Cuba
75	..	..	+	..	..	..	Dominica
4 873	9	206 <sup>5)</sup>	1 100	20	0.2	d	Dominican Republic
2 139	..	30	(12)	10	0.06	d	El Salvador
34	..	..	..	..	..	..	Grenada
178	..	..	..	38	0.2	..	Guadeloupe
10 889	..	(1 000)	3 800	46	1.0	d	Guatemala
2 775	..	75	..	7	0.04	d	Haiti
11 209	(300)	2 700	2 150	63	2.7	d	Honduras
1 096	..	..	41	8	0.04	d	Jamaica
110	..	..	..	25	0.08	..	Martinique
197 255	..	15 000	16 500	15	0.6	d	Mexico
10	..	..	..	..	..	..	Montserrat
96	..	..	..	..	..	..	Netherlands Antilles
13 000	..	700	(4 500)	53	3.1	d	Nicaragua
7 565	..	..	4 080	53	2.8	d	Panama
143	..	..	..	..	..	..	Panama Canal Zone
890	..	..	..	13	0.04	..	Puerto Rico
36	..	..	..	..	..	..	St. Kitts-Nevis-Anguilla
62	..	..	..	..	..	..	St. Lucia
24	..	..	..	..	..	..	St. Pierre and Miquelon
34	..	..	..	..	..	..	St. Vincent
513	..	..	..	46	0.2	d	Trinidad and Tobago
43	..	..	..	..	..	..	Turks and Caicos Islands
15	..	..	..	..	..	..	Virgin Islands (UK)
34	..	..	..	..	..	..	Virgin Islands (US)
277 689	..	(1 000)	(1 500)	3	0.3	d	Argentina
109 858	-	+	900	44	9.6	d	Bolivia
851 197	..	(7 000)	20 000	28	2.5	d	Brazil
75 695	..	250 <sup>82)</sup>	520	7	0.5	d	Chile
113 891	..	..	2 400	48	2.4	d	Colombia

Table I. Forest and Other Wooded areas. Central and South America

Country	Accuracy class	Year of estimate	Forest and Other Wooded areas (natural)				Man-made forest
			Total	Closed forest	Open woodland	Scrub and brushland	
			1000 ha				
Ecuador	3	1970	18 085	18 085	..	..	45
Falkland Islands	..	1966 (PY)	..	..	..	..	..
French Guiana	3	1970	8 646	8 646	..	..	3
Guyana	2	1970	18 230	18 230	..	..	0.2
Paraguay	5	..	21 000	(8 000)	(13 000)	..	21 or 3
Peru	5	..	87 000	65 000	..	..	20
Surinam	3	..	14 800	14 800 <sup>11)</sup>	..	..	5
Uruguay	3	1965	456	456	..	..	154
Venezuela	5	1970	48 000	(48 000) <sup>13)</sup>	..	..	(7)

Total area 1000 ha	Special types of closed forest		Inventoried area	Closed forest in percent of land	Closed forest per caput	Probable change in closed forest area	Country
	Mangrove	Coniferous					
28 356	..	..	1 000	64	3.0	d	Ecuador
1 217	..	..	..	..	..	..	Falkland Islands
9 100	70	-	1 500	97	196.5	0	French Guiana
21 497	..	-	17 600	85	23.9	d	Guyana
40 675	-	-	6-7 000	21	3.4	d	Paraguay
128 522	..	..	9) (12 000) <sup>10)</sup>	51	4.8	d	Peru
16 327 <sup>12)</sup>	115	-	260	92	36.5	d	Surinam
17 751	..	..	-	3	0.2	0	Uruguay
91 205	..	..	2 400	53	4.4	d	Venezuela

Table I. Forest and Other Wooded areas. Africa

Country	Accu- racy class	Year of estimate	Forest and Other Wooded areas (natural)					Man-made forest
			Total	Closed forest	Open woodland		Scrub and brushland	
					Dense	Open		
1000 ha								
Algeria	4	1971	2 400	490 <sup>14)</sup>	..	..	2-3 000 <sup>15)</sup>	(100)
Angola	4	1971	72 660	1 000 <sup>16)</sup>	58 500	10 400	..	120
Botswana	4	1971	..	- <sup>18)</sup>	1 000 <sup>18)</sup>	10 000	..	0
British Indian Ocean Territory	..	1970 (PY)	..	..	..	..	..	..
Burundi	4	1971	..	100	..	(200)	..	25
Cameroon	4	1971	30 000	17 500	12 500	..	..	6
Cap Verde Islands	..	1961 (WFI)	1	1	..	..	..	..
Central African Rep.	3	1971	28 000	3 000	25 000	..	..	1
Chad	5	1971	..	-	..	16 500	..	0
Comoro Islands	4	1964	51	42	..	9	..	0
Congo	4	1971	..	17 000	..	(10 000)	..	10
Dahomey	3	1971	2 144 <sup>20)</sup>	250	..	(6 500)	..	18
Egypt	..	..	-	-	-	-	-	1
Equatorial Guinea	4	1971	..	1 000 <sup>21)</sup>	..	..	..	..
Ethiopia	5	1971	..	5 000 <sup>22)</sup>	3 000	(25 000)	..	40
Fr.Terr.of Afars and Issas	4	1971	..	6	..	..	100	..
Gabon	2	1971	..	21 500	..	3 000	..	25
Gambia	4	1971	..	25	40	..	..	1
Ghana	3	1971	..	2 000 <sup>24)</sup>	10 000	..	..	21
Guinea	4	1971	..	1 100	6 000	10 000	..	2
Ivory Coast	3	1971	..	9 000 <sup>26)</sup>	(10 000)	..	..	28
Kenya	3	1971	..	935	(1 000)	..	..	138
Lesotho	..	1971	-	-	-	-	..	0
Liberia	3	1971	..	2 500 <sup>28)</sup>	..	..	..	1
Libyan Arab Republic	4	1971	460	70 <sup>14)</sup>	..	..	390 <sup>15)</sup>	75
Madagascar	5	1971	..	7 500	5 000	..	.. <sup>29)</sup>	200
Malawi	4	1971	..	20	..	(7 000)	..	37
Mali	5	1971	4 457	-	4 500	..	..	0
Mauritania	5	1971	..	-	-	-	15 000	0
Mauritius	3	1971	31	2	..	..	29	9
Morocco	3	1971	5 200	400	..	4 800 <sup>32)</sup>	..	294
Mozambique	4	1971	66 500	1 500	60 000	5 000	..	21
Namibia	5	..	..	-	-	10 000	..	0
Niger	5	1971	..	-	-	4 000	12 000	0
Nigeria	5	1971	..	4 400 <sup>33)</sup>	..	30 000	..	70
Portuguese Guinea	4	1971	..	760	130	180 <sup>34)</sup>	..	0
Réunion	5	1971	..	100 <sup>35)</sup>	..	..	..	9
Rhodesia	4	1965	..	10	15 800 <sup>36)</sup>	8 000	..	83
Rwanda	4	1971	..	300	..	(200)	..	29
St. Helena, Ascension, Tristan da Cunha	..	1962 (PY)	..	1	..	..	..	..

Total area	Special types of closed forest			Inventoried area	Bush fallow	Closed forest in percent of land	Closed forest per caput	Probable change in closed forest area	Country
	Mangrove	Coni-ferous	Dry forest						
1000 ha						%	ha		
238 174	-	410	..	106	..	0	0.04	i	Algeria
124 670	750	-	..	2 910 <sup>17)</sup>	..	0.9	0.2	..	Angola
60 037	-	-	1 000 <sup>18)</sup>	500 <sup>19)</sup>	..	-	-	..	Botswana
8	..	..	..	..	..	..	..	..	British Indian Ocean Territory
2 783	-	..	..	-	..	3.9	0.04	d	Burundi
47 544	100	-	..	2 700	(4 500)	37	3.0	d	Cameroon
403	..	..	..	..	..	0	0	..	Cap Verde Islands
62 298	-	-	..	1 000	..	5	2.0	d	Central African Rep.
128 400	-	-	-	-	..	-	-	d	Chad
217	..	..	..	..	..	19	0.15	..	Comoro Islands
34 200	..	-	-	1 930	..	50	19.1	d	Congo
11 262	..	-	50	-	..	2.2	0.1	..	Dahomey
100 145	-	-	-	-	-	-	-	..	Egypt
2 805	..	-	-	..	1 100	36	3.4	d	Equatorial Guinea
122 190	-	850	..	-	..	4.6	0.2	d	Ethiopia
2 200	..	2	..	..	..	0	0.07	..	Fr.Terr.of Afars and Issas
26 767	1 095 <sup>23)</sup>	-	-	5 700	..	81	43.8	0	Gabon
1 130	25	-	..	-	360	2.6	0.07	d	Gambia
23 854	..	-	..	1 400 <sup>25)</sup>	(2 000)	8.8	0.2	d	Ghana
24 586	400	-	400	..	..	4.5	0.3	d	Guinea
32 246	..	-	..	13 000	5 701 <sup>27)</sup>	28	1.8	d	Ivory Coast
58 264	45	..	..	130	..	1.9	0.1	..	Kenya
3 036	-	-	-	-	-	-	-	..	Lesotho
11 137	..	-	..	1 600	(3 000)	26	2.1	d	Liberia
175 954	-	70	..	-	-	0	0.07	i	Libyan Arab Republic
58 744	500	..	.. <sup>30)</sup>	390	9 400 <sup>31)</sup>	13	1.1	d	Madagascar
11 848	-	..	20	..	..	0	0.01	..	Malawi
124 000	-	-	-	-	..	-	-	d	Mali
103 070	-	-	-	-	..	-	-	d	Mauritania
186	..	..	..	..	..	6	0.01	..	Mauritius
44 505	-	200	..	75	..	1.6	(0.04)	i	Morocco
78 303	1 500	-	..	..	..	1.9	0.2	..	Mozambique
82 429	..	-	..	-	..	-	-	..	Namibia
126 700	-	-	-	-	..	-	-	d	Niger
92 377	..	-	-	400	6 000	4.8	0.1	d	Nigeria
3 612	465	-	..	-	..	27	1.4	d	Portuguese Guinea
251	..	..	..	..	..	43	0.2	..	Réunion
38 936	-	..	800 <sup>36)</sup>	..	..	0	0.02	..	Rhodesia
2 634	-	..	..	-	..	9	0.09	d	Rwanda
31	..	..	..	..	..	..	..	..	St. Helena, Ascension, Tristan da Cunha



Table I. Forest and Other Wooded areas. Africa

Country	Accu- racy class	Year of estimate	Forest and Other Wooded areas (natural)					Man-made forest
			Total	Closed forest	Open woodland		Scrub and brushland	
					Dense	Open		
1000 ha								
Sao Tomé and Príncipe	..	1956 (WFI)	-	-	-	-	-	-
Senegal	4	1971	..	430 <sup>37)</sup>	(2 000)	(3 000)	..	14
Seychelles	4	1971	..	-	..	..	4	1
Sierra Leone	3	1971	..	290	66	..	..	7
Somalia	4	1972	..	200	..	..	(18 000)	0
South Africa <sup>38)</sup>	2-3	1971	..	255	..	2 700	..	1 025
Spanish Sahara	..	..	-	-	-	-	-	-
Sudan	5	1972	42 000	1 500 <sup>39)</sup>	16 400 <sup>39)</sup>	5 400 <sup>39)</sup>	16 600 <sup>39)</sup>	81
Swaziland	4	1971	..	-	-	40	..	76
Tanzania	3	1972	..	1 330	37 600	..	..	29
Togo	2	1971	..	380	700	2 500	..	6
Tunisia	3	1971	..	253	..	..	323	114
Uganda	3	1971	..	720	1 200 <sup>40)</sup>	..	..	29
Upper Volta	4	..	3 500 <sup>41)</sup>	-	1 000	..	..	2
Zaire	4	1972	..	90 000	90 000	..	..	50
Zambia	4	1972	..	.. <sup>42)</sup>	37 330 <sup>42)</sup>	..	..	19 <sup>83)</sup>

Total area	Special types of closed forest			Inventoried area	Bush fallow	Closed forest in percent of land	Closed forest per caput	Probable change in closed forest area	Country
	Mangrove	Coni-ferous	Dry forest						
1000 ha						%	ha		
96	-	-	-	-	-	-	-	..	Sao Tomé and Príncipe
19 619	200	-	210	-	..	2.3	0.12	d	Senegal
38	-	-	-	-	..	2.5	-	..	Seychelles
7 174	0	-	..	107	..	4.1	0.12	0	Sierra Leone
63 766	..	130	70	-	..	0	0.07	d	Somalia
122 104	..	..	..	..	..	1.0	0.06	..	South Africa
26 600	-	-	-	-	-	-	-	..	Spanish Sahara
250 581	-	..	..	15 300	..	0.7	0.1	d	Sudan
1 736	-	-	-	..	..	4.4	-	..	Swaziland
93 970	80	..	..	..	..	1.5	0.1	d	Tanzania
5 600	..	-	..	2 555	115	7	0.2	..	Togo
16 415	-	80	..	253	..	2.4	0.07	i	Tunisia
23 604	-	..	..	500	..	3.9	0.09	d	Uganda
27 420	-	-	-	-	..	-	-	d	Upper Volta
234 541	280	-	..	-	..	38	5.1	d	Zaire
75 261	-	-	650 <sup>42)</sup>	..	..	0	0	d	Zambia

Table I. Forest and Other Wooded areas. Europe and Other Temperate regions.

Country	Accuracy class	Year of estimate	Forest and Other Wooded areas				
			Total	Closed forest			Open woodlands, scrub and brushland
				All	Coniferous	Broadleaved	
1000 ha							
EUROPE							
Albania	..	1961 (WFI)	..	1 282	..	..	..
Andorra	..	1970 (PY)	..	..	..	..	..
Austria	1	1961-67	3 675	3 673	..	..	2
Belgium	2	1959	618	603	265	338	15
Bulgaria	2	1967	3 639	3 349	723	2 422	290
Czechoslovakia	2	1968	4 453	4 453	3 000	1 148	..
Denmark <sup>43)</sup>	2	1965-68	421	421	267	153	..
Faeroe Islands	..	1949 (PY)	-	-	-	-	-
Finland	1	1964-70	22 371	18 697 <sup>44)</sup>	17 082	1 540	3 674
France	3	1967	..	13 022	2 194	1 987	..
Germany, Fed. Rep. of	2	1961	7 210	7 210	4 717	2 120	..
German Dem. Rep.	2	1963 (WFI)	..	2 953	2 037	643	..
Greece	3	1964	5 754	2 512	966	1 346	3 243
Hungary	2	1967	1 451	1 451 <sup>45)</sup>	109	1 134	..
Iceland	2	1968	100	5	2.5	2.5	95
Ireland	2	1971	255	255	205	18	..
Italy	3	1968	7 708	6 147	1 343	4 793	1 561
Liechtenstein	..	1953 (PY)	4	..	..	..	..
Luxembourg	2	1965	83	81	24	56	2
Malta	..	1969 (PY)	-	-	-	-	-
Netherlands	2	1964-68	328	276	197	79	52
Norway	1	1964-71	8 907	8 319	5 693	2 594	588
Poland	2	1967	8 264	8 264	6 852	1 388	..
Portugal	2	1966-71	3 641	2 941	1 301	185	700
Azores and Madeira	..	..	..	..	..	..	..
Romania	2	1967	6 229	6 219	1 578	4 514	10
Spain	3	1971	27 477	14 263 <sup>48)</sup>	6 775	7 488	13 214
Sweden	1	1953-62	27 301	23 419	13 655 <sup>49)</sup>	7 399 <sup>49)</sup>	3 882
Switzerland	3	1952-65	981	960	670	288	21
United Kingdom:							
Great Britain	2	1971	1 858	1 524	1 125	399	334
Northern Ireland	2	1968	50	49	41	8	1
Jugoslavia	2	1961	8 688	7 366	1 360	5 685	1 322
USSR	2	1966	914 900	765 400	553 259	174 957	149 500
NEAR EAST (EUROPE)							
Cyprus	3	1967	175	95	89	7	..
Israel	2	1972	107	85	29	14	22
Turkey	3	1968	18 235	7 048 <sup>50)</sup>	3 741	3 048	11 187

Total area	Inventoried area	Stocked forest	Closed forest in percent of land	Closed forest per caput	Country
1000 ha			%	ha	
EUROPE					
2 875	..	..	47	0.7	Albania
45	..	..	..	..	Andorra
8 385	2 822	3 607	44	0.5	Austria
3 051	-	590	20	0.06	Belgium
11 091	3 168	3 178	30	0.4	Bulgaria
12 787	4 148	4 370	35	0.3	Czechoslovakia
4 306	420	390	10	0.09	Denmark
140	-	-	-	-	Faeroe Islands
33 708	18 622	17 893	61	4.0	Finland
55 139	4 181	..	24	0.3	France
24 728	4 938	7 160	30	0.1	Germany, Fed. Rep. of
10 830	..	2 680	28	0.2	German Dem. Rep.
12 795	2 312	2 262	20	0.3	Greece
9 303	1 136	1 370 <sup>45)</sup>	15	0.1	Hungary
10 302	-	2.5	0	0.03	Iceland
7 031	-	255	4	0.09	Ireland
30 126	830	6 037	21	0.1	Italy
16	..	..	..	..	Liechtenstein
259	-	81	31	0.2	Luxembourg
32	-	-	-	-	Malta
3 662	276	272	8	0.02	Netherlands
32 388 <sup>46)</sup>	6 194	7 904	27	2.2	Norway
31 268	7 402	8 117	27	0.3	Poland
8 886 <sup>47)</sup>	1 486	2 921	34	0.3	Portugal
314	..	..	..	..	Azores and Madeira
23 750	6 092	6 121	27	0.3	Romania
50 474	8 675	13 963	29	0.4	Spain
44 975	21 054	21 679	57	3.0	Sweden
4 129	958	960	24	0.2	Switzerland
22 990	1 524	1 497	7	0.03	United Kingdom:
1 420	-	49	4	0.03	Great Britain
25 580	3 960	..	30	0.4	Northern Ireland
					Jugoslavia
2 240 200	(728 216)	751 700	36	3.3	USSR
NEAR EAST (EUROPE)					
925	79	95	10	0.1	Cyprus
2 070	9	85	4	0.03	Israel
78 058	2 761	6 935	9	0.2	Turkey

Table I. Forest and Other Wooded areas. Europe and Other Temperate regions.

Country	Accuracy class	Year of estimate	Forest and other wooded areas				
			Total	Closed forest			Open woodlands, scrub and brushland
				All	Coniferous	Broadleaved	
1000 ha							
OTHER TEMPERATE							
Australia	3	1970	137 748	37 939	7 300	..	99 809
New Zealand	1	1968	8 499	6 192	4 400	..	2 307 <sup>51)</sup>
Canada <sup>52)</sup>	3	1968	322 281	322 281 <sup>53)</sup>	..	..	..
USA <sup>54)</sup>	2-3	1968	308 185	..	..	..	..
Japan <sup>55)</sup>	1	1969	25 274	25 267	10 865	..	7
Korea	3	1969	6 685	(6 683)	3 295	..	2
South Africa	2-3	1970	4 089	1 256	..	..	2 833

Total area	Inventoried area	Stocked forest	Closed forest in percent of land	Closed forest per caput	Country
1000 ha			%	ha	
OTHER TEMPERATE					
768 702	19 000	37 342	5	3.2	Australia
26 872	8 499	5 585	23	2.3	New Zealand
997 541	180 268	291 435	35	15.5	Canada
..	(308 185)	..	(34)	1.5	USA
36 988	25 274	24 778	68	0.25	Japan
9 848	1 028	5 841	(68)	0.22	Korea
122 344	..	1 232	3	0.06	South Africa

Table I. Forest and Other Wooded areas. Near East (Asia)

Country	Accuracy class	Year of estimate	Forest and Other Wooded areas (natural)				Man-made forest
			Total	Closed forest	Open woodland	Scrub and brushland	
			1000 ha				
Afghanistan	4	1970	700	190	300 <sup>56)</sup>	210	(0.8)
Bahrain	..	1970 (PY)	..	..	..	..	..
Cyprus	See under	Europe and Other Temperate regions					
Iran	3-4	1958	..	3 000	1 000		..
Iraq	4	1966	1 500	20	880		(4-8 000)
Israel	See under	Europe and Other Temperate regions					
Jordan	3	1964-65	122 <sup>58)</sup>	36	..	..	(7)
Kuwait	..	1967	5	..	..	..	(0.3)
Lebanon	4	1966	135	70 <sup>59)</sup>	65 <sup>60)</sup>		(3.2)
Muscat and Oman	..	1948 (WFI)	80	..	..	..	..
Qatar	..	1969 (PY)	-	-	-	-	-
Saudi Arabia	5	..	1 200	.. <sup>61)</sup>	..	1 200	..
Syrian Arab Republic	4	..	470 <sup>62)</sup>	40	(30)	..	(10)
Turkey	See under	Europe and Other Temperate regions					
United Arab Emirates	..	1970 (PY)	..	..	..	..	-
Yemen Arab Republic	5	1963	..	(2)	..	..	-
Yemen, People's Dem. Rep. of	..	1966 (PY)	2 590	..	..	(2 590)	..



Total area	Coniferous forest	Inventoried area	Closed forest in percent of land	Closed forest per caput	Probable change in closed forest area	Country
1000 ha			%	ha		
64 750	190	560 <sup>57)</sup>	0.3	0.01	d	Afganistan
60	..	-	..	..	..	Bahrain
					0	Cyprus
164 800	..	1 630	1.8	0.1	d	Iran
43 492	20	-	0	0	d	Iraq
					i	Israel
9 774	8	36	0.4	0.02	..	Jordan
1 600	..	-	-	-	..	Kuwait
1 040	20	-	1	0.03	..	Lebanon
19 500	..	-	0	0	..	Muscat and Oman
2 201	-	-	-	-	..	Qatar
214 969	..	-	0	0	..	Saudi Arabia
18 518	(40)	-	0.3	0.01	..	Syrian Arab Republic
						Turkey
8 360	..	-	..	..	..	United Arab Emirates
19 500	-	-	-	-	..	Yemen Arab Republic
28 768	..	-	-	-	..	Yemen, People's Dem. Rep. of

Table I. Forest and Other Wooded areas. Asia

Country	Accu- racy class	Year of estimate	Forest and Other Wooded areas (natural)				Man-made forest	Total area
			Total	Closed forest	Open woodland	Scrub and brushland		
			1000 ha					
Bangla Desh	3	1968	2 300	1 300	..	..	(68)	14 279
Bhutan	5	1972	..	3 000	..	..	..	4 700
Brunei	3	1968	435	435	(117) <sup>64)</sup>	..	0	577
Burma	5	1955	45 000	33 000	6 000 <sup>66)</sup>	6 000	..	67 803
China	5	1972	..	80 000	..	..	(10-100 000)	956 100
Hong Kong	..	1958 (WFI)	5	5	..	..	..	103
India	5	..	75 351	(40 000)	..	..	(1 100)	326 809
Indonesia	5	1970	124 700 <sup>69)</sup>	85 000	..	..	(1 200)	190 435
Japan	See under Europe and other temperate regions							
Khmer Republic	3	1958-64	13 170	12 410	..	760	6	18 104
Korea North	..	1958 (WFI)	8 970	8 970	..	..	..	13 009
Korea South	See under Europe and other temperate regions							
Laos	5	1969	14 800	2 400 <sup>70)</sup>	3 600 <sup>70)</sup>	..	..	23 680
Malaysia								
Sabah	3	..	6 000	6 000	..	..	0	7 611
Sarawak	3	..	9 500	9 500	..	..	0	12 521
West Malaysia	2	1969	9 500 <sup>71)</sup>	8 100	..	..	1	13 131
Maldives	..	1970 (PY)	..	..	..	..	..	30
Mongolia	5	1972	..	15 000 <sup>72)</sup>	..	..	..	156 500
Nepal	3	1970	4 660	4 660	..	..	4	14 080
Pakistan	5	..	2 300	1 500 <sup>73)</sup>	800	..	300	80 393
Philippines	2	1971	15 900	12 700 <sup>74)</sup>	..	..	100	30 000
Portuguese Timor	..	1970 (PY)	1 100 <sup>75)</sup>	..	..	..	..	1 493
Ryukyu Islands	..	1963 (WFI)	120	100	..	..	..	220
Sikkim	..	1958 (WFI)	..	..	..	..	..	711
Singapore	..	1970 (PY)	4	..	..	..	..	58
Sri Lanka	3	1966	2 480	(2 480)	..	..	40	6 561
Taiwan	3	1956 (1969)	1 964	1 549	..	..	314 <sup>76)</sup>	3 596
Thailand	3	1971	28 967	27 600	..	..	57	51 400
Viet-Nam North	5	..	..	1 900	..	..	..	15 875
Viet-Nam South	5	1966	5 620	..	..	..	17	17 381

Special types of closed forest				Inventoried area	Bush fallow	Closed forest in percent of land	Closed forest per caput	Probable change in closed forest area	Country
Mangrove	Bamboo	Coni- ferous	Dry deciduous						
1000 ha						%	ha		
600	130	-	..	(1 600) <sup>63)</sup>	..	9	..	d	Bangla Desh
-	..	1 500	..	-	..	64	3.5	d	Bhutan
11 <sup>65)</sup>	..	-	..	-	..	75	3.6	d	Brunei
1 600- 2 500	(9 000) <sup>67)</sup>	1 950	4 000 <sup>68)</sup>	..	..	50	1.2	d	Burma
..	..	(25 000)	..	+	..	8	0.1	i	China
..	..	..	..	-	-	5	-	..	Hong Kong
..	..	4 000	29 000	4 260	..	12-23	0.1	d	India
..	..	100	..	(20 000)	..	48	0.7	d	Indonesia
90	410	10	5 360	13 370	..	72	1.8	d	Japan
..	..	..	..	..	..	69	0.8	..	Khmer Republic
..	..	..	..	..	..	69	0.8	..	Korea North
-	..	120	(9 000)	880	7 250	11	(0.8)	i	Korea South
280	..	-	..	+	..	79	9.1	d	Laos
174	..	-	..	1 293	..	76	9.7	d	Malaysia
145	..	-	..	8 300	..	62	0.9	d	Sabah
..	..	..	..	..	..	..	..	d	Sarawak
..	..	..	..	..	..	..	..	d	West Malaysia
..	..	..	..	..	..	..	..	..	Maldives
-	..	(10 000)	..	9 400	..	(10)	11.7	..	Mongolia
-	..	(1 500)	..	(2 000)	..	33	0.4	d	Nepal
300	..	900	..	(2 000)	..	2	..	d	Pakistan
450	..	205	..	15 400	..	43	0.3	d	Philippines
..	..	..	..	..	..	74	1.8	..	Portuguese Timor
..	..	..	..	..	..	48	0.11	..	Ryukyu Islands
-	..	..	..	..	..	..	..	..	Sikkim
..	..	..	..	..	..	..	..	..	Singapore
..	..	-	2 185	2 900	1 000	38	0.19	d	Sri Lanka
..	114 <sup>77)</sup>	370	..	2 200	..	53	0.13	..	Taiwan
447 <sup>78)</sup>	..	136	10 349	28 967	4 799	(57)	0.8	d	Thailand
..	500	..	..	..	..	12	0.09	..	Viet-Nam North
480	..	125	..	..	..	(33)	(0.3)	..	Viet-Nam South

Table I. Forest and Other Wooded areas. Pacific area

Country	Accuracy class	Year of estimate	Forest and Other Wooded areas (natural)				Man-made forest
			Total	Closed forest	Open woodland	Scrub and brushland	
			1000 ha				
American Samoa	..	1970 (PY)	10	..	..	..	..
Australia	See under Europe and Other Temperate regions						
British Salomon Islands	3	..	2 560	390	..	..	4
Canton and Enderbury Islands	..	1970 (PY)	..	..	..	..	..
Christmas Island	..	1970 (PY)	..	..	..	..	..
Cocos Islands	..	1970 (PY)	..	..	..	..	..
Cook Islands	..	1964 (WFI)	5.1	3.9	..	..	..
Fiji	3	..	1 250	500	390	360	15
French Polynesia	..	1964 (PY)	115	..	..	..	..
Gilbert and Ellice Islands	..	1970 (PY)	2	..	..	..	..
Guam	..	1959 (PY)	10	..	..	..	..
Nauru	..	1963 (PY)	..	..	..	..	..
New Caledonia	..	1961 (PY)	270	..	..	..	..
New Guinea and Papua	4	1970	40 400	36 400	4 000	..	11
New Hebrides	4	1972	..	16 <sup>80)</sup>	..	..	0
New Zealand	See under Europe and Other Temperate regions						
Niue Island	4	..	..	5	..	14 <sup>81)</sup>	..
Norfolk Island	..	1964 (WFI)	1	0.8	..	..	..
Pacific Islands (Trust territ.)	..	1965 (PY)	40	..	..	..	..
Tokelau Islands	..	1970 (PY)	..	..	..	..	..
Tonga	..	1970 (PY)	8	..	..	..	..
Western Samoa	..	1958 (WFI)	184	52 <sup>80)</sup>	..	..	..

Total area	Coniferous forest	Inventoried area	Closed forest in percent of land	Closed forest per caput	Probable change in closed forest area	Country
1000 ha			%	ha		
20	..	..	(50)	(0.3)	..	American Samoa
					0	Australia
2 979	6	..	14	2.5	..	British Salomon Islands
7	..	..	..	..	..	Canton and Enderbury Islands
14	..	..	..	..	..	Christmas Island
1	..	..	..	..	..	Cocos Islands
23	..	..	17	0.2	..	Cook Islands
1 827	..	..	28	1.0	..	Fiji
400	..	..	(29)	(1.1)	..	French Polynesia
74	..	..	(3)	(0.03)	..	Gilbert and Ellice Islands
55	..	..	(18)	(0.1)	..	Guam
2	..	..	-	-	..	Nauru
1 900	..	..	(14)	(2.7)	..	New Caledonia
46 169	50 <sup>79)</sup>	6 800	77	15.4	d	New Guinea and Papua
1 476	..	..	1	0.2	..	New Hebrides
					i	New Zealand
26	..	..	19	1.0	..	Niue Island
3.6	..	..	24	0.8	..	Norfolk Island
178	..	..	(22)	(0.4)	..	Pacific Island (Trust territ.)
1	..	..	..	..	..	Tokelau Islands
70	..	..	(11)	(0.1)	..	Tonga
284	..	..	68	0.4	..	Western Samoa

Notes to table I

- 1) Includes unstocked land. (WFI 1963)
- 2) Woodland and pine land.
- 3) Degraded forests.
- 4) Of which 166 000 ha covered with dry forest.
- 5) Mixed forest 128 000 ha.
- 6) Of which 802 000 ha of pine forest with low density or "unstocked".
- 7) Temporarily unstocked forests.
- 8) Pine savanna included in this figure.
- 9) Estimated to be 11.6 million ha of mixed forest.
- 10) Mainly reconnaissance surveys.
  
- 11) Of which 1 360 000 ha covered with swamp forest.
- 12) 170 000 ha covered with bush fallow.
- 13) This area probably includes large areas of denuded land. An area of 17.5 million ha has been given as loggable forest.
- 14) Probably an overestimate.
- 15) Can give fuelwood.
- 16) In addition 2 760 000 ha of coffee forest is reported to exist. These forests - used for the protection of coffee plantations - are sometimes classified as moist semi-deciduous forests and sometimes as open woodlands.
- 17) Of which 2 600 000 ha in open woodland.
- 18) Around 1 million ha of dry deciduous forest exists. These are often classified as real forests but are practically always very open. They have therefore been classified as open woodland here.
- 19) In open woodland (dry deciduous forest).
- 20) Area classified as forest land.
  
- 21) 700 000 ha should be undegraded and unexploited.
- 22) Of which 1 million ha with bamboo.
- 23) Including swamp forest.
- 24) Of which 1 550 000 ha are reserved.
- 25) Inventories for the preparation of working plans.
- 26) Of which swamp forest 720 000 ha.
- 27) Degraded closed forest.
- 28) Of which swamp forest 200 000 ha.
- 29) Degraded woodland areas. See also point 31.
- 30) Given as dense open woodland.

Notes to table I cont.

- 31) Degraded forests.
- 32) Forests mainly of importance for fuelwood and protection.
- 33) Very uncertain figure.
- 34) In reality this is palm forest.
- 35) Large parts of it degraded to scrub.
- 36) In Rhodesia found 800 000 ha with dry deciduous forest (Zambesian teak forest). These "dry forests" are classified as open woodland here.
- 37) Of which 20 000 ha bamboo.
- 38) Compare also the information under Europe and Other Temperate regions.
- 39) "Productive area" of different vegetation types.
- 40) An area of 6.5 million ha has recently been transformed from forest land to land for agricultural development.
  
- 41) The area of "classified forest".
- 42) In open woodlands is included 680 000 ha with dry deciduous forest (Rhodesian teak forest).
- 43) Inventoried figures relate to various years, estimated figures to 1968.
- 44) Includes all areas whose capacity to grow stem wood, without site improvement, are at least 1.0 m<sup>3</sup>/ha/year, including bark.
- 45) Includes areas occupied by trees in lines, windbreaks etc.
- 46) Does not include Svalbard and Jan Mayen.
- 47) Does not include Madeira and Azores.
- 48) Some open woodland included in forest.
- 49) Unstocked and high mountain coniferous forests (614 000 ha) are excluded. Included in broadleaved forests is 6 652 742 ha of mixed forests.
- 50) Open woodland with a crown-cover of 10 to 20 percent is included in forest.
  
- 51) Not all the area included under "Open woodland" could be considered as wooded as defined.
- 52) Provincial and Federal Government data. Reliability not ascertained.
- 53) Forest land: Land capable of producing stand of trees 10 cm dbh. and larger on 10 percent of the area. Shelter belts and units of forest 2 ha (5 acres) or less and scattered are excluded. This land class does not include agricultural land currently in use, although capable of producing trees as above.
- 54) All data is updated to 1967-1968 from most recent local inventories.



Notes to table I cont.

- 55) The data in this table is from the inventory on sub-compartments carried out when management plans were prepared. In this inventory sampling methods or complete enumeration was used.
- 56) Includes degraded forest and areas that can supply fuelwood.
- 57) Of which 370 000 ha in open woodland.
- 58) Declared forest area.
- 59) Only 30 000 ha reported to be closed forest according to another report. The area given here should have a crown cover of more than 10 percent.
- 60) Degraded forests.
  
- 61) Some scattered stands with dense forest may occur.
- 62) Areas recorded as forest.
- 63) Inventory results available for 332 000 ha.
- 64) Secondary forest.
- 65) Another 100 000 ha of peat swamp forest.
- 66) Includes "Dry forest" and "Deciduous Dipterocarp forest".
- 67) Not known if this means pure bamboo or if it also includes bamboo in understorey which is most probable.
- 68) Included in open woodland.
- 69) Forest land. A similar figure has been used for the last 50 years.
- 70) This is the exploitable forest area. Of the so-called total forest area, 9 million ha is classified as open forest (forêt claire), 2.5 million ha as semi-dense forest, 2.5 million ha as dense forest and 0.3 million ha as coniferous.
  
- 71) Of this area 1 400 000 ha have been alienated for other uses than forestry.
- 72) Figure found in FAO Production Yearbook 1969. This figure gives the area of forest land. Another source gives 23.5 million ha (or 15 percent) as being situated in the forest zone.
- 73) Only 850 000 ha according to another source.
- 74) An additional forest area of 2 600 000 ha has been alienated to other uses. It is uncertain how much of this area is still covered by forest. Philippine authorities often give the forest area as 13 760 000 ha.
- 75) Information from WFI 1958.
- 76) Of which 78 000 ha is bamboo.
- 77) Most of this area is planted. Included in total forest land.
- 78) 79 000 ha is swamp.
- 79) This information is from commercial forests (14.4 million ha). In addition there is 530 000 ha with mixed forest.

Notes to table I cont.

80) Commercial forest land.

81) Secondary forests.

82) In addition there are 3 million ha of mixed forest.

83) Information from 1974.

Table II. Standing timber. Central and South America

Country	Accuracy class	Forest area for which the volume information is given	Total forest area in same region	Standing timber		
				Total	Coniferous	Broadleaved
		1000 ha		million m <sup>3</sup>		
CENTRAL AMERICA						
Costa Rica	..	30	..	8.2 <sup>1)</sup>	-	8.2
Dominican Republic	..	668	..	22 <sup>2)</sup>	5	17
El Salvador	4	1 300	1 300	51	1.5	50
Guatemala						
Inv. El Petén	..	3 600	..	468 <sup>4)</sup>	-	468
Inv. Salama	..	45	..	3.3 <sup>5)</sup>	3.3	-
Honduras	..	2 150	2 700	134	134 <sup>6)</sup>	-
Jamaica	..	41	..	5.2	..	..
Mexico						
Inv. I	..	8 600	..	540 <sup>8)</sup>	540	-
Inv. II	..	87	87	8 <sup>8)</sup>	8	-
Inv. III	..	914	..	83	..	..
Nicaragua						
Inv. I	..	300	..	5.6 <sup>9)</sup>	5.6	-
Inv. II	..	..	1 000	..	..	..
Inv. III	..	101	..	17.3 <sup>11)</sup>	-	17.3
Panama						
Inv. I	..	2 160	2 160	350 <sup>12)</sup>	-	350
Inv. II	..	153	..	..	..	..
Inv. III	..	130	..	..	..	..
Inv. IV	..	3 799	..	423 <sup>15)</sup>	..	423
SOUTH AMERICA						
Argentina <sup>16)</sup>	5	39 320	..	(2 300)	..	..
-Eastern Subtropical	4	2 150	2 150	..	..	..
-Western Subtropical	4	2 600	2 600	..	..	..
-Subantarctic	4	2 250	2 250	..	..	..
-Gran Chaco	5	27 000	27 000	..	..	..
-Eucalyptus	3	75	75	(5.6)	..	(5.6)
Brazil						
-Amazonas	5	200 000	200 000	(40 000)	-	(40 000)
-Parana	4	6 800	6 800	215	215	-
-East Atlantic	5	30 000	30 000	(7 500)	-	(7 500)
Chile total	4	4 640 <sup>17)</sup>	..	(1 240) <sup>18)</sup>	(136)	(1 100)
-Man-made	2	331	331	67 <sup>21)</sup>	D	..
Colombia	5	(50 000)	(50 000)	(6 000)	..	(6 000)
-Amazonas						
Caqueta	5	..	10 537	..	..	..
Amazonas	5	..	9 562	..	..	..
West Vaupés	5	..	12 412	..	..	..
East Vaupés	5	..	4 988	..	..	..

Standing timber per ha			Presently commercial volume	Number of species exploited at present	Country
Total	Coniferous	Broadleaved			
m <sup>3</sup> /ha			million m <sup>3</sup>	no.	
CENTRAL AMERICA					
256	-	256	..	..	Costa Rica
30-40	..	..	11.9 <sup>3)</sup>	..	Dominican Republic
..	..	..	..	..	El Salvador
					Guatemala
45-155	-	45-155	5-25 m <sup>3</sup> /ha	..	Inv. El Petén
70	70	..	..	..	Inv. Salama
60	60	-	..	2	Honduras
125	..	..	2.4 <sup>7)</sup>	..	Jamaica
					Mexico
60	60	-	(540)	..	Inv. I
90	90	-	(8)	..	Inv. II
90	..	..	..	..	Inv. III
					Nicaragua
20	20	-	..	..	Inv. I
40-170 <sup>10)</sup>	40-170	-	..	..	Inv. II
..	..	..	2.7	18	Inv. III
					Panama
160	-	160	25 m <sup>3</sup> /ha	13	Inv. I
127 <sup>13)</sup>	-	127	..	..	Inv. II
100-300	..	100-300	28 <sup>14)</sup>	..	Inv. III
111	..	111	..	..	Inv. IV
SOUTH AMERICA					
..	..	..	(450)	..	Argentina
(250)	..	..	..	..	-Eastern Subtropical
(200)	..	..	..	..	-Western Subtropical
(150)	..	..	..	..	-Subantarctic
(30)	..	..	..	..	-Gran Chaco
70	..	70	..	..	-Eucalyptus
					Brazil
(250)	-	(250)	(8 000)	..	-Amazonas
30	30	-	90	..	-Parana
(250)	-	(250)	..	..	-East Atlantic
(270) <sup>19)</sup>	..	..	(35) <sup>20)</sup>	..	Chile total
200	..	..	(67)	..	-Man-made
(120)	..	(120)	(2 000) <sup>22)</sup>	..	Colombia
					-Amazonas
..	..	..	50 m <sup>3</sup> /ha	..	Caqueta
..	..	..	80 m <sup>3</sup> /ha	..	Amazonas
..	..	..	45 m <sup>3</sup> /ha	..	West Vaupés
..	..	..	45 m <sup>3</sup> /ha	..	East Vaupés

Table II. Standing timber. Central and South America

Country	Accuracy class	Forest area for which the volume information is given	Total forest area in same region	Standing timber		
				Total	Coniferous	Broadleaved
		1000 ha		million m <sup>3</sup>		
Colombia						
<u>-Pacific region</u>						
Rio Atrato	4	..	3 294	..	..	..
Pacifico	4	..	3 618	..	..	..
Nariño	4	..	2 088	..	..	..
-Carare	3	..	1 760	..	..	..
-Motilones	4	..	3 590	..	..	..
-Sierra Nevada de Santa Marta	4	..	400	..	..	..
-Sierra Nevada del Cocuy	4	..	200	..	..	..
Ecuador	..	1 100 <sup>23)</sup>	2 700	135 <sup>24)</sup>	-	135
French Guyana	..	1 500	..	..	..	..
Guyana	..	4 920	..	..	..	..
Paraguay						
Inv. I	..	720	..	..	..	..
Inv. II	..	6 401	..	(1 054) <sup>28)</sup>	-	(1 054)
Surinam	..	260	..	..	..	..
Uruguay	3	155 <sup>30)</sup>	155	16	2.5	14
Venezuela	..	600	..	123 <sup>31)</sup>	-	123

Standing timber per ha			Presently commercial volume	Number of species exploited at present	Country
Total	Coniferous	Broadleaved			
m <sup>3</sup> /ha			million m <sup>3</sup>	no.	
Colombia					
<u>-Pacific region</u>					
..	..	..	188m <sup>3</sup> /ha	..	Rio Atrato
..	..	..	120m <sup>3</sup> /ha	..	Pacifico
..	..	..	90m <sup>3</sup> /ha	..	Nariño
..	..	..	110m <sup>3</sup> /ha	..	-Carare
..	..	..	137m <sup>3</sup> /ha	..	-Motilones
..	..	..	123m <sup>3</sup> /ha	..	-Sierra Nevada de Santa Marta
..	..	..	60m <sup>3</sup> /ha	..	-Sierra Nevada del Cocuy
Ecuador					
90-140	-	90-140	..	..	
82-177 <sup>25)</sup>	-	82-177	33-104m <sup>3</sup> /ha	..	French Guayana
133-217 <sup>26)</sup>	-	133-217 <sup>26)</sup>	..	..	Guyana
Paraguay					
200 <sup>27)</sup>	-	200	60	..	Inv. I
(165)	-	(165)	32 m <sup>3</sup> /ha	..	Inv. II
Surinam					
140-210 <sup>29)</sup>	-	140-210	45-50 m <sup>3</sup> /ha	..	
105	..	..	..	..	Uruguay
150-160 <sup>32)</sup>	-	150-160	100 m <sup>3</sup> /ha	..	Venezuela

Table II. Standing timber. Africa

Country	Accuracy class	Forest area for which information is given	Total forest area in same region	Standing timber (Forest)			Presently commercial volume Broadleaved
				Total	Coniferous	Broadleaved	
				million m <sup>3</sup>			
		1000 ha					
Angola	4	..	..	..	..	..	..
Botswana	4	-	-	-	-	-	-
Cameroon	3	7 700 <sup>31a)</sup>	..	..	..	..	15-70 m <sup>3</sup> /ha <sup>32a)</sup>
Central African Rep.	3	3 000	3 000	..	..	..	147 <sup>33)</sup>
Congo	5	17 500	17 500	..	..	..	70
Dahomey	4	250	250	..	..	..	5
Gabon							
Zone I	3	3 365	3 365	..	-	..	62 <sup>34)</sup>
Zone II	3	11 420	11 420	..	-	..	124 <sup>34)</sup>
Zone III	..	6 550	..	..	-	..	..
Inv. I	..	1 200	..	39 <sup>35)</sup>	-	39	10.8
Inv. II	..	3 300	..	92 <sup>35)</sup>	-	92	19.6
Ghana	4	1 380	..	330 <sup>36)</sup>	-	330	30 <sup>37)</sup>
Guinea	5	710	710	..	-	..	10
Ivory Coast	3	15 700	15 700	4 150 <sup>38)</sup>	-	4 150 <sup>39)</sup>	..
Inv. I	..	13 100	13 100	660 <sup>40)</sup>	-	660	433 <sup>41)</sup>
Inv. II	..	2 600	2 600	..	-	..	40 m <sup>3</sup> /ha
Kenya	..	1 264	1 264	109	30	79	50
Liberia	..	1 550	2 500	..	..	..	..
Madagascar	5	8 000 <sup>44)</sup>	8 000	575 <sup>45)</sup>	..	575	..
Inv. I	..	61 <sup>47)</sup>	..	..	..	..	..
Morocco	4	(5 000)	(5 000)	150 <sup>48)</sup>	15	135	..
Nigeria	5	(4 400)	(4 400)	..	..	..	71
Inv. I	..	400	..	74 <sup>49)</sup>	-	74	22
Senegal	4	(5 000)	..	..	..	..	43 <sup>50)</sup>
Sierra Leone	4	250	290	..	-	..	6.4 <sup>51)</sup>
South Africa	See under Europe and Other Temperate regions						
Sudan	5	..	..	..	..	..	.. <sup>53)</sup>
Togo	2	449	..	27 <sup>55)</sup>	-	27	4 <sup>56)</sup>
Tunisia	3	367 <sup>57)</sup>	367	7.8 <sup>58)</sup>	3	4	..
Uganda	4	900	900	(200)	..	..	..



Standing timber per ha (Broadleaved)	Normally extracted volume	Number of species exploited at present	Area of open wood-land with information	Standing timber in open wood-land	Country
m <sup>3</sup> /ha		no.	1000 ha	million m <sup>3</sup>	
..	..	..	2 500	8-45m <sup>3</sup> /ha <sup>29a)</sup>	Angola
-	-	..	518	0.26 <sup>30a)</sup>	Botswana
..	..	16	..	..	Cameroon
..	..	..	..	..	Central African Rep.
..	..	20-25	..	..	Congo
..	..	..	..	..	Dahomey
..	..	..	..	..	Gabon
..	10	10	..	..	Zone I
..	10	10	..	..	Zone II
..	..	..	..	..	Zone III
..	..	..	..	..	Inv. 1
..	..	..	..	..	Inv. 2
..	..	28	..	..	Ghana
..	..	..	..	..	Guinea
..	..	..	..	..	Ivory Coast
..	..	..	..	..	Inv. I
175 <sup>42)</sup>	..	..	..	..	Inv. II
85	..	..	..	..	Kenya
102-146 <sup>43)</sup>	..	..	..	..	Liberia
70	..	..	(2 000)	(35) <sup>46)</sup>	Madagascar
80	..	..	..	..	Inv. I
30	..	..	..	..	Morocco
..	10-25	24	..	..	Nigeria
185	..	24	..	..	Inv. I
..	..	..	..	..	Senegal
(115) <sup>52)</sup>	23	..	..	..	Sierra Leone
..	..	..	..	..	South Africa
..	..	..	45 000 <sup>54)</sup>	(1 500)	Sudan
60	..	..	1 292	4.4	Togo
20	..	..	..	..	Tunisia
220	..	..	(7 500)	(150)	Uganda

Table II. Standing timber. Europe and Other Temperate regions

Country	Accuracy class	Forest area covered	Inventory	Standing timber (o. b.)					
				In forest				Outside forest	
				Total	Per ha	Coni-ferous	Broad-leaved	Coni-ferous	Broad-leaved
		1000 ha	%	mill. m <sup>3</sup>	m <sup>3</sup> /ha	million m <sup>3</sup>			
EUROPE									
Albania <sup>59)</sup>	..	1 282	..	80	62	..	..	..	..
Austria	1	2 882 <sup>60)</sup>	100	660	236	563	98	.. (80) <sup>61)</sup>	..
Belgium	3	603	-	57	95	31	26	-	1
Bulgaria	2-3	2 823	100	226	80	76	150	.. (26) <sup>61)</sup>	..
Czechoslovakia	2	4 148	100	669	161	495	174	..	..
Denmark	2-3	420	100	36	86	17	19	..	..
Finland	1	18 622	100	1 441	77	1 168	273	38 <sup>65)</sup>	11 <sup>65)</sup>
France	3	4 181 <sup>66)</sup>	39	380	91	199	180	1.6	30
German Dem. Republic <sup>69)</sup>	2	2 680	100	350	131	257	93	..	..
Germany, Fed. Rep. of	3	6 837	72	1 022 <sup>69)</sup>	149	722	300	.. (20) <sup>61)</sup>	..
Greece	3	2 312	..	152	66	73	79	0	0
Hungary	2-3	1 324	99	152	115	11	141	.. 71 <sup>1)</sup> (8) <sup>61)</sup>	.. 71 <sup>1)</sup>
Ireland	3	255	-	11	43	..	..	.. (11) <sup>61)</sup>	..
Italy	3	6 136	25	371	60	168	203	46 (1) <sup>61)</sup>	247
Luxembourg	3	81	-	12	148	2	10	0	0
Netherlands	2-3	250 <sup>72)</sup>	100	20	80	16	4	0.2	2.3
Norway	1	8 287	75	513	62	425	89	..	..
Poland	2-3	8 240	94	829	101	669	160	.. (2) <sup>61)</sup>	..
Portugal	2-3	2 881	52	174	55	90	84	0.5	0.7
Romania	2-3	6 092	100	1 142	187	427	715	8 (24) <sup>61)</sup>	11
Spain	3	14 263	61	357	25	248	109	5	10
Sweden	1	23 408	100	2 158	92	1 830	328	58	7
Switzerland	3	958	71	240	251	180	60	1	1
United Kingdom									
Great Britain	2-3	1 524	100	120	79	68	52	4	30
Northern Ireland	3	49	-	3	61	2	1	..	..
Yugoslavia	3	7 045	54	913	130	251	662	18 (50) <sup>61)</sup>	5
USSR	3	691 800	100 <sup>73)</sup>	73 250 <sup>74)</sup>	106	61 240	12 010	.. (5 590) <sup>61)</sup>	..
NEAR EAST									
Cyprus	3	173	85	3.4 <sup>75)</sup>	20	3.4	..	0	0
Israel	2-3	44	50	2	39	1	1	-	0
Turkey	4	6 806	48	659	97	476	183	65	119
OTHER TEMPERATE									
Australia	4	35 924	52	1 053	29	79	974	..	..
New Zealand <sup>78)</sup>	2	6 192	100	272	110	258 <sup>79)</sup>	14 <sup>80)</sup>	..	..
Canada	4	180 268 <sup>83)</sup>	100	17 811	99	14 228	3 583	..	..
USA <sup>86)</sup>	2	206 483 <sup>87)</sup>	100	18 261	88	12 385	5 876	..	..
Japan	1	25 267	100	1 850	76	960 <sup>88)</sup>	890 <sup>89)</sup>	..	..
Korea	4	6 675 <sup>91)</sup>	..	61	11	37	29	..	..
South Africa	3	1 139	(100)	110	97	55	55	..	..

## Increment. Europe and Other Temperate regions

Increment (o. b.)								Country
Gross				Losses	Net			
Total	Per ha	Coniferous	Broad-leaved		Total	Coniferous	Broad-leaved	
1000 m <sup>3</sup>	m <sup>3</sup> /ha	1000 m <sup>3</sup>						
EUROPE								
..	..	..	..	..	..	..	..	Albania
16 743 <sup>60)</sup>	6.0	14 200	2 543	37	16 706	14 171	2 535	Austria
2 675 <sup>62)</sup>	4.4	1 575	1 100	90	2 585	1 500	1 085	Belgium
6 079	2.2	1 596	4 483	..	..	..	..	Bulgaria
14 400 <sup>63)</sup>	3.5	11 500	2 900	..	..	..	..	Czechoslovakia
2 150 <sup>64)</sup>	5.1	1 400	750	56	2 094	1 344	750	Denmark
55 280	3.0	43 600	11 680	1 000	54 280	..	..	Finland
15 500 <sup>67)</sup>	3.7	9 166	6 334 <sup>68)</sup>	..	..	..	..	France
..	4.9	..	..	..	13 200	..	..	German Dem. Republic
37 632 <sup>70)</sup>	5.5	28 672	8 960	3 360	34 272	26 096	8 176	Germany, Fed. Rep. of
5 000	2.2	2 516	2 484	1 000	4 000	1 816	2 184	Greece
7 103	5.4	511	6 592	16	7 087	505	6 582	Hungary
707 <sup>59)</sup>	3.2	581	126	-	707	581	126	Ireland
12 840	2.1	3 182	9 658	152	12 688	3 131	9 557	Italy
260	3.2	115	145	3	257	114	143	Luxembourg
1 200	4.8	1 032	168	..	1 200	1 032	168	Netherlands
15 576	1.9	12 383	3 193	313	15 263	12 198	3 066	Norway
22 660	2.8	18 843	3 817	0	22 660	18 843	3 817	Poland
8 831	2.8	6 853	1 978	..	..	..	..	Portugal
26 312	4.3	8 775	17 537	..	..	..	..	Romania
17 444	1.2	10 939	6 505	520	16 924	10 549	6 375	Spain
77 600	3.3	65 100	12 500	3 000	74 600	..	..	Sweden
4 500	4.7	3 300	1 200	50	4 450	3 250	1 200	Switzerland
6 800	4.5	5 300	1 500	300	6 500	5 100	1 400	United Kingdom
207	4.2	181	25	0	207	181	25	Great Britain
22 689	3.2	5 834	16 854	252	22 437	5 734	16 703	Northern Ireland
..	1.2	..	..	..	844 000 <sup>74)</sup>	577 000	267 000	Yugoslavia
..	..	..	..	..	..	..	..	USSR
NEAR EAST								
63 <sup>76)</sup>	0.5	63	..	3	60	60	..	Cyprus
110	2.5	62	48	2	108	61	47	Israel
16 217 <sup>77)</sup>	0.9	9 189	7 028	35	16 182	9 165	7 017	Turkey
OTHER TEMPERATE								
21 940	0.6	5 665	16 275	4 160	17 780	5 615	12 165	Australia
8 638 <sup>81)</sup>	15.3	8 638	..	992	7 646 <sup>82)</sup>	7 646	..	New Zealand
..	1.5 <sup>84)</sup>	..	..	..	304 000 <sup>85)</sup>	226 000	78 000	Canada
647 064	3.1	383 076	264 988	156 801	491 263	282 224	209 039	USA
..	3.1 <sup>84)</sup>	..	..	..	76 500 <sup>90)</sup>	41 500 <sup>90)</sup>	35 000 <sup>90)</sup>	Japan
1 318	0.24	295	1 023	24	1 294	273	1 021	Korea
13 876	(12.2)	6 768	7 108	-	13 876	6 768	7 108	South Africa

Table II. Standing timber. Asia

Country	Accuracy class	Area for which the volume in-formation is given	Total forest area in same region	Standing timber		
				Total	Coniferous	Broadleaved
		1000 ha		million m <sup>3</sup>		
Afganistan	3	360	..	30	30	..
Cyprus	See under Europe and Other Temperate regions					
Iran	3	1 600 <sup>92)</sup>	..	380 <sup>93)</sup>	..	380
Israel	See under Europe and Other Temperate regions					
Jordan	3	36	..	0.87	0.27	..
Syria	4	40	..	..	..	..
Turkey	See under Europe and Other Temperate regions					
Bangladesh						
Inv. I	..	97	600	21 <sup>94)</sup>	-	21
Inv. II	..	235	600	18 <sup>95)</sup>	-	18
China	5	80 000	80 000	6 000	(2 000)	..
India	5	75 351	75 351	(10 180)	750	..
Inv. I Central Zone	..	2 008	..	123	-	123
Inv. II Southern Zone	..	458	..	110	-	110
Inv. III Northern Zone	..	412	..	83	64	19
Inv. IV Northern Zone	..	374	..	102	89	13
Inv. V	..	811	..	..	..	..
Inv. VI	..	194	..	45	-	45
Indonesia						
Operable forest	5	(42 000)	(42 000)	(4 000) <sup>97)</sup>	..	(4 000)
Protection forest	5	(43 000)	(43 000)	(4 300) <sup>97)</sup>	..	(4 300)
Japan	See under Europe and Other Temperate regions					
Khmer Republic						
Inv. I	..	3 357 <sup>98)</sup>	..	270	..	270
Inv. II	..	2 922	..	128 <sup>99)</sup>	..	128
Inv. III	..	337	..	25 <sup>100)</sup>	..	25
Korea, Republic of	See under Europe and Other Temperate regions					
Laos	..	616 <sup>102)</sup>	..	67 <sup>103)</sup>	-	67
Malaysia						
Sarawak	..	1 060	..	..	..	..
West Malaysia	..	8 300	8 300	900 <sup>105)</sup>	-	900
Mongolia	..	9 467	..	1 209	1 165	44
Nepal						
Inv. I	..	1 250	..	102 <sup>107)</sup>	..	..
Inv. II	..	157	..	9.1 <sup>108)</sup>	7.3	1.8
Pakistan	4	347	..	55	55	-
Phillipines	2	12 700	12 700	1 990 <sup>110)</sup>	15	1 975
Sri Lanka						
Wet zone	3	161	161	17 <sup>111)</sup>	-	17
Intermediate zone	3	130	130	6 <sup>111)</sup>	-	6
Dry zone	3	2 185	2 185	84 <sup>111)</sup>	-	84

Standing timber per ha			Presently commercial volume	Potentially commercial volume	Number of species exploited at present	Normally extracted volume	Country
Total	Coniferous	Broadleaved					
m <sup>3</sup>			million m <sup>3</sup>		no.	m <sup>3</sup> /ha	
80	80	..	..	..	..	..	Afganistan
240 <sup>93)</sup>	..	240	..	..	..	..	Cyprus
							Iran
24	..	..	..	..	..	..	Israel
							Jordan
40	..	..	..	..	..	..	Syria
							Turkey
							Bangladesh
217	-	217	..	..	..	..	Inv. I
76	-	76	9.5	..	..	..	Inv. II
75	..	..	..	..	..	..	China
135	200	(130)	..	..	..	..	India
61	-	61	..	..	..	..	Inv. I Central Zone
220	-	220	..	..	..	..	Inv. II Southern Zone
200	261	114	..	..	..	..	Inv. III Northern Zone
272	305	154	..	..	..	..	Inv. IV Northern Zone
71	-	71	..	..	..	..	Inv. V
23	-	23	..	..	..	..	Inv. VI
							Indonesia
(100)	..	..	(2 000)	..	..	..	Operable forest
(100)	..	..	(2 000)	..	..	50-60	Protection forest
							Japan
							Khmer Republic
..	..	..	176	..	..	..	Inv. I
..	..	..	..	..	..	..	Inv. II
..	..	..	4.6 <sup>101)</sup>	..	..	..	Inv. III
							Korea, Republic of
110	-	110	11 <sup>104)</sup>	..	..	..	Laos
							Malaysia
94-148	-	94-148	..	..	..	..	Sarawak
108	-	108	560	94	..	..	West Malaysia
127	135	50	310 <sup>106)</sup>	..	..	..	Mongolia
							Nepal
80	..	..	66 <sup>108)</sup>	..	..	..	Inv. I
..	..	..	9.1 <sup>109)</sup>	..	..	..	Inv. II
160	160	-	55	-	..	..	Pakistan
124	70	124	..	..	..	..	Phillipines
							Sri Lanka
106	..	106	..	..	..	..	Wet zone
45	..	45	..	..	..	..	Intermediate zone
38	..	38	..	..	..	..	Dry zone

Table II. Standing timber. Asia

Country	Accuracy class	Area for which the volume information is given	Total forest area in same region	Standing timber		
				Total	Coniferous	Broadleaved
		1000 ha		million m <sup>3</sup>		
Taiwan total	2	1 960	1 960	193	50	140
Natural productive forest	2	574	574	80	44	35
Man-made	2	235	235	8	4	4
Thailand	2	27 100	27 100	1 283 <sup>112)</sup>	6	1 277

Standing timber per ha			Presently commercial volume	Potentially commercial volume	Number of species exploited at present	Normally extracted volume	Country
Total	Coniferous	Broadleaved					
m <sup>3</sup>			million m <sup>3</sup>		no.	m <sup>3</sup> /ha	
100	..	..	..	..	..	..	Taiwan total
140	270	85	..	..	..	..	Natural prod. forest
35	..	..	..	..	..	..	Man-made
50	..	50	..	..	..	..	Thailand



Notes to table II

- 1) All species above 30 cm d.b.h. Without bark.
- 2) See the country note.
- 3) Industrial volume. (Trees above 20 cm d.b.h.)
- 4) All species above 10 cm d.b.h. With bark.
- 5) Volume above 10 cm d.b.h.
- 6) Volume above 15 cm d.b.h. Without bark.
- 7) Sawlog volume.
- 8) Trees above 12.5 cm d.b.h. With bark.
- 9) Volume of pine above 14 cm d.b.h. Without bark.
- 10) All species above 10 cm d.b.h. Without bark.
- 11) All trees above 40 cm d.b.h.
- 12) All species above 45 cm d.b.h. Without bark.
- 13) All species above 10 cm d.b.h. Without bark.
- 14) Sawnwood.
- 15) All species above 40 cm d.b.h.
- 16) See country notes for location of vegetation types.
- 17) Exploitable forest.
- 18) Volume above 12.5 cm d.b.h.
- 19) Such a high mean value is hardly possible.
- 20) Trees of sawtimber size in natural forests (pessimistic source).
- 21) Volume above 10 cm d.b.h. Without bark.
- 22) The potentially commercial volume estimated to 4 000 million m<sup>3</sup>.
- 23) Result for three inventories in the coast region.
- 24) All species above 10 cm d.b.h. (in the case of 30 million m<sup>3</sup> all species above 17.5 cm d.b.h.). Without bark.
- 25) Volume above 40 cm d.b.h. All species.
- 26) All species above 25 cm d.b.h.
- 27) All species above 15 cm d.b.h. Without bark.
- 28) Included is all trees above 35 cm d.b.h. See also the country note.
- 29) Total gross volume above 25 cm d.b.h.
- 29a) Of which as a mean 4 m<sup>3</sup>/ha is exploitable.
- 30) Information for man-made forests.
- 30a) Volume above bark of timber.

Notes to table II cont.

- 31) All species above 40 cm d.b.h. Without bark.
- 31a) Estimate for south-eastern high forest regions given in UNDP/IBRD Regional Transport survey.
- 32) All species above 10 cm d.b.h. Without bark.
- 32a) Volume above 62 cm d.b.h. of 14 "principal species".
- 33) Volume above 62 cm d.b.h. of 12 "principal species".
- 34) Commercial volume (extracted logs from exploitable trees).
- 35) Volume above 50 cm d.b.h. Extractable volume. Commercial and potentially commercial species.
- 36) Gross volume in productive reserved areas.
- 37) Volume for commercial species above 32 cm d.b.h.
- 38) Gross volume above 60 cm d.b.h. With bark.
- 39) Of this volume 56 million m<sup>3</sup> are in degraded forests.
- 40) Volume of 43 commercial or commerciable species. Trees above 32 cm d.b.h.
  
- 41) Volume above 62 cm d.b.h.
- 42) All species above 10 cm d.b.h.
- 43) Volume above 40 cm d.b.h. All species.
- 44) Unexploited forests and open woodlands.
- 45) All species above 30 cm d.b.h.
- 46) Included under forest.
- 47) Inventory on the east coast. (Fierenana)
- 48) All species. All diameters. Bark included. Volume in man-made forest included.
- 49) Total volume above 15 cm d.b.h. All species.
- 50) Figure given to WFI 1970. Means probably commercial species. Uncertain to which area it belongs. Man-made forests included.
  
- 51) All exploitable trees above 46 cm d.b.h. With bark.
- 52) Volume under bark of trees above 38 cm d.b.h.
- 53) Estimated annual yield 155 000 m<sup>3</sup>.
- 54) Includes closed forest and open woodland.
- 55) All species above 62 cm d.b.h.
- 56) Principal species above 62 cm d.b.h.
- 57) Man-made forest is included.
- 58) Volumes include bark.
- 59) Information from WFI 1963.
- 60) All forests not under exploitation are excluded.

Notes to table II cont.

- 61) Volume in protection forest.
- 62) Assessment based on sold quantities.
- 63) Uncertain if bark is excluded or not.
- 64) All forests not under exploitation are excluded for the calculation of increment.
- 65) Total on poorly productive land. Included in total volume of standing timber.
- 66) Information about total growing stock and increment was estimated in European Timber Trends and Prospects 1950-1980, An interim review. Total area given as 12 396 000 ha and total growing stock 944 million m<sup>3</sup>.
- 67) This information is for inventoried forests. To the WFI 1963 France reported a total increment of 43 million m<sup>3</sup> of which 15 million m<sup>3</sup> was coniferous and 28 million m<sup>3</sup> broadleaved.
- 68) Excluded is the increment of Fagus in the Department of Meuse.
- 69) Information about standing timber given in "Millionen Vorratsfestmeter Derbholz mit Rinde".
- 70) Information given in "1000 Erntefestmeter mit Rinde".
- 71) Included in forests.
- 72) From total forest area 26 000 ha of coppice is excluded.
- 73) USSR reports 40 percent of the forest area to be covered by a ground survey and 60 percent of the area by an aerial survey.
- 74) Not known whether bark is included or not.
- 75) Volume is given for coniferous in State forests.
- 76) Increment is given for coniferous in Main state forest.
- 77) This volume has been calculated on all normal forests, degraded forests and scrub but excluding private forests.
- 78) Exotic species to 10 cm top diameter under bark. Merchantable indigenous timber of sawtimber quality only (above 15-20 cm top diameter under bark).
- 79) Exotic coniferous 212 million m<sup>3</sup>. Indigenous coniferous 45 million m<sup>3</sup>.
- 80) Exotic hardwoods 0.3 million m<sup>3</sup>. Indigenous hardwoods 14 million m<sup>3</sup>.
- 81) Annual gross increment has been calculated for areas of fast growing exotic conifers only. For indigenous forests annual increment of vigorous trees is balanced by mortality of trees so that stands can be regarded as static.
- 82) Net increment is considered as the increment occurring on the productive exotic stands only.
- 83) This information is from the inventoried area of 180 268 000 ha. That is 57 percent of the total forest area.

Notes to table II cont.

- 84) For net increment.
- 85) The net increment reported here is actually the allowable or permissible annual harvest as defined by the province. For the most part it takes into account entomological and pathological losses. The status of fire losses is unknown. The degree of utilization introduced to arrive at the allowable harvest varies from province to province. The area of forest to which this data applies is 205 million ha.
- 86) All data for growing stock of trees 12.7 cm (5.0 inches) d.b.h. and larger on commercial forest land.
- 87) Commercial forest land only. Growing stock of trees 12.7 cm (5.0 inches) d.b.h. and over.
- 88) *Cryptomeria japonica* 330 million m<sup>3</sup>, *Chamaecyparis obtusa* 140 million m<sup>3</sup>, others 490 million m<sup>3</sup>.
- 89) *Fagus crenata* 160 million m<sup>3</sup>, other 730 million m<sup>3</sup>.
- 90) The inventory was carried out in every compartment by using actual yield table by species.
  
- 91) Includes protection reserves.
- 92) Caspian forest.
- 93) Probably derbholz volume.
- 94) All trees above 12.5 cm d.b.h. Bark excluded.
- 95) All trees above 60 cm d.b.h. Bark excluded.
- 96) Volume under bark. Minimum diameter 5 cm d.b.h. over bark.
- 97) Timberspecies above 35 cm d.b.h.
- 98) Information from the only report published after the USAID inventory.
- 99) All trees above 60 cm d.b.h.
- 100) All trees above 10 cm d.b.h.
  
- 101) Commercial species above 45 cm d.b.h.
- 102) CIDA-USAID inventory.
- 103) Volume above 10 cm d.b.h.
- 104) Loggable volume (volume above 60 cm d.b.h.).
- 105) Trees above 45.7 cm d.b.h.
- 106) Volume in commercial forest (2 970 000 ha).
- 107) Gross volume to 10 cm top. All species.
- 108) Net sawlog volume. (Volume to 20 cm top with deductions for defects.)
- 109) Total net volume timber.
- 110) Volume for all species above 15 cm d.b.h.

Notes to table II cont.

111) Probably volume of all species above 9.6 cm d.b.h. (1 foot girth).

112) All trees above 30 cm d.b.h.

Table III. Man-made forest

Country	Accuracy class	Year of estimate	Total area planted	Species				Present annual planting rate	Planned annual planting rate
				Euca-lyptus	Other broad-leaved	Pine	Other coniferous		
				1000 ha					
CENTRAL AMERICA									
Bahamas	..	..	..	..	..	..	..	..	..
Barbados	4	..	0	..	..	..	..	..	..
Belize	4	1972	2.9	..	..	1.9	..	(0.1)	..
Costa Rica	4	..	0.2	..	..	..	..	..	..
Cuba	3	1965	215 <sup>1)</sup>	53	40	15	10	..	..
Dominican Republic	4	1972	4.2	..	..	..	..	..	..
El Salvador	..	..	-	-	-	-	-	..	..
Guadeloupe	4	1972	2.8	..	..	..	..	..	..
Guatemala	4	1965	1	..	..	..	..	..	..
Haiti	4	1973	0.3	..	..	..	..	..	..
Honduras	4	..	0	..	..	..	..	..	..
Jamaica	3	1972	12	..	8	3	..	..	..
Mexico	4	1967	50	20	20	10	..	..	..
Nicaragua	4	..	0	..	..	..	..	..	..
Panama	4	..	4	..	..	..	..	..	..
Puerto Rico	3	1972	9.6	..	..	..	..	..	..
Trinidad and Tobago	3	1971	11.6	..	8.2	3.5	..	(0.5)	..
SOUTH AMERICA									
Argentina	3	1972	325	75	155	62	33	..	35
Bolivia	4	..	(24)	23	..	1	..	..	..
Brazil	3	1972	1 350	840	145	368	..	..	..
Chile	2	1972	440	30	..	410	..	10-12	..
Colombia	3	1972	40	15	..	25	..	(5)	..
Ecuador	3	1970	45	45	..	..	..	..	..
French Guiana	3	1967	3	..	(3)	..	..	..	..
Guyana	3	1972	0.2	..	..	0.2	..	..	..
Paraguay	5	1972	3 <sup>2)</sup>	2.9	..	0.1	..	..	..
Peru	4	1970	20	20	..	..	..	..	..
Surinam	3	1972	6.2	(2.5	.. )	3.7	..	..	..
Uruguay	3	1966	155	105	24	25	0.5	(2)	..
Venezuela	4	1972	7	..	..	..	..	..	..
AFRICA									
Algeria	4	1967	(72)	30	.. <sup>3)</sup>	42	.. <sup>4)</sup>	6	10
Angola	3	1970	120	.. <sup>5)</sup>	..	..	..	..	7
Botswana	3	..	0	0	..	..	..	..	..
Burundi	3	1971	25	16	..	..	3	0.25	0.25
Cameroon	3	1970	6	6	..	0	..	..	..
Central African Rep.	4	..	1	0	0	..	..	..	..
Chad	4	..	0	..	0	..	..	..	..

Table III. Man-made forest

Country	Accuracy class	Year of estimate	Total area planted	Species				Present annual planting rate	Planned annual planting rate
				Euca-lyptus	Other broad-leaved	Pine	Other coniferous		
1000 ha									
Comoro Islands	4	..	0	..	..	..	..	..	..
Congo	3	1970	12	..	6	..	..	..	1
Dahomey	3	1972	18.4	..	18.4	..	..	..	..
Egypt	3	..	10	..	..	-	-	..	..
Equatorial Guinea	..	..	-	-	-	-	-	..	..
Ethiopia	3	1971	40	40	..	0	..	..	..
Gabon	2	1971	25	0	25	0	-	..	..
Gambia	2	1971	0.8	..	..	-	-	..	..
Ghana	3	1969	11	0	11	..	..	..	6
Guinea	3	1971	2	-	1.5	0.6	-	..	0.8-1.8
Ivory Coast	4	1972	28	0	28	0	..	..	4
Kenya	3	1967	138 <sup>6)</sup>	8	7	55	60	..	5
Lesotho	3	..	0	..	..	..	..	..	..
Liberia	4	1971	0.5	..	0.5	..	..	..	1.3
Libyan Arab Republic	4	1972	75	..	..	..	..	..	6
Madagascar	3	1971	240	200	..	40	..	12	10
Malawi	2	1971	37 <sup>7)</sup>	3	..	34	..	5	4
Mali	4	..	0	..	0	..	..	..	..
Mauritania	..	..	-	-	-	-	-	..	..
Mauritius	2	1970	9	4	..	4	1	..	..
Morocco	2	1971	294	169	22	71	33	25	20
Mozambique	3	1971	21	..	..	..	..	..	..
Namibia	..	..	-	-	-	-	-	..	..
Niger	..	..	0	..	..	..	..	..	..
Nigeria	4	1970	70	3 <sup>8)</sup>	32 <sup>8)</sup>	0 <sup>8)</sup>	0 <sup>8)</sup>	..	(14)
Portugese Guinea	4	1970	0.3	..	..	..	..	..	..
Réunion	3	..	9	..	(9)	..	..	..	..
Rhodesia	4	1967	94	..	58	..	36	..	..
Rwanda	3	1971	29	23	..	..	..	..	0.25
Senegal	3	1970	14	..	14	..	..	..	1.5
Seychelles	4	1970	1	..	1	..	..	..	..
Sierra Leone	3	1970	6.5	..	6.5	..	..	..	..
Somalia	..	1970	0	..	..	..	..	..	..
South Africa	2	1969	1 025 <sup>9)</sup>	290	198	471	..	(23)	..
Spanish Sahara	..	..	-	-	-	-	-	..	..
Sudan	4	1969	81	8	70	0.2	1.6	..	4.5
Swaziland	2	1970	76	8	0	68	..	..	..
Tanzania	3	1969	29 <sup>10)</sup>	0	4	19	5	..	4
Togo	4	1971	3	0	3	..	..	..	..
Tunisia	2	1970	114	(+)	..	(+)	..	11	18
Uganda	3	1971	22 <sup>11)</sup>	10	2	10	..	..	2
Upper Volta	4	..	2	..	..	..	..	..	..
Zaire	4	..	57	..	55	2	..	..	..
Zambia	2	1970	8.5	2.5	..	6.3	..	..	3



Table III. Man-made forest

Country	Accuracy class	Year of estimate	Total area planted	Species				Present annual planting rate (1971/72)	Planned annual planting rate
				Euca- lyptus	Other broad- leaved	Pine	Other coniferous		
1000 ha									
EUROPE <sup>x)</sup>									
Albania	..	..	..	..	..	..	..	..	..
Austria	..	WW	3 613	..	..	..	..	26	..
Belgium	..	WW	287	-	(33)	(83)	(180)	..	..
Bulgaria	..	..	..	..	..	..	..	..	..
Czechoslovakia	..	WW	4 457	..	..	..	..	44	..
Denmark	..	WW	38	..	..	(20)	(100)	..	..
Finland	..	WW	1 750	..	(1)	(120)	(20)	145	..
France	..	1965	(1 100)	-	(121)	(374)	(605)	..	..
German Dem. Rep.	..	..	..	..	..	..	..	..	..
Germany, Fed. Rep. of	..	WW	1 200	-	(24)	..	..	60	..
Greece	..	WW	2 500	(0)	(12)	(115)	(10)	5	..
Hungary	..	1965	(514)	..	(434)	( 80 )		..	..
Ireland	..	WW	269	..	..	..	..	10	..
Italy	..	WW	6 169	(32)	(301)	(210)	(290)	8	..
Luxembourg	..	WW	16	-	-	(3)	(22)	..	..
Netherlands	..	WW	275	..	..	..	..	0.5	..
Norway	..	WW	623	..	..	..	(170)	30	..
Poland	..	WW	104	..	..	..	..	..	..
Portugal	..	1965	(180)	(180)	..	..	..	..	..
Romania	..	..	..	..	..	..	..	..	..
Spain	..	WW	2 800	(102)	(10)	(1 485)	(3)	113	..
Sweden	..	WW	3 750	..	..	(20)	(120)	157	..
Switzerland	..	1965	(38)	..	(8)	(3)	(27)	..	..
United Kingdom	..	WW	1 535	-	(360)	(311)	(595)	51	..
Yugoslavia	..	WW	23	..	..	..	..	2	..
USSR	..	1965	(11 000)	..	..	..	..	..	..
NORTH AMERICA									
Canada	..	WW	1 220	-	(151)	(54)	(90)	130	..
USA	..	1965	(10 353)	-	(678)	(7 166)	(2 509)	..	..

<sup>x)</sup> In spite of what has been said in 5.2.2 (Table III: Man-made forests. General) I have finally decided to include figures for Europe and North America in Table III. Most of the information has been taken from World Wood 1973 (WW). To give an indication of the area covered by different species figures from Unasylva 1967, Vol 21 (3-4) have been utilized (these figures are put within brackets). Some of the strange results among the Unasylva figures are caused by a misinterpretation in some countries of the definition of man-made forest. The exact wording of the World Wood definition is not either known.

Table III. Man-made forest

Country	Accuracy class	Year of estimate	Total area planted	Species				Present annual planting rate	Planned annual planting rate
				Euca-lyptus	Other broad-leaved	Pine	Other coniferous		
1000 ha									
ASIA									
Afganistan	4	1965	0.8	..	0.8	..	..	..	..
Cyprus	2	1969	15	0.9	1	13	0.2	1	1
Iran	4	..	100 <sup>12)</sup>	..	(100)	..	..	..	..
Iraq	4	1970	4-7.5	..	3.5	..	..	..	..
Israel	1	1972	50	..	..	..	..	2-3	..
Jordan	4	1972	7	..	..	..	..	..	2.5
Lebanon	4	1966	3.2	..	..	(3.2)	..	..	..
Kuwait	4	1967	0.4	..	..	..	..	..	..
Syria	4	1965	10	..	10	..	..	..	..
Bangladesh	4	1968	68	..	50	..	..	..	..
Brunei	3	..	0	..	..	..	..	..	..
Burma	5	..	(100)	..	(100)	..	..	(7)	..
China	5	..	(20 000)	..	..	..	..	..	..
India	5	..	1 100	(400)	(700)	..	..	80	..
Indonesia	5	1967-72	(1 200)	(1)	(1 053)	(117)	(22)	..	..
Japan	1	1973	8 863	..	..	..	+	350	2-300
Khmer Republic	4	1967	6	..	5.6	0.2	..	..	..
Korea South	5	1967	2 025 <sup>13)</sup>	..	1 200	617	215	..	100
Laos	5	1960	0.7	..	..	..	..	..	..
Malaysia									
Sabah	3	..	0	..	..	..	..	..	..
Sarawak	..	..	..	..	..	..	..	..	..
West Malaysia	2	1970	1	..	..	..	..	..	..
Nepal	3	1970	4	..	..	..	..	..	..
Pakistan	3	1969	300 <sup>14)</sup>	..	300	..	..	..	..
Philippines	4	1970	100	..	..	40	-	(2)	..
Sri Lanka	4	1970	41	7	33	0.6	..	..	..
Taiwan	2	1968	235 <sup>15)</sup>	(..	139)	(97	..)	..	15
Thailand	3	1972	57	0	55	2.2	-	..	3.5
Vietnam South	4	1966	17	..	..	..	+	..	..
PACIFIC AREA									
Australia	2	1972	482 <sup>16)</sup>	..	(27)	(398)	(70)	..	31
British Solomon Islands	3	1972	4.4	..	..	..	..	..	..
Fiji	2	1971	14.7	0	7.8	6.8	..	..	3
New Guinea and Papua	3	1970	11	(4	..)	(7	..)	..	1.5
New Zealand	2	1968	405	(19)	..	(318)	(68)	..	20

Notes to table III

- 1) This is the area that have been planted over the last 15 years.
- 2) At the end of 1967 the area planted was reported to be 21 000 ha.
- 3) Shown under Eucalyptus.
- 4) Shown under Pine.
- 5) Plantations are mainly Eucalyptus.
- 6) In addition it is estimated that 141 000 ha of private fuelwood plantations exist.
- 7) In addition there are 4 000 ha of private plantations on tea and tobacco farms.
- 8) Breakdown of species from 1967 on 36 000 ha.
- 9) The breakdown in species is done for an area of 959 000 ha.
- 10) In addition 30 000 ha of wattle is reported to exist.
- 11) In addition 7 000 ha of private fuel and pole plantations exist.
- 12) Another source gives the area planted as 14 000 ha in 1972.
- 13) This is the planted area. Failure percentage have been high.
- 14) In addition there is an unrecorded resource of private plantations in agricultural land.
- 15) In addition there are 114 000 ha of bamboo plantations.
- 16) The breakdown in species is done for an area of 495 000 ha.

## 6 Analyses of the results

### 6.1 General

In this chapter the information presented in the tables is discussed. What is given here is - to some extent - a comparison with the figures given in the 1963 WFI. The different concepts discussed in the 1963 WFI are briefly discussed in this chapter too even when they are not included in the new tables.

It must be clearly stated here that the intention of this report is to give statistical data and not so much to analyse them. The important thing here then is to summarize the main items for the different regions and the world as a whole. It has not been considered necessary to comment on all the figures in the text tables.

### 6.2 Reliability of the data

Present knowledge about forests is scarce in many countries. In the summary tables an attempt has been made to classify the information for each country after level of accuracy. Summarized, this information gives the following information concerning the accuracy of the figures for area of closed forest.

For definition of the accuracy classes see page 174.

Table 1 Distribution of closed forest area after accuracy class

Region	Accuracy class				
	1	2	3	4	5
	million ha				
Central America	-	5	48	5	0.2
South America	-	18	42	110	360
Africa	-	22	21	132	19
Europe	55	47	37	-	-
USSR	-	765	-	-	-
Other temperate	31	(310)	374	-	-
Asia	-	22	64	8	263
Pacific area	-	-	1	36	-
Total World	86	1,189	587	291	642
-----					
%	3	43	21	10	23

According to this table information about 33 percent of the closed forest area is poor while 46 percent has been classified as being relatively reliable. The enormous forest areas in USSR are included in the latter figure.

The information concerning standing timber is still more unreliable than the figures concerning areas.

Table 1 (Forest and Other Wooded Areas) gives the areas covered by forest inventories. Table 2 summarizes this information and gives additional information about the area covered by relatively detailed inventories (it must be possible to reach at least some useful conclusions concerning growing stock).

Table 2 Inventoried areas

Region	Percent of forest area <sup>a)</sup> inventoried (1971 estimate)	Total area <sup>b)</sup> inventoried (1973 estimate)	Relatively detailed inventories (1973 estimate)	Percent of closed forest area with detailed inventories (1973 estimate)
	%	million ha		%
North America	60	489	489	78
Central America	10	33	33	54
South America		66	54	10
Africa	15	51	25	13
Europe	74	100	100	71
USSR	40 +	728 <sup>c)</sup>	290	40
Asia <sup>d)</sup>	35	150	128	40
Pacific area	20	34	32	40
World	35	1,650	1,150	42

a) Based on a forest area of 3,800 million ha

b) Not included are certain areas covered by management plan inventories

c) 40 percent of the forests have been covered by a field inventory, the remaining 60 percent by an aerial reconnaissance survey

d) China not included

According to this table about 60 percent of the closed forest area should be covered by some form of inventory. Included in this figure are, however, considerable areas of aerial reconnaissance surveys, certain inventories in open woodlands, inventories which cover only a limited number of species, management plan inventories (these rarely give information suitable for utilization at a national level), old inventories and so on. The crude evaluation of the area of closed forest that is covered by inventories giving at least acceptable volume information lowers the inventoried proportion to roughly 40 percent.

As field inventories are necessary to reach an acceptable level of information about growing stock, good or acceptable information can only be available for 30-40 percent of the closed forest area. Information for the remained is best considered a more or less qualified guess.

For other items the reliability of the figures is discussed under each item. In summary one may say that the information even in these cases often have serious limitations.

### 6.3 Forest and Other Wooded areas

The table below summarizes the information given in Table I and shows for comparison the total areas of Forest land and Forest from the 1963 WFI.

Table 3 Forest and Other Wooded areas (forest land)<sup>a)</sup>

Region	1973				WFI 1963			
	Forest land	Closed Forest	Open woodland	Total land area	Closed Forest % of land area	Open woodland % of land area	Forest land	Forest
	million ha				%		million ha	
North America	630	630	..	1,841	34	..	750	710
Central America	65	60	(2)	272	22	..	76	71
South America	730	530	(150)	1,760	30	(9)	890	830
Africa	800	190	(570)	2,970	6	(19)	710	700
Europe	170	140	29	474	30	6	144	138
USSR	915	765	115	2,144	35	5	910	738
Asia	530	400	(60)	2,700	15	(2)	550	500
Pacific area	190	80	105	842	10	13	96	92
World	4,030	2,800	(1,000)	13,003 <sup>b)</sup>	22 <sup>c)</sup>	8	4,126	3,779

a) For definitions of the terms see Appendix I. Note that forest land (in 1973) is not always the sum of closed forest and open woodland as scrub and brushland areas are not included in the table above. When "forest land" is used for 1973 it is synonymous with "forest and other wooded areas". Note also that when "forest" is used in connection with figures from the 1973 appraisal it always means "closed forest".

b) Antarctic, Greenland and Svalbard are not included.

c) 19 percent if Arctic regions are included

Though the total area of forest land in the 1963 and 1973 inventories is very similar, the area classified as closed forest in 1973 is much smaller than the area classified as forest in 1963. This results from the different and more meaningful definition of "closed forest" compared with "forest". The area classified as forest in 1963 included considerable areas of open woodland, scrub and brushland.

The areas given as forest land are more or less the same in the two estimates but this does not really mean much since in 1963, a lot of scrub areas for example were included as forest land. If these areas were included for all countries the total of forest land would really be much larger.

The area covered by closed forest is now roughly 20 percent of the land area. In reality the area really covered by closed forest is probably well below 20 percent - perhaps 17-18 percent. The 20 percent figure

certainly includes considerable areas of degraded forests, open forests etc. For some of the main forest countries in the world the information is also very unreliable. Most estimates are a few years old and considerable areas may have been lost for forestry. Overestimates of the forest area seem to be a rule.

The open woodland areas which are of great importance in large parts of the world are very poorly known. They are also rather difficult to estimate as they are so intermixed with other uses.

The table shows that in relation to land area the main concentrations of closed forests are found in North and South America, Europe and USSR. Africa and Asia have relative to total land area small forest resources.

Instead of comparing these totals it is perhaps of still greater interest to compare the closed forest area per caput in different regions as this gives a better information of resource capacity relative to demand. This information is given in table 4.

Table 4 Area per caput

Region	1973			WFI 1963	
	Closed forest	Open woodland	Forest land	Forest	Forest land
	ha				
North America	2.8	..	2.8	3.4	3.8
Central America	0.7	..	0.7	0.97	1.0
South America	2.8	0.8	3.8	5.3	5.7
Africa	0.5	1.6	2.2	2.4	2.4
Europe	0.3	0.06	0.4	0.32	0.33
USSR	3.2	0.47	3.8	3.3	4.0
Asia	0.2	(0.03)	0.25	0.28	0.3
Pacific area	4.1	5.4	9.9	5.4	5.7
World	0.8	0.26	1.1	1.2	1.3
More industrial	1.5	0.16	1.8	1.9	2.1
Less industrial	0.45	0.28	0.8	0.9	0.95

North America, South America, USSR and the Pacific area show the most considerable closed forest areas per caput. The other regions show considerably lower values. As could be expected the forest area per caput has decreased drastically in the whole world and in practically all regions. Even the area of Forest and Other Wooded areas (forest land) has decreased as compared to forest land in the 1963 WFI. A decrease is naturally to be expected as the population has increased considerably since the 1963 estimate. The new definition of forest (closed forest) used in 1973 is another reason for the decrease.

The more industrialized countries have a comparatively much larger forest resource than the less industrialized countries.

The comparisons done about the closed forest area per caput are quite interesting but they give only a small part of the truth. To be really meaningful the "forest land area" ought to be translated into an index



based on area of closed forest, area of open woodland, accessible forest etc. Only in this way would it be possible to make a meaningful comparison between regions and countries and between estimates done at different times.

Still more valuable would be to utilize volumes instead of areas for such comparisons. Volume is a much better index than area of resource capacity relative to demand.

In 1963 the following figures were given for protection forests.

Table 5. Protection forests

Region	Protection forests million ha
North America	10
Central America	-
South America	20
Africa	20
Europe	1
USSR	10
Asia	10
Pacific area	4
World	75

No attempt has been made to estimate the area of protection forests in this appraisal. To evaluate the areas of productive forests in the world it is naturally necessary to know at least the approximate extension of the protection forests so that these can be subtracted from the total forest area.

If the 1963 figure would be accepted as approximately correct certain adjustments are necessary. First of all new areas have certainly been set aside as protection forest. Secondly in the 1963 figure considerable areas of open woodlands are probably included. A qualified guess would be that, of the area given as closed forests, around 50 million ha would be protection forests or forest in which all exploitation is forbidden. It appears therefore that the area of protection forest may be only one or two percent of the total closed forest area and is therefore of small significance in relation to the total productive capacity of this forest.

Sometimes considerable areas have been set aside as protection reserves without any really good reason. More often anyhow forest areas ought to be set aside as protection reserves. That forest areas are declared as protection reserves does not necessarily, except in the case of National parks, mean that these cannot even be exploited under special regulations.

It must be expected that in coming years the utilization of considerable forest areas in densely populated countries will (especially in Europe and North America) be restricted due to the pressure for recreational areas.

Whether the forest (or woodland) area of the world is decreasing or not is often discussed nowadays. No sure answer to this question can be given from the information presented in this report. The scattered information available makes it quite certain that the closed forests (and the area of forests and other wooded areas) are decreasing in Africa, Asia and Latin America. In Europe and North America the forests are - on the other hand - increasing in area. From information given in the answers to the WFI questionnaire for European countries 1968 it was estimated that, in all, the forest area would increase by 7 million ha (or 5 percent) over the next ten years. In both Southern Europe and on the British Isles most of the expected new forest area is said to be under plans for afforestation. In Northern Europe these new forests mostly consist of land now classified as agricultural, but which will be abandoned in the near future and of swamps which will be transformed into forest after draining.

Even if it is certain that the forest area is decreasing in tropical countries it is hardly possible to make any qualified "guesstimate" of how much it is decreasing annually. This is largely a problem of definition. Instead of discussing area it would be better to discuss changes in different kinds of volumes.

Most of the decrease is caused by shifting cultivation. Large areas of forest are also officially released for other uses than forestry (mostly agriculture). There is also - in many parts of the world - a continuous degradation of the forest vegetation by cutting for fuel and other household wood. This degradation does not immediately show up as a decrease in area. Natural regeneration of dry areas is difficult due to grazing.

Table I shows in the case of countries in Africa, Asia, Latin America and the Pacific area if the closed forest area in a country is decreasing or increasing. The classification is summarized in Table 6.

Table 6 Changes of closed forest area

Region	Area with probable decrease	Area with probable increase	No change	No infor- mation available	% of closed forest area with probable decrease
million ha					
Central America	58.8	-	-	0.7	99
South America	521.4	-	9.1	-	98
Africa	165.4	10	27.8	0.5	85
Asia	253.3	86.8	25.4	40.3	62
Pacific	36.4	6.2	37.9	1.4	44

As this table is done country-by-country it gives a somewhat misleading impression. The forest area is certainly decreasing in most countries in the regions discussed but this increase normally occurs only in certain areas. This is the case e.g. in the countries in South America where the decrease is serious in many densely populated areas while no decrease whatsoever occurs in less populated areas. A much more detailed study is therefore necessary before it is possible to assess how much the forest area is decreasing annually. It is probably a question of several million ha. The continuous degradation of the open woodlands can for the time being not be assessed at all.

#### 6.4 Coniferous forests

In WFI 1963 the species composition of the forests were reported only for 68 percent of the forest area. The overall estimates for 1963 given below are therefore only crude estimates. Many of the figures included in the 1973 estimate are not really much more secure. The considerable areas of mixed forests certainly also cause some confusion. The extension of these areas are poorly known. Considerable areas of mixed forests are probably included in broadleaved forests.

Table 7. Composition

Region	1973		WFI 1963		
	Coniferous million ha	Broadleaved	Total <sup>a)</sup>	Coniferous	Broadleaved
North America	(400)	(230)	630	440	260
Central America	(20)	(40)	60	35	36
South America	(10)	550	560	10	800
Africa	2	188	190	4	676
Europe	75	50	140	80	57
USSR	553	175	765	553	175
Asia	65	335	400	90	400
Pacific Area	11	69	80	4	84
World	1140	1640	2800	1216	2488
More industrial	1050	500	1550	1077	576
Less industrial	90	1140	1230	139	1912

a) The sum of coniferous and broadleaved do not always add up to the total as no breakdowns have been given for areas excluded from exploitation by law (in Europe and USSR)

Many figures are uncertain as detailed information is missing for many countries. The areas covered by coniferous forests are quite considerable.

#### 6.5 Ownership

In the 1963 WFI the following information was given concerning ownership.

Table 8. Ownership of forest land.

Region	Public	Private	Coverage
	million ha		%
North America	476	173	87
Central America	21	26	62
South America	341	269	69
Africa	250	68	40
Europe	67	77	29
USSR	910	-	100
Asia	283	25	56
Pacific area	21	62	86
World	2369	700	75

The breakdown given above is probably much the same today. A basic disadvantage is that it gives information for the so-called forest land which is a very imprecise concept. What is needed in addition is ownership categories for closed forests, man-made forests and open woodlands. It is probable that the ownership categories for these categories in much show the same tendencies as the table above giving information for all forest land (except perhaps in the case of man-made forests).

It must be noted that the ownership conditions over considerable areas are quite unclear. Large areas given as being under public ownership in the table may in reality be under some form of tribal ownership or it may be claimed by several different owners.

#### 6.6 Management status

The 1963 WFI collected a considerable amount of data concerning the management status of the world's forests. No such data is given in this report because not enough data was available. Furthermore it is difficult to collect meaningful information about management status.

Existing management systems vary so much that it is quite impossible to press them into a couple of main categories and believe that this says much about the truth. It is important to remember that a large proportion of the forests in many regions are officially under working plans or legal control and are reported as such, while in reality the different plans and laws are not followed making information presented of very limited value.

In 1963 the table showing management status looked as follows:

Table 9. Management status. From WFI 1963

Region	Coverage <sup>a)</sup>	Working plans million ha	Legal and contractual	Other forests
	%			
North America	12	85	-	-
Central America	71	7	(2)	..
South America	67	10	105	445
Africa	61	13	87	375
Europe	97	62	69	3
USSR	100	300	438	-
Asia	35	59	59	55
Pacific area	99	7	45	37
World	61	570	805	915

a) Percent of the forest for which information has been received.

In 1963 4 percent of the total area under legal and contractual management control were reported to be under concession agreements. In many regions of the world the areas being under concession agreements have expanded considerably over the last years.

### 6.7 Growing stock

In 1963 information about growing stock was given for 55 percent of the forest area. In this investigation information for 70 percent of the closed forest area has been traced.

It is evident that the information given in table 10 below is of limited value. The total volume given does not really say much about which kind of volumes are included. Minimum diameters, whether bark is included or not or whether all species are included is not always known. Many of the estimates are very uncertain and it is rarely known how much of the total gross volume is commercial.

The information is normally only given for closed forests. Very rarely is any information given for open woodlands. In an ideal situation growing stock should be shown separately for natural closed forests, man-made forests, open woodlands and areas outside forest land.

Summarized, the information in Table II gives the following table.

Table 10 Growing stock

Region	Area covered	Total volume closed forests	Coniferous	Broad-leaved	Standing timber outside forest	Total volume Mean value
	million ha	100 million m <sup>3</sup>				m <sup>3</sup> /ha
North America	386	360	265	95	..	93
Central America	24	22	7	15	..	92
South America	346	600	5	595	..	173
Africa	39	52	0.5	51	(140)	133
Europe	128	120	80	40	8	94
USSR	692	733	612	120	56	106
Asia	353	340	55	285	..	96
Pacific area	42	13	3	0	..	31
World	2010	2240	1028	1200	..	110

A study of the m<sup>3</sup> per ha figures indicates that many of the figures must be treated with great care. Many of the volume figures certainly include considerable areas with very low-productive forests. Many of the differences must also depend on the fact that the total volume shows very different things. In the case of inventories one could expect that the best forests have normally been covered by inventories. It may be that the crude estimates giving the total volume for a country also quite often take into consideration the best part of the forests. More often the information is given only for a limited number of species and for trees of sawtimber size. If these results are taken as representative of the remaining area not covered by volume statistics, 30 percent of the world's forests, the total volume in closed forests would be around 310,000 million m<sup>3</sup> (above perhaps 20-30 cm d.b.h. in broadleaved forests and above perhaps 5-10 cm d.b.h. in coniferous forests). In addition to this volume in the closed



forest area there are also considerable volumes in open woodland areas. In Africa this volume has been estimated as 13,500 million m<sup>3</sup>. For the whole world the volume in open woodlands may be around 30,000 million m<sup>3</sup> (a volume of the same size may be found in the areas outside forest land). A crude breakdown of these totals by regions would give the following table.

Table 11. Growing stock

Region	Total closed forest area	Total volume in closed forest	Area in open woodland	Volume in open woodland
	million ha	100 million m <sup>3</sup>	million ha	100 million m <sup>3</sup>
North America	630	585	..	..
Central America	60	55	2	1
South America	530	915	150	40
Africa	190	250	570	140
Europe	140	120	29	8
USSR	765	733	115	56
Asia	400	380	60	20
Pacific	80	60	105	25
World	2,800	3,100	(1,000)	(300)

The total estimated volume of coniferous is 100,000 million m<sup>3</sup>. It is not unlikely that this figure is an underestimate. According to FAO Yearbook of Forest Products 1970, the total removals of coniferous was 1,080 million m<sup>3</sup> or 1.1 percent of the total growing stock of coniferous. Both these figures may be uncertain but prove at least that the intense discussion about the lack of coniferous wood is more a discussion about accessibility than about any real lack of wood.

As was mentioned in chapter 6.3 volume per caput is a much better index of the importance of the forest resource than area. The table below gives the estimated volume per caput in different regions:

Table 12. Volume per caput

Region	Population 1970 millions	m <sup>3</sup> /caput (closed forest)	m <sup>3</sup> /caput (forest land)
North America	227	250	..
Central America	93	60	60
South America	191	500	500
Africa	356	70	110
Europe	462	25	30
USSR	243	300	325
Asia	2132	20	20
Pacific	19	315	450
World	3723	85	90

These figures, although most uncertain, indicate at least the scarcity of wood in Europe and particularly Asia. It is probable that these figures would increase a little if volumes situated outside forest land were to be included (at least locally).

Many regions show considerable volume per caput. The forests are anyhow not always situated where most of the population lives. A classification of countries according to accessibility would give a truer picture since a great deal of the volume is found in hitherto inaccessible regions.

The crude "guesstimates" given for total growing stock in the world's forests may be far away from the actual truth. The method used to reach to a total must also be seriously criticized. A better method might be to utilize all existing information to make estimates for each vegetation-type country-by-country. Even such a calculation would anyhow give a very unreliable endresult and it has at this stage not been considered meaningful to do it.

The mean values per ha given for different regions in table 10 (as well as in the country notes) can be compared with the figures given in table 13. This table shows volume per ha in different formation classes. The formation classes listed in table 13 follow Weck-Wiebecke 1961. The information has been taken from detailed inventories undertaken in different parts of the world.

Table 13. Volume per ha ( $m^3$ ) in different formation classes. (Total volume under bark from 10 cm diameter including branchwood.)

Formation class	Example of reported volume per ha, $m^3$ /ha			
	1	2	3	4
	India	Malaysia	Cameroon	Gabon
1. Tropical wet evergreen rainforests	393	350	390	325
	India	Cambodia		
2. Moist deciduous forests	177,171	150		
	India			
3. Dry deciduous forests	68,70			
	30,40			
	India	India	India	India
4. Deciduous (Hill) forests	Pine (Chir)	Pine (Kail)	Cedar	Fir
	141,127	214,205	249,378	380,351
	151	232,170	298	302,384
5. Subtropical moist forests	(200)			
6. Subtropical dry forests	(50)			
	Austria	Germany (DDR)		
7. Temperate broadleaved forests	180	180		
	Sweden (South)	Austria	Germany (DDR)	Germany (DDR)
8. Temperate coniferous (spruce) forests	136	135	132	129
	Sweden (Centr.)	Finland (North)	Alaska	
9. Boreal forests	59	60	62	



The hypothesis is that different formation classes have more or less the same amount of wood in different parts of the world is not contradictory to these figures. It must be mentioned however that the figures are not fully comparable between formation classes. The values for temperate formation classes are mean values for managed forests as opposed to the information for tropical formation classes which normally gives the information for mature natural forests.

In *Weltforstwirtschaft* by Weck-Wiebecke (1961) an estimate of the proportions of the world's closed forest area situated in the different formation classes has been given. These proportions have been used to make a breakdown of the total area of closed forest recorded in this report. For formation classes, on the basis of this allocation, an estimate of the total volume has been calculated.

Table 14: Distribution of forest area by major formation classes and the volume of standing timber in each formation class.

Formation class	Area million ha	Meanvalue m <sup>3</sup> /ha	Total volume 1000 mill m <sup>3</sup>
I Tropical zone	1456		
1. Wet evergreen	560	350	196
2. Moist deciduous	308	160	49
3. Dry "	588	50	29
II Subtropical zone	224		
4. Wet evergreen	8	80	0.6
5. Subtropical moist	20	200	4
6. Subtropical dry	196	50	10
III Temperate zone	448		
7. Broadleaved forests	} 448	} 150	} 67
8. Coniferous forests			
IV Boreal zone	672		
9. Boreal forests	672	60	40
Total	2800	(157)	400

The absolute maximum amount of wood available in the world's closed forests would therefore, according to this calculation, reach roughly 400,000 million m<sup>3</sup>. This estimate would probably change somewhat if the area of the different formation classes were brought better up to date with the help of the information presented in this report. Its uncertainty would probably be the same.

Accepting the figure 30,000 million m<sup>3</sup> as the total volume in open woodlands and, for the sake of completeness, a volume of the same size outside forest land, the total amount of wood in the world would be a maximum of 450,000 million m<sup>3</sup>.

This maximum figure must certainly be reduced. The per ha figures used for different formation classes can not be valid for the total area. The necessary reductions may lead to the conclusion that the amount of wood available is somewhere around 350,000 million m<sup>3</sup>, the figure actually

derived from the inventory information.

### 6.8 Annual growth

The 1963 WFI tried to give information about the annual growth in the world's forests. In the case of the temperate zone this information is also given here (in Table II). For countries in the tropical and subtropical regions no attempts have been made to estimate the annual growth as this is completely unknown for these countries. Increment can hardly be calculated for unexploited natural forests as natural losses cancel increments. Where an area is under selective cutting it is not known how much of the net increment has any value.

### 6.9 Man-made forests

In this report a great effort has been put to identify the areas of man-made forests. Figures for Europe and North America have been included in the summary tables at the very end.

Available information is summarized in table 15.

Table 15: Man-made forests

Region	Total area planted	Species			
		Eucalyptus	Other broad- leaved	Pine	Other coniferous
	1000 ha				
North America <sup>a)</sup>	10,600	..	(829) <sup>b)</sup>	..	(9,819) <sup>c)</sup>
Central America	300	(75)	(75)	(35)	(10)
South America	2,400	1,150	325	900	35
Africa	2,800 <sup>d)</sup>	(820)	(570)	(825)	(140)
Europe (and USSR) <sup>a)</sup>	(7,500)	..	1,676 <sup>b)</sup>	..	(4,993) <sup>c)</sup>
Asia (except China, Japan)	5,400	(410)	(3,750)	(890)	(240)
China	(20,000+)	..	..	..	..
Japan	8,900	..	..	..	..
Pacific area	900	(23)	(35)	(730)	(140)
World	(100,000)	..	..	..	..

a) Information from Unasylva 1967, Vol. 21 (3-4). The year of estimate was 1965. The figure for Europe is an underestimate caused by a misinterpretation in some countries of the definition of man-made forest.

b) Broadleaved

c) Coniferous

d) Information given in World Wood 1973 indicates a total planted area of 30 million ha (USSR not included, but a FAO estimate from 1965 gave 11 million ha).

In the table, the breakdown in species is not always complete as some countries have given a total area planted but no breakdown of this area according to species. Further on the total area planted has been rounded to the nearest 100,000.

The data for Africa, South America and the Pacific is rather complete whilst the data for Asia and Central America is out of date and incomplete.

It is not much use trying to make a detailed analysis of this table. It seems clear that the total area covered by fast growing species in the regions discussed above (excluding China, Japan, Europe and North America) is perhaps in all 8 million ha. These plantations can not drastically change the wood balance situation in the world. The actual planting rate in the regions discussed (except China, Japan, Europe and North America) is unknown but probably falls around 0.5 million ha annually.

#### 6.10 Crown-density

Information on crown-density has earlier been collected in the WFI's. The data presented in e.g. the 1963 WFI is only to a very small degree based on measurements. How close the different estimates come to the truth is impossible to judge.

No information concerning crown-density has been given here simply because not enough data can be traced. Furthermore crown-density is a meaningful concept mainly in temperate regions or in more open vegetation types. In the tropics crown-density is a rather meaningless concept as most forests show a good density, even if they have recently been cut over or if they consist of valueless secondary species.

#### 7. Conclusions and recommendations

Throughout this report the limitations and deficiencies of the presented information are discussed in every connection. All this concern about deficiencies and limitations is caused by the simple fact that they are known (or at least believed) to exist. It may be that many or even most reports have these deficiencies but that they are not mentioned or simply blamed on unreliable sources. It might have been possible to hide or ignore most of deficiencies in this report too but this would drastically reduce the value of the report as a working document. The pointing out of all possible sources of errors will hopefully direct the reader's attention and encourage him to help improve the situation.

Another thing is that readers of reports often do not accept any mistakes whatsoever. The discovery of a few mistakes in a report may lead to a very negative final judgement of the report. In the case of this report it is therefore better to explain why certain mistakes are unavoidable.

It seems also to be a fact that most users of forest resource statistics are unaware of their unreliability. For this reason too it has been considered valuable to give a description of the limitations of such information. In this way misuse of the information given in this report can hopefully be avoided. It may also help in making it clear that adequate resources must be made available if any considerable improvement in knowledge of the world's forest should come about.

The information presented in this report does certainly not by far give the final truth about the world's forest and not even the best possible picture of existing forests that could be reached by utilizing all possible sources. Lots of work remain before a report can be written which gives the best possible information.

The intention is that this report should be used as a reference book where the first information about the forests in a country is given. It is also important to get a first preliminary report published so that improvements can start with this as a base.

A statistical report of the type presented here can in reality never be exact and finalized. It is hardly an overstatement to say that if I try to make this report complete before I publish I will have to work with it for the rest of my life and no results will ever be published. During my work in this field I have learnt that it is better to keep one's aspiration low. Some of the deficiencies in this report may actually be caused by too high aspirations.

The frank admission of the deficiencies in the presented information may unfortunately cause some people to distrust the results completely. This has naturally not been my intention. Perhaps I have failed to express myself clearly enough. At this somewhat late stage I have a feeling that I have sometimes been too critical and written too much about deficiencies. As a matter of fact the first draft of this report certainly contained many unnecessary deficiencies but most (or hopefully all) of them have been corrected in this last version.

As has been mentioned in an earlier chapter a couple of very good reports of a similar type have been prepared before. They very soon became outdated. It is most important that reports of this type be updated often. A report about the world's forest resources ought to be published every second or third year. FAO or some other institution must take over the routine work of updating the information given in this report.

The best way to improve this report would be to send it for comments to all countries concerned. This would mean corrections of errors that may have been included in this report and additions of new facts considered to be of interest. The report should be sent for comments at the same time as a set of complementary questions are sent to each country where all information which can be of any possible interest is requested. This method has been used for the African countries and it has proved quite successful. If the same method was used for the improvement of this report a good report could hopefully be published in a couple of years time.

If this approach worked well the next reports could be published region-wise. A World report containing all possible information would be too voluminous. It is already clear that detailed reports of this type soon will be published for both Africa and Asia-Pacific. More details concerning methodology and problems with Forest Resource Appraisals will probably be given in a special report. Information of the following type ought to be included in an improved version of this report.

#### A. Tables

The summary tables in this report should be corrected and completed as far as possible. If new and more detailed information becomes available it would be possible to introduce new breakdowns of both the forest area and the standing timber. The only practical way to make meaningful tables at least close to the truth is to make very detailed breakdowns.

#### B. Maps

Forest maps will be prepared for most countries. These maps probably in A4 format (the same as this report) will try to show the same information as the map outlined on page 6.

#### C. Country notes

The country notes given in this report must be corrected in all details and if possible completed with new and/or more detailed information. These



country notes can, in the new report, be more clearly written as it will all the time be possible to relate the text to a map. If summary of an inventory is given it must for instance always be shown where this specific inventory is situated.

The expanded country notes must at least give information on the following points:

- a) A general description of the forests (and vegetation types)
- b) Summary of inventory results
- c) Information about plantation: areas, species etc.

These three points are briefly given also in most of the country notes in this report. In the new report they will be further expanded.

In addition the following information will be given:

- d) Some indication of the accessibility
- e) Some notes about exploitation and concessions
- f) Other information of interest
- g) Bibliography

What has been discussed here so far deals mainly with the best way to produce as fast as possible an acceptable publication about the world's forests. On the other hand it is not necessary that all the material collected in an approach of this type be published. What must be published is a summary of the information.

When the whole world is covered by Forest Resource Appraisals of the type described, the work must continue to improve the information about forest resources.

The work to make adequate forest resource statistics available will have to be done in several steps. The accuracy of the statistics will increase if necessary means are made available. The recommendation given in the following are based on the belief that improved information is necessary at the national level. Few, if any, investigations can be done to meet any specific demand at the international level. This means that the improvement of information given in an International Forest Resource Appraisal must mainly be based on improved knowledge at the national level. International organizations must (or ought to) guide and support this improvement work at the national level as well as trying to standardize the information collected so that it can be compared from country to country. Some investigations may be quite suitable to be undertaken directly by international organisations (e.g. monitoring of changes in the natural vegetation cover).

The steps to be taken are:

- a) Creation of a Forest Resource Data Bank at FAO Headquarters  
(follow up of the WFI.)

The continuation of the WFI programme will have to try to fill the gaps which will remain in the versions of the Regional Forest Resource Appraisals outlined earlier. The basic task is to build up a system where the latest available information about the world's forests are to be found. This means the creation of a Forest Resource Data Bank at FAO Headquarters. The country reports and maps outlined before will be the "starting capital" in this bank. The main thing being to complement this information and keep it up to date.

When the Forest Resource Data Bank works it will give the best available knowledge about the world's forest. This does not mean that it gives an accurate picture of the world's forest.

It is necessary for FAO to take an active part in the work to improve the information. In this work the following investigations can be foreseen:

b) Organizing of existing knowledge at the national level. (National Forest Resource Data Banks)

At the national level there is an urgent need to organize existing knowledge about forest resources in a proper way. In many countries a great amount of information has been collected over the years but this has never been comprehensively summarized. It is therefore often more important to organize the knowledge that actually exists than to undertake inventories of selected areas. The Forest Resource Data Bank at FAO would also greatly benefit from this work.

c) Area estimates must be made more accurate

The area of closed forest and other vegetation types of forestry interest must be as defined and detailed as possible. A breakdown of the closed forest area into forest types of different importance must also be done. In the first run this work will be done for countries where knowledge is most inadequate. Afterwards countries with somewhat more accurate information may be studied. Finally such investigations shall be done for all countries where such an investigation is of any interest and where a new investigation can improve existing knowledge. It is assumed that such information is needed at a national level.

As a first run it may be adequate to start from point sampling on satellite photographs to decide the total area of different vegetation types in a country or a region (if this really is possible). It may also be advisable to try to include land-use studies and forestry map preparation in FAO projects.

d) Land-use and land-capability studies

One of the basic tasks at the national level is to make studies showing the present land-use as well as making a land-capability classification. Such studies would be valuable also at an international level as it would give information about the areas that will be (or can be expected to be) kept as forest in the future as well as information about the areas that can (or will) be made available for planting. Land-use studies would naturally also mean that the area estimates become more accurate.

e) Decrease in forest area must be checked

A repeated area appraisal is necessary to study the change in forest area or the change in area of other vegetation types. In the first run such studies can be done from space satellite photographs taken at intervals. FAO Projects may also be advised to study aerial photographs taken at different times. The UN Conference on the Human Environment in 1972 recommended that a monitoring system should be developed.

f) Classification of forest areas in accessibility classes

The first-mentioned studies will give better information about forest areas. It is then necessary to make a crude accessibility-classification so that areas of basic interest for utilization can be identified. For the time being not even pilot methods for making such studies exist. Methods must be developed first so that such studies can be done. Note that methods exist for making detailed accessibility-classifications.

g) Inventories in promising areas

Inventories ought to be undertaken in all forest areas that are of interest for utilization and which have not yet been inventoried. In the first run the most valuable and most accessible forest areas must be inventoried. Afterwards even more remote and less valuable areas should be covered.

h) World Inventory

In the final stage all forests in the world of any interest for utilization should be covered by a World Inventory or at least by comparable continuous inventories.

Above has only been included steps which give the basic information needed at an international level. At the national level additional studies must naturally be done.

We know quite a lot about the moon but do not know how much of the world's surface is covered by forest and woodlands. It is remarkable that already in the beginning of this century far-seeing men recommended an appraisal of the world's forest. So far rather little has been done about this.

In our time with a future lack of wood and other raw material it is necessary to improve knowledge about the world's forests in order to utilize them in the best way. Due to the unequal distribution of forest between countries this is definitely an international problem.

Finally I urge anyone who finds some unclarities in this report or who knows about any report giving new and additional information to send this information to Reidar Persson, Royal College of Forestry, Fack, S 104 05 Stockholm 50, Sweden. Only through cooperation from colleagues in all parts of the world this report can be improved.



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### Sammanfattning

I detta arbete beskrivs kortfattat skogsresurserna i praktiskt taget samtliga länder i Afrika, Asien, Latinamerika och Oceanien. De länderbeskrivningar som utarbetats innehåller information om naturlig skogsvegetation, planteringar och utförda inventeringar. För länderna i Europa och Nordamerika presenteras inga länderbeskrivningar utan endast tabeller som ger information om skogsmark och virkesförråd. Sådana tabeller har också utarbetats för de länder för vilka länderbeskrivningar finns.

Kunskapen om världens skogar är ganska bristfällig. En ytterst grov klassificering i tillförlitlighetsklasser visar att arealsiffrorna för 46 procent av världens skogsareal är relativt tillförlitliga medan arealuppskattningar för 33 procent av skogsarealen är mycket bristfällig. Endast 30-40 procent av världens skogsareal är täckt med någorlunda tillförlitliga inventeringar.

Världens totala areal av sluten skog har beräknats till 2.800 millioner ha eller 22 procent av totala landarealen (19 procent om arktiska regioner medräknas) medan arealen savannskogar eller torra skogstyper täcker åtminstone 1.000 millioner ha. Arealen barrskog har uppskattats till 1.140 millioner ha eller 40 procent av den totala skogsarealen.

Den totala arealen av planteringar i världen ligger förmodligen runt 100 millioner ha. I Afrika, Asien (utom Japan och Kina), Latinamerika och Oceanien utgörs omkring 12 millioner ha av planteringar. Av denna areal utgörs kanske 8 millioner ha av snabbväxande trädslag som exempelvis Eucalyptus. Den årligen planterade arealen i dessa sist nämnda regioner är förmodligen ca 0,5 millioner ha.

Det totala virkesförrådet i världens skogar kan inte uppskattas med någon säkerhet men en grov höftning som gjorts med utgångspunkt från tillgängliga data visar på en slutsiffra av 300.000 millioner m<sup>3</sup> (över en brösthöjdsdiameter av 20-30 cm för lövskog och 5-10 cm för barrskog). Dessa förrådssiffror är möjligen underskattningar. Totala virkesförrådet i områden som ej klassas som skog (exempelvis savannskogar) är möjligen i storleksordningen 50.000 millioner m<sup>3</sup>.

För att förbättra kunskapen om världens skogar föreslås följande:

- a) Skapandet av en Data Bank för information om skogsresurser vid FAO:s huvudkontor i Rom.
- b) Existerande kunskap om skogsresurserna på den nationella nivån bör summeras och organiseras i nationella Data Banker.
- c) Existerande uppskattningar av skogsarealen bör förbättras i de länder där de är otillförlitliga.
- d) Studier av nuvarande landanvändning och av lämpligaste landanvändning bör företas.
- e) Skogsarealens eventuella minskning bör kontrolleras kontinuerligt (t ex från rymdsatellit).
- f) Skogsarealen bör klassificeras i avsättningslägen.
- g) Inventeringar bör företas i områden som kan utnyttjas för kommersiellt skogsbruk (om de inte redan har inventerats).

- h) Som sista punkt föreslås en framtida inventering av alla världens skogar (åtminstone av de som kan ha något kommersiellt intresse).



## Appendix I

### Definitions

#### General:

Here the terms used in the three summary tables and in the text tables to the conclusion chapter are defined. The terms have - as far as possible - been taken from the 1970 WFI questionnaire for Africa. It is quite certain that all the figures given do not exactly follow the definitions. These definitions do principally give the intention with a certain term. The terms are defined only the first time they occur in one of the tables. It has often been necessary to give certain comments in addition to the definitions.

#### Table I - Forest and Other Wooded areas

#### Accuracy class: See 5.2.3

Year of estimate: This figure is intended to show the year of the estimate. Often it shows the year the figures were provided or the year of a report in which the figure has been given. If the information is based on unpublished reports it is not always possible to give any year of estimate. That a year of estimate is given does not always mean that all the figures come from the same year, only that most of the figures or the most important figures come from this year. WFI means that the information has been taken from WFI 1963. PY means that the information has been taken from FAO Production Yearbook 1971.

Forest and Other Wooded areas: Areas covered with trees and/or shrubs and not used primarily for agriculture or other non-forestry purposes.

The following general rules are applied concerning all "forest and other wooded areas":

#### Includes:

- a) Public and private forest and other wooded areas.
- b) All plantations, including one-rotation plantations primarily used for forestry purposes and including wattle plantations (*Acacia* spp).
- c) Forest roads and streams and other small open areas, as well as forest nurseries, that cannot be readily excluded by the survey system used.
- d) National parks

#### Excludes:

- a) City parks and gardens.
- b) Areas occupied by orchards of fruit or nut trees, and plantations for non-forestry crops such as rubber and cinchona.
- c) Wooded pastures and range lands.
- d) Areas not meeting the conditions of forest and other wooded areas as described above, even if administered by Forest Authorities.

Total: This heading shows the total area of "forest and other wooded areas".

In Europe and Other Temperate regions this is practically always the case. Other regions - for want of adequate data - often give a total of forest and other wooded areas but no complete breakdown of this into forest, open woodland and scrub and brushland. More often information is given for one or two of these categories but not any total of forest and other wooded areas.

Forest land: The term forest land used in the WFI 1963 and in the FAO Production Yearbook has often been taken as synonymous with "forest and other wooded areas". The exact wording of the definitions of this term in these two publications are as follows:

WFI 1963: All lands bearing vegetative associations dominated by trees of any size, exploited or not, capable of producing wood or other forest products, of exerting an influence on the climate or on the water regime, or providing shelter for livestock and wild life.

FAO Production Yearbook: Forest land refers to land under natural or planted stands of trees, whether productive or not. It includes land from which forests have been cleared but which will be reforested in the foreseeable future. Permanent meadows and pastures on which scattered trees and shrubs are grown should not be included under forest land.

Closed forest: Land with a "forest cover", i.e. with trees whose crowns cover more than 20 percent of the area, and not used primarily for purposes other than forestry. (Forestry purposes: Wood production and benefits from the environmental effects of forests.) All open woodland as defined below are excluded even if trees cover more than 20 percent of its area.

The following general rules are applied concerning all "closed forest":

Includes:

- a) Forests in which trees have been temporarily removed by cutting or burning to such an extent that not more than 20 percent of the area is covered by tree crowns as well as young natural stands and all plantations, including one rotation plantations, established for forestry purposes which have not yet reached a crown-density of more than 20 percent.
- b) Areas of windbreaks and shelterbelt trees sufficiently large to be managed as forest.
- c) Land under shifting cultivation which is expected to return to forest in the foreseeable future, except those areas which are at present being prepared or used for agricultural crops.
- d) Areas satisfying the conditions of the definition, even if not under forest administration, e.g. all forest on private land.
- e) Areas satisfying the conditions of the definition but planned to be converted into other land utilization categories.

## Excludes:

- a) Isolated tree groups smaller than 0.5 ha
- b) Land under shifting cultivation which is at present being prepared or used for agricultural crops or which is unlikely to return to forest in the foreseeable future.

Note: In running text "forest" is normally used instead of "closed forest". The term "closed forest" is used only to distinguish it clearly from "forest" in the 1963 WFI which had another definition than "closed forest" in 1973.

Open woodland: Land, other than forests, with trees whose crowns cover 5 to 20 percent of the area, not primarily used for agricultural or other non-forestry purposes (such as grazing of domestic animals). This basic rule cannot always be followed. Certain additional remarks are therefore necessary.

The category includes mainly savanna belts found in the tropics. Broadly speaking, the term savanna denotes vegetation of which the characteristic feature is a more or less dense graminaceous or herbaceous layer. Woody cover may or may not be present and if so, is invariably irregular. Open woodlands may be the natural vegetation but are often a degraded form of a vegetative cover with a more closed and higher canopy. It is normal that the degrees of degradation vary within an area under the influence of such factors as distance from villages, steepness, slope aspect etc.

The category "open woodland" used for the purpose of this report includes only areas which have a certain tree cover and excludes sheer shrub - succulent - or grasslands. This is to distinguish areas which, besides their use as grazing land, are able to produce a substantial supply of wood, at least fuelwood and poles for local consumption.

Open woodland, (savanna forest) as broadly defined above, may be covered with trees whose crowns cover more than 20 percent of the area. Such areas are to be included in open woodland and not in forest.

In the case of Africa (for the WFI 1970) the following scheme has been followed in deciding whether a vegetation type is forest (closed forest) or open woodland:

Yangambi scheme (Boughey 1957)	Vegetation map of Africa	W. African Terminology (Keay 1953)
Forest types:		
Closed forest formations except non bamboo thickets	(a) Montane evergreen forest (b) Temperate and sub-tropical evergreen forest (c) Moist forest at low and medium altitudes (d) Dry deciduous forest (and savanna): - with abundant <i>Baikiaea plurijuga</i> and - Madagascar types.	(Not covered by this terminology)

Yangambi scheme (Boughey 1957)	Vegetation map of Africa	W.African Terminology (Keay 1953)
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(d) cont.  
Exclude, if possible,  
areas degraded to savanna.

(e) Forests which occur in  
other types, not described  
in detail due to their  
lack of homogeneity, such  
as "Montane communities  
undifferentiated"  
and "Ditto, with Afro-  
alpine communities"

(f) Bamboo thickets

(g) Mangroves and coastal palm,  
forests

Open woodland types:

(a) Woodland	(a) Forest - savanna mosaic	(a) Derived savanna
(b) The following categories of savanna: 1. Savanna woodland 2. Tree savanna	(b) Coastal forest - savanna mosaic	(b) Southern Guinea zone
(c) The following sub- categories of steppe: Tree and/or shrub steppe	(c) Woodlands, savanna (and steppes)	(c) Northern Guinea zone
	(d) Wooded steppe with abundant Acacia and Commiphora	(d) Sudan zone
	(e) Such areas of dry deciduous forest that are degraded to savanna	(e) Sahel
	(f) Part of montane "commu- nities - un-differentiated" and "ditto, with Afro- alpine communities"	

Other regions do not have uniform vegetation schemes of the above type. In the classifying of certain vegetation types into forest or open woodland the same principles have been used in other regions too.

In the WFI questionnaire which was drafted for Asia the following examples of open woodland types in different countries was included to help define the necessary distinctions between forest and open woodland.

Examples:

Afghanistan: The Pistacia and the Juniperus woodland

Burma: Indaing dry Dipterocarp forest (dry deciduous Dipterocarp forest),  
savanna forest, thorn forest.

Cambodia: Forêts inondées (around Tonle Sap), savanes, forêts claires  
(dry deciduous).

Ceylon: Savanna forest

India: Dry alpine scrub, moist alpine scrub, sub-tropical dry evergreen forest, thorn forest, tropical dry deciduous forest

Indonesia: Savanna forest

Iran: The *Quercus*, *Amygdalis* and *Pistacia* woodland of the Zagros mountains

Jordan: Machie formations

Laos: Savanes, forêts claires

Pakistan: The sub-mountain and scrub forest with *Acacia* and *Olea*

Thailand: Dry deciduous Dipterocarp, savanna forest, scrub forest

Vietnam: Savannes, forêts claires

Note: Of tropical dry deciduous forest, dry deciduous Dipterocarp and forêts claires only the areas degraded to open woodland shall be shown in this category.

Scrub and brushland: This is a residual category which is distinguished since the areas concerned may have some forestry characteristics in their vegetation or administrative status and some countries may therefore have shown them together with the other forestry categories.

In Africa the following vegetation types of this type are distinguished:

Yangambi scheme	Vegetation map of Africa	W.African terminology
<u>Scrub and brushland types</u>		
(a) Scrub savanna	(a) Part of "montane communities - undifferentiated" and "ditto, with Afro-alpine communities"	Not covered by this terminology
(b) Grass savanna	(b) Thickets: Itigi type Madagascar types and Ethiopian evergreen types - all excluding bamboo thickets	
(c) Dwarf-shrub steppe	(c) Cape Macchis	
(d) Succulent steppe	(d) Madagascar grass savanna and grass steppe	
(e) Grass and/or herb steppe	(e) Grass steppe with thicket clumps: - Western Uganda type	
(f) Thickets other than bamboo	(f) Subdesert steppe: - Karoo shrub and grass transi- tional and mixed Karoo and tropical types	

In Europe and Other Temperate regions open woodland, scrub and brushland, forest tree nurseries, seed orchards, and areas occupied by trees in lines, and shelterbelts are shown under one category (open woodland).

Open Woodland (dense): For Africa relatively dense types of woodlands like Guinea savanna, Miombo etc. are shown under this heading.

Open Woodland (open): For Africa relatively open types of woodlands like Sudan savanna, Mopane etc. are shown under this heading.



Man-made forests: According to "FAO, Forestry and Forest Industries Division: Guideline for Questionnaire on Man-Made Forests. Revised Version, 1968" man-made forests consists of the following three categories. The same rules are followed in this report.

a) Afforestation: Forests established artificially by afforestation on land which previously did not carry forest. This is the most clear-cut example of a man-made forest and invariably involves the extension of the area of the forest. A clear definition of the period of time for which the land previously carried no forest is needed. "Within living memory" is suitable for areas where there are no records, but "within 50 years" is suggested as an alternative for areas where records exist.

b) Reforestation: Forests established artificially by reforestation on land which carried forest within the previous 50 years or within living memory, and involving the replacement of the previous crop by a new and essentially different crop. The change most frequently involved is species conversion, but the use of seed orchards consisting of superior genotypes demonstrated by progeny trials, would also qualify. In as much as the forest established artificially by man is essentially different from its predecessor, this too is a clear-cut example of a man-made forest, though it does not involve any change in forest area. The term "reforestation" it is suggested should be confined to this type, to distinguish it from the following.

c) Artificial regeneration: Forests established by artificial regeneration on land which carried forest within the previous 50 years or within living memory, and involving the renewal of what is essentially the same crop as before. In as much as the new crop is essentially the same as its predecessor, this is a forest remade, rather than made, by man.

Total area: Under this heading is shown the total area of a country (including areas of inland water bodies). The information has been taken from FAO Production Yearbook 1970. Total land area cannot be shown as information is incomplete.

Special types of closed forest: Areas of certain special types of forest (mangrove, bamboo, coniferous, dry forest and dry deciduous forest) which it is of interest to distinguish are shown here.

Inventoried area: Here the area covered by forest inventories is shown. Working plan inventories etc. are normally not included.

Closed forest in percent of land: Here the proportion of the land area covered by closed forest is shown. Forest includes both natural and man-made forests. Land area from FAO Production Yearbook 1970. When information about land area was missing the total area was used.

Closed forest per caput: Here the closed forest area per inhabitant is shown. Forest includes both natural and man-made forests. Population figures from FAO Production Yearbook 1970.

Probable change in closed forest area: In the case of countries in Africa, Asia, Latin America and the Pacific area a crude classification has been made showing whether the forest area in a country is decreasing or increasing.

An increase in the forest area means in the case of these countries that planting of previously unforested land is larger than the eventual decrease in the area of natural forest.

A classification of a country lacking closed forest means that there is a probable decrease or deterioration of the open woodlands.

Symbols used:

- i Probable increase
- d Probable decrease
- 0 Probably no change
- .. Information inadequate, no judgement possible

Bush fallow: In this category is shown the areas that are covered by secondary vegetation after that the areas have been cultivated for a number of years. If these areas are not cleared any more they will normally return to forest or open woodlands.

Stocked forest: Forest in which more than 20 percent of the area is actually covered by tree crowns. This category is shown only in Europe and Other Temperate regions as "forests temporarily unstocked" are included in the total forest area. Certain areas with forest temporarily unstocked are certainly also found in other regions but these areas are not known and can consequently not be shown separately.

#### Table II - Standing timber and Increment

Forest area for which the volume information is given: Here is shown the area for which information about standing timber is given. In the case of Europe and Other Temperate regions the volume is given for all forests except those excluded from exploitation by law. In other regions the "areas excluded from exploitation by law" have rarely been excluded.

Total forest area in same region: Often only a part of a forest region or a vegetation type has been covered by an inventory. Under this heading the total area for which the inventory may be roughly representative is shown.

Standing timber: Volume of standing trees, all species, all diameters, all ages and including bark unless otherwise specified. Species which do not reach upright trunk forms (brushes) are not considered as trees.

This definition has only occasionally been followed. For more details see the footnotes.

Standing timber outside forest: Information is given on the volume of trees outside forest which can be used as industrial wood or fuelwood (trees in lines, in shelterbelts, open woodlands etc). This information is given only in the case of Europe and Other Temperate regions (in other regions information concerning standing timber in open woodlands has occasionally been given).

Inventory: Gives the percentage of the data derived from inventories. This information is given only for Europe and Other Temperate regions.

Gross increment: Average volume of annual increment of all trees.

Net increment: Average annual net increment equals gross increment minus losses.

#### Table III - Man-made forest

For definition of man-made forest see page 250.



Terms used in chapter 6General:

In some of the text tables in chapter 6 figures from the 1963 WFI are used for comparison or for information. This makes it necessary to give the definitions for certain terms used in the 1963 WFI.

Table 3

Forest: Forest lands bearing a tree or bamboo cover, whether productive or not.

Table 5

Protection reserves: Reserved lands, the management of which is principally aimed at the protection of natural resources, of fauna and flora or at other purposes not directly related to the production of wood (e.g. parks, watershed, soil conservation etc).

Table 8Publicly owned forest:

State forest: Forest owned by national, state, and cantonal governments, government-owned corporations and Crown forests.

Other: Forest belonging to towns, villages and communes. Includes any other publicly-owned forest not elsewhere specified.

Privately owned forest: Forest owned by enterprises, individuals, families or corporations engaged in agriculture as the primary enterprise.

Table 9

Forest managed under working plans: Forest managed under working plans on the basis of systematic plans designed to assure the maintenance of the crops.

Forest with controlled exploitation: Forest without working plans, but with the exploitation limited by legal or contractual provisions.

- a) By public law: legal provisions exist to regulate effectively the exploitation, e.g. by imposing size or volume limits, by delivery of restrictive cutting licences etc.
- b) By concession agreements: a concession contract provides rules to control the exploitation.

## Appendix II

### Glossary

#### Main sources:

Anon. 1953: British Commonwealth Forest Terminology. - Published by The Empire Forestry Association. London (code B)

FAO 1973: Manual of Forest Inventory with special reference to mixed tropical forests. Rome (code FAO)

Ford-Robertson, F C 1971: Terminology of Forest Science, Technology Practice and Products. - Society of American Foresters. Cambridge (code T)

Note: The definitions taken from those sources have sometimes been modified somewhat.

Afforestation: See definition in Appendix I (page 250)

Alfa grass: *Stipa tenacissima* is a grass found on the high plateaus in North Africa. It is used for pulp production.

Arid climate: A climate in which the rainfall is insufficient to support vegetation. The aridity of a region depends in part on temperature. The word is often used with the meaning of "dry".

Broadleaved: (T) A term applied to trees and shrubs of the botanical group *Angiospermae* in loose contrast to the generally needle-leaved *Gymnospermae*.

Browsing: (B) Feeding on twigs or shoots, with or without attached leaves of shrubs, trees or woody climbers.

Brush: (B) Shrub vegetation and stands of tree species that do not produce marketable timber.

Bush: (B) See shrub

Bush fallow: (B) Secondary woody growth developing between periods of cultivation.

Climax (T): The culminating stage in plant successions for a given environment, the vegetation being conceived as having reached a highly stable condition.

Closed forest: See high forest. See also definition in Appendix I (page 246)

Coffee forest: Coffee is normally grown under the shelter of trees. *Grevillea robusta* is a species often used in coffee plantations.

Colombo plan: A plan for development within the Commonwealth. The Canadians have undertaken many forest inventories under this plan.

Commercial (merchantable) volumes: (FAO) When this term is added to the terms "industrial", "log" or "other usable volume" or to specified portions of the volume it distinguishes the volume which can be economically removed under given conditions.

Note: If the term "commercial" is used a "utilization study" is necessary. For details see FAO 1973: Manual of Forest Inventory.

Concession (timber): (B) A contract, licence or permit granted to a firm or person, to extract and market timber commercially from a defined area of forest or a certain number of trees in a given time. Syn. Timber lease.

Conifers: (FAO) All trees classified botanically as Gymnospermae - e.g. fir (*Abies*), parana pine (*Araucaria*), deodar (*Cedrus*), ginkgo (*Ginkgo*), larch (*Larix*), spruce (*Picea*), pine, chir, kail (*Pinus*, etc.).

Coppice: (FAO) Forest composed of stool-shoots or root suckers with or without scattered trees of seedling origin and treated to produce mainly small-sized trees on a short rotation basis.

Coupe: (B) A felling area, usually one of annual succession unless otherwise stated.

D.b.h.: (FAO) The diameter at 1.30 m (4.3 feet) above ground level. In certain countries the height of the d.b.h. differs somewhat from the 1.30 m mentioned. In North America d.b.h. is e.g. 4 feet 6 inches.

If buttresses exist and are higher than the breast height level, d.b.h. measurements are useless. In this case the diameter is measured just above the swelling or irregularity or at a given distance above that point (d.r.h. = diameter at reference height).

Deciduous: (B) A term applied to perennial plants which are normally leafless for some time during the year.

Degradation (of natural vegetation): This means a continuous thinning without sufficient regeneration of the natural vegetation. This can then cause erosion problems and a drying out of the soils.

The term is used mainly for areas where the land-use is not yet stabilized or in areas where no productive use is made of the land after it has been cleared of forest. See also "destruction".

Dense forest: See high forest

Derived savanna: Savanna that have been derived from moist forest due to human influence. See under Forest - Savanna mosaic.

Destruction (destroyed, lost for forestry): This is an emotional loaded term used by foresters to describe a decrease in the forest (or woodland) area. Naturally this is not always negative. This term should not be interpreted as implying a critical judgement. When it is a question of unplanned destruction (e.g. because of fire) it is anyhow normally negative.

These words are normally used only in tropical or subtropical regions where the land-use pattern is not yet stabilized. In temperate regions these words are rarely used as the destruction occurred rather long ago.

Dry deciduous forest: Physiognomically these forests in Africa, Asia and Latin America are similar to moist forest. Dry deciduous forests are very susceptible to fire and repeated burning leads to replacement by savanna.

Equatorial forest: The wet evergreen forest of the tropics.

Evergreen (B): Never entirely without green foliage, leaves persisting until a new set has appeared.

Forest: See definition in Appendix I (page 246).

Forest and Other Wooded areas: See definition in Appendix I (page 245).

Forest land: See definition in Appendix I (page 246).

Forest reserve: (B) Originally an area so constituted under the Indian Forest Act. The term has been adopted widely in the Commonwealth for use in Forest Acts or Ordinances to denote an area given fullest legal protection by such Acts etc, or popularly to denote an area set aside for permanent maintenance under forest. Syn. Demarcated forest.

The French word is "forêt classé". In French speaking countries the protection of the reserves are normally not as strong as in English speaking countries.

Forest Resource Appraisal (Regional): The name World Forest Inventory is no longer used by FAO. Instead "Forest Resource Appraisals" is used. These appraisals will probably become regional.

Forest - savanna mosaic: In this mosaic, patches of moist forest (not confined to streamsides) are surrounded by savanna of tall grasses.

If the fires are excluded for several years the savanna may be invaded by moist forest species. In much of the country mapped as forest - savanna mosaic the climate is not more arid than parts of the moist forest regions, and it is generally agreed that the savanna in the mosaic has been derived by degradation from moist forest. (Vegetation map of Africa.)

Gallery forest: (B) Tree growth which owes its existence or condition to its proximity to a water course, lake, swamp or spring. Syn. Fringing or riparian forest.

Grazing: (B) The eating of any kind of standing vegetation by domestic livestock or wild animals. Sometimes limited to the eating of herbage, in contrast with browsing. Grazing is often a serious problem in dry areas. It may make natural regeneration impossible.

Gross volume: (FAO) The volume of a specified portion of a tree without bark or deduction for defects. Note that gross volumes include bark in many inventories. The term should be qualified by a word or statement specifying the portion of the tree to which it refers, e.g. total tree gross volume. In the tropics, the gross volume is often given up to the first living branch.

Gross volumes as well as all other volumes refer to a minimum d.b.h. (or d.r.h.) of the relevant trees and also to a minimum diameter of the small end of the stem and branches.

Guesstimate: A word built up of the words guess and estimate. Means a qualified guess which is probably not far from the truth.

Guinea savanna: Is the West African name for the relatively moist type of woodland with abundant *Isobberlinia doka* and *I. dalzielii* which covers considerable areas north of the moist forest belt.

Hardwood (T): A conventional term for the timber of broadleaved trees, and the trees themselves, belonging to the botanical group Angiospermae.

High forest: (B) Sometimes used for a closed forest of tall trees, in contrast to savanna woodland or scrub.

Holdridge system: This system for climatic-vegetation analyses has been devised by Dr L.R. Holdridge. The Holdridge system divides the range of climates on earth into a series of ecological units called plant formations or natural life zones. In the system, about 120 units have been established for practical application.

This system has been applied to the compilation of ecological maps in several countries of Latin America.

A summary of the theory and application is given in Tosi (1964).

Humid climate: A climate with enough rainfall to support a forest vegetation. The minimum rainfall may be as little as 375 mm in cool regions.

Hydrophyte: (B) A plant which grows wholly or partly immersed in water.

Industrial volume: (FAO) The potentially usable net volume of round wood, without deduction for losses due to utilization standards of logging and manufacturing processes; it equals the sum of log volumes plus other usable volume.

Kerangas forest: (Brunei) An inland forest type growing on white sandy soils. Is found on beach terraces and on watered steep ridges at higher elevations.

Log volume: (FAO) The net volume of a tree considered suitable for veneer, Togs, sawlogs, sleeper logs, piling and poles; this volume may also be used for pulpwood, chipboard or other industrial use.

Mangrove: Mangrove vegetation occurs in brackish swamps by river estuaries along tropical and subtropical coasts.

Man-made forest: See definition in Appendix I (page 250).

Maquis: (T) Scrub vegetation, generally rather dense composed of much branched thorny and often aromatic shrubs found in the Mediterranean region in areas where climax forest has been destroyed.

Mediterranean climate: This climate has mild winters of light to moderate rainfall and warm to hot summers with a considerable period rainless. The natural vegetation consists partly of droughtresistant trees and shrubs.

Mesophyte: (B) A plant whose normal habitat is neither very wet, nor very dry.

Miombo: This is the local African name of the relatively moist types of woodlands with abundant *Brachystegia* and *Julbernardia* that are found over extensive areas in Angola, Mozambique, Tanzania and Zambia.

Moist forest: See Equatorial forest.

Mopane (and Adonsonia woodlands): Is the local African name for the relatively dry type of woodland with abundant *Colospermum mopane* which is found in Southern Africa.



Net volume: (FAO) The volume of a specified portion of a tree without bark and with deductions made for defects or unusable material; the term should also be qualified according to the portion of the tree to which it refers.

Open woodland: See Savanna woodland. See also definition in Appendix I (page 247).

Other usable volume: (FAO) The net volume of a tree not suitable for purposes listed under log volume but usable for posts, pulpwood, chipboard and other industrial use.

Peat: (B) The residues of natural vegetation which have been affected by process of anaerobic decomposition, usually under waterlogged conditions. Peat swamp.

Rainforest: See Tropical rainforest.

Rear mangrove: (Cambodia) Occur on the landward side of the "shore" mangrove forest, usually on moist brackish sites.

Reconnaissance: (B) A preliminary inspection or survey of a forest area, made in order to gain a general knowledge of all facts likely to be useful in determining future management.

Redwoods: A term with many different meanings (normally pines). In Africa often used as a common name for commercial species with a reddish coloured wood, e.g. *Khaya* spp., *Entandophragma* spp. and *Afrormosia* spp.

Reforestation: See definition in Appendix I (page 250).

Riparian forest: (B) See gallery forest.

Riverine forest: (B) Forest growing along or on islands in river beds.

Sahel: This is the West African name for the "wooded steppe with abundant *Acacia* and *Commiphora*" that are found in the dry areas north of the Sudan savanna.

Saline forest: Forest growing in salt marshes.

Savanna: (B) Tropical or subtropical grassland containing scattered trees or shrubs. The Spanish word *zavana*, from which it is derived, means a grass-covered treeless plain.

Savanna woodland: Open tropical or subtropical forest having an undergrowth mainly of grass. The trees are of moderate height and usually deciduous, or if evergreen have small leaves. Syn. Savanna forest, open woodland. (B)

Shrub: (B) Inferior growth consisting chiefly of small or stunted trees or shrubs.

Scrub and brushland: See definition in Appendix I (page 249).

Secondary forest: A forest that has developed after the old mature forest have been exploited or cut over. Secondary forests often (but not always) contain species of little value.

Secondary species: (T) Species of inferior quality and/or size, and of relatively little or no silvicultural value, associated with the principal species.

Selective cutting: (T) A type of exploitation cutting that removes only certain species above a certain size or of high value.

Semi-: Latin meaning half, but also somewhat, more or less. Ex. semitropical.

Semiarid climate: The characteristic climate of the regions intermediate between the true deserts and subhumid areas.

The upper limit of the average annual rainfall in cool regions is as low as 300 mm and as much as 900 mm in hot regions. The vegetation is close-growing or scattered short grass, bunchgrass, or shrubs.

Shifting cultivation: (B) A method of cyclical cultivation, chiefly in the tropics, where cultivators cut some or all the tree crop, burn it and raise field crops for one or more years before moving on to another site and repeating the process.

Shrub: (B) A woody perennial plant differing from a perennial herb in its persistent and woody stem, and less definitely from a tree in its low stature and its habit of branching from the base. Often restricted to plants up to 6 m in height. Syn. Bush.

Softwood: (T) A conventional term for both the timber and the trees belonging to the botanical group Gymnospermae.

Steppe: (B) A wide, treeless plain of grassland, characteristically xerophytic.

Sub-: Latin meaning under. Ex. subtropical.

Subhumid climate: The climate intermediate between semiarid and humid with sufficient rainfall to support a moderate to heavy growth of short and tall grasses, or shrubs, or of these and widely spaced trees or clumps of trees. The upper limit of rainfall may be as low as 500 mm in cold regions and as high as 1,500 mm in hot regions.

Subtropical (semitropical) climate: This is the type of climate found at the tropical margins of the temperate zone.

Sudan savanna: Is the West African name for the relatively dry type of woodland which is found north of the Guinea savanna.

Sustained yield: (B) a/ The material that a forest can yield annually (or periodically) in perpetuity. b/ As applied to a policy, method or plan of management (sustained yield management), implies continuous production with the aim of achieving, at the earliest practical time and at the highest practical level, an approximate balance between net growth and harvest, either by annual or somewhat longer periods.

Temperate climate: The climate in the midlatitudes, characterized by cool or cold winters and warm or hot summers.

Temperate regions: North America, South Africa, Europe, USSR, Japan, South Korea, Australia and New Zealand was covered by a WFI questionnaire for "temperate regions". (Europe and Other Temperate regions.)

Tidal (forest): (T) Forest within reach of the influence of tides.



Total volume: (FAO) The volume included in the main stem of a tree; for de-tiquescent-formed trees, up to the crown point; for excurrent-formed trees up to the tip of the tree.

Tropical climate (or zone): The climatic zone lying between the two tropics. The climate can be both dry and wet, e.g. dry tropical.

Tropical rainforest: (B) One of the many terms used to describe the luxurious natural forests found in the moist tropical regions. Syn. Equatorial rainforest (High forest belt).

Tropophyte: (T) A plant that markedly changes its character, particularly its water requirements, with seasonal changes of climate, e.g. a deciduous tree.

UNDP/FAO: FAO is often the executing agency for forestry projects paid by the UNDP.

White woods: A term used in certain African countries for commercial woods which are not redwoods (e.g. samba). The normal meaning of white woods is spruce.

Volume: This term can mean very different things. In FAO's Manual of Forest Inventories the following different terms have been defined: gross volume, net volume, total volume, industrial volume, log volume, commercial volume and other usable volume. See the definitions of these terms.

Woodland: Generally a wooded area. In certain connections it means a wooded area of scrub or brush type.

Xerophyt: (B) A plant that can subsist in dry situations.

Appendix IIIMain species commonly used in the text

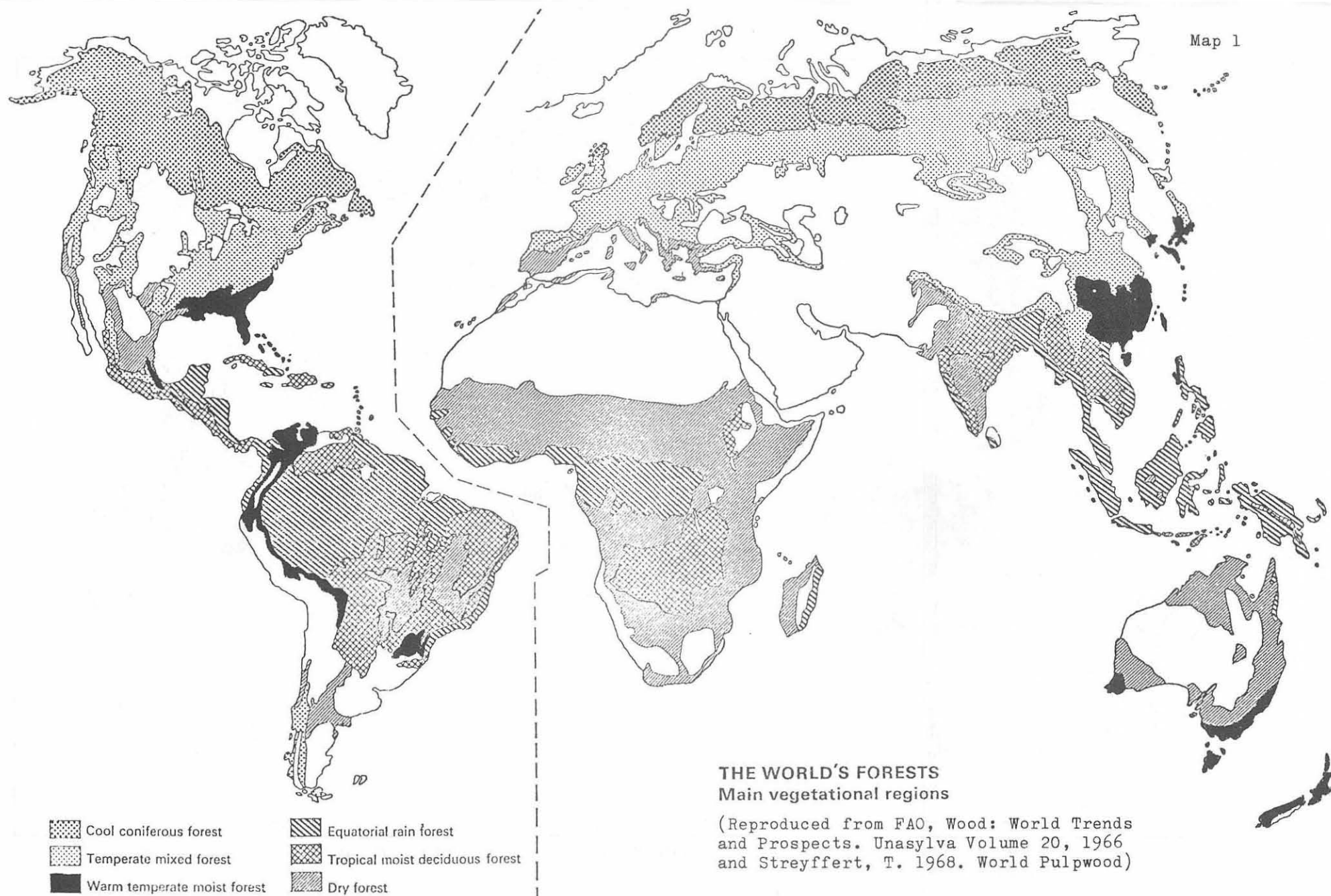
Note: Here are only given the species for which the trade (or local) name often have been used single. For other species the scientific name have been given single or in close connection with the trade name.

<u>Trade (or local) name</u>	<u>Scientific name</u>
Acajou	Khaya ivorensis, K. anthoteca
Ako	Antiaris africana
Asaméla	Pericopsis elata
Ayous (Obeche, Samba)	Triplochiton scleroxylon
Azobé	Lophira alata
Beté	Mansonia altissima
Blue pine	Pinus excelsa
Cedar (East Africa)	Juniperus procera
Cedar (North Africa)	Cedrus atlantica
Cedrela, Cedro	Cedrela spp.
Chestnuts (Sarawak)	?
Chir pine	Pinus roxburghii
Civit	Swintonia floribunda
Cork oak	Quercus suber
Deodar	Cedrus deodara
Dibétou	Lovoa trichilioides
Doussié	Afzelia bipindensis, A. pachyloba
Dow (Dum) palm	Hyphaene thebaica or H. benadirensis
Fraké-Framiré	Terminalia spp.
Fromager	Bombax flammeum and Ceiba pentandra
Garjan	Dipterocarpus spp.
Genuine mahogany (Bolivia)	Swietenia macrophylla
Gewa	Excaecaria agalocha
Greenheart	Tabebuia guayacan
Guayacan (Bolivia)	(Tabebuia serratifolia, T. rufesens)
Honduras mahogany	Swietenia macrophylla
Ilomba	Pycnanthus angolensis
Iroko	Clorophora excelsa
Jak	Jacaranda spp.
Kosipo (Sapelli)	Entandrophragma cylindricum
Limba	Terminalia superba
Loliondo	Olea welwitschii
Mahoe (planted in Panama)	(Ochroma pyramidale)
Mahogany (Africa)	Khaya spp., Entandrophragma spp.
Mahogany (South America)	Swietenia spp.
Mukulungu	Autranella congolexis
Mvule (Iroko, Uvule)	Chlorophora excelsa
Okoumé	Aucoumea klaineana
Ozigo	Dacryodes büttneri
Padouk	Pterocarpus soyauxii
Quebracho	Schinopsis balansae
Rhodesian teak	Baikiaea plurijuga
Sal	Shorea robusta
Samba (Obeche, Ayous)	Triplochiton scleroxylon

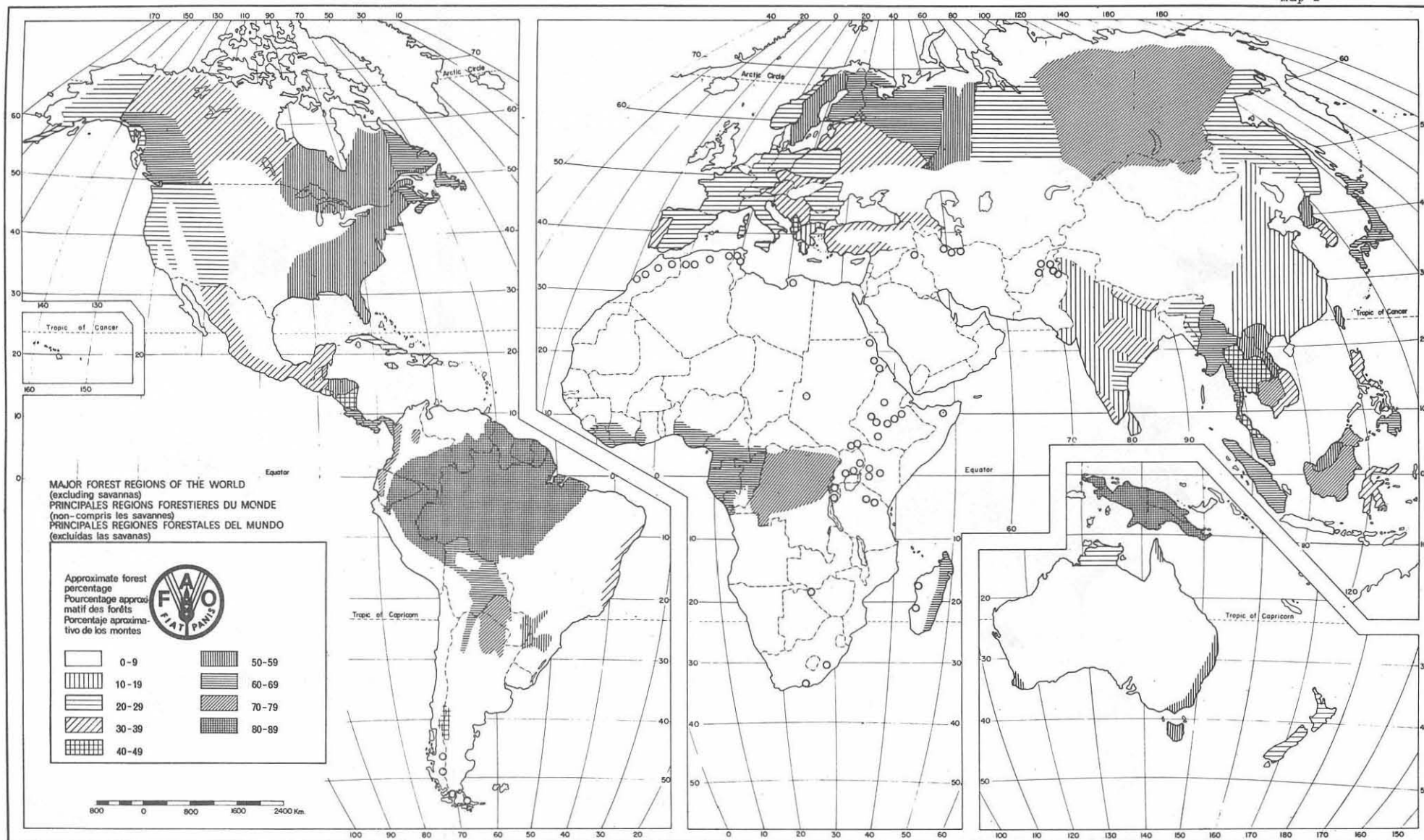
Sapelli (Kosipo)  
Sipo  
Spanish cedar (Bolivia)  
Sundri  
Tamarisk  
Teak  
Tiama

True walnut (Bolivia)  
Wattle  
Willow  
Yeppa  
Zambesian teak

Entandrophragma cylindricum  
Entandrophragma utile  
Cedrela sp. or C. spp.  
Haritiera minor  
Tamarix spp.  
Tectona grandis  
Entandrophragma angolense,  
E. grassei  
?  
Acacia spp.  
Salix spp.  
Hardwichia binata  
Baikiaea plurijuga

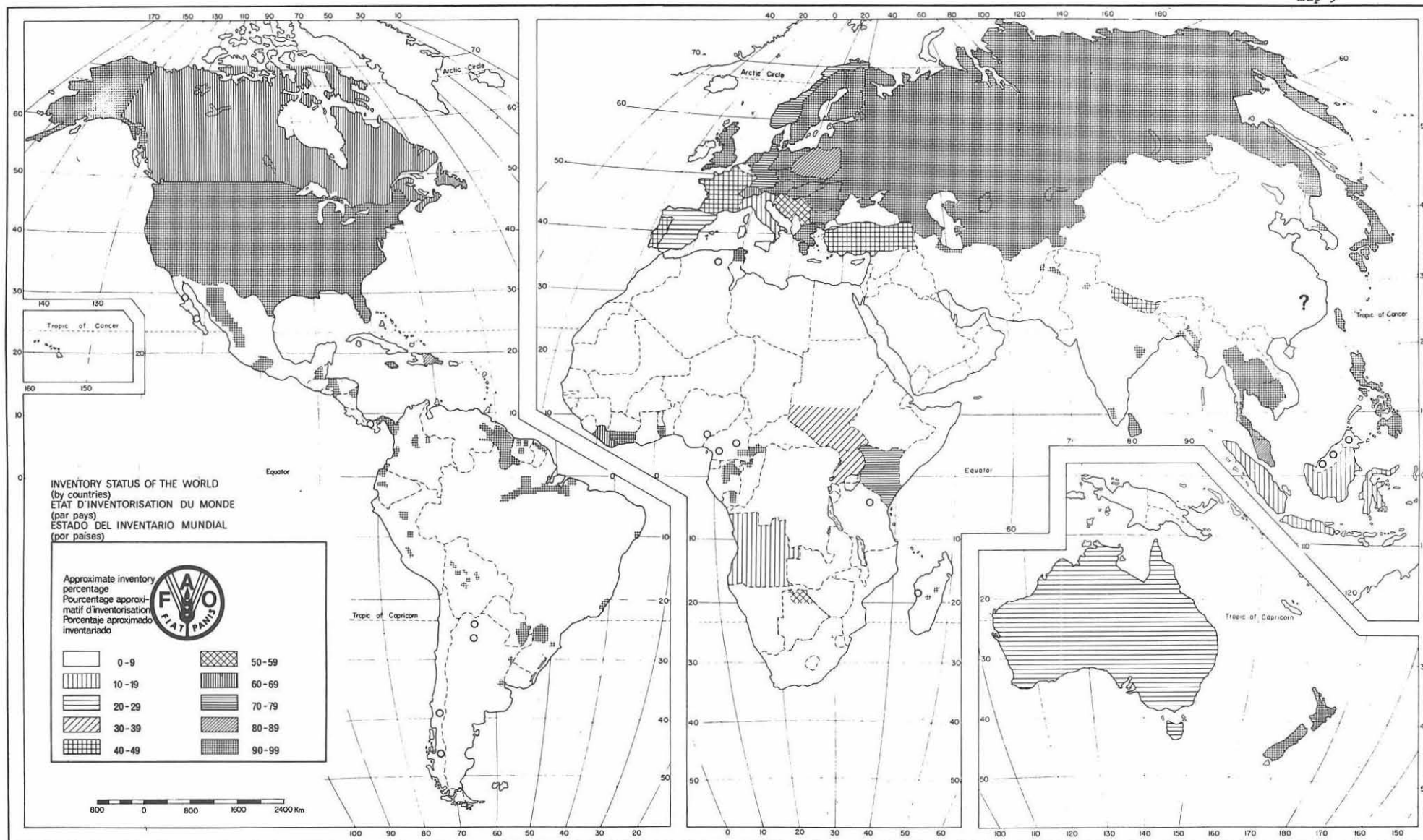


1) In southern Africa mainly Miombo (OW). In Brazil Campos Cerrado (OW), except in north-east where it is thorn scrub. In Colombia and Venezuela mainly savanna (llanos). In Argentina, Bolivia and Paraguay it is mainly chaco (OW). In Asia considerable areas are covered with dry deciduous forest. 2) In the tropics and subtropics mainly open woodlands (OW).



NOTE: PRELIMINARY MAP PREPARED IN 1971 FOR FAO ADVISORY COMMITTEE ON PULP AND PAPER (STATE OF KNOWLEDGE OF RESOURCE POTENTIAL FO: PAP/DST/71/3.4). THE MAP SHOWS THE PERCENTAGE OF COUNTRIES OR REGIONS THAT ARE COVERED BY CLOSED FOREST. CERTAIN ADDITIONS HAVE BEEN MADE.

○ = APPROXIMATE LOCATIONS OF MINOR FOREST AREAS (IN COUNTRIES OR REGIONS WITH LESS THAN 10 PERCENT FOREST COVERAGE)



NOTE: PRELIMINARY MAP PREPARED IN 1971 FOR FAO ADVISORY COMMITTEE ON PULP AND PAPER (STATE OF KNOWLEDGE OF RESOURCE POTENTIAL FO: PAP/DST/71/3.4). THE MAP SHOWS THE EXACT LOCATION OF INVENTORIES OR, WHEN THIS IS UNKNOWN, THE PERCENTAGE OF THE CLOSED FOREST AREA (IN ANGOLA, BOTSWANA AND SUDAN OF OPEN WOODLANDS) IN A COUNTRY COVERED BY INVENTORIES. CERTAIN CHANGES HAVE BEEN MADE.

○ = RECENT INVENTORIES WHICH AREAS CANNOT BE SHOWN EXACTLY.