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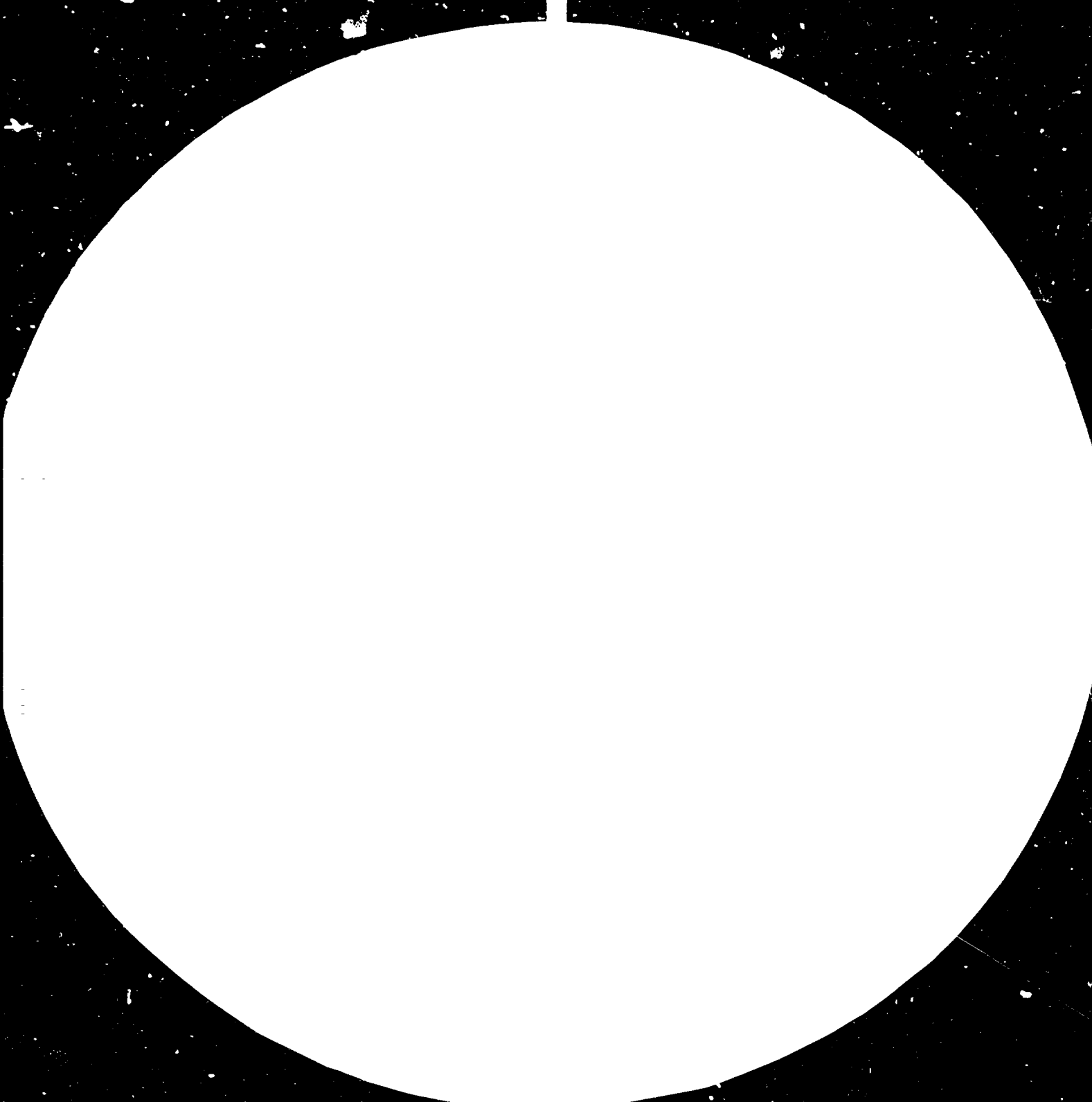

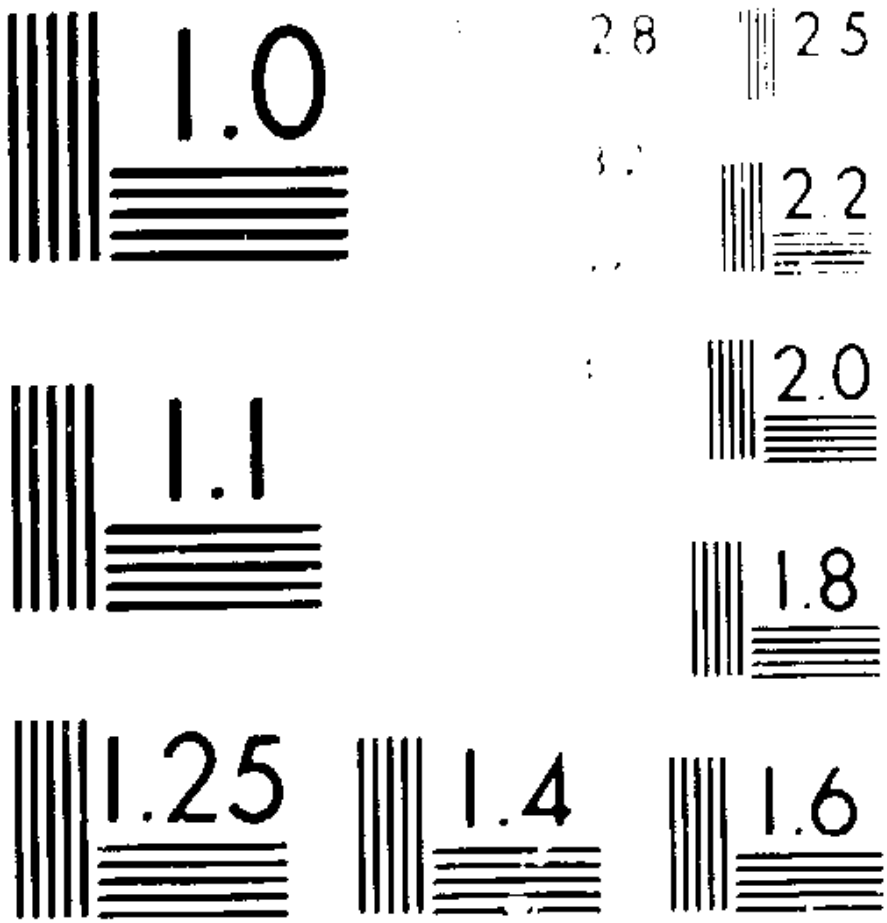
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MANAGEMENT OF FOREST RESOURCES IN DEVELOPING COUNTRIES *

prepared by the

Forestry Department
FAO

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INTRODUCTION

PURPOSE AND SCOPE OF THE PAPER

1- This paper is a contribution by the Food and Agriculture Organisation of the United Nations (FAO) for the preparatory meeting of the first Consultation on Wood Industries and Wood Products, to be held in Helsinki (Finland) in September 1983, in accordance with a recommendation of the second United Nations Conference on Industrial Development, which was held in Lima (Peru) in March 1975.

2- It provides a basis for discussion for the participants in the preparatory meeting, planned for Vienna (Austria) in February 1983 and to be held under the aegis of UNIDO. It provides a brief synthesis of research carried out in recent years on forest resources in developing countries, their recent and future evolution according to present trends, and the possible ways of improving this evolution when it is judged to be unsatisfactory, in particular by industrial users of wood or wood products, whether they come from the developing or developed countries.

3- The basic information about the state and evolution of forests of 76 tropical countries (covering 97% of all tropical countries) has been taken from the study carried out by FAO from 1976 to 1981 (1) 1/ with the financial assistance of the United Nations Environment Program (UNEP), in the framework of the Global Environment Monitoring System (GEMS). For the forests of non-tropical developing countries the statistics gathered and the studies carried out are, for the most part, less accurate, sometimes even incomplete and more or less outdated. The information in this paper has been gathered from various FAO reports, a list of which can be found in the bibliographical appendix.

4- Similarly, the figures used for predictions up to the year 2000 have been taken from FAO papers, in particular Forestry Study No. 29, "Wood Forest Products, demand and supply 1990 and 2000", (not available in French or Spanish) (2).

5- To avoid any misunderstanding in the discussions where this paper will be used we have attached a short glossary of the technical terms and abbreviations used in the text.

1/ The figures in parenthesis refer to the bibliographical appendix.

GLOSSARY

This glossary is only valid for the present paper. It is based in particular on the following papers:

- Tropical forest resources. (FAO Forestry Paper No 30) (I)
- Classification and definitions of forest products. (FAO Forestry Paper No 32 (20);
- Harmonizing international action in support of national efforts for tropical forests resources management (FO:MISC/8I/25-Rome, January I982) (3).

Forest : an association of vegetation constituted by trees.

Closed forest: forests with continuous (or closed) cover, as opposed to forest with discontinuous cover, indicated by the expressions: "clear forest", "open forest" or "other wooded areas".

Natural forest: the expression is only used as opposed to "plantations" which are entirely artificial.

Undisturbed forest or primary forest: forest that has not recently been modified.

Productive forest: closed forest considered capable of production regardless of distance from centres of transformation or of export. It is contrasted with unproductive forest, whether for "physical" reasons or for "legal" reasons.

Managed forest: forest where there is a classical management plan or which is subject to institutional rules with regard to the extraction of wood.

Growing stock (VOB): gross volume over bark of free bole of all living trees more than I0 cm diameter at breast height.

Annual increment: increase in volume of standing boles.

Annual allowable cut: the volume that can be harvested every year without damaging the capital (stated in the management plan in the case of managed forests).

Roundwood: all wood in the rough, in the same state as after logging.

Fuelwood: all wood used as a source of energy.

Other industrial roundwood: wood in the rough used directly (without industrial transformation) such as poles, posts, pilings, pit props etc.

Saw and veneer logs: wood that undergoes industrial transformation (sawing, squarring or veneering) before being used. Railway sleepers come into this category.

Pulpwood: wood used for the manufacture of pulp, boards or wood wool.

Conservation: management of human use of the biosphere so that it may yield the greatest sustainable benefit to present generations, while maintaining its potential to meet needs and aspirations of future generations. (World conservation strategy - UICN I980-)

Shifting cultivation: farming systems in which crops are grown for a few years in strips of cleared forest and then abandoned for varying periods of time, during which a woody covering returns, and then cultivated once again.
Agrosylviculture: mixed agricultural and forest systems combing in the same area, either simultaneously or in sucession, crops and/or natural or artificial pasture on the one hand, and the production of forest trees on the other.

SUMMARY

I - Developing countries possess considerable forest resources, both in the temperate and in the tropical zones. These forests fulfill many functions and assume an ever greater importance for the neighbouring populations, as well as for the national communities as a whole.

2- However, the growing encroachment on productive forest area, caused essentially by an ever greater need for land for cultivation, has led to fears of a significant reduction of wood-producing potential that could not be replaced by the products of plantations established in the last few decades. Some have even voiced fears about the rapid disappearance of forest resources, in particular of the closed tropical rain forest.

In fact, the global figures conceal wide disparities, not only regionally but locally, and the shrinking of forested areas is not of the same gravity everywhere. Nevertheless it is extremely worrying in some parts of the world.

3- The effects on the ability to satisfy wood needs are also variable. The situation in many countries is already very grave as regards the supply of firewood for poor populations, which is of almost vital necessity for them, and it can only get worse as a result of the growing need and the disappearance of extensive productive areas, even taking into consideration the beginning of production in the plantations that have been established in recent years.

On the other hand, in the light of recent studies, and of the prospects for the development of the world economy, it appears that the closed forests of the developing countries will be able to supply the foreseeable demand for industrial wood, whether it be for sawlogs, for roundwood or for pulpwood, and that there will not be a shortage, at least in terms of quantity, of industrial wood, between now and the end of the century.

4- But to achieve this require better care of forest resources, so as to derive the maximum benefit from them both directly and indirectly, while ensuring their normal renewal, as well as an intensification of forest management, with all that implies in terms of increasing knowledge, of intellectual and financial investment, and of organisational effort.

CHAPTER I

Definition of forest resource management

I- A recent FAO working paper (I) gives the following definition of forest resource management:

"In its wide and multidisciplinary function this expression encompasses the environmental, productive and social functions of forests and refers to the entire system formed by:

a) the forest, its resources and its functions,

b) the population, its needs and its contribution to the system,

c) the enterprise as the dynamic factor in the system.

Forest resource management involves the planning, execution and monitoring, in space and in time, of the necessary activities so that the forest resources under management provide the desired level of products and services, bearing in mind that the resources are renewable and are part of a system and that their potential must be maintained."

2- This definition, devised for tropical forests, can be applied equally well to temperate forests, particularly in developing countries but also in developed countries. It clearly and explicitly expresses the awareness, developed after the Second World War, of the complex problems involved in the exploitation of forests, of the many functions forests have in the life of a country, whether it be developed or not, not merely in financial terms, in the development of the country and of the populations, neighbouring or not, who live by them and depend on them.

3- The increase in knowledge about the factors and mechanisms which govern the functioning and evolution of forest ecosystems, as well as the interaction between forests and their environment has revealed the beneficial influence of forests on climate, on the protection of soil against erosion, and on the water table. Through their various products, direct and indirect, through the jobs that their management provides, through the recreational and cultural opportunities they offer, still fairly insignificant in the developing world it is true, forests are important factors in the social and economic development of countries which are lucky enough to possess them.

4- The multiple uses of the forest have been and continue to be a traditional part of life for the populations closest to them, and the growth of these populations makes it increasingly difficult to maintain a management policy directed solely towards the production of commercial wood by local or outside enterprises. On the contrary, the generally increasing pressure from ever more numerous neighbouring farmers seeking new lands necessitates -as is quite natural- that forest management should consider their needs and their security in a very special way. Any steps

taken to restrict their rights of usage of the forest, or diminishing the resources which they derive from it, must be accompanied by compensation either inside or outside the forest (such as the provision of pasture or agrosylviculture rights) or the transfer of resources to them.

5- The governments of the different developing countries are now aware of the importance of their choices and decisions with regard to forestry policy:

-in the priority they attach to forests through investment;
-in the categories they decide on for land use with regard to suitability and socio-economic pressures;
-in the priorities set for the exploitation of forests;
-in the combinations made between different uses of the forests, so that they are complementary rather than opposed;

The treatment and management of every forest depends on these choices and decisions. The effects will be long term and sometimes irreversible.

6- As a result forest management and the administration of forest resources becomes part of a much larger system involving management of the territory and of development. It implies a widening of the notion of "intensive forest management", which is sometimes used in a more restrictive sense. In some countries where the pressure from neighbouring populations has been decreasing or has remained slight it has been possible to promote wood production until it has become almost the exclusive activity. In that case a management plan must determine the rules for administration, for sylviculture, for equipment, for exploitation and also for protection for many years into the future, taking into account all the ecological, technological and socio-economic information available about the forest; the expected and probable result being a sustained production of wood, constant, at the very least, in quantity and quality. A regular flow can then be established from the forest to the industries which use wood as an ingredient or as a raw material and as result a wood-based economy can be created.

7- The wider concerns of integrated management of forest resources clearly are not at odds with these management principles with a view to wood production, in those sectors where wood production is recognised as being of high priority. Quite the contrary, in these well-defined and demarcated sectors sylvicultural efforts can and should tend to improve wood production in quality and quantity. The management can be intensive and make the maximum use of the growing knowledge of the administrators on the best techniques to use as well as on the forest's response to the different measures taken by the foresters. Great prudence is needed on their part as there are many unknowns and the forest, particularly the tropical forest, is a fragile environment where one cannot afford to run risks, damages to that environment can be irreversible.

8- In particular, the prime requirement of a working plan is the renewal of the resource. That is to say that the forest must not suffer from the acitivities of its exploiters, either technologically or ecologically. Exploitation

must therefore be followed by either natural (spontaneous or assisted) replacement or artificial replacement of the stock harvested. If foresters have enough knowledge and skills to achieve this in the temperate forests they are not certain of achieving it yet in the tropical forests, and in particular in the closed moist tropical forest. Ruthlessly practised selective harvesting can alter the ecosystem; practised moderately it allows for the regrowth of the forest, but its composition is no longer the same.

9- Plantations, and in particular plantations intended to supply industrial wood, cannot be considered as separate in the management of forest resources. In fact, their planning, their preparation, their creation and their exploitation depend on the same rules for management as apply to natural forest. Apart from their cost effectiveness they have less limitations than natural forests and can be planned with greater precision since the destination of their products is generally known in advance. Further, the choice of species used often allows the reduction of the rotation period.

IO- To be complete a forest management working plan must consider the problems involved in the utilization of its products and therefore of commercialization. For wood in particular, where the market is both local, national and international, management must take into account marketing possibilities, commercial trends, and as far as possible, projections for the development of supply, of demand (in global quantities and by categories of product) and of prices.

TABLE NO I

GROUPING OF COUNTRIES IN THE DIFFERENT SUB-REGIONS

Countries have been grouped in sub-regions according to the following list. Not all developing countries are listed, but only those which possess recognised forest potential and for which sufficiently accurate information is available.

LATIN AMERICA

Central America: Costa Rica, El. Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama. (7 countries)

Carribbean and CARICOM: Belize, Cuba, Dominican Republic, French Guyana, Guyana, Haiti, Jamaica, Surinam, Trinidad and Tobago.(9 countries)

Tropical South America: Bolivia,Brazil, Colombia, Equador, Paraguay, Peru, Venezuela. (7 countries)

Temperate South America:Argentina, Chile, Uruguay, (3 countries)

AFRICA

Mediterranean Africa (temperate and sub-temperate): Algeria, Egypt, Libya, Morocco, Tunisia, (5 countries)

Northern Savannas: Chad, Mali, Mauritania, Niger, Senegal, Upper Volta (6 countries)

West Africa: Benin, Ghana, Guinea, Guinea Bissau, Ivory Coast, Liberia, Nigeria, Sierra Leone, Togo. (9 countries)

Central Africa: Angola, Cameroon, Central African Republic, Congo, Equatorial Guinea, Gabon, Zaire. (7 countries)

East Africa and Madagascar: Burundi, Ethiopia, Kenya, Madagascar, Malawi, Mozambique, Rwanda, Somalia, Sudan, Tanzania, Uganda, Zambia, Zimbabwe. (I3 countries)

Southern Africa: Botswana, Lesotho, Namibia, Swaziland. (4 countries)

ASIA

Near East and West Asia: Afghanistan, Iraq, Iran, Jordan, Lebanon, Syria, Turkey. (7 countries)

Eastern Asia (temperate): China, Democratic Republic of Korea, Republic of Korea, Mongolia, Taiwan. (5 countries)

Southern Asia: Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka. (6 countries)

Continental Southeast Asia: Burma, Kampuchea, Laos, Thailand, Vietnam. (5 countries)

Insular Southeast Asia: Brunei, Fiji, Indonesia, Malaysia, Papua-New Guinea, The Philippines, Solomon Islands. (7 countries)

CHAPTER II

ESTIMATE OF PRESENT FOREST RESOURCES IN DEVELOPING COUNTRIES 2/

2.1. General Remarks

1- Since the scope of this paper is limited to resources of industrial wood there is no mention, in this chapter, of forest products other than wood, although they are significant in quantity and value, nor is there any mention of the less concrete profits and advantages, which are sometimes difficult to quantify, which human societies and groups derive either directly or indirectly from their forests. However, these products and these benefits will not be overlooked when we deal with the development and management of forest resources taken as a whole, and with the insertion of forest management in the administration of the territory (cf below, chapters III, IV and V).

2- The total wooded area of the whole world covers about 4,100 million ha (hectares) or 30% of the land surface. The closed forests cover about 2,500 million ha, the rest being made up by "other wooded areas" in the temperate regions (400 million ha) and by "open" tropical forests (750 million ha). In terms of volume, the total growing stock of closed productive forests is estimated at some 255 milliards of m3, 108 of which are in the temperate regions and 162 in the tropical forests (of which 13 milliards are in open forests). 3/

The following table elaborates on these figures for productive forests:

2/ Statistics for the year 1980.

3/ These figures should be compared with the population figures for the areas under consideration, ie. 2353 million for the temperate regions and 2062 million for the tropical regions.

World forest resources

Region	Population (in millions)	Forest areas (in million hectares)		Growing stock of productive forests (milliard m3)
		All forests	Productive forests	
Developed	II64	I9I0	940	96
Developing	325I	22I5	I035	I74
temperate	II89	I0I5	150	I2
tropical	2062	I200	885	I62
World total	44I5	4125	I975	270

It can be seen that the developing countries constitute 3/4 of the world's population and that they have only a little more than half of the world's productive forests. On the other hand, their growing stock per hectare (on average) is more than double that of the developed countries.

3- In giving a brief analysis of forest resources in the developing world, even limiting oneself to those aspects concerned with the development of forest industries, the information on a given subject is not consistent for all countries and one had to compare elements coming from various sources and obtained by different techniques.

4- Most of the information for an estimate of usable forest potential for industry comes from the recent FAO/UNEP study (FAO Forestry Paper No 30) (I) which focuses on 76 tropical countries covering 97% of the total area of all tropical countries. Fragmentary and more or less recent estimates for a number of developing countries with mainly temperate or sub-temperate climates have been added to complete the results for the three continents of America, Africa and Asia: Chile, Argentina and Uruguay for the first; Maghreb for the second; Turkey, Iran and Afghanistan for Western Asia. In so far as they were available the figures for China and the two Koreas have been added to those for the East Asian countries. When the data for these countries are not completely consistent with that of the FAO data bank for the other countries this is mentioned in the text or in the attached tables.

5- The same applies for the inventories of the tropical forests, which are not strictly comparable to those of the temperate forests. In the past many tropical forest inventories concentrated only on "commercial" species, that is to say species capable of being commercialized in response to specific demands and according to projections on their availability. In this case, tables in

the FAO study include a special column showing the "volume actually commercialized" (VAC), while the data on growing stock (VOB) show the volume of stems for all species, without considering quality or potential use. This last aspect is, however, rightly considered to be one of the essential elements for an estimate of development potential.

6- This growing stock provides sawlogs and veneer logs in varying proportions according to the species, but it should be mentioned that the branches can also provide fuelwood or pulpwood. After numerous measurements, this supplementary volume has been estimated to be around 40% of the VOB of closed forests, whether it is used or not. In the "other wooded areas" it could even exceed this percentage.

7- With regard to the accessibility of forests it should be pointed out that this has not been considered a factor in determining whether forests are productive or non-productive, any more than the "distance" factor, which makes for economic as well as technical inaccessibility. In reality, inaccessibility, whatever its cause, can be a serious constraint on forestry development.

8- The notion of net annual increment (NAI), which is important in forestry in temperate zones, is purely theoretical in tropical forests. In the undisturbed closed climax forest of the tropics the global NAI is theoretically and practically nil, since the forest is in equilibrium. It is the intervention of man which causes a positive NAI. What is more, because of the multiplicity of species and the selectivity of exploitation the notion of increment has no commercial significance because it does not necessarily apply to useable species.

Besides, the measurements in this field have not yet shown enough results to be taken into consideration in analysing the resource or in establishing rules of forest management.

2.2. Analysis of resources by sub-region (cf table 2 and 2a)

2.2.I. LATIN AMERICA

The wooded areas of Latin America cover about 930 million ha, of which about 690 million are considered "closed forests". The total area is 2,000 million ha, of which 1700 are on South America. The total population is 370 million. The climate is tropical as far as the Tropic of Capricorn and temperate beyond that, but cooler zones exist in the mountain chains near the Pacific coast.

It is divided into 4 sub-regions:

A- Central America

This sub-region comprises the 7 countries situated between Panama and the southern border of the United States. It covers 247 million ha and contains a population of 93 million people (or 37 people per km2). The northern part, in Mexico, is covered by transitional vegetation, from sub-tropical to temperate.

Of the 64.9 million ha of closed forest, 38.5 million ha are considered productive, and only 0.3 million ha are managed. 37% of these productive forests are of softwoods and they represent 9I% of all productive softwood forests in Latin America. I.5 million ha of broadleaved forests are mangroves and feature in the column for "unproductive forests". The growing stock of all the closed forests is estimated at 5.2 milliard m3 of which 3.8 millard are in productive forests. In these latter I.I millard m3 are softwoods. The growing stock per hectare of productive forest is , on average, II0 m3 for hardwoods and 75 for softwoods. The effectively commercialized growing stock in undisturbed productive formations goes from I0 to 30 m3/ha for hardwoods and from 35 to 40 for softwoods.

Industrial plantations amount in total to about I85,000 ha of which slightly more than half are softwoods. The annual rate of these plantations seems to have reached 30,000 ha. 60% of the plantations are of an industrial nature. On the other hand the annual rate of deforestation of the closed productive forests reaches 660,000 hectares.

B- Carribbean and CARICOM

This sub-region covers the Carribean islands, Belize and the three Guyanas (French Guyana, Guyana and Surinam). The area covers 70 million ha with a population of 27 million (38 people per km2). It is an entirely tropical region with a consistently high temperature and humidity. The rainfall goes from 2,000 to 2,500 mm and there are no high altitudes. The forest resources are concentrated principally in the Guyanas, a sparsely populated area. The soil of the islands is volcanic and generally fertile.

The total area of closed forest is estimated at 46 million ha, of which 36 million ha are considered productive forests. More than 33 million ha of these latter are found in the 3 Guyanas. 0.4 million ha are of conifers, of which half are in Cuba. Mangroves, classed as unproductive broadleaved forests, cover 0.830 million ha. The total growing stock of closed forest is estimated at about 8 milliard m3, of which 7.25 are in productive forests. This figure corresponds to 200 m3 per ha on average, which gives a good idea of its potential.

TABLE NO 2

ESTIMATED AREA OF NATURAL WOODY VEGETATION AT THE END OF 1980
CLOSED HARDWOOD FORESTS (IN THOUSANDS OF HECTARES)

SUB-REGIONS	PRODUCTIVE AREAS				UNPRODUCTIVE AREAS (#)	TOTAL AREA		FOREST FALLOW
	UNMANAGED		MANAGED	TOTAL		AREA	% OF REGION	
	UNDIS-TURBED	LOGGED OVER						
LATIN AMERICA								
CENTRAL AMERICA	19822	4440	0	24262	18022	42284	6.33	19686
CARIBBEAN AND CARICOM	31884	3857	14	35755	9717	45472	6.81	2012
TROPICAL SOUTH AMERICA	401270	45190	0	446460	119710	566170	86.58	77640
TEMPERATE SOUTH AMERICA	8502		0	8504	5223	13725	2.05	U
TOTAL	514965		14	514979	152672	667651	100%	99338
SUB-SAHARAN AFRICA								
NORTHERN SAVANNAS	514	5	0	519	266	785	0.36	E
WEST AFRICA	3051	7091	1168	11310	6617	17927	8.36	34037
CENTRAL AFRICA	111630	25960	0	137590	35605	173195	80.78	21615
EAST AFRICA AND MADAGASCAR	2985	8797	545	12327	10169	22496	10.50	5979
DEVELOPING SOUTHERN AFRICA	0	0	0	0	E	E	0	E
TOTAL								
ASIA								
DEVELOPING EAST ASIA	(2		(1383)	(2249)	(1389)	(3638)	(1.23)	U
SOUTHERN ASIA	6718	6071	30235	43024	9566	52590	17.79	9644
CONTINENTAL SOUTHEAST ASIA	27012	8276	3419	38701	22737	61438	20.78	34310
INSULAR SOUTHEAST ASIA	63529	44081	2359	110149	67974	177923	60.19	23292
TOTAL	156547		37576	194123	101666	295589	100%	67246
GENERAL TOTAL	831545		39303	870848	306795	1177643		228215

U : FIGURE UNAVAILABLE

( ) : FIGURES FROM A DIFFERENT SOURCE WHOSE CONSISTENCY WITH THE OTHER FIGURES HAS NOT BEEN VERIFIED

: THIS CATEGORY INCLUDING ALL MANGROVES

BAMBOO FORESTS ARE NOT INCLUDED IN THE ABOVE FIGURES

SOURCE : FAO (5)

TABLE NO 2 a

ESTIMATED AREA OF NATURAL WOODY VEGETATION AT THE END OF 1980

SOFTWOOD FORESTS (IN THOUSAND HECTARES)

	PRODUCTIVE AREAS				UNPRODUCTIVE AREAS	TOTAL AREA		FOREST FALLOW
	UNMANAGED		MANAGED	TOTAL		AREA	% OF REGION	
	UNDISTURBED	LOGGED-OVER						
LATIN AMERICA								
CENTRAL AMERICA	1018	12906	308	14232	8413	22645	88.95	8990
CARIBBEAN AND CARICOM	48	229	200	477	17	494	1.94	284
TROPICAL SOUTH AMERICA	465	0	0	465	1125	1590	6.24	0
TEMPERATE SOUTH AMERICA	(550)		0	(550)	(180)	(730)	(2.87)	0
TOTAL LATIN AMERICA	15216		508	15724	9735	25459	100%	9274
SUB-SAHARAN AFRICA								
NORTHERN SAVANNAS	0	0	0	0	0	0	0	0
WEST AFRICA	0	0	0	0	0	0	0	0
CENTRAL AFRICA	0	0	0	0	0	0	0	0
EAST AFRICA AND MADAGASCAR	270	295	20	585	535	1120	100%	15
DEVELOPING SOUTHERN AFRICA	0	0	0	0	0	0	0	0
TOTAL SUB-SAHARAN AFRICA	270	295	20	585	535	1120	100%	15
ASIA								
SOUTHERN ASIA	1282	538	2887	4707	1915	6622	59.89	652
CONTINENTAL SOUTHEAST ASIA	457	42	0	499	255	754	6.82	180
INSULAR SOUTHEAST ASIA	35	365	E	400	630	1030	9.32	130
DEVELOPING EAST ASIA	(633)		(1340)	(1973)	(677)	(2650)	23.97	U
TOTAL ASIA	3352		4227	7579	3477	11056	100%	962
TOTAL DEVELOPING COUNTRIES	19133		4755	23888	13747	37635		10251

SOURCE: FAO (5)

It is made up almost exclusively of hardwoods, with a great variety of species. The volume actually commercilized goes from 7 to 20 m3/ha.

There are about 200,000 ha of plantations, of which 3/4 are in Cuba, and of which half are softwoods. The annual rate of plantation is of 18,000 ha, of which over 2/3 are softwoods. The rate of deforestation (of closed productive forests) is low, from 20,000 to 25,000 ha a year.

C-TROPICAL SOUTH AMERICA

This includes the whole of the South American continent except for Argentina, Chile and Uruguay, and the three Guyanas. The 7 countries in the group cover, in all, 13,500 million ha, with a population of 200 million (an average density of 15 people per km2).

The zone is characterised by the vast wooded basin of the Amazon in the centre, which is flanked by savannas to the south and east and the chain of the Andes to the west. In the low-lying areas the temperatures are high, between 20 and 30C, and the rainfall is between 1.5 and 2.5 m per year, with an increasingly pronounced dry season towards the south. The Andes, to the west, have lower temperatures and diminishing rainfall, with even desert conditions in the western part.

The Amazon basin is by far the largest broadleaved tropical forest in the world; it extends over about 550 million ha and 5 countries, particularly Brazil. The population density is low.

The total area of closed forest is estimated at around 570 million ha, or 80% of all Latin American forest resources. 450 million ha are considered productive (of which 300 million are in Brazil) and represent roughly 40% of world productive forest reserves.

Almost all the species are hardwoods, with a few exceptions. Mangroves cover 3.5 million ha.

The total growing stock of the closed forests is estimated at some 78 milliard m3, of which 68 are productive (of the latter 47 milliard are in Brazil). The average VOB of the closed productive forests is therefore about 150 m3/ha, but there are areas where it is much higher (from 200 to 250 m3/ha).

The VAC ranges from 5 to 20 m3/ha for hardwoods and from 25 to 65 m3/ha for softwoods, but the total volume of softwoods commercialized does not reach 1% of the total for hardwoods.

Large development projects and localised population pressure have raised the annual rate of deforestation to about 3.3 million ha, of which 2.5. are in the productive forests. It is even expected that this rate will increase. On the other hand, the rate of replanting is impressive.

In 1980 the total area planted in South America was 4.2 million ha (of which 91% was in Brazil, as an annual rate of 450,000 ha).

D- TEMPERATE SOUTH AMERICA

This sub-region, going from sub-tropical to temperate, covers 3.7 million km 2 and has a population of 41 million, or 11 people per km2.

The area of productive forest is estimated at 9.1 million ha. The VOB is estimated between 50 and 70 m3/ha. Almost all the natural forests are hardwood, but of mediocre quality. The volume per hectare decreases from north to south, where the risk of fires is high.

There is no natural managed forest.

On the other hand, the plantations programme is significant, and plantations cover almost 1.5 million ha, 60% of which are softwoods. 85% are industrial plantations. The annual rate of industrial planting is of 80,000 ha, with productivity of about 20 m3/ha for softwoods (pines) and 15 m3/ha for hardwoods (Eucalyptus).

Plantations have considerably increased the forestry potential of the sub-region.

2.2.2. -AFRICA

A-MEDITERRANEAN SUB-REGION

This sub-region, for which recent and accurate forestry data is lacking, covers the North African part of the Mediterranean belt, The total population is about 900 million. It contains very little forest, except in Maghreb; the forests are mainly hardwood, with however some softwood species. The growing stock is estimated at 60 m3/ha in the 100,000 ha of managed forests. The rest of the sub-region is covered by vegetation ranging from xerophytic to desert.

Plantations are estimated at about 20,000 ha destined essentially for the production of wood for local populations.

B-NORTHERN SAVANNA SUB-REGION

This sub-region has a population of 30 million, It is made up of a desert zone in the north, which is replaced as one goes south by a transitional belt with combinations of savanna trees, then, on the southern fringe by forest associations of the Guineo-Sudan type, with a small growing stock sufficiently large to supply sawlogs, but with a very limited potential for industrial wood.

The area of closed and open forest is estimated at some 44 million ha, of which about 6.7 million are considered productive, with a growing stock of 265 million m3, or less than 40 m3/ha.

The forest formations in this sub-region produce essentially fuelwood, other industrial roundwood and numerous non-wood products (as for example rubber for erasers);

Plantations cover almost 37,000 ha, and the annual rate is of 8,000 ha, entirely of hardwood species and almost exclusively for the production of fuel-wood.

C- WEST AFRICA

Lying along the northern coast of the Gulf of Guinea, this sub-region is made up of 9 countries, with a population of II5 million in an area of 2.I million km2. It has a closed moist forest vegetation along the coast where the rainfall is high. The rainfall decreases towards the interior. The closed forest covers about I8 million ha, of which only II.3 million are considered productive (I million ha are managed). Of the unproductive 6.6 million ha, 5.6 million are so for physical reasons including the mediocre quality as well as inaccessibility.

The total growing stock is estimated at 2.9 milliard m3, of which about 2 milliard are productive forest. The VOB is therefore about I80 m3/ha; but there are some forests where it reaches and even exceeds 300 m3/ha. Further, most of the stands have been exploited (73%), which influences both the volume and the quality of the remaining potential. The VAC can still however reach 35 m3/ha (in Nigeria) because of the increase in the number of species exploited.

Data on the rate of increment refer above all the specific "commercial" species, and there are practically none on the general volume of the forest. We have already seen (page 6) that the notion of net annual increment is of only limited interest for the closed tropical forest. What is more there is virtually no intensive forest management in the sub-region.

Planted areas at present amount to 330,000 ha (more than 70% of which are in Nigeria) and the annual rate is about 37,000 ha (300,000 in Nigeria and 290,000 in the Ivory Coast).

D- CENTRAL AFRICA

The sub-region (7 countries) covers an area of 5.3 million km2, with a population of 49 million and includes the large extent of tropical forest in the middle of Africa.

The total area of closed forest, practically all closed moist forest, covers about I73 million ha, of which I38 million are considered productive. A large part of the area, the central basin of Zaire, still possesses enormous potential but the problem of transport has not yet been resolved.

The total growing stock of the closed forests is estimated at 40 milliard m3,of which 35 milliard are in productive forests. These are therefore very rich in volume with about 250 m3/ha. They are all closed hardwood forests. One finds islands of closed homogeneous forest and large areas of closed

semi-deciduous forest. These have very different technological characteristics. There is no managed forest.

For this sub-region, as for the previous one, there is a lack of data on increments, which are strongly influenced by clearings and other environmental conditions.

The total area of plantations is 235,000 ha, of which 133,000 ha or 2/3 are in Angola. The present rate of planting is very low (6,000 ha a year). Deforestation is about 350,000 ha a year, particularly in Zaire and Cameroon.

E- EAST AFRICA AND MADAGASCAR

This sub-region (13 countries) includes a continental section, between the Rift Valley and the Indian Ocean, and the large island of Madagascar. It covers an area of 8.8 million km2 and the population, which is growing rapidly, was about 150 million in 1980. The climate is hot except in the high altitude zones on the continent and in Madagascar.

Closed forest covers a total of 23.6 million ha, of which 12.9 million are considered productive. Only a little more than 3 million ha of these latter are still undisturbed. Many of the unproductive forests have a poor rate of increment because of the poverty of the soil and the topography. About 1.1 million ha are of softwoods and situated in the northern part of the sub-region, of which 60% are productive. Of all the closed forests in the sub-region about 565,000 ha are managed. There are also 900,000 ha of mangroves exploited to a greater or lesser degree in reality (but classed as unproductive for the sake of statistical consistency).

The total growing stock of the closed forest is of the order of 2.4 milliard m3, of which 1.4 is productive forest. The average growing stock per hectare of closed productive broadleaved forest for the sub-region as a whole is low, between 50 and 180 m3/ha according to the zone, and only between 20 and 60 m3 in the productive open forests. The total growing stock in the productive softwood forests is 65 million m3, or 110 m3/ha.

There is little data on annual increments in these forests. The VAC ranges from 5 to 30 m3 per hectare for hardwoods and from 30 to 70 for softwoods, but the total volume logged of the latter remains very small (of the order of 150,000 m3). The total area of plantations is estimated at about 1 million ha, the annual rate of planting being 56,000 ha. On the other hand deforestation continues at a rate of 395,000 ha every year.

F- DEVELOPING SOUTHERN AFRICA

This sub-region, which excludes the Republic of South Africa, comprises 4 sparsely forested countries (Botswana, Lesotho, Namibia and Swaziland), and covers less than 1.5 million km2, with a population of 3.6 million. It includes vast areas of desert. There is not much information about the whole of the

sub-region, but the only forest vegetation consists of bushland or barely shrubland formations which are classed as unexploitable and whose use is purely local.

Until now work on plantations has been very limited, except in Swaziland where there are about 90,000 ha of industrial plantations.

2.2.3.- ASIA

The forest resources of Asia and the Southeast Asian Archipelago cover 600 million ha, of which 425 million can be classed as closed forest. The total population can be estimated at some 2,4 milliard for a total area of 27 million km2 of land, or an average density of 88 people per km2.

A- WEST ASIA-NEAR EAST

This sub-region has a population of some I35 million. For climatic reasons (low rainfall) it is characterised by scarce forest cover, which has also suffered the effects of human action. A few natural forest resources remain, in some of the countries, and provide a bit of roundwood for local craftsmen; but they cannot be considered significant for industrial purposes.

The forest continues to shrink, and efforts at plantation are not able to match this shrinkage.

B- EAST ASIA (temperate)

This sub-region is made up of 5 countries, among them China, in terms of area, of population and of forested land, has a dominating position. It is an essentially temperate country, but which covers an immense area with very varying ecological and climatic conditions. There is little recent information available about it. The population is close to I milliard for a total area of 9.5 million km2. Closed forests cover I2.7% of this area or about I2I.4 million ha. There is also I5.6 million ha of open forests and 29.75 million ha of s hrub and brush formations. What is more, 4.5 million ha of new plantations have been established in very recent years.

Forest resources have been and are intensively used, and the forests are almost all managed, at least those which are reasonably close to populated areas. The plantations are planned for the medium and long term according to the needs, which are enormous. A huge programme has therefore been planned to try and satisfy them.

However, on the whole, accurate statistical data is lacking for China, Mongolia and the Democratic Republic of Korea; as a result we cannot properly discuss the sub-region.

C- SOUTHERN ASIA

Ecologically, the present situation of the forest resources of what is in fact a sub-continent, with 850 million inhabitants, offers several parallels with the preceding sub-region, if only for the population density.

There are no longer any significant areas of moist sempervirente tropical forest except in the soutnern section and despite the situation in the sub-tropical and tropical belt of the continent.

The forests fall into 6 principal types going from deciduous moist tropical to subalpine forest, to which should be aided bamboo and mangroves.

The area of closed forest is estimated at around 60 million ha, of which 49 million are considered productive.

The growing stock of the closed forests is of 4.4 milliard m3, of which 3.8 are in the productive forests. This represents an average growing stock of 73 m3 per hectare, but depending on local conditions there are wide variations around this average (25 m3/ha in the semi-arid forest of Rajasthan, 200 m3/ha in certain temperate and subtropical forests. The softwood forests contain nearly 0.9 milliard m3, with densities ranging from 6 m3/ha (Nepal) to 275 m3/ha (Bhutan).

The proportion of managed forests in the subcontinent is high (nearly 70% of the productive forests and up to more than 75% in India), and explains the high degree of utilization of the forest. In the managed forests an exploitable volume of industrial roundwood of I m3/ha per year is generally agreed upon. However, despite the efforts of governments, II million ha approximately are subjected to shifting agriculture, which represents a loss of forest capital.

The VAC in the undisturbed forests ranges from 30 to 76 m3/ha for hardwoods and 50 to 80 m3.ha for softwoods.

Remarkable results have been achieved with regard to plantations: a total of 2.5 million ha have been established, 740,000 of which between I976 and I980. In India, since the middle of the century, plantations have increasingly been integrated with efforts for planned rural development.

D- CONTINENTAL SOUTHEAST ASIA

With a population of I85 million, closed forests cover 66 million ha, of which 4I million are considered productive (3.5 million of which are managed).

It is an area of closed moist tropical forest.. In Burma and Kampuchea forest covers 40 to 50% of the total area; in Thailand the proportion is only 18%. Softwood forests cover about 0.75 million ha in the countries of the sub-region, with the exception of Kampuchea. Mangroves cover some 1.1 million ha in Burma and Thailand.

Part of the wooded area is constituted by mountainous tropical forest up to altitudes of 2,000 m, with an average temperature of 27% and rainfall between 1,800 and 3,000 mm. In the low lying territories where the rainfall is less high, with pronounced dry seasons, one finds some dry deciduous forests. In these zones teak is the dominant species.

The total growing stock for the whole of the closed forests is estimated at some 8.8 milliard m3, of which 6.65 milliard in forests considered to be productive. The average volume for closed productive forests is 160 m3/ha; it is less in Thailand, of about this order in Burma and higher in Kampuchea and Laos.

The managed forests, principally teak and a mixture of dipterocarps, have an excellent annual exploitable volume of 0.6 m3/ha.

In undisturbed forests and depending on the country, the VAC goes from 12 to 30 m3/ha an average for hardwoods and from 30 to 70 for softwoods.

One of the principal causes of deforestation is shifting agriculture which destroys about 550,000 ha a year. Damage to 4 million ha is attributed to bombing during the Vietnam war.

The programme of plantations is continually growing. In 1980 the total reached 350,000 ha. They are currently being established at a rate of 55,000 ha a year (of which 23,000 ha are in industrial plantations). The total includes about 70,000 ha of softwood plantations in Vietnam.

E-INSULAR SOUTHEAST ASIA

This sub-region, made up of a series of islands stretching almost to the Pacific, contains the most important forest resources in Asia, not only in terms of volume but of quality.

The population is about 220 million.

The forest is almost all closed moist tropical forest, with some sections of semi-deciduous forest. The dipterocarp family is the dominant one (Dipterocarpus, Shores, Parashorea), particularly in the west of the zone. They are tall trees with similar characteristics and well known technological qualities. These forests constitute therefore an extremely valuable capital. To the east of the Wallace line passing to the west of the Moluccan Islands the dipterocarps are much less numerous. One should draw attention to the presence of peat swamp forests, which are easy to exploit, in the sub-region, as well as the mangroves of Indonesia, Malaysia and Philippines.

In the sub-region as a whole closed forest covers about 148 million ha or more than 55% of the total area, and of which more than 3/4 are in Indonesia, particularly in Kalimantan (the Indonesian part of Borneo), in Sumatra and Irian Jaya (the Indonesian part of the island of New Guinea). Softwoods cover about 500,000 ha, particularly in Indonesia and the Philippines. The total growing stock is about 31.5 milliard m3 of which 21 milliard are in productive forests, with an average volume of about 200 m3/ha, even exceeding 300 m3/ha in the undisturbed closed Dipterocarpus forests of Borneo and the Philippines.

The gross annually exploitable volume in most of the managed forests, which cover 2.5 million ha, goes from 1.5 to 2.2 m3/ha.

The VAC in the undisturbed closed hardwood forests goes from 12 to 90 m3/ha.

The annual rate of deforestation is of 980,000 to I,000,000 ha, particularly as a result of shifting agriculture and programmes of agricultural colonization and migration.

Significant efforts are being made with regard to plantations. These cover a total of 2.25 million ha, I.6 million ha of which are industrial plantations, especially in the Philippines and Indonesia. Their annual rate is of 250,000 ha, 95,000 of which are in industrial plantations.

2.3. CURRENT FORESTRY PRODUCTION

In order to make predictions on the development of forest resources in the coming 2 decades one must evaluate, at least briefly, the use currently being made of them. Table No 3 shows the production of roundwood for I980 for developing countries (3). The numbers quoted, because of the world economic situation, can be considered as slightly less than the average for recent years, but the way that production is distributed around the world has not been noticeably modified. One finds that a little more than 40% of production comes from the developed world, the rest comes from the developing world. This proportion corresponds fairly accurately to the distribution of resources (38/62%), but this analogy is more apparent than real when one considers wood for fuel (including wood for charcoal). This accounts for 54% of the total production of roundwood, but only for I3% in the developed countries and 82% in the developing world. It should be noted that the production of fuelwood comes in large part from variety of wooded terrain, whether or not it is classified as forest.

With regard to industrial wood (including pulpwood), only 20% is produced by developing world, I/3 by countries in the temperate zones and 2/3 in the tropical zones (whilst the ratio of growing stock is of I: I2), or I04 million m3 and I9I million m3. In these figures, softwood forests account respectively for 65% or 65 million m3 and for I6% or 32 million m3. It should also be noted that in this last figure 27 million are from forests and plantations in Brazil and Mexico which are not situated in a tropical climate.

It would also be useful to examine the production of industrial wood in developing countries in greater detail. Of the 295 million m3, 27 are for pulpwood, I9I for sawlogs and veneer logs and 77 for use as roundwood (poles, posts, pickets, pilings) which do not, in fact, go to industry, in developing countries posts are used above all for construction. Besides, not all woods of this category come from the forest.

Saw and veneer logs account for a volume of 52 million m3 in the temperate countries (36 million in China) and I39 million in the tropical countries: divided between Latin American (45), Africa (2I) and Asia (73).

Latin America, with 53% of the tropical forest resources, only produces 1/3 of the sawlogs of tropical wood. These figures are anyway partially.

TABLE NO 3

Production of roundwood in developing countries in 1980
(thousands of cubic metres)

Sub-region	Total production (*)	Fuelwood and charcoal	Pulpwood	Industrial roundwood (**)
LATIN AMERICA				
Central America	39732	29652	2637	7443
Caribbean and CARICOM	8001	6617	0	1384
Tropical South America	289471	235499	8905	45067
Temperate South America	24063	10707	3357	9989
Total Latin America	361807	282485	14899	63883
AFRICA				
Mediterranean Africa	8501	7604	235	662
Northern Savannas	49915	48155	0	1760
West Africa	142236	124884	0	17352
Central Africa	34623	28773	140	5710
E.Africa and Madagascar	174836	164541	166	10131
Developing South Africa	3663	1549	1675	438
Total Africa	413773	375506	2216	36053
ASIA				
West Asia and Near East	38642	23043	1032	14567
East Asia	301390	228960	5546	66884
Southern Asia	268420	257208	1271	9941
Continental Southeast Asia	137912	126538	0	11374
Insular Southeast Asia	243389	175484	1623	66282
Total Asia	989753	811233	9472	169048
Total developing world	1765333	1469224	26587	268984
Entire world	3020306	1626835	38391	1355080

(*) all categories, in and outside forest

(**) not including pulpwood

Source: FAO Handbook of forest products (1982)

misleading since the harvesting in the forests of Brazil is concentrated in the softwood stands in the south of the country, close to the principal markets, but which constitute a limited resource, rather than in the almost limitless resource of the Amazon basin, which is far away from the markets. The pine forests are exploited well beyond their potential and the situation is likely to precipitate rapidly. Most of the other Latin American countries exploit their forests at a rate at least equal to the rate of exploitation of tropical forests in the rest of the world.

The utilization of forest resources in Africa suffers from the same kind of distortion since more than half the total growing stock is concentrated in Zaire, which possesses 20 milliard m3 of growing stock in the closed productive tropical forest but produces only 300,000 m3 of saw and veneer logs. The mobilization of these enormous forest resources is above all a question of economic accessibility.

In the countries of West Africa the rate of exploitation exceeds the rate of renewal. But there too the problem is one of global land-use policy rather than of long term forest development policy.

Asia, in general, makes fuller use of its tropical forest resources. With 21% of world resources it produces more than half the saw and veneer logs. This, which is due to a number of complementary factors, shows however that these resources, despite the technical difficulties, can substantially contribute to the development of forest industries.

In the countries of Southern Asia, between Pakistan and Bangladesh, the production of saw and veneer logs has been of 8.5 million m3 from a growing stock of 3.I milliards of M3 in the productive forests, or a level of mobilization more than double the world average for tropical forests. As in Latin America part of these forests could just as well be described as subtropical or even temperate, but the good results are also the consequence of a high level of forest management and the presence of a vast market very close to the forest.

The degree of utilization in continental Southeast Asia, between Burma and Vietnam, is at the least average, but it can be expected to increase noticeably because of the enormous potential market as well as the quality of the forests, where the teak stands or a large part of the growing stock.

In the countries of insular Southeast Asia the contribution of forest resources to industrial development has grown spectacularly. The sub-region, with I4% of tropical forest resources (closed productive forests) produced, in I980, about 50% of the world supply of hardwood sawlogs and veneer logs. Certainly conditions are favourable, with the presence, at least in the western part, of fairly homogeneous diterocarp forests, and also of a large market for local and export consumption, exports going to countries in the region, notably Japan.

As for the figure of 27 million m3, for world production of pulpwood, I2

million come from the temperate countries and I5 million from tropical countries. For the latter, they come mainly from plantations and 60% from softwoods. Only a small part comes from the tropical hardwood forests.

2.4. Intensity of resource utilization

This intensity can be expressed in diff erent ways. One is to compare the effective production per hectare to the annual potential. Another is to calculate the proportion of roundwood extracted from the forest to the volume of growing stock. The two methods give only a vague indication of the real productivity, especially as part of the product comes from plantations, where it is important to know the distribution according to age and volume of growing stock. However, in this way it is possible to make comparisons between the temperate and tropical countries, as well as between developed and developing countries.

The following table gives the comparisons:

Regions	Population %	Volume of growing stock %	Total production of round-wood %	Industrial roundwood %	Saw and veneer logs %	Pulp wood %
Developed	26	37	4I	79	77	92
Developing (temperate)	32	5	I2	7	6	3
Developing (tropical)	4I	58	47	I4	I7	5
Total develop-ing	74	63	59	2I	23	8
Entire world	I00	I00	I00	I00	I00	I00

Production of roundwood in the developed world is of I.2 m3/ha of productive forest. This figure can be compared to the annual po tial, or to the annual increment, when that is available. In the forests of .he developed world the latter is on average of I.7 m3/ha. In the temperate developing countries the rate of exploitation is about 0.7 m3/ha and 7.5% of the

TABLE NO 4

TOTAL GROWING STOCK AT THE END OF 1980

CLOSED FORESTS (HARDWOOD AND SOFTWOOD) IN MILLIONS OF M3

SUB-REGION	PRODUCTIVE FORESTS				UNPRODUCTIVE FORESTS	TOTAL
	UNMANAGED		MANAGED	TOTAL		
	UNDISTURBED	LOGGED OVER				
LATIN AMERICA						
CENTRAL AMERICA	2339	1428	15	3782	1443	5225
CARIBBEAN AND CARICOM	6774	472	6	7252	1040	8292
TROPICAL SOUTH AMERICA	62225	5378	0	67603	10373	77976
TEMPERATE SOUTH AMERICA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
TOTAL	71338	7278	21	78637	12856	91493
SUBSAHARAN AFRICA						
NORTHERN SAVANNAS	62	E	0	62	13	75
WEST AFRICA	525	1337	175	2037	849	2886
CENTRAL AFRICA	29292	5960	0	35252	4393	39645
EAST AFRICA AND MADAGASCAR	479	897	62	1438	967	2405
DEVELOPING SOUTHERN AFRICA	0	0	0	0	0	0
TOTAL	30358	8194	237	38789	6222	45011
ASIA						
DEVELOPING WESTERN ASIA	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
SOUTHERN ASIA	1056	294	2492	3842	564	4406
CONTINENTAL SOUTHEAST ASIA	4918	1220	513	6651	2134	8785
INSULAR SOUTHEAST ASIA	15302	5145	556	21003	10639	31642
TOTAL	21276	6659	3561	31496	13337	44833
GENERAL TOTAL	122972	22131	3819	148922	32415	181337

Source: FAO (2)

volume of growing stock.

In the tropical zone these same figures are respectively (and approximately) 0.22 m3/ha for the closed productive forest and of the order of I/I,000 for the volume of growing stock of the closed productive forest.

It is difficult to make a comparison between the forests of the developed world (particularly the European ones) and the forests of the developing countries for numerous reasons:

- production of pulpwood in the European forests is large while it is very small in the tropical forests.
- a large proportion of European forests are planted or regenerated artificially while the tropical plantations, even if they are taken into consideration, are proportionally less extensive and above all more recent.
- the European productive forest sector is relatively stable and in large measure subjected to sustained management, while the productive tropical forests, once logged over, are largely devoted to agriculture or other uses and cannot again produce saw and veneer logs in a cyclical way. It is for this reason that only the volume actually commercialized (VAC) for undisturbed forests has been given in the analysis of forested areas by sub-region.

Table No 5 shows the estimated area of undisturbed closed productive forest exploited annually for saw and veneer logs in the tropical sub-regions studied (forecast 8I-85). One can see then that existing"reserves" of forest, in the light of a regretable but unfortunately very widespread type of exploitation akin to mining, represent another 40 or so years of logging under present conditions and without increasing the VAC in tropical Asia, more than I00 years in Africa and nearly I80 years in Latin America - assuming that these forests are not cleared beforehand and that all productive forests become little by little economically accessible.

2.5. PLANTATIONS -(see Table No 6)

This word signifies forest stands artificially established by planting on lands which did not have forest cover before or where the forest cover was fundamentally different from the plantations which replced it. Artificial regeneration of forest is not considered to be plantation.

Only plantations in tropical countries are mentioned since the data available for non-tropical developing countries are much too inaccurate.

Lastly, the distinction between industrial plantations and non-industrial plantations is the generally accepted one which was spelt out in FAO Forestry paper No 30 (2).

2.5.1. Few plantations were carried out in the entire tropical world before I950, and most of them can be considered to have disappeared,

TABLE No 5

Estimated area of undisturbed closed productive tropical forest exploited annually (saw and veneer logs) from I98I-85 (thousand hectares)

Sub-region	hardwoods	softwoods	total
LATIN AMERICA			
Central America	I28	43	I7I
Caribbean and CARICOM	39	0	39
Tropical South America	I793	0	I793
Total tropical America	I960	43	2003
TROPICAL SUBSAHARAN AFRICA			
Northern savannas	0	0	0
West Africa	I64	0	I64
Central Africa	43I	0	43I
East Africa and Madagascar	40	4	44
Tropical Southern Africa	0	0	0
Total tropical Africa	635	4	639
TROPICAL ASIA			
Southern Asia	I4	9	23
Continental Southeast Asia	344	4	348
Insular Southeast Asia	I383	I	I384
Total tropical Asia	I74I	I4	I755
Total tropical developing	4336	6I	4397

Source: FAO Study No 30

TABLE NO 6

EST. ED AREA OF PLANTATIONS ACHIEVED BY THE END OF 1980
IN TROPICAL DEVELOPING COUNTRIES
(IN THOUSAND HECTARES)

SUB-REGION	INDUSTRIAL PLANTATIONS				NON-INDUSTRIAL PLANTATIONS			
	HARDWOODS		SOFTWOODS	TOTAL AREA	HARDWOODS		SOFTWOODS	TOTAL AREA
	NOT FAST GROWING	FAST GROWING			NOT FAST GROWING	FAST GROWING		
TROPICAL LATIN AMERICA								
CENTRAL AMERICA	28	16	53	97	27	16	44	87
CARIBBEAN AND CARICOM	25	71	103	197	1	0	6	7
TROPICAL SOUTH AMERICA	76	781	1415	2272	391	1567	0	1958
TOTAL TROPICAL AMERICA	129	868	1571	2568	419	1583	50	2052
TROPICAL SUBSAHARAN AFRICA								
NORTHERN SAVANNAS	2	3	0	5	32	0	0	32
WEST AFRICA	164	70	6	240	65	24	0	89
CENTRAL AFRICA	50	58	25	133	0	101	0	101
EAST AFRICA AND MADAGASCAR	78	30	511	619	197	358	6	561
TROPICAL SOUTHERN AFRICA	0	E	0	E	0	0	0	0
TOTAL TROPICAL AFRICA	294	162	541	997	294	483	6	783
TROPICAL ASIA								
SOUTHERN ASIA	727	994	76	1797	0	697	0	697
CONTINENTAL SOUTHEAST ASIA	81	1	69	151	74	126	0	200
INSULAR SOUTHEAST ASIA	1005	88	461	1554	89	397	226	712
TOTAL TROPICAL ASIA	1813	1083	606	3502	163	1220	226	1609
GENERAL TOTAL	2236	2113	2718	7067	876	3286	282	4444

SOURCE: FAO STUDY NO 30

either through natural disappearance for a variety of reasons, or through logging followed by replacement.

Since I950, though, there has been considerable effort in this field and more than 90% of forest plantations existing in I980 have been established in the interval at a rapidly growing rate. In recent years a relatively high priority has been given, notably to satisfy fuelwood needs, to non-industrial plantations which now account for less than 40% of existing plantations.

Table No 7 gives, for each of the tropical sub-regions, an estimate of the total planted area (of sufficient density) until the end of I980.

In tropical America large scale plantations started in I960 and have been developed, especially since I970. The proportion of stands created in the last 5 years (I976-80) is of 44%.

In tropical Africa a first series of plantations dates back to the years I950-60: about 330,000 ha of them still survive. After slowing down for several years, work restarted at an increased rate, at an annual average of 58,000 ha between I96I and I975, and 93,000 ha between I976 and I980.

In tropical Asia the decades of the 50s and 60s saw the development of plantations mainly for industrial purposes in most of the countries. The principal criteria considered were the predicted size and distributed of wood consumption and the capacity of the natural forests to satisfy these needs. Plantations designed to satisfy the needs of rural populations and to reduce their poverty subsequently took on a greater relative importance, which resulted in an increase of the proportion of non-industrial plantations in the last 5 years.

2.5.2. Industrial plantations of slow growing hardwoods (or "low productivity") are destined for saw and veneer logs, those with rapid growing (or high productivity") species for veneer and pulpwood. 36% have been established in the last 5 years.

Particular attention should be drawn to several points:
- in tropical America 77% of industrial plantations are concentrated in Brazil, and 20% are distributed among the other 5 countries, foremost among them Cuba. 78% of the fast growing industrial plantations are in Brazil; - in tropical Africa, the West African sub-region alone contains 56% of the fast growing hardwood plantations. For fast growing hardwood species, Nigeria and Angola contain 2/3 of the plantations between them. 96% of the industrial softwood plantations are found in East Africa, Kenya and Madagascar sharing half of them;
- the two sub-regions in tropical Asia where industrial plantations are most advanced are Southern Asia and insular Southeast Asia, which between them account for 85%. India has 85% of the fast growing hardwood plantations (intended for pulpwood), and Indonesia 7I% of all the industrial softwood plantations of the region.

2.5.3. Non-industrial plantations are not within the compass of this study.

They deserve mention however for their possible protective role, and as sources of wood for charcoal destined for industry: as an example, 73% of Brazilian eucalyptus plantations, that is to say I.5 million ha, are destined to supply charcoal to the country's steel industry

CHAPTER III

EVOLUTION OF THE RESOURCES UNTIL THE YEAR 2000 ACCORDING TO CURRENT TRENDS

3.1 Influences on the evolution. The evolution of the resources depends on a certain number of factors of various kinds, which should be examined in turn.

a- Since forest occupies large areas of ground it may be found that other forms of land use are given preference to it by neighbouring populations or by politicians and other decision-makers. Its very existence could be put in doubt.

b- On the other hand, the action of man, or even natural causes alone, may increase its size.

c- Since the forest is subject to the influence of its environment, including man, it may suffer damage, sometimes irreversibly, caused by that environment.

d- The influence of the environment can be beneficial though. It can improve the state of the forest and increase the value of the resource qualitatively and quantitatively.

e- Rational exploitation is not just one of the ways of mobilizing forest resources but it is man's most effective means of action upon the forest and upon the development of this resource. It is an integral part of forest management and conditions its regeneration and renewal.

3.1.1. Deforestation: This problem has rightly been worrying the international community for some years, Above all it concerns the tropical forests and in particular the closed forests. All research shows that the tropical forest is shrinking throughout the world. However, this worrying general situation conceals very great disparities, not only between regions and sub-regions, but inside the same country. In particular, deforestation for the purposes of agriculture, notably shifting agriculture, is a phenomenon of varying intensity. The pressure of farmers of forest lands depends on factors such as the growth of the rural population, the size and duration of cultivation of a plot of shifting agriculture, the topography of the coveted forest lands, even on local traditions. This pressure cannot be transmitted from one country to another or even within the same country, as the mobility of the migrant farmers is not great.

The essential thing is to appreciate the rate and the extent of the deforestation in the critical areas so as to prevent excesses, to counter the danger of irreversibility and to enable those responsible for the administration of the territory, in the countries concerned, to intervene in good time. The forestry authority must appreciate the loss compensating for the corresponding loss of the resources.

The deforestation of tropical forests was the subject of an in-depth analysis in the UNEP/FAO (2) project. Its results are briefly summarized below (see Table

No 7).

Closed hardwood forests were cleared and converted to other uses at an average annual rate of 5.9 million ha during the 76-80 period, which corresponds to a rate of 0.6% a year, broadly similar for the 3 regions.

The rate of reduction is much greater for the productive forests (0.67%) and much less for the unproductive forests (0.41%), because, in particular, a large part of the latter is either unsuited to agriculture or because occupation and utilization is forbidden by the authorities. It appears that the rate of clearing of unproductive forests is increasing more rapidly than that of productive forests. The undisturbed closed hardwood forests are proportionally much less cleared than the closed forests that have already been logged over, especially in Latin America and in Africa (from I to 12-13 in the report): the former are less accessible than the latter and clearing tends to follow closely on logging.

The annual rate of clearing for softwood forests is noticeably higher than that for hardwood forests (1.20% for productive forests, 0.72% for unproductive). It seems in any case that managed forests, whether they be managed for production or protection, are less affected by clearing. Around the average rates given above one finds notable variations, by sub-region and even more by country. The most extreme rates are found in Africa, going from 0.20% in the closed hardwood forests of the Congo-Cameroon massif to 6% for the closed productive hardwood forests of West Africa, already destined progressively to disappear. Everywhere it is the spontaneous practice of shifting agriculture which is the first cause of clearing, whether or not it follows logging. This traditional form of peasant activity can no longer be tolerated by the forest because of the continuous growth of rural populations, despite a marked exodus towards urban centres. Other factors - extensive pasturing, permanent agriculture, dams, infrastructure, urbanization - play a less significant role.

TABLE NO 7

AVERAGE ANNUAL DEFORESTATION DURING THE PERIOD 1976-1980
IN CLOSED TROPICAL FOREST FORMATIONS (‡)
(IN THOUSAND HECTARES)

SUB-REGION	PRODUCTIVE FORESTS			UNDPRODUCTIVE FORESTS	ALL
	UNDISTURBED	LOGGED OVER	ALL		
TROPICAL LATIN AMERICA					
CENTRAL AMERICA	310 (17)	299 (127)	609 (144)	303 (38)	912 (182)
CARIBBEAN AND CARICOM	3 (1)	13 (1)	16 (2)	8 (0)	24 (2)
TROPICAL SOUTH AMERICA	924 (84)	1500 (0)	2424 (84)	759 (44)	3183 (128)
TOTAL TROPICAL AMERICA	1237 (102)	1812 (128)	3049 (230)	1070 (82)	4119 (312)
TROPICAL AFRICA					
NORTHERN SAVANNAS	E	E	E	1	1
WEST AFRICA	20	671	691	33	724
CENTRAL AFRICA	151	177	328	4	332
EAST AFRICA AND MADAGASCAR	51 (2)	192 (4)	243 (6)	33 (2)	276 (8)
TROPICAL SOUTHERN AFRICA	0	0	0	0	0
TOTAL TROPICAL AFRICA	222 (2)	1040 (4)	1262 (6)	71 (2)	1333 (8)
TROPICAL ASIA					
SOUTHERN ASIA	63 (4)	171 (13)	234 (17)	39 (5)	273 (22)
CONTINENTAL SOUTHEAST ASIA	391 (8)	191 (3)	582 (11)	51 (1)	633 (12)
INSULAR SOUTHEAST ASIA	49 (0)	832 (1)	881 (1)	28 (E)	909 (1)
TOTAL TROPICAL ASIA	503 (12)	1194 (17)	1697 (29)	118 (6)	1815 (35)
GENERAL TOTAL	1962 (116)	4046 (149)	6008 (265)	1259 (90)	7567 (355)

(‡) BAMBOO FORESTS ARE INCLUDED IN THE ABOVE FIGURES, SOFTWOOD FORMATIONS ARE SHOWN IN PARENTHESES
Source: FAO Study No. 30

The same applies for deforestation through planned colonizations, which should not, in general, be harmful to the environment. Finally, one cannot consider the establishment of forest plantations after the elimination of the closed forest to be an unfavourable factor, if they have been sufficiently well planned, as they increase and improve the resource. Open forest formations also suffer damage through clearing. The average annual rate of regression is 0.52%, slightly more in America and Asia than in Africa. Agriculture, particularly shifting agriculture, is also the principal cause of clearing in open formations.

It should also be noted that a clearing, by destroying the mantle of the forest, eliminates not only the trees which made up the forest but entirely destroys the resource, including its indirect advantages. This should be taken into consideration in the cost-benefit forecast for such an operation, if it is deliberately planned.

3.I.2. Degradation

Unlike deforestation, whose effect on wooded formations is radical, swift and generally quantifiable, most forms of degradation lead to gradual changes, often less easy to observe and measure, even if their consequences on the forest, and the environment are, in the end, as damaging as sudden clearing. This is particularly the case with overgrazing, overexploitation for fuelwood and fires. This explains the lack of accurate statistical data on the loss ' resources for the great geographical and human blocks.

The causes of degradation are often multiple and combine their effects, sometimes increasing them: this is the case with repeated fires and overgrazing in the African savannas. The overexploitation of fuelwood, beyond the productive capacity of the wooded formations, and overgrazing frequently become more intensive around population centres, in particular around towns and along lines of communication; but the transformation of wood into charcoal, which is easy to transport, leads to degradation even in distant forests. Degradation through overexploitation is one of the causes of the lack of fuelwood, already acute in some countries and which will inevitably get worse in the next decades.

Overexploitation, overgrazing and forest fires are damaging in their direct effects,but perhaps even more so in their indirect effects: the denuding of fragile soils, especially tropical soils, leads to rain and wind erosion which can become irreversible and which results in deforestation and desertification.

There are numerous other causes of degradation in forests, distinct from logging and which will be dealt with separately. Their effects are not generally as serious globally as those of the factors mentioned above. But locally and even at country level they can represent a serious danger. They are:

- disease and insects;
- natural disasters, notably cyclones (Caribbean Southeast Asia)

- human actions, such as the consequences of war (e.g. defoliants).

3.1.3. Logging deserves to be examined separately because it can if it is badly practised or too harsh be damaging to the forest. On the other hand, since it is the principal, if not the only means of human intervention in the evolution of the forest, it is an indispensible tool of management; integrated into a well studied and coherent management plan it is a prime positive factor in this evolution.

In the very heterogeneous closed hardwood forests of America and tropical Africa felling is very selective but of a mining type; it involves taking out a few trees, the best shaped and the biggest of a few "commercializable" species (generally for foreign markets) without the exploiter or the owner of the forest worrying about replacing them in the short or even medium or long term. The extraction of mature trees, sometimes even old and beginning to deteriorate has a stimulating effect on the forest. The canopy closes up rapidly and the ecosystem has been changed but not upset; there is not real degradation. The composition of the new stand is different from the previous one.

Observations and experiments carried out in recent years show the disappearance of very sought after species, particularly if all age groups are felled and logging over the same area is repeated too soon. But there is nothing to prevent the new species which get established in their place from being commercializable as well. In sum, there may only be a loss of technological, and therefore financial, potential, which would force wood users to modify the list of species which they require. There is an indirect risk of degradation when felling causes damage to the remaining stands, of if the sitting and construction of logging roads is incorrect, or if nothing is done to prevent the spontaneous instalment of itinerant farmers or herdsmen in search of new lands.

The same does not apply to the logging of more homogeneous forests, either hardwood forests or almost pure forests or softwood forests or the dipterocarp forests of Southeast Asia where a large part of the species can be commercialized. In this it is essential to ensure the regeneration, natural or assisted, of the logged over stands, or their replacement immediately after felling.

Logging of closed tropical forests for fuelwood or other industrial roundwood, or to obtain other products such as gems, can have just as damaging effects as the exploitation of saw and veneer logs. In both cases the damage can affect not only the stands themselves but also the soil, the water table and the neighbouring lands, whether or not they are wooded.

3.1.5. Agrosyviculture

Agrosyviculture is another important factor in the management and evolution of forests resources, whose important should increase in coming years. Depending on how one considers it, it is a diminishing of wooded areas "stricto sensu" and a form of

of deforestation; but it is also a form of multiple use of forest lands, making it possible to derive a maximum of direct and indirect advantage, while maintaining a productive potential of wood outside the rules of forest management understood in its limited sense. Its economic advantages can be calculated, as well as its cost-benefit ratio; these can very widely depending on local physical and ecological conditions and the choice made between the different possible systems. But its social benefits are incalculable because it is a land use of benefit above all to the neighbouring populations, to whom it provides work, food and money. It is an effective way of attracting the understanding and cooperation of neighbourhood dwellers for forestry work. It is certainly destined to develop in the next decades because of the growth of rural populations and their needs, although its cost is a limiting factor.

3.I.6. The factors examined so far, except for the last one, correpond to a reduction in forest areas and their resources. Among the factors for expansion one should note reforestation, whether they are plantations outside the forest (the difficulty) then is to find suitable land which is not desired for agriculture) or within the natural forest after the clearing of the existing stands immediately after logging. As with agrosylviculture, the limiting factor is the cost of the operation, which can vary, according to a recent UNCTAD/FAO paper (4), from $780 US to $1700/ha. Such expense, if it can be recouped by rapid earnings (high productivity short cycle plantations), will find various sources of finance without great difficulty. The same does not hold true for production of saw and veneer logs over the medium and long term (medium term: 30 years, long term: 50 to 80 years), and where the productivity per hectare is distinctly smaller in volume.

3.I.7. An increase in productive areas-corresponding to an increase in mobilizable resources - can be obtained by the creation of infrastructures making production economically viable in forests previously classed as unexploitable because inaccessible. Such an operation is generally onerous, but can be combined with the administration of the agricultural land. It can be risky since it makes stands accessible to itinerant farmers and herdsmen which were previously out of their reach.

3.I.8. Finally we should point out that in the classical type of intensive management as practised in the developed world, exploitation is the consequence of management rules, the resource having been evaluated beforehand. In most of the systems of exploitation used in the developing world it is the users' demand which determines the mode of exploitation and therefore the value of the resource. The estimation of value is therefore liable to vary according to demand, even if physically it has not changed (the same applies to the value of land according to the use that is made of it).

In the same vein, variations in the intensity of harvesting (thanks to the

possibility of commercializing new species), or in the use made of forest products (more complete utilization of logs and trees, recovery of wastes, technological improvements in the manufacture of products derived from wood) modify the value attributed to the potential resource, and influence its management.

3.2. Current trends

We have just seen that the evolution of tropical forest resources is the result of a complex combination of various factors, varying from country to country and even within the same country. Only the intensively managed forests, where the different factors and their variation in time have been analysed and quantified, enable us to evaluate what their resources will be, within a given period and barring unforseen accidents, distinguishing the capital of growing stock from the annual increment. In an unmanaged forest one is reduced to measuring and recording typical results at regular intervals, then analysing the the variations in order to deduce the evolution of the resource. Predictions can only be the prolongation of curves showing trend, with a varying degree of probability depending on the accuracy of the data.

The rates of population growth in the developing countries remain high, even for agricultural populations despite the large exodus from the country-side.[4/] It will be people born between 1960 and 1980, during the boom years, who determine the pressure on forested lands in the tropics in the year 2,000. The rate of deforestation and degradation caused by man is therefore growing and will continue to do so in years to come. On the other hand, there are number of signs of an intensification of management in the tropical countries as a whole, particularly in Latin America - at least at the planning stage, implementation is still causing many difficulties-.

The creation of protective forest reserves, after growing steeply during the last decade, seems to be levelling off. The implementation of the rules of protection is often difficult, if not impossible.

With regard to exploitation, the situations are too diverse to allow for generalization. One can however mention an intensification of harvested per unit area of the closed hardwood tropical forests as the result of the concentration of secondary species.

Finally the rate of planting continues to grow generally, but the current tendency is to give priority to non-industrial plantations, the proportion of which is growing because of the scarcity of fuelwood which is becoming ever more severe.

4/ Only the caricom countries recorded a generally negative growth rate between 1975 and 1980 (-1.26%).

3.3. Prospects for the year 2000

It is always difficult, but often necessary, to predict what will be the probable medium and long term development of current trends. With regard to deforestation the quickest solution would be to assume a linear development until the year 2000 at a global level, removing from the area of forest formations in 1980 20 times the area cleared annually between 1981 and 1985, or 150 million ha of closed forest (12.5% of areas in 1980) and 76 million ha of open tree formations (10% of 1980 areas). This hypothesis involves the assumption that the slight increase in clearing in the closed forests of tropical America would be compensated for by the decrease following on a slight reduction of levelling off of the rate of clearing in the closed forests of tropical America as well, in which case the figure of 150 million ha of reduction of the closed forests until the year 2000, for all the 76 countries studied, could be a slight overestimation.

Assuming the levels of reduction and logging of the undisturbed closed forests continues at the same rate from now until the year 2000, at that date there would only be 540 million ha of undisturbed closed productive forest left (390 million in tropical America, 100 million in tropical Africa and 50 million in tropical Asia).

On the other hand everything leads one to believe that the rate of planting will continue to grow even faster than it did between 1976 and 1980 (920,000 ha a year) and at a faster rate than foreseen for 1981-85 (1,100,000 ha a year). However work on plantations is still far from compensating for the areas cleared and a fortiori from countering the cumulative effects of reduction and degradation of all tree formations. It is interesting to note however in this regard that it is in tropical Asia, where human pressure is greatest and the forest formations least deforested extensive that the average between planted and areas deforested annually is the highest (1 ha planted for 4.5 deforested).

As for production, a tentative prediction has been made by the FAO Forestry Department (unpublished). The results are given in Table No. 10.

Furthermore, FAO Forestry paper No. 29, prepared by the Working group on Industry constituted for the purpose, publishes projections for supply and demand for the major regions of the world in the years 1990 and 2000. It allows the establishment of a provisional balance based on 2 hypotheses for growth of GNP presented by FAO in the study "Agriculture, Towards 2000" which give two different figures for demand for industrial wood at the end of the century. The working group based its projections on a third hypothesis of its own.

For production it worked in the same way, adjusting down the predictions made by FAO on the basis of its own calculations.

The study's conclusions with regard to industrial wood (roundwood or

pulpwood) are not pessimistic for the end of the century, while other studies have shown that the fuelwood situation is more alarming. A balance should generally be achieved between supply and demand through changes in commercial trends and despite local and regional tensions.

World demand for sawn wood should go from 455 million m3 to 1980 to 570 million in 2000. For wood-based boards, the corresponding figures would be 109 million m3 and 169 million m3. For paper 180 million tonnes and 357 million tonnes. It is not easy to convert these figures into their equivalent volumes of roundwood, for that requires a hypothesis for conversion rates

(about 2 m3 of roundwood for I m3 of sawn wood,
I.6 m3 roundwood for I m3 of panels,
2.8 m3 of roundwood for I tonne of paper)

and on the percentage of residues from sawing and veneering recovered for board and pulp for paper.

In general, the demand for wood raw materials from the forest for industry should go from 1.470 to 2.086 milliards on m3 (excluding the volume of residues recovered).

In the fact of this demand, which could be satisfied by the whole of world production, the part supplied by developing countries would noticeably increase. However, their own consumption for their own industries would also increase significantly, so their export potential would change little, even tending to diminish.

The study emphasises that the pressure on softwood forest resources will be very great and that the forests will reach the physical limit of their productivity. On the other hand, the tropical hardwood forests will be capable of producing a much greater volume than required and possible difficulties will be economic and qualitative than quantitative.

TABLE NO 8

ESTIMATED VOLUME OF INDUSTRIAL WOOD HARVESTED FROM NATURAL FORESTS AND PLANTATIONS IN THE YEAR 200 (IN THOUSAND M3)

SUB-REGION	HARDWOODS				SOFTWOODS				GENERAL TOTAL
	NATURAL FORESTS	LOW PRODUCTIVITY PLANTATIONS	HIGH PRODUCTIVITY PLANTATIONS	TOTAL	NATURAL FORESTS	LOW PRODUCTIVITY PLANTATIONS	HIGH PRODUCTIVITY PLANTATIONS	TOTAL	
LATIN AMERICA									
CENTRAL AMERICA	5,60	0.09	0,32	6,0I	I3,8I	0,24	0.07	I4,I2	20,I3
CARIBBEAN AND CARICOM	2,I2	0,08	I,35	3,55	0,29	I,I3	0	I,42	4,97
TROPICAL SOUTH AMERICA	43,89	2,69	20,9I	67,49	8,6I	I,62	38,29	48,52	II6,0I
TEMPERATE SOUTH AMERICA	3,4I	3,56	6,40	I3,37	I,65	0,85	30,96	33,46	46,83
TOTAL	55,02	6,42	28,98	90,42	24,36	3,84	69,32	97,52	I87,94
AFRICA									
NORTHERN SAVANNAS	0.08	0	0,0I	0,09	0	0	0	0	0,09
WEST AFRICA	6,77	0,I3	I,87	8,77	0	0	0,89	0,89	9,66
CENTRAL AFRICA	I5,I3	0,33	3,58	I9,04	0	0,06	0,90	0,96	20,00
EAST AFRICA AND MADAGASCAR	I,32	0,42	0,70	2,44	0,33	2,55	2,95	5,83	8,27
DEVELOPING SOUTHERN AFRICA	0,06	0	0,78	0,84	0	I,26	0,66	I,92	2,76
TOTAL	23,36	0,88	6,94	3I,I8	0,33	3,87	5,40	9,60	40,78
ASIA									
SOUTHERN ASIA	24,70	0	0	24,70	5,70	0,68	I,46	7,84	32,54
CONTINENTAL SOUTHEAST ASIA	I9,22	0	0,87	20,09	0,50	0,56	0	I,06	2I,I5
TEMPERATE SHOUTHEAST ASIA(I)	I,37	0	5,22	6,59	I,23	6,60	0	7,83	I4,42
INSULAR SOUTHEAST ASIA	67,4I	0,57	6,56	74,54	0,34	0,22	4,73	5,29	79,83
TOTAL	II2,70	0,57	I2,65	I25,92	7,77	8,06	6,I9	22,02	I47,94
TOTAL DEVELOPING COUNTRIES:				247,52					376,66

(I) EXCLUDING CHINA, MONGOLIA AND DEMOCRATIC REPUBLIC OF KOREA

CHAPTER IV

LIMITATIONS AND CONSTRAINTS

4.1. Even if, in the space of about 20 years, there is little risk of a general deficit in wood resources for industry, this apparently reassuring prediction should not conceal the reasons for anxiety, if not alarm over the future maintenance of this resource, that is to say of the forest environment and its productive potential. It should not either make us forget the disparity of situations, still satisfactory in the sparsely populated areas, but already critical in the overpopulated areas with unfavourable ecological situations, of many tropical countries. Some forests are still virgin and little threatened, others are already destined to disappear.

However, if there has been no lack of awareness and of warnings as to the gravity of the situation and of the urgency of measures to redress it (such as the need to manage forest resources in a rational and coherent way), if effective actions have been taken and progress unquestionably made, it seems that the results are still not sufficient; powerful constraints and obstacles still exist. It is worth considering them briefly in turn.

4.2. The reasons for the destruction and degradation of tropical forests are complex, but the poverty of the neighbouring populations who depend largely on the forests for their subsistence seems generally to be the immediate cause of this development. The damage caused to society as a whole in this way, inevitable as long as these populations have no viable alternative solutions for their survival, is considerate.

While tropical forests play an important role in the protection of the soil, of water and of genetic resources, and supply essential forest products and services, principally wood, neighbouring populations gain no advantage and receive no incentive to participate in the conservation and upkeep of the forests. They are therefore indifferent and even hostile to the exploitation and development of forests as long as these actions are not undertaken for their immediate benefit.

Demographic expansion is general in the developing world; even in rural and forest zones it is not currently compensated for by the exodus towards urban centres. The result is a constantly increasing pressure from agriculture on available lands - or those so judged; all the greater since the errors and abuses in land use frequently result in the definitive ruining of abandoned lands. The idea of the spontaneous rehabilitation of lands through repose and of the indefinite renewal of natural resources, previously traditionally taken for granted in most systems of agricultural or forest land use by the populations themselves when they were not too large, can have no place when the available

space is limited and has to be shared between more and more claimants.

Populations accustomed to the multiple use of the forest in a traditional manner, which is flexible and causes little damage to the forest, cannot understand that the increase in their number and needs makes their pressure on the forest excessive and intolerable, and they refuse to accept a change in their behaviour and their way of life which can be overwhelming. All the more so since their rights to compensation, when they have to accept a limitation to their benefits or even loss as a result of an operation decided upon without consulting them, are not always sufficiently recognised.

As a result the preservation of all costs of the tropical forests in their entirely is not possible. The decision-makers in the field of land management, who are responsible for the fate of the populations and aware of their immediate needs, though sometimes insufficiently informed on the consequences of their decisions on the forests and their environment, tend to favour, in the many possible uses of the forest, those which are directly and immediately profitable rather than the functions which are more difficultly quantifiable, although equally necessary, such as the protection of the environment, and of delayed profitability such as sustained forestry production.

However, the concern to protect certain particularly critical zones and maintain their wood cover, zones threatened through overpopulation or by bad management, should prevail: such zones for example as mountain watersheds with under utilized soil, or lands used beyond their capacity, or even overexploited forests. But the identification and the evaluation of the problems and of the means of resolving them, and the choice of priorities among the actions to be undertaken present complex questions which are sometimes beyond the means of the responsible authorities.

With regard to forest production, selective logging of a mining type, either directly by the public or private owner, or indirectly through a concessionaire, is almost always the rule. Management, within the framework of a management plan, should show more concern for the future and ensure regeneration, but it would be less immediately profitable because it would require an outlay of funds and the owner would not be able effectively to control it. Often too, the price for wood on international markets, once the cost of production and transport, taxes, and the remuneration of the middlemen have been deducted, leaves too little profit margin on the growing stock to permit further deductions to pay for the expenses of sylviculture and renewal.

Few developing countries have had the opportunity to formulate a forestry policy fixing long term objectives, defining the means to attain them and serving as a basis for forestry management plans. Forestry institutions are not always orientated towards management of resources and often lack the necessary weight

in decision-making at a national level. Furthermore, their activity is not sufficiently well coordinated with that of institutions responsible for agriculture, for infrastructures and for services. Finally, legislation and rules are often unsuited to the needs of forestry.

4.3. Technical limitations. Paralysing technical limitations are added to these social and institutional constraints:

4.3.I. Technical knowledge has greatly increased in the course of the last decades, particularly with regard to forest inventories. However they are still very inadequate in almost all fields, especially sylviculture and ecology. The reciprocal influences of the different constituents of ecosystems, their reaction to external influences either natural or humna; the potential for natural or assisted regeneration; annual increments after exploitation, for each species and for the stands as a whole; great progress is still possible in all these subjects.

The fragility of the environments, the risk that degradations, however intense may become irreversible, make the planning of a rational sylviculture difficult.

4.3.2. Even when the data, although imcomplete, is already usable, the developing countries lack the qualified and able personnel to put into effect decisions that may be taken with regard to forestry, despite the efforts and the progress made:

- to prepare rules to implement the policy,
- to draw up and implement management plans,
- to plan for production,
- to contract out and monitor work (assuming that a permanent specialized labour force exists, which is rarely the case),
- to oversee the application of the rules (particularly with regard to unauthorized clearings),
- to spread information among the populations concerned on the objectives to be attained and the methods to be employed.

Besides, part of the resource is at least temporarily rendered useless by the lack of infrastructures allowing access to physically productive forests.

Lastly, a further reduction must be made in the volume theoretically available because of imperfect or unsuitable equipment for logging and for primary transformation, when this is carried out on the spot. Unrecovered losses is felling and sawing affect in general at least 20% of the gross volume logged, often because of poor use of logs at the first cutting stage; and the residues cannot be used.

4.4. Economic and commercial limitations

In an open market like the world wood market price variations are sudden

and large; demand is likely to fluctuate considerably both for quantity and quality and it is impossible to impose goods on the consumer that are not desired; long term projections and planning for the logging of industrial wood and the establishment, beforehand, of management plans are well high impossible, especially since the viable local demand is still generally weak in the developing countries and the absence of local industries makes it impossible to absorb the second choice wood and the secondary species.

Equally, for wood exported over a great distance, the cost of transport and of maintenance takes a heavy toll of profits, leaving only a small value, and sometimes none, for the growing stock.

Finally, selective logging is harmful to the good condition of the forest, leaving the ill-formed or old trees standing as unprofitable; this selection in reverse causes a loss of quality, and therefore of value in the resource.

4.5. Financial limitations

The developing countries have an acute lack of funds available for inventories, for the necessary studies, for payment of staff, for work on infrastructure and for running expenses, whether for the regeneration of natural forests or for plantations. And obtaining long term credits (30 years or more) on the financial markets is very difficult. For forest resource management this is one of the most difficult limitations to overcome.

CHAPTER V

WAYS OF IMPROVING THE SITUATION

5.1. In the temperate developing countries, as in the developed countries, the problems of the forest are not as complex as those of the tropical forests; forestry and agriculture overlap less, the rate of deforestation is less rapid and the ratio of deforested areas to planted areas is not too unfavourable. Ecological and sylvicultural knowledge is sufficiently advanced for the management of forest resources to be undertaken on a solid basis and so that the forest can effectively be renewed. As soon as the governments responsible show the will, it is possible for them, with the aid of appropriate international cooperation, and bearing in mind that forest cycles are inevitably slow, to proceed with the planning and execution of an adequate forest policy.

As a result, this chapter deals only with countries possessing tropical forests. It is based on the work of the second meeting of experts on tropical forests (Rome - January 1982) sponsored by UNEP, FAO and UNESCO, and more particularly on the paper FO: MISC/81/25 prepared on that occasion (I).

5.2. Responsibility for tropical forests, as for other natural resources, falls exclusively under the sovereignty of the states where the forests are found; and these states have the uncontestable right to use them for the development and the well-being of the populations under their authority. One starts from the assumption that each government is prepared to exercise a sufficiently strong political will to conserve and manage tropical forests and a renewable natural resource, in the framework of a national policy for the classification and utilization of lands; this general framework should in fact be adopted, bearing in mind the interdependence and complementarity of agriculture and forestry rather than considering them to be two conflicting forms of land use.

The management of tropical forest resources must be integrated into the framework of rural development and be harmonized with the nation's socio-economic development policy.

5.3. The following objectives should be given particular attention:

a- improving the standard of living of the poor populations living closest to the forest as soon as possible, by involving them with productive activity, including industrial acitivity based on the tropical forest resources, even going as far as giving them individual or collective rights of ownership;

b- preserving the integrity and the advantages of the tropical forest environment, particularly in mountain watersheds;

c- increasing and maintaining in a lasting way the social and economic advantages of the tropical forests on behalf of the national community by the integrated management of resources;

d- reducing as rapidly as possible the activities leading to deforestation and to the degradation of the tropical forests.

5.4. Putting such principles into practice requires;

-the existence and application of suitable laws which should be a dynamic and positive force and not just a restrictive and coercive influence;

- the existence of an adequate insitutional structure in both public and private sectors. For the former an appropriate national forestry administration is above all needed, to be responsible for the management of forest resources and working in close coordination with related institutions responsible for rural affairs;

- forestry teaching and the training of a sufficient number of technicians at all levels, in particular forestry engineers with minds open to related disciplines and capable of taking on the planning of land use and the integrated management of the forests for which they are responsible;

- the training of forest officers in vulgarization and information work aimed at the whole of the population, particularly the politicians, government bodies, general teaching staff and the inhabitants of the regions most concerned by forest management;

- the existence of forestry institutions on the spot capable of controlling the evolution of forest resources, of administrating them and making the best use of them, and with sufficient powers for swift action and the rapid fulfilment of their task;

- the training of forest workers to improve their efficiency, productivity and safety; these forest workers must form the nucleus of the teams responsible for carrying out work on the spot;

- the organization of forestry research adapted to the needs, that is to say involving two levels, that of urgent research to try and find acceptable short term pragmatic responses to immediate problems, and that of a more elaborate research including research into ecology and other related disciplines. The quantity of information already available on tropical forests makes it possible, from now, to introduce prudent forms of management, so long as one preserves the possibility of choice and flexibility in the methods used;

- the monitoring and periodic updating of existing forest inventories.

5.5 Forest resources management should determine in advance the predominant role to be attributed to each forest entity depending on the ecological and social-economic conditions and which can be altered to keep pace with changing conditions, whether it be:

- protection of the resource itself, including genetic resources (parks and reserves) and the fauna;

- protection of the environment (watersheds, eroded zones);

- production of industrial wood;

- a social role (the provision of fuelwood or other industrial roundwood, controlled grazing, food).

5.6. In forests producing industrial wood the activities of logging and transportation, which are instruments for the management of the resource, should not interfere with natural regeneration or damage the protection of the forest. For this purpose it is essential to pay special attention to the following points:

- design and use of equipment that does not cause too much damage to the soil and the ecosystem;

- planning and building forest roads in conformity with conservation criteria;

- measures to check the expansion of spontaneous agriculture following the opening of roads;

- reduction of waste in logging.

5.7. Forest resources can serve as a powerful force for economic development in the developing countries, provided that forest industries, which are an integral part of management, add to the value of the raw material and provide jobs for the population, so creating a link between the population and the forest. But industrialization of the forest requires:

- sufficient knowledge of the rural and national development that these industries represent;

- the possibility of a regular supply for the industries, therefore the management of the forests that are already accessible and, if need be, the possibility of reaching new productive areas;

- the presence of qualified personnel at all levels, including business management and direction;

- technology suitated to local conditions, particularly with regards to conservation;

- the possibility of sufficient local outlets for secondary species and residues, allowing a lowering of prices;

- adequate infrastructure and services.

Besides, satisfactory commercialization is the dynamic behind all wood enterprises, by permitting a more complete use of forest products and by getting maximum value from these products according to their respective uses. It aids the management of forest resources by making the necessary work on upkeep and renewal economically possible.

5.8. What has been said of the natural forests in the preceding paragraphs applies -mutatis mutandis-to the zones destined for artificial forest plantations. Plantations, because of their high productivity, make it possible to lighten the pressures on the natural forests and to respond better to the needs of the populations.

The planning and management of artificial forests should take into account

the foreseeable demand for products - world and national - as well as the social demands of the nearest populations. These should have their share in the ownership of the artificial forests and in the rights and duties that stem from it, and should participate in the development of the industries based on the plantation programme.

5.9. If the decision to exploit the natural resources of a country belongs exclusively to its government, it is possible to draw up bilateral or multilateral accords to obtain technical, scientific and financial assistance for its own efforts in this field, efforts which might otherwise be inadequate for the needs.

The international organizations concerned are devoting more and more attention to the tropical forests, increasing their efforts to learn more about them and about the techniques necessary for integrating these resources in rural development and economic development in general. International banks are tending more and more to finance a wider range of forest projects in the tropics. Bilateral and multilateral aid programmes of the developed countries include a growing number of activities linked to tropical forests. The results achieved so far have been significant, but it will be necessary to both coordinate and considerably to increase the funds available.

With regard to the production of industrial wood, international cooperation in its various forms could be used to:

- formulate and carry out management plans in the natural forests (including research and the training of staff):
- plan and implement plantation programmes;
- organise the productive forestry sector (filiere bois) including pre-investment studies, training of staff and financing).

This last form of cooperation could go as far as buying shares in local industries ("joint ventures") and the signing of multi-year wood buying accords after on the spot processing.

CONCLUSION

PROPOSALS FOR DISCUSSION

- The degree of accuracy of the estimates up to the year 2000 and the diversity of the situations within each of the developing countries render any assessment by region of the possibilities for improving the present situation with regard to the management of forest resources illusory. Data still has to be gathered and studies still have to be made. The meeting of experts on tropical forests, held in Rome in January 1982 (I) examined a series of actions to be taken, at national level or in the framework of international co-operation, so as to overcome the obstacles which get in the way of a rational management of forest resources in the tropics.

- Many developing countries are not tropical, and the problems which they face in the management of their forest resources, though technically more simple, are no less acute. These countries, either as producers or as importers - sometimes as both-, will penetrate the world wood market to an ever greater extent. They should not then be excluded from the network of information, of research and of international assistance which already exists for tropical countries.

- The need to transport their forest products over a great distance, often across the sea, to the main consuming countries reduces the financial value of the resource, the value which would otherwise allow expenditure on a rational management of the forests, ensuring the development and indefinite renewal of the resource. How can the developing countries finance their management ? If the financing is considered as a medium or long term investment, depending on the subsequent harvest, these countries will tend to favour short cycle species, which are of less interest to the international market.

- Socio-economic considerations also encourage them to give priority to fast growing, high productivity plantations, as well as to non-industrial plantations rather than industrial plantations. The developing world's contribution to the world supply of saw and veneer logs, which has been predicted as growing, could be compromised, just as the predicted equilibrium could be compromised if help is not supplied, in a form that has yet to be determined, by the community of consumers, developed countries and enterprises.

- The export of new species cannot be developed unless the producing countries create commercialization services and market studies in the main consuming countries. The latter could assist them in this field, in a form to be decided on.

- The establishment of processing plants for forest products in developing countries would be of advantage both to those countries and to the importing countries. The plants, suited to local capacity and needs, should provide the opportunity for a permanent association between the producers and consumers, providing the former with investment facilities and guaranteed outlets and the latter with guaranteed supply.

APPENDIX

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