Study of

WORLD WOOD FIBRE SUPPLIES AND CANADIAN PULP AND PAPER PROSPECTS TO 1990

Industry, Trade and Commerce
Industrie et Commerce

WORLD WOOD FIBRE SUPPLIES AND CANADIAN PULP AND PAPER PROSPECTS TO 1990

Prepared for

The Department of Industry,
Trade and Commerce, Ottawa

Paul H. Jones
Vancouver, British Columbia

1975

WORLD WOOD FIBRE SUPPLIES AND CANADIAN PULP AND PAPER PROSPECTS TO 1990

Table of Contents

Appendices con't...

CHARTS

CONVERSION FACTORS

Canadian Equivalents of Metric Quantities Used in This Report

1 metric ton - 1.102 short tons of 2000 lbs.

1 m^3 (cubic metre) - 35.315 cubic feet

1 m^3 (cubic metre) - 0.353 cunit (of 100 ft^3 of solid wood)

1 m^3 (cubic metre) - 0.276 cord (of 128 stacked ft^3)

1 m^3 (cubic metre) - 1.13 1,000 square feet 3/8" plywood

1 metric ton - 3.57 1,000 square feet 1/8" compressed fibreboard

1 metric ton - 3.43 1,000 square feet ½" non-compressed fibreboard

1 metric ton - 1.04 1,000 square feet 5/8" particleboard

FOREWORD

This report "World Wood Fibre Supplies and Canadian Pulp and Paper Prospects to 1990" was prepared for the Department of Industry, Trade and Commerce by Mr. Paul H. Jones. It was developed originally as a working paper for consideration by the Government of Canada and the provincial governments as part of a review of the Canadian pulp and paper industry. As well as a number of estimates prepared by the author, the findings are based on several reports made by governments and national and international agencies. This present report attempts to develop an outlook for the Canadian position in world forest products markets in the years through 1990.

The preparation of any report and particularly one as far-ranging as this one, imposes upon its author the need both to accept a great deal of previously prepared work in the area and also to make or accept a number of assumptions concerning the social, commercial and technical background. For these reasons, the attention of the reader is drawn to the list of caveats found on page 130, when considering the views expressed in this report.

Many of these caveats themselves are sufficiently large and imponderable as to suggest extensive separate study in their own right. This course of action was not open to the author of this report, who naturally had to overcome the problem of reducing the scope of his study to a manageable size. This report has itself received extensive study by officials of the federal and provincial governments. It was felt generally that the study should receive wider distribution than at the official level and, while no official position has been taken on the validity of the report's projections, the study should add to the body of knowledge of the forest products sector.

SUMMARY OF MAJOR FINDINGS

World Forest Potential

Existing FAO information on world forest growth and wood removals appears to overstate growth of wood suitable for industry and understate the level of present removals, and especially that used for fuel. This report suggests that industrial wood removals could be increased by 65 percent from 1,275 to 2,100 million cubic metres, while the prospects for increasing fuelwood output, above present use of 1,100 million cubic metres are not good. Canada's forests represent only 8 percent of world forest increment. U.S. rates of growth are two and a half times higher than the Canadian rate. Only a marginal increase in overall world fibre output could be expected from plantations of fast growing species in tropical areas between 1975 and 1990.

World Wood Fibre Demands

Present measures to conserve fossil fuels could lead to increasing pressures on wood fibre for paper and wood products between 1975 and 1990, especially for packaging. World demands for industrial roundwood are expected to grow by 900 million cubic metres in the 1970-1990 period, with 540 million m^3 for pulp and paper and 360 million for wood products. In the same period, fuelwood demands could also increase by 900 million cubic metres.

Thus, the world forest potential could have been reached for industrial wood and greatly exceeded for fuelwood. By 1990 wood fibre requirements of Canadian industry could exceed the stated annual growth rate of Canadian forests, as a result of rising world demands for wood and paper products and diminishing wood supplies in other countries.

World Pulp and Paper Prospects

Between 1975 and 1990 world consumption of pulp, paper and paperboard is expected to double from 160 million metric tons to 335 million for paper and paperboard and from 134 to 274 millions tons of pulp. Wood fibre requirements for pulp and paper will grow to 1,029 million cubic metres of which 180 million or 17 percent will be used in the form of wood residues deriving from the wood products industries. In 1990 the world's paper economy will continue to be dominated by and concentrated in the developed regions.

North America will be the largest net exporting region in 1990 and Western Europe will remain the largest net importing region. The USSR is expected to become a major net exporter of pulp and paper after 1985, and Latin America will replace Japan as a net exporter by that date.

Canadian Outlook

The overall outlook to 1990 is favourable for Canada to increase the size of its pulp and paper sector in order to fulfill substantial export demands, especially in the U.S., Western Europe, and Japan.

The Western European market appears particularly attractive for Canada in respect of the rate of growth forseen in import requirements. While the U.S., Western Europe, and Japan will likely account for some 85 percent of Canadian exports of pulp and paper in 1990, the growing requirements of China suggest exports to that market could also be significant. Expansion beyond 1990, however, would appear to be severely limited, with wood supplies acting as the major constraint. Between 1970 and 1990 exports of pulp could quadruple against a doubling in exports of paper and paperboard. This situation would conflict with Canadian resource upgrading prospects and run contrary to the trend in the structure of exports from Scandinavia to other Western European countries which is dominated by paper and paperboard rather than pulp.

WORLD WOOD FIBRE SUPPLIES AND CANADIAN PULP AND PAPER PROSPECTS TO 1990

0.1 Study Objectives

Examine Canada's pulp and paper prospects to 1990 following a review of world demands for paper and paperboard and world forest potential and arrive at estimates of Canada's probable share of world markets for the 1974 - 1990 period. Identify any caveats encountered during the study which might affect the estimates made.

0.2 Terms of Reference

1. Arrive at best estimates to 1990 for the world forest inventory, roundwood removals and annual allowable cut by major regions for softwoods and hardwoods, following consideration of forestry practices in the major producing regions. Although the study is oriented towards pulp and paper, supply estimates should also take into account the wood fibre requirements of wood products industries at the regional level.

2. Estimate paper and paperboard consumption by grade to 1990 and for intermediate five year periods (i.e., 1975, 1980, 1985) by taking into account demand projections made by the Canadian Working Party and estimates made by other agencies, notably the Food and Agriculture Organization of the U.N.

3. Estimate regional pulp and paper production and capacity requirements to 1990 based on the consumption estimates made above.

4. Estimate probable regional net trade balances and trade patterns for pulp and the major grades of paper and paperboard to 1990.

5. Based on the analyses made in prior sub-sections, estimate the probable Canadian share of world markets to 1990.

6. Prepare a final report setting out the findings of the study.

INTRODUCTION

1.0 General

To cover all aspects of a study with the huge scope implied in the "Study Objectives" could easily have required up to three years to complete. One of the underlying conditions for the study, however, was that it be completed quickly using the best available projections of paper and paperboard consumption, most of which covered the period to 1985, and other readily available economic data bearing on the availability of world forest resources. This report looks at world demands for paper and wood products and tries to assess the impact of these demands on Canada's forest industries and forest resources. The report presents essentially a single result for a given set of assumptions. Naturally, changes in the assumptions would change the result.

The imposition of Arab oil embargoes shortly after the study commenced cast a shadow of uncertainty over the validity of earlier forecasts and the assumptions they were based upon. Was it realistic to discount the effects of the energy crisis, and could one realistically build upon assumptions which foresaw unaltered world trading patterns and an unchanged monetary system? The substantial increases in world fuel prices announced in early 1974 suggested that some changes might be imminent.

A new appraisal of U.S. paper and paperboard requirements and forecasts of industrial roundwood output was released during the course of this investigation, thus strengthening the body of information available to the analyst.

The analysis was made in Ottawa following consultations with FAO officials in Rome and OECD staff in Paris. The author wishes to acknowledge the helpful assistance received from members of the FAO Forestry and Forest Products Division in Rome and especially from Bjorge Steenberg, Jack Westoby, Peter Vakomies and Stan Pringle. Finally, the author offers a special note of appreciation to the Canadian Government's Department of Industry, Trade and Commerce for proposing the study and supporting the work accomplished.

The author of course accepts full responsibility for any errors which may have been made.

1.1 Prior Investigations

Several recent investigations by various agencies and individuals have a close bearing on the topics covered by this study. The present study could not have been carried out quickly if this important body of information, much of it involving in-depth studies, had not been available.

A number of published and unpublished studies of the Food and Agriculture Organization of the United Nations, notably those prepared by the FAO Secretariat for the FAO Advisory Committee on Pulp and Paper, served as the foundation for the present analysis. Chief among these studies were:

1. Document No. 4 "Outlook for Pulp and Paper Consumption, Production and Trade to 1985" (FO:PAP/72/4) of April 14, 1972;
2. Annex 3 of FO:PAP/72 of October 1972 "The Outlook for Pulpwood Demand and Supply to 1985";

3. FO:PAP/73/4 "A Preliminary Appraisal of the World's Temperate Hardwoods and the Pulpwood Potential" of May 1973.

For a U.S. perspective, the recently published U.S. Forest Service Report No. 20 was useful, especially in its treatment of paper and paperboard consumption and forest resource potential. With regard to future world pulp, paper and paperboard capacity, the series prepared by FAO and OECD were found invaluable. In respect of world pulp, paper and paperboard consumption FAO data were well supplemented by new projections to 1985 by the Interdepartmental Working Party of the Canadian Government. The recent study of the Canadian forest potential by F.L.C. Reed and Associates provided useful background material for appraising the Canadian resource potential in a world perspective.

Besides the above noted studies, the recent work of Madas, Vorobiov, Zivnuska, some of it presented at the 1972 Seventh World Forestry Congress in Argentina, was also useful in presenting an economic setting for future world wood supplies.

1.2. Consultations

The views of FAO and OECD officials were sought early in the study following a preliminary investigation of reference material and a preliminary analysis of world trends in paper and paperboard consumption. The discussions involved an appraisal of FAO's recent methods of preparing forecasts of paper and paperboard consumption and new approaches under consideration. In addition, other matters of a wider nature were covered including international financing of pulp and paper mills, the probable future of multi-national companies in overseas development, trends in world paper and paperboard trade, and probable developments in plantations of fast

growing species. The possible impact on world paper and paperboard development arising from fuel shortages was also touched upon. The question of wood fibre availabilities was also covered in some depth, including the validity of FAO's World Forest Inventory data.

Some of the specific questions discussed were as follows:

1. To what extent could Japan and Western Europe be expected to develop their own resources or alternatively import roundwood, or wood residues, pulp, or paper and paperboard to meet their growing requirements?

2. To what extent would the world be dependent upon Canada as a prime supplier of paper and paperboard in the face of a growing trend towards the use of short fibred woods?

3. What would be the relative competitive strength of Canada and the USSR in supplying world paper and paperboard markets?

4. Could plantations of fast growing species, notably hardwoods,in other parts of the world pose a threat to the future of Canada's pulp and paper industry?

1.3 Study Assumptions

Even though events today may suggest that changes in world trading patterns are imminent and that a new monetary system may emerge, this study has adopted the assumptions underlying most long term forecasts, including those of the FAO and the Canadian Working Party, of paper and paperboard consumption, that there will be no major wars, that world trading patterns will not change significantly; and that the monetary system will continue to function more or less as it has in the past. Study caveats, which include assumptions as well as other factors having a bearing on the study's findings, are listed in Appendix VII.

In addition to these overriding assumptions, the study expects:

1. That wood based paper and paperboard will continue to dominate the world paper scene even to the extent of some recovery of a lost market from synthetic papers between 1975 and 1990.

2. That wood presently classed as fuelwood will not be a significant source of wood fibre for the pulp and paper sector over the same period.

3. That there may be some changes in trading patterns of pulp and paper products prior to 1990.

1.4. Notes on Methodology

A simple sequential approach to estimating future paper and paperboard consumption, production and wood requirements, similar to that used by FAO, was employed in the present study. In the time available, it was not possible to make any independent time series analyses although all available projections were plotted, weighted, compared and the most probable extended, harmonized and equalized. The method chosen was subjective and relied upon the logic of starting with larger aggregates of total paper and paperboard consumption, and moving sequentially to production of total paper and paperboard, then total pulp consumption in the paper and paperboard production, then pulp production and deriving from these and the relationships worked out by FAO, the capacity requirements by grade and region for both pulp and paper. Wood requirements were, of course, derived from the pulp production estimates, again according to the regional breakdown of paper grade pulps and the wood-use coefficients used by FAO for each grade of pulp.

At the outset it was considered appropriate to adopt a set of guidelines. Among these were the acceptance of the U.S. Forest Service estimates for 1990 of the U.S. total paper and paperboard consumption, the

acceptance of the Canadian Working Party estimates of total paper and paperboard consumption to 1985 for Western Europe and Canada, the acceptance of FAO estimates to 1985 for all other countries except Japan, for which a revised estimate was made to account for the probable use of wood-based rather than synthetic papers. The estimates of the so called "production constrained outlook for consumption of paper and paperboard" of FAO and the CWP were favoured over other estimates.

In extending FAO and CWP consumption estimates to 1990, most of them from 1985, consideration was given to the constraints which wood supplies might exert on the development of new pulp and paper capacity. Other factors taken into account were those highlighted in the conclusions to the FAO Pulp and Paper Advisory Committee's reports of October 1972- Annex 3 FO:PAP/72 and Document No. 4 FO:PAP/72/4. In brief, these conclusions were that there would be an intensification of the already severe wood deficit in Japan and an increasing reliance by Western Europe on imports in one form or another. That while the USSR forest resources are substantial, their development could not be anything but very slow. That the U.S. would face substantial pressure on its raw material supplies by the end of the century. That while plantations of fast growing species might be the ultimate answer to increasing pulpwood supplies, especially in tropical areas, in only a few locations could plantations add significantly to supplies by 1985.

2.0 WORLD FOREST INVENTORY

The FAO World Forest Inventory 1963, published in 1966, is the most comprehensive statement of world forest resources available. Although more recent forest inventory information has been collected by FAO chiefly by questionnaire from most countries since 1966, these data have not been assembled and published in the same form. Recent estimates have, however, been made by major world regions of wood availabilities for pulping which take into account probable demands for pulpwood and wood products to the year 1985, (for the FAO Advisory Committee on Pulp and Paper). One of these documents (Ref. 28) of 1971 commented on FAO's probable future role in resource appraisal: "The World Forest Inventory is to be reoriented with the emphasis on the developing regions."

The subject of a truly World Forest Inventory based on a world inventory design, and drawing on satellite coverage, was seen by FAO as a "potential project for the more distant future". Concluding the statement on resource appraisal FAO noted that financial resources are, however, very limited and it is clear that progress will be very slow unless there is the possibility of maintaining and expanding outside assistance on this project.

The situation at time of writing is that little, if any, progress has been made towards improving the information base relating to world forest resources in terms of regional comparability of standing volumes,

growth rates or, more simply, the economics of the supply situation as it affects individual regions or countries. FAO, as the U.N. agency responsible for the collection and dissemination of such information, is of course only too aware of the limitations of much of these World Forest Inventory data. That agency has been unable to monitor any real change in the resource situation over time. It has, in presenting recent forest resource data to the FAO Advisory Committee on Pulp and Paper, stressed the weakness of the information and has had to make some arbitrary assumptions about the resource potential. One of these assumptions has been a volumetric reduction of ten percent for bark for forest increment in an attempt to present figures which compare with "removal" values which are also recorded without bark.

This is not meant as a criticism of the work of FAO in this complex area so importantto future world forest industry development, and even more so to the capital intensive pulp and paper sector. But it remains, nevertheless, that there is presently no statement of the World Forest Inventory in terms of the strictly merchantable volumes that can be harvested annually from it and the costs of so doing. To obtain this information, and information which is uniform for each country would require the kind of in-depth appraisal of the resource potential proposed earlier by FAO. Yet the appraisal has hardly begun and would require, at the rate accomplished so far, more than ten years to complete. Whether the rate of increase in world demands for roundwood will allow for such a delay will be discussed later in Section 3.

During the 1960's considerable forest inventory work was carried out, especially in developing countries. Unfortunately, much of this work could not be related directly to the World Forest Inventory since it was largely undertaken by, or on behalf of, large forest industry companies and was concentrated in relatively small areas in only a few regions. Nevertheless, FAO assisted with inventories in 40 countries. Also, some developed countries, through bilaterial arrangements, provided assistance in this field. The outlook is for a continuation of these trends throughout the 1970's.

2.1 World Forest Inventory by Region

Tables 1 and 2 provide the latest available FAO information, with the limitations noted above, of World Forest Inventory and Forest Increment by region for coniferous, temperate hardwoods, and tropical hardwoods in metric units, with bark. Of major significance is the fact that coniferous resources, comprising a little less than one third of the total growing stock, account for more than half the apparent annual growth of world forest resources. Also of note is the fact that temperate hardwoods, of increasing interest to pulping interests, and representing only 9 percent of growing stock, account for 26 percent of world forest growth. In contrast, tropical hardwoods, comprising 56 percent of growing stock, chiefly in Latin America, only account for 20 percent of world forest increment.

In specific regions, it is of interest that the coniferous reserves of the USSR are nearly twice as large as those of North America and Western Europe combined, while for temperate hardwoods the resources are about equal.

Table 3 provides a U.S./Canada breakdown of North American rates of forest growth as derived from the new U.S. Forest Resource Report No. 20 (Ref. No. 23) and the recent F.L.C. Reed and Associates' study for Canada, (Ref. No. 6). From this table it will be seen that forest increment for softwoods in the U.S. South alone exceeds the growth in all Canada; that growth of temperate hardwoods in the U.S. is seven times that in Canada; and that total wood fibre growth in the U.S. is nearly two and a half times the rate of growth in Canada.

FORESTRY SITUATION IN EUROPE

1965

Million Cubic Metres

(Excluding Bark)

	Growing Stock	Annual Growth[1]
Northern Europe	3,687	129.8
EEC	2,288	92.8
Central Europe	1,798	40.5
Southern Europe	1,165	31.7
Eastern Europe	3,220	83.6
Total Europe	12,078	374.4

1. Vegetative growth.

Source: FAO. ETTS II (Ref. 39)

In Europe, as a whole there was a general increase of 6 percent in growing stock and 12 percent in annual growth between 1950 and 1965 which may be attributed in part to an increase in the rate of establishment of forest plantations and also to better statistical coverage.

Temperate hardwoods are being given increasing attention as a source of wood fibre for pulping because technical developments in pulp and paper manufacture have made their use possible and also because of their relatively low price compared with coniferous species.

The huge tropical hardwood forests of South America, West Africa and South East Asia are generally comprised of a myriad of different species, even on small areas, with different physical and mechanical properties. The forests are, by and large, remote from transportation networks and centres of population. Exceptions are those selected species which are readily marketable in Europe, North America and Japan for veneer, plywood and sawnwood. To date their use for pulping has been negligible.

Table 1

WORLD FOREST INVENTORY BY REGION

Growing Stock (with bark)

1000 Million Cubic Metres

1970

Region	Total Growing Stock	Conifers	Temperate Hardwoods	Tropical Hardwoods
Western Europe	9.0	6.6	2.4	-
North America	36.1	26.6	9.5	-
Japan	1.9	1.0	0.9	-
Oceania	1.2	0.1	1.0	0.1
USSR	73.2	61.2	12.0	-
Eastern Europe	3.5	1.4	2.1	-
Latin America	124.0	1.0	-	123.0
Asia & Far East	32.6	2.6	-	30.0
Africa & Middle East	22.7	0.2	0.1	22.4
China	11.4	11.4	-	-
World Totals	315.6	112.1	28.0	175.5

Source: FAO. This table is based chiefly on FO:PAP/72/Report October 1972 and FO:PAP/73/4 May 1973 in addition to the 1963 World Forest Inventory. North American data is consistent with "Canadian Reserve Timber Supply" of March 1973 by FLC Reed and Associates and the US Forest Service "The Outlook for Timber in the United States" of October 1973.

Table 2

WORLD FOREST INCREMENT

BY REGION

1970

Million Cubic Metres
(with bark)

Region	Total Annual Wood Increment	Conifers	Temperate Hardwoods	Tropical Hardwoods
Western Europe	312	212	100	
North America	794	529	265[1]	-
Japan	77	35	42	-
Oceania	29	8	16	-
USSR	844	577	267	5
Eastern Europe	90	36	54	-
Latin America	400	10[2]	-	390
Asia & Far East	155	52[2]	-	103
Africa & Middle East	110	7	7	96
China	80	80[2]	-	-
World Totals	2,891	1,546	751	594

NOTE: [1] Ref. No. 34

Table 3 of FO:PAP/73/4 gives 491 million cubic metres with 226 for Canada and 265 for the U.S. This is not supported by "Canada Reserve Timber Supply" of FLC Reed & Associates or the U.S. Forest Service "The Outlook for Timber in The United States".

[2] Author's estimates.

3. See Table 3 for Canada /U.S. comparison of increment.
4. See also footnote in Sec. 2.4 for a definition of increment.

Table 3

NORTH AMERICAN RATES OF FOREST GROWTH

Million Cubic Metres

	Softwoods	Hardwoods	Total
Canada[1]			
British Columbia	92	-	92
Alberta	9	7	16
Saskatchewan	5	4	9
Manitoba	5	1	6
Ontario	24	10	34
Quebec	41	6	47
New Brunswick	10	3	13
Nova Scotia	3	1	4
PEI			
Newfoundland	6	1	7
Territories	1	-	1
Total Canada	196	33	229
United States[2]			
South	166	101	267
North	37	119	156
Pacific Coast	88	9	97
Rocky Mountains	42	3	45
Total United States	333	232	565
Total North America	529	265	794

Sources: [1] "Canada's Reserve Timber Supply", FLC Reed for ITC 1973.
[2] "The Outlook for Timber in the United States"-USDA 1973.

Notes: 1. Annual Allowable Cut Estimates.
2. Net Growth Estimates for 1990 Corresponding figures for 1970 were: Softwoods 303 M^3, Hardwoods 224 M^3 - Total of 527 M^3.

2.2 Roundwood Removals By Region

Roundwood removal statistics present less difficulty than forest inventory statistics but information on removals is still subject to error, usually on the low side, because some removals are never recorded before they enter into consumption or the chain of processing. The difference between industrial wood and fuelwood is not always clear since there is always some overlapping depending upon the supply and demand situation for each category and its respective price. Similarly, there are major difficulties in determining whether fuelwood originates from productive forests or non-productive forests, so that a realistic assessment can be made of the impact on growing stock and forest growth of fuelwood removals. Roundwood removals, of course, are only one aspect of the measure of drain on world forest resources. While most of the developed countries attempt to arrive at values for overall drain on growing stock and increment resulting from removals, fire, insects, disease, wind and other agents of tree mortality, little progress has been made in developing countries in making estimates of total drain.

Table 4 summarizes the world situation for roundwood removals by hardwoods and softwoods for both industrial wood and fuelwood by major world region.

Industrial wood represents slightly more than half the total removals, with softwoods predominating for industrial purposes (72 percent) and hardwoods for fuelwood, (85 percent). Also nearly three quarters of all fuelwood removals are made in the developing regions of Latin America, Asia and Africa while more than four fifths of industrial wood removals are made from the temperate forests of Europe, the USSR, North America, and Japan.

Roundwood removals for pulping occur essentially where pulp and paper industries have been established although some significant inter-regional movements of wood for pulping take place from North America and the USSR to Japan and Western Europe. To quote an FAO source:

> "Unlike the northern countries of Western Europe, where well over half of industrial wood is consumed for pulping, North America, Japan, Oceania and South Africa and the rest of Western Europe utilized approximately two thirds to three quarters of industrial wood removals for other than pulping. In Eastern Europe, Mainland China, Latin America and especially the USSR, the portion for pulping is even less, from one-fifth to less than one-tenth. From the forests of Asia and Africa, wood for pulping is an insignificant portion."

2.3 Annual Allowable Cut by Region

Annual growth information is lacking for most world regions and, where it has been available, it has not always been translated into annual allowable cut values, which require further inputs of data on age classes, stand composition, and increment for individual species or groups of species. The FAO World Forest Inventory attempted to collect national data on allowable cuts; however, information returns were generally unusable and lacking in harmony, coverage, and comparability. Thus, annual growth rather than allowable cut is relied upon as the common measure of a country or regions' forest potential.

2.4 Relationship Between Annual Growth and Removals

Table 5 presents a comparison of wood growth with total removals for hardwoods and softwoods for 1970 by region. Table 6 shows the same comparison, excluding fuelwood.

If it is accepted that fuelwood originates from growing stock, as presented in the World Forest Inventory, then world forests are presently close to being cut at capacity. The values are 70 percent for softwoods (conifers) and 96 percent for hardwoods or broad leaved species. How realistic is this? FAO does not appear to have the answer.[1] If, on the other hand, all fuelwood originates from forests other than those for which growing stock and increment values are given in the World Forest Inventory, which is obviously not the case, then world forests are being cut at only 44 percent of their capacity, at nearly 60 percent for softwoods and 27 percent for hardwoods. The true values probably lie somewhere in between, indicating perhaps 65 percent for both softwoods and hardwoods in terms of cut alone. If appropriate allowances are made for other factors such as bark, stumps, tops (since many inventories are given in terms of gross volume), and the depletion agents of fire, insects, disease, and grazing are also taken into account, then the extent of drain must exceed 75 percent of the world potential. The removal of forests for recreation purposes and other environmental considerations would seem also to push this rate of use even higher.

---

[1] In this context, FAO defines growing stock as "volumes of standing timber (industrial wood and fuelwood, excluding bamboo)". Gross increment as "average volume of annual increment of all trees." Net growth as "average annual net growth equals gross increment less losses". Losses as "average volume rendered unusable annually by forest fires, shifting, cultivation, insect pests, tree diseases, natural thinning, wind, snow avalanches, other climatic factors etc." The practice of excluding fuelwood from removals when, by definition, growth includes fuelwood appears illogical. While some fuelwood unquestionably comes from forests which may not fall into the "high forest" category, and, therefore, lie outside the forests for which regulated cuts and removals have been prescribed, most fuelwood originates from high forests, and it follows, therefore, that most fuelwood removals should be counted against annual growth. Fuelwood in most regions is a by-product of logging activities. The merchantable volumes of industrial wood recoverable from forests, thus are accompanied by a corresponding output of fuelwood in the form of unmerchantable tops, limbs, and broken pieces, as well as undersized and dead trees.

The volumes of wood for pulping that might be available between that which is being cut now and the sustained yield capacity of world forests is to some extent a function of the requirements of the wood products sector in the future, the residues which will derive from that sector for use in pulping, and also the plantations of fast-growing species which might be established or expanded. It has been noted already that a close similarity exists between pulpwood and fuelwood, especially in developing regions, in terms of size, price and general availability and it follows that some overlapping in supply and use may occur in the future.

Table 4

ROUNDWOOD REMOVALS BY REGION

Million Cubic Metres (under bark)

1970

Region	Totals			Softwoods			Hardwoods		
	Industrial Wood	Fuel Wood	Total	Industrial Wood	Fuel Wood	Total	Industrial Wood	Fuel Wood	Total
Western Europe	211	47	258	155	7	162	56	40	96
North America	434	24	458	356	5	361	78	19	97
Japan	45	5	50	27	-	27	19	4	23
Oceania	23	5	22	10	1	11	13	4	17
USSR	300	86	386	265	56	321	35	30	65
Eastern Europe	58	15	73	38	3	41	21	12	33
Latin America	48	233	281	21	19	40	26	214	240
Asia & Far East	69	298	367	6	13	19	63	285	348
Africa & Middle East	50	258	308	11	10	21	39	248	287
China	40	127	167	25	51	76	15	76	91
WORLD TOTALS	1,278	1,098	2,376	914	165	1,079	365	932	1,297

Note: Totals may not add due to rounding.

Source: FAO Yearbook of Forest Products 1970.(Ref. 43.)

Table 5

WOOD GROWTH REMOVAL COMPARISON
BY REGION AND HARDWOODS & SOFTWOODS
(Fuelwood included in Removals)

Million Cubic Metres

1970

Region	Growth (Includes bark)			1970 Removals (excludes bark)			1970 Removals as a % of growth		
	Softwoods	Hardwoods	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods	Total
Western Europe	212	100	312	162	96	258	76	96	83
North America	529	265	794	361	97	458	68	37	58
Japan	35	42	77	27	23	50	77	55	65
Oceania	8	21	29	11	17	28	138	81	96
USSR	577	267	844	321	65	386	56	24	46
Eastern Europe	36	54	90	41	33	74	114	61	82
Latin America	10	390	400	40	240	280	400	62	70
Asia & Far East	52	103	155	19	348	367	37	337	236
Africa & Middle East	7	103	110	21	287	308	300	279	280
China	80	-	80	76	91	167	95	?	209
World Totals	1,546	1,345	2,891	1,079	1,297	2,376	70	96	82

Table 6

WOOD GROWTH - REMOVAL COMPARISON
BY REGION AND HARDWOODS & SOFTWOODS

Fuelwood excluded from Removals

Million Cubic Metres

1970

Region	Growth (includes bark)			1970 Removals (excludes bark)			1970 Removals as a % of Growth		
	Softwoods	Hardwoods	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods	Total
Western Europe	212	100	312	155	56	211	73	56	68
North America[1]	529	265	794	356	78	434	67	29	55
Japan	35	42	77	27	19	46	77	45	60
Oceania	8	21	29	10	13	23	125	62	79
USSR	577	267	844	265	35	300	46	13	36
Eastern Europe	36	54	90	38	21	59	106	39	66
Latin America	10	390	400	21	26	47	210	7	12
Asia & Far East	52	103	155	6	63	69	12	61	45
Africa & Middle East	7	103	110	11	39	50	157	38	45
China	80	-	80	25	15	40	31	-	50
WORLD TOTALS	1,546	1,345	2,891	914	365	1,279	59	27	44

Note: [1]North America figures exclude bark and are net merchantable growth estimates.

2.5 Regional Fibre Supply Outlook to 1990

In quantitative terms, the difference between the volume of wood being cut now and the annual growth is the indicated balance available for future forest industry development. Table 6 illustrates these regional balances for softwoods and hardwoods, using the "fuelwood excluded" option, as is the practice of FAO.

The implication on a world basis is that removals can be more than doubled from a level of 1,279 million cubic metres to the maximum possible ceiling of 2,891 million cubic metres, the estimated annual growth for all world forests. But whereas the ratio of existing usage of softwoods to hardwoods is in the order of 2.5:1.0, the future ratio may have to move towards 1.1:1.0.

Using the "fuelwood included" option, as in Table 5, the outlook is very different. The indicated balances available for future forest industry growth are only 467 million cubic metres for softwoods and a mere 48 million cubic metres for hardwoods. The results are alarming, implying that world forests could only sustain a forty percent increase in wood fibre output.

A recent investigation carried out by FAO in Turkey revealed that the future potential of Turkish forests could sustain only half the forest industry development originally forseen for that country, since the forest inventory represented full tree volumes and not net merchantable volumes, where the rate of recovery of industrial wood was only 56 percent of gross standing volumes. Similar situations have been found in other countries which indicate that stated growth is not a true measure of forest potential. In addition, constraints of an administrative or social nature may also limit the volumes of wood available for new forest industry development.

Economy of scale considerations can also impose their own constraints on development since the bringing together of a large number of fibre resource pockets to supply one large new forest industry complex may pose undue strains on the social structure or disrupt existing small industry based on the resource.

Table 7 is a statement of the estimated forest potential for each region based on a set of arbitrary downward adjustments[1] to annual growth to reflect merchantable volumes of industrial wood (under bark) which may be available in 1990. The estimated industrial wood potential in 1990 is 2,112 million cubic metres (under bark), with a North American potential of 755 million m^3 (comprised of 538 million for the U.S. and 217 for Canada) followed by the USSR with 578 million m^3, Western Europe with 240 million m^3 and Latin America with some 200 million m^3.

The difference between the indicated forest potential and 1970 removals is also shown in Table 7 for softwoods and hardwoods.

This report considers, therefore, that industrial wood output could be increased by some 65 percent above the 1970 rate of removals. The following section discusses regional demands to 1990 and examines whether it will be necessary to attain the levels of industrial wood output implied by the indicated forest potential. The availability of wood residues is also discussed.

CHART 1

ANNUAL GROWTH AND INDUSTRIAL WOOD POTENTIAL

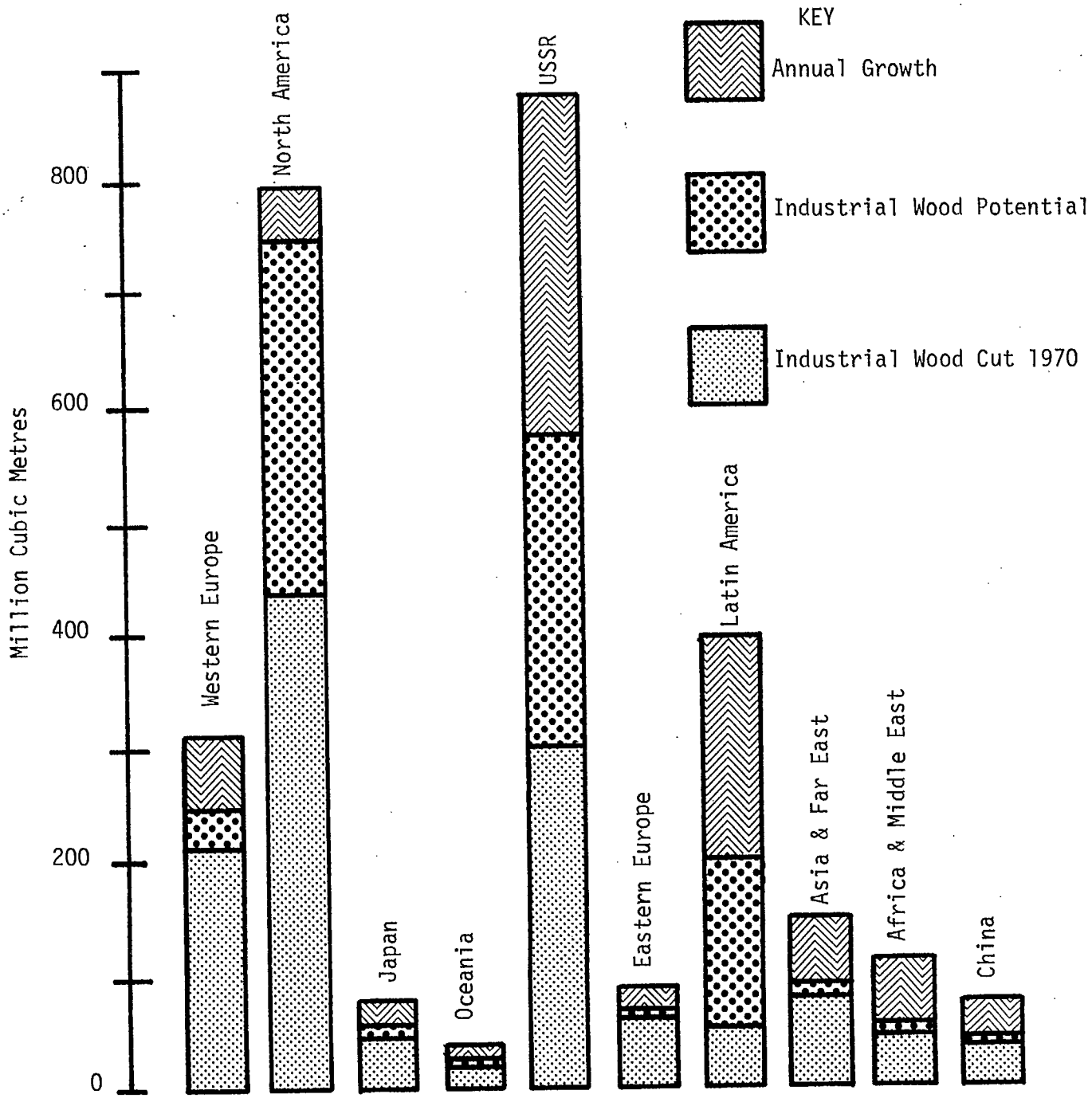

Table 7

REGIONAL FIBRE SUPPLY OUTLOOK FOR 1990

Million Cubic Metres

	Adjustment Factors Reducing Annual Growth to Net Realisable Volumes of Industrial Wood		Adjusted Indicated Forest Potential Net Volumes of Industrial Wood (under bark)			Difference Between 1970 Removals and Adjusted Indicated Forest Potential		
	Softwoods	Hardwoods	Softwoods	Hardwoods	Total	Softwoods	Hardwoods	Total
Western Europe	.80	.70	170	70	240	15	14	29
North America	.95	.95	503	252	755	147	174	321
Canada	.95	.95	186	31	217	75	24	99
United States	.95	.95	317	221	538	72	150	222
Japan	.80	.75	28	32	60	1	13	14
Oceania	.60	.60	5	12	17	-5	-1	-6
U.S.S.R.	.70	.65	404	174	578	139	139	278
Eastern Europe	.75	.70	27	38	65	-11	17	6
Latin America	.60	.50	6	195	201	-15	169	154
Asia & Far East	.60	.50	31	52	83	25	-11	14
Africa Middle East	.60	.55	4	57	61	-7	18	11
China	.65	.60	52	-	52	27	-15	12
World Total	.80	.65	1,230	882	2,112	316	517	833

NOTES TO TABLE 7

1. Tentative estimates of industrial roundwood removals for all Europe (i.e. W. Europe and E. Europe) in ETTS 11 (Ref. 39) give a high estimate of 410 million m^3 and a low estimate of 380 million m^3 for 1990 . The adjusted values would be, high 307 million, and low 285 million m^3. This study's estimate is 305 million m^3, corresponding to FAO's high estimate.

2. The impact of tropical plantations, both existing and planned, is not expected to significantly alter the supply situation before 1990.

3.0 WORLD FIBRE DEMANDS

3.1 Fibre Demands by Region and Product Group 1970

In the previous section it was noted that industrial wood removals from world forests in 1970 were 1,275 million m^3 and that fuelwood removals were slightly lower at 1,100 million m^3 for a world total of 2,375 million m^3. The industrial wood removals comprised some 784 million m^3 of large size material, chiefly destined for sawmilling and plywood & veneer manufacture, 312 million m^3 of pulpwood for pulp and paper manufacture, and a remaining volume of 179 million m^3 for such uses as mine timbers, poles, and particle board, and fibreboard manufacture.

By region, the situation, in terms of requirements for domestic use (plus net exports or minus net imports) was as follows in 1970.

TABLE 8

1970 Requirements of Industrial Roundwood

Million Cubic Metres

Region	Sawlogs & Veneer Logs	Pulpwood	Other Small Size Wood	Total
Western Europe	112	80	19	211
North America	264	154[1]	17	435
Japan	28	15	2	45
Oceania & South Africa	19	7	3	29
USSR	189	33	77	299
Eastern Europe	35	11	12	58
Asia & Far East (incl. China)	80	3	29	112
Africa & Middle East	19	2	17	38
Latin America	38	7	3	48
WORLD TOTALS	784	312	179	1,275

Source: FAO - Ref. 29

Note[1] : Excludes some 13 million m^3 apparently from large material. Actual roundwood inputs into North American pulping were 118 million m^3 for the U.S. and 49 million for Canada.

Unfortunately, it is not possible to provide a breakdown by major world regions by hardwoods and softwoods. However, using broad FAO converting factors, some idea of world wood and paper product output values can be derived in terms of their roundwood equivalents.

TABLE 9

Industrial Roundwood Equivalents
Related to Product Output

1970

	Product Output	Approximate Roundwood Equivalent Million m^3 (under bark)
Sawnwood		
Softwoods	311 Million m^3 (sawnwood)	544
Hardwoods	96 " "	174
total	407 " "	718
Panel Products		
Plywood	33 million M^3 (solid)	76
Particle Board	18 " "	36
Fibre	8 million Metric tons	16
Total		128
Pulp and Paper		
Mechanical Pulp	26 million metric tons	65
Chemical Pulp	77 " "	377
		442
Total Roundwood Equivalent		1,288

One cautionary note with respect to Table 9 is that it does not account for poles and their corresponding roundwood equivalent. Offsetting the volume of poles and their roundwood equivalent of some 117 million m^3 is the volume of residues, used in pulp and paper, and certain panel products, derived from the sawnwood sector.

3.2 Prospects for Sawnwood to 1990 and Related Fibre Requirements

Forecasts by FAO of world sawnwood requirements were presented in Wood: World's Trends and Prospects of 1967 (Unasylva 20(1-2)) and for Europe in the European Timber Trends and Prospects -- Interim Review of 1969 (Reference 39). A more recent 1972 estimate, in terms of industrial roundwood for both sawmilling and veneer and plywood, was made to 1985 in Annex 3 for the Advisory Committee on Pulp and Paper (Reference 29).

Other estimates for future world sawnwood requirements have been made by Madas (Ref. 18) and Keays (Ref. 1). All estimates including those of FAO foresee a relatively slow rise in sawnwood growth to 1985 and beyond of between 1 and 2.5 percent, in keeping with earlier trends in consumption, depending largely upon the length of time series used as the basis for the forecast. Extrapolation of Madas' forecasts for sawnwood consumption to 2000, gives a value for the year 1990 of 875 million m^3 in terms of the roundwood equivalent implying an annual growth rate of 1.3 percent. Keay's value includes panel products and is somewhat lower. FAO's Annex 3 estimate, for large size industrial wood for sawmilling, plywood, and veneer, increases from 784 million m^3 (r) in 1970 to 1,033 million m^3 (r) for 1985 implying an expected growth rate of about 1.9 percent per year for the period.

Table 10 sets out world fibre requirements for sawnwood, allowing for trade in logs between some regions where trade flows are already well established. The estimates for 1970 and 1985 are those of FAO. Extrapolations have been made for intermediate years, including a projection to 1990. It should be noted

here that while the U.S. Forest Service Report No. 20 expects a modest decline in U.S. domestic output of sawnwood (partly as a result of a drop in U.S. sawtimber availabilities) and a corresponding rise in imports, the declining trend shown for North America in Table 10 may, in fact, not take place, but rise instead, depending upon the price and availablity of sawtimber in Canada. Unfortunately, fuller treatment of this matter is not possible in this report.

Probably the most notable feature of future sawnwood prospects is the anticipated levelling off, or in some cases decline, in the output of sawnwood in the developed world and the relatively major rise in sawnwood output chiefly for domestic needs in developing countries. In any event, the prospects for Canadian lumber in the U.S. and world markets continue to look favourable.

Sawmilling activity in the future naturally has a bearing on wood fibre supplies for pulping both as a consequence of residues which derive from it and also because it competes to some extent for fibre. The extent to which sawmilling can supply fibre for pulping depends upon the degree of integration which can be achieved with the pulp and paper sector, either in the building of new integrated complexes or in organizing collection points for available sawmill residues for transfer to pulp mills. Some residues, especially in Europe and the developing countries, are increasingly being used for particle board and fibreboard, whereas only recently they were burned for domestic fuel purposes.

TABLE 10

INDUSTRIAL ROUNDWOOD REQUIREMENTS
FOR SAWMILLING

Million Cubic Metres of Roundwood

1970 - 1990

Region	Sawnwood 1970	1975	1980	1985	1990
Western Europe	102	105	108	112	114
North America	220	230	225	220	210
Japan	18	17	16	15	13
Oceania	9	10	12	14	16
USSR	185	195	205	219	232
Eastern Errope	32	34	35	36	37
Latin America	37	52	67	79	95
Asia & Far East	55	77	99	111	130
Africa & Middle East	27	35	44	56	79
China	23	25	30	32	38
WORLD TOTALS	708	780	841	894	964

Source: FAO Based on Table 3 of Ref.29 and also Ref. 41

Notes: Estimates for 1970 and 1985 are those of FAO. Estimates for intermediate years and 1990 are those of the author.

TABLE 10a

ESTIMATES OF RESIDUES DERIVING FROM SAWMILLING FOR PULPING[1]

Million Cubic Metres

Region	1975	1990
Western Europe	14	23
North America	64	100
Canada[3]	9	16
U.S.A.[2]	55	84
Japan	16	24
Oceania	-	2
USSR	5	18
Eastern Europe	3	6
Latin America	1	2
Asia & Far East	-	1
Afica & Middle East	-	-
China	-	3
WORLD	103	179

Source: FAO, based on Annex 3 Ref. 9.

Notes: [1]Some of the residues are also derived from plywood and veneer operations.

[2]U.S. Forest Service estimates.

[3]The Canadian values are the difference between FAO's North American value and the U.S.F.S. estimate. Indications are that the real Canadian values should be closer to 28 million m^3 for 1975 and 46 million m^3 for 1990. Statistics Canada reports use of 24.1 million m^3 of residues and 45.9 million m^3 of roundwood in 1972 by pulp and paper mills.

According to FAO, utilization of residues from sawmilling and plywood and veneer operations was 25 percent of log intake in North America and only 18 percent in Europe in 1970. The same source notes that clear trends are not evident in the USSR and elsewhere as to residue utilization but that the rates of utilization may be expected to increase in North America and to a lesser extent in Europe and Japan.

In summary, therefore, while world fibre requirements for sawmilling are expected to increase to 964 million cubic metres by 1990, because of the volume of residues which will be derived from this sector, and to some extent from plywood and veneer, the net requirements for sawmilling will be in the order of some 785 million m^3 of industrial roundwood.

3.3 Prospects for Panel Products to 1990 and Related Fibre Requirements.

3.3.1 Plywood and Veneer

Table 11 sets out estimates for industrial roundwood requirements of the world plywood and veneer sector, based on a reappraisal made by FAO in 1970 (Ref. 41) and also in the advisory Committee on Pulp and Paper,"Annex 3" (Ref.29) of 1972. Annual percentage growth rates in the world consumption of plywood and veneer decreased from a rate of 9.0 percent between 1960 and 1965 to 5.8 percent between 1965 and 1970. Between 1970 and 1980 the rate is expected to drop further to 5.1 percent, partly as a result of competition from other panel products and also as a result of declining supplies of large-size raw material.

Table 12 shows FAO estimates of all panel products output by region for 1970 and 1980.

Wood requirements for plywood and veneer in most western countries are expected to double between 1970 and 1990 while there is likely to be a tripling of requirements for roundwood in many developing regions, reflecting a need both to meet their own domestic needs for these products and for increasing volumes of exports, as a result of improved trade access to developed countries. Total world requirements are thus expected to rise from a 1970 level of 76 million m^3 of large sized roundwood to some 165 million m^3 in 1990. On a regional basis there may be some reason to believe that softwood plywood will maintain or even improve its relative position in world markets.

3.3.2 Fibreboard and Particle Board

Table 13 provides regional estimates for industrial roundwood requirments for the world fibreboard and particle board sectors in combination with the needs of other miscellaneous wood products. A separate breakdown for each is unfortunately unavailable. Some idea of the expected regional increase in output of fibreboard and particle board between 1970 and 1980 may be obtained from the FAO estimates presented in Table 12.

In general, annual growth rates for fibreboard are expected to slow down from a rate of 7.4 percent in the 1965-1970 period to 5.2 percent in the 1970-1980 period. Similarly, a sharper drop is forseen for particle board growth rates, from 15.4 percent per year to 9.5 percent over the same periods.

As has been mentioned already, both industries derive some wood fibre, in the form of residues, from sawmilling and veneer and plywood operations. This trend is expected to continue with an increasing proportion going to particleboard. In fact, particleboard has already demonstrated a stronger capacity to acquire residues than the pulp and paper sector in some regions.

In the developing world, both fibreboard and particle board plants also derive a substantial portion of their raw materials from wood classed as fuelwood. The relatively small increase in industrial wood requirements in both sectors is believed to be a reflection of this practice. Overall, the increase of industrial wood requirements for fibreboard, particle board, and other miscellaneous uses is expected to climb from 179 million m^3 to 200 million m^3 between 1970 and 1990.

3.3.3 All Panel Products

While world output of panel products may rise from some 40 million metric tons to over 100 million metric tons during the 1970-1990 period reflecting an annual growth rate of almost 5 percent, the fibre requirements of the sector, in terms of industrial roundwood needs, are expected to increase at a rate of less than 2 percent, from 255 million m^3 to 365 million m^3 in the same period. And while the wood requirements for plywood and veneer will more than double, the fibreboard and particle board sectors will depend heavily upon residues and fuelwood and impose little extra drain on industrial wood supplies.

TABLE 11

INDUSTRIAL ROUNDWOOD REQUIREMENTS
FOR VENEER & PLYWOOD

Million Cubic Metres of Roundwood

1970 -1990

Region	Veneer & Plywood 1970	1975	1980	1985	1990
Western Europe	10	12	15	18	22
North America	44	50	60	70	80
Japan	10	12	15	18	22
Oceania	1	1	2	2	2
USSR	4	5	7	9	11
Eastern Europe	3	4	5	6	8
Latin America	1	2	3	5	7
Asia & Far East	1	2	3	5	6
Africa & Middle East	1	1	2	4	5
China	1	1	1	2	2
WORLD TOTALS	76	90	113	139	165

Source: FAO Based on Table 3 of Ref.29 and also Ref. 41.

Notes: Estimates for 1970 and 1985 are those of FAO. Estimates for intermediate years and 1990 are those of the author.

TABLE 12

ESTIMATES OF
PANEL PRODUCTS OUTPUT
1970 and 1980

Region	Plywood & Veneer		Fibreboard		Particle Board		All Panel Products	
	1970	1980	1970	1980	1970	1980	1970	1980
	Million m^3		Million m tons		Million m tons		Million m tons	
Europe (all)	4.3	6.0	2.9	3.7	6.5	12.5	12.2	20.2
North America	17.1	23.2	2.9	3.5	2.1	6.7	16.3	25.5
Japan	5.0	7.0	0.4	1.2	0.3	1.5	4.0	7.3
Pacific Area	0.2	0.6	0.2	0.4	0.2	0.5	0.5	1.3
USSR	2.1	4.8	0.8	2.2	1.2	3.8	3.4	9.2
Latin America	0.8	3.0	0.3	0.9	0.2	0.8	1.0	3.7
Asia (Excl. Japan)	2.8	6.2	0.4	1.1	0.1	0.4	2.4	5.6
Africa	0.5	2.0	0.2	0.4	0.1	0.3	0.6	2.0
World	33.0	52.8	8.1	13.4	10.7	26.5	40.4	74.8

Source: FAO:WPP/70/33 "A Reappraisal of the Outlook of the Future" September 1970 FAO Committee on Wood-Based Panel Products. (Ref.41) See also Appendix V for FAO Estimates of Panel Products Consumption.

TABLE 13

INDUSTRIAL ROUNDWOOD REQUIREMENTS
FOR FIBREBOARD PARTICLE BOARD
AND OTHER INDUSTRIAL USES

Million Cubic Metres of Roundwood

1970 - 1990

Region	Fibreboard, Particle Board and Other				
	1970	1975	1980	1985	1990
Western Europe	19	18	17	16	15
North America	17	18	19	20	21
Japan	2	2	2	2	2
Oceania	2	2	3	3	3
USSR	77	78	79	80	81
Eastern Europe	12	12	12	12	12
Latin America	3	4	7	10	13
Asia & Far East	21	21	21	20	20
Africa & Middle East	18	19	20	21	22
China	8	9	9	10	11
WORLD TOTALS	179	183	189	194	200

Source: FAO Based on Table 3 Ref.29 and also Ref. 41

Notes: Estimates for 1970 and 1985 are those of FAO. Estimated for intermediate years and 1990 are those of the author.

TABLE 14
SUMMARY
INDUSTRIAL ROUNDWOOD REQUIREMENTS
OF THE WOOD PRODUCTS SECTOR

Million Cubic Metres of Roundwood

1970 - 1990

Region	Total Wood Products Sector 1970	1975	1980	1985	1990
Western Europe	131	135	140	146	151
North America	281	298	304	310	311
Japan	30	31	33	35	37
Oceania	12	13	17	19	21
USSR	266	278	291	308	324
Eastern Europe	47	50	52	54	57
Latin America	41	58	77	94	115
Asia & Far East	77	100	123	136	156
Africa & Middle East	46	55	66	81	106
China	32	35	40	44	51
WORLD TOTALS	963	1,035	1,143	1,227	1,329

Source: FAO Based on Table 3 Ref. 29 and also Ref. 41.

Notes: Estimates for 1970 and 1985 are those of FAO. Estimates for intermediate years and 1990 are those of the author.

3.4 Fibre Demands for Fuelwood to 1990

Fuelwood, because of its low value, and because statistics of output and use are difficult to collect, remains one of the world's most neglected wood products sectors as far as its economic significance is concerned. The world energy crisis may be expected to focus more attention on this sector.

In the section dealing with removals, it was seen that fuelwood output and consumption is a feature of developing countries; where it serves as a fuel, not only for domestic heating and cooking but also to some extent for industry. During the past few years, fuelwood consumption declined slightly in some regions, probably as a result of increasing usage of fossil fuels. Now, with higher priced fossil fuels, it is not unlikely that the demands for fuelwood will again begin to climb. How fast they will climb is, of course, a matter of speculation.

Madas estimated future world fuelwood requirements of 1,000 to 1,200 million m^3 by the year 2000 (Ref.18). The present recorded level of use is 1,100 million m^3 and to quote from the 1970 Yearbook of Forest Products (Ref. 43) "the statistics of the removals of fuelwood remain very incomplete." In fact, it is not inconceivable that the true volume is closer to 1,500 million m^3. If we accept the per capita values for consumption of fuelwood of some 0.4 m^3 in developing countries (excluding China) and 0.1 m^3 per capita in developed countries as implied by recorded volumes in 1970, the 1990 use of fuelwood, providing it is available, could be as high as or higher than 2,000 million m^3 or twice the 1970 volume. The implications of this requirement on future forest industry development are real and startling, especially since they are based on the assumption that the energy shortage will

not give rise, which, of course it might, to increased per capita levels of consumption.

TABLE 15
WORLD FUELWOOD REQUIREMENTS

1970 -1990

Millions of Cubic Metres

	1970			1990		
Regions	Softwood	Hardwood	Total	Softwood	Hardwood	Total
Western Europe	7	40	47	7	48	55
North America	5	19	24	4	27	31
Japan	-	4	4	1	4	5
Ociania	1	4	5	1	6	7
USSR	56	30	86	46	64	110
Eastern Europe	3	12	15	3	15	18
Latin America	19	214	233	17	468	485
Asia & Far East	13	285	298	5	556	561
Africa & Middle East	10	248	258	8	510	518
China	51	76	127	70	147	217
WORLD TOTALS	165	932	1,097	162	1,845	2,007

Note: Totals may not add due to rounding. 1990 figures are investigator's estimates and are based on the assumption that per capita use of fuelwood will not change between 1970 and 1990.

Source: FAO for 1970 data.

3.5 Aggregate Wood-Fibre Demands for Non-Pulping Uses to 1990

The aggregate wood-fibre demands for non-pulping uses for all regions of the world, combining roundwood for wood products and for fuelwood, is expected to rise from a level of 2,060 million m^3 in 1970 by some 2.5 percent per year, to 3,336 million m^3 in 1990. In the same period industrial roundwood for wood products is estimated to rise at a rate of 1.7 percent per year from 963 million m^3 to 1,329 million m^3 while fuelwood demands will grow at about 3.1 percent from 1,097 to 2,007 million m^3. Higher use per capita in developing countries and slightly higher population growth rates compared with developed countries gives rise to a growth rate for fuelwood consumption which exceeds the 2.6 percent average growth rate for world population expected between 1970 and 1990. (See Table 22)

Table 16 presents a summary of wood fibre demands for non-pulp uses by region for 1970 and 1990.

TABLE 16

SUMMARY

WOOD FIBRE DEMANDS OF THE
WOOD PRODUCTS SECTOR AND FOR FUELWOOD

1970 and 1990

Millions of Cubic Metres

Region	1970 Industrial Wood	1970 Fuelwood	1990 Industrial Wood	1990 Fuelwood
Western Europe	131	47	151	55
North America	281	24	311	31
Japan	30	4	37	5
Oceania	12	5	21	7
USSR	266	86	320	110
Eastern Europe	47	15	57	18
Latin America	41	233	115	485
Asia & Far East	77	298	156	561
Africa & Middle East	46	258	106	518
China	32	127	51	217
WORLD TOTALS	963	1,097	1,329	2,007

Table 16 suggests that total wood fibre requirements in the regions of Oceania, Latin America, Asia & the Far East, Africa, the Middle East, and China will all exceed the annual wood increment estimates of FAO given in the World Forest Inventory in Table 2.

3.6 Fibre Demands for Woodpulp to 1990

Considering total world demands for all wood fibre for use in pulping, the findings of this study are that requirements, between 1975 and 1990, will almost double, rising at a rate of some 4.3 percent per year in the fifteen year period, from 541 million m^3 to 1,030 million m^3. This is expected to be comprised in 1990 of 851 million m^3 of

industrial roundwood and 179 million m^3 of residues, chiefly from sawmilling, as compared with 438 million m^3 of roundwood and 103 million m^3 of residues in 1975.

Fibre demands for pulping are, of course, a derived demand, relating directly to total world paper and paperboard consumption. The methodology used to arrive at wood fibre requirements is explained in section 1.4 of the Introduction. Detailed estimates by grade are given in the following section. It is important to note here, however, that whereas total paper and paperboard consumption is estimated to grow at a rate of 5 percent between 1975 and 1990, that wood fibre needs, both for industrial roundwood and for residues, will grow at a slower pace of 4.5 and 3.7 percent respectively. This reflects the increasing use of short fibred wood species and improved refiner technology which will combine to give higher yields. The figures also suggest that there are fairly firm maximum limits to residues output and utilization, depending upon the availability of large size logs and transfer possibilities.

Table 17 sets out the industrial roundwood requirements for pulp production by region from 1975 to 1990, after deducting for wood residue transfers. In terms of absolute requirements, North America shows the largest increase of 143 million m^3, followed by Western Europe, the USSR, and Japan, with increases of 67, 59, and 57 million m^3 respectively, and Latin America with 34 million m^3. The remaining regions of the world, mostly developing countries, account for the balance of 53 million m^3.

TABLE 17

INDUSTRIAL ROUNDWOOD REQUIREMENTS
FOR PULP PRODUCTION

1975 - 1990
Million Cubic Metres

Region	1975	1980	1985	1990
Western Europe	113	137	162	180
North America	221	265	315	364
Japan	25	49	66	82
Oceania	7	12	17	21
USSR	33	43	61	92
Eastern Europe	16	20	24	30
Latin America	7	14	20	41
Asia &Far East	7	10	15	23
Middle East & Africa	4	5	6	8
China	5	7	9	10
WORLD TOTALS	438	562	695	851

Note: These values are net roundwood requirements after deducting for wood residue transfers from the sawmill, plywood/veneer sector. Corresponding FAO estimates for 1980 and 1985 are 534 million m^3 for 1980 and 663 million m^3 for 1985(Ref. 29). See also Section 3.2 of this report for note on residue transfers.

Before proceeding to a summary of all wood fibre demands to 1990 a comparison is made in the following table of the 1985 industrial roundwood requirements for pulping made by FAO and this report. As may be seen, minor differences appear in the requirements, particularly for North America, the USSR, and in certain developing regions other than Latin America.

TABLE 18

COMPARISON OF INDUSTRIAL ROUNDWOOD REQUIREMENTS FOR PULPING - 1985

Million Cubic Metres

Region	FAO[1]	This Report
Western Europe	155	162
North America	296	315
Japan	65	66
USSR	73	61
Eastern Europe	23	24
Latin America	19	20
Other Regions	32	47
WORLD TOTALS	663	695

[1] Source: FAO Table 2, Annex 3 (Ref. 29).

Note: Using the higher rate of residue utilization suggested in Table 10a and extrapolated for 1985, the total roundwood requirement may be only 675 million m^3 or 20 million m^3 lower than suggested in the above table.

3.7 Aggregate Demands for Wood Fibre to 1990

The findings of the first part of this study are that world demands for industrial roundwood and fuelwood, presently at a level of some 2,600 million m^3, will rise at a rate of about 2.8 percent per year to 4,187 million m^3 by 1990. Industrial roundwood is expected to account for 52 percent of total requirements in 1990 compared with nearly 54 percent of requirements in 1975. During the period, pulpwood will increase its share of total requirements from 16 percent in 1975 to some 20 percent in 1990. Fuelwood will increase slightly from 46 to 48 percent over the same period. See Table 19.

Referring back to Tables 2 and 7, it will be seen that the wood supply situation could be very critical in most regions by 1990. Severe shortages will exist in Western Europe, Japan, Asia, the Far East, the Middle East, and Africa for industrial roundwood. The only surplus areas will be the USSR and North America.

Unless fast growing plantations are able to alter the supply situation before 1990, even Latin America, because of mounting demands for fuelwood, will be unlikely to meet its own requirements. The prospects for doing so before 1990 are not encouraging.

This outlook results from, first, the likelihood that fuelwood demands will double and second, that present assessments of forest potential may be overstated by as much as 37 percent.

TABLE 19

TOTAL WOOD FIBRE REQUIREMENTS TO 1990

Million Cubic Metres - Roundwood

	1975				1990			
Region	Industrial Roundwood	Of Which Pulpwood	Total Fuelwood	Indicated Level of Removals	Industrial Roundwood	Of Which Pulpwood	Total Fuelwood	Indicated Level of Removals
Western Europe	248	113	49	297	331	180	55	386
North America	519	221	26	545	675	364	31	706
Japan	56	25	4	60	119	82	5	124
Oceania	20	7	5	25	42	21	7	49
USSR	311	33	92	403	416	92	110	526
Eastern Europe	66	16	16	82	87	30	18	105
Latin America	65	7	280	345	156	41	485	641
Asia & Far East	107	7	348	455	179	23	561	740
Middle East & Africa	59	4	308	367	114	8	518	632
China	40	5	145	185	61	10	217	278
World Totals	1,473	438	1,273	2,746	2,180	851	2,007	4,187

As was stated earlier, FAO recognizes the weakness of its growth data in the World Forest Inventory and has sought assistance in arriving at a position on world forest potential. Because help has not been forthcoming, it would seem that FAO has been forced into a position of using the only information at its disposal, thereby giving a distorted picture of world wood supplies. Plantations of fast growing species of pine, hybrid poplars and eucalyptus seem to be the most promising way of providing additional world wood fibre. Remaining virgin stands of conifers in the USSR, Canada, and the U.S. will undoubtedly continue to be a source of wood fibre for existing mills and of large size material for sawmilling and veneer production in the future. However, for pulping material, plantations of pine and eucalyptus would seem to be the best solution especially in tropical and sub-tropical areas where growth rates are highest. Poplars in temperate regions, may also ease the supply situation, although there are now signs that some hybrids are subject to disease.

It might well be asked why estimates for pulpwood removals have been allowed for in the report when there would appear to be no possibility in many regions of making supplies available. The only answer to this question, involving a possible conflict of use between pulpwood and fuelwood, is that pulpwood offers a higher economic use over the long run because of its greater potential for improving living standards. Higher incomes, in their turn, could mean alternative sources of fuel.

Finally, Table 20 provides a comparative summary for 1990 of the supply of wood fibre and the demands which are expected at that time in terms of industrial roundwood and fuelwood.

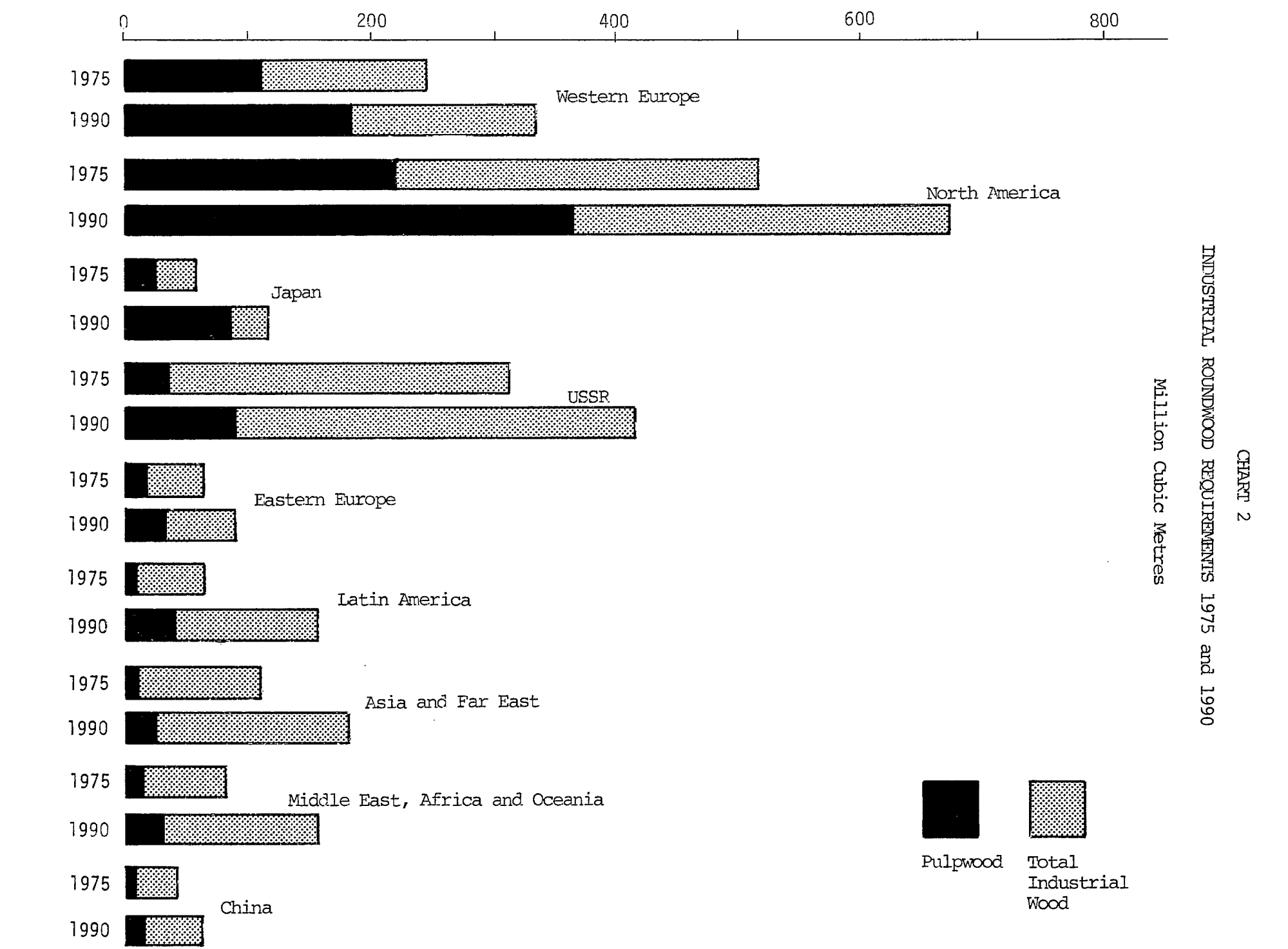

CHART 2

INDUSTRIAL ROUNDWOOD REQUIREMENTS 1975 and 1990

TABLE 20

REGIONAL FIBRE SUPPLY AND DEMAND OUTLOOK IN 1990

Million Cubic Metres

Region	Industrial Roundwood Requirements 1990	Estimated[2] Industrial Wood Potential 1990	Industrial Roundwood Surplus (+) or Deficit (-)	Fuelwood Requirements 1990	Fuelwood[1] Supply 1990	Fuelwood Surplus (+) or Deficit (-)
Western Europe	331	240	- 91	55	72	+ 17
North America	675	755	+ 80	31	39	+ 8
Japan	119	60	- 59	5	17	+ 12
Oceania	42	17	- 25	7	12	+ 5
USSR	416	578	+162	110	266	+156
Eastern Europe	87	65	- 22	18	25	+ 7
Latin America	156	201	+ 45	485	199	-286
Asia & Far East	179	83	- 96	561	72	-489
Africa & Middle East	114	61	- 53	518	49	-469
China	61	52	- 9	217	28	-189
World Totals	2,180	2,112	- 68	2,007	779	-1,228

Notes: [1]Difference between Total Annual Wood Increment (Table 2) and Industrial Roundwood Potential (Table 7). Additional volumes of unknown quantity will be available from non-productive forests including Savannah type especially in Africa.

[2]These are adjusted values. See Table 7.

4.0 PROSPECTS FOR WORLD PULP AND PAPER CONSUMPTION, CAPACITY AND OUTPUT

The Food and Agriculture Organization has a creditable record in making reliable long term forecasts of world paper and paperboard consumption. That agency has been engaged in making periodic assessments, at the regional and world level, for the past twenty years. In so doing it has frequently reviewed its own forecasting technology, sometimes with the assistance of outside experts (References 12 and 26).

The most recent global estimates are contained in Document No. 4, "Outlook for Pulp and Paper Consumption, Production and Trade to 1985" (Ref. 31), presented to the Thirteenth Session of the FAO Advisory Committee on Pulp and Paper in Rome in May 1972. The estimates themselves are a revision of a tentative outlook presented earlier before the Second Consultation on World Pulp and Paper Demand, Supply and Trade. Document No. 4 is, in effect, a departure from earlier work in that it presents what are called "production constrained" estimates, based on an appraisal of production limits under a capital availability constraint. Wood supplies were looked at but were not considered to be a specific production limiting factor up to 1985. The FAO study is essentially a modification of its own earlier estimates using income-based methods of forecasting. Whereas the income-based methods had suggested a world level of paper and paperboard consumption in 1985 of 282 million metric tons the new production constrained estimates reduced the forecast to 260 million metric tons, with 75 percent of the reduction occurring in Western Europe, North America and Japan.

Yet FAO attaches its own provisos to both of these estimates as follows:

"The presentation of an outlook based on production limitations, together with but differing from, an outlook prepared in line with current methodology of relating consumption to income, could raise the question of which one represents FAO's view. The correct answer at this stage should be "neither, necessarily". The income-based consumption outlooks have performed creditably in the past, so that on the grounds of performance there is no reason for not adopting the income-based consumption outlook and the outlooks for pulp production and trade associated with it. On the other hand, signs of changing circumstances are too strong for them to be ignored. The most that might be read into them is that they represent FAO's tentative views on the upper and lower levels of the outlook for the pulp and paper sector".

4.1 Introduction to Study Forecasts

The adoption by this study of FAO's production constrained estimates of paper and paperboard consumption for all regions other than North America and Western Europe, for which the estimates of the Canadian Working Party were accepted, (except for the United States where the Forest Service estimates were used) led to only a small difference in the overall outlook to 1985 compared with the estimates of FAO. This study's estimate for 1985 world paper and paperboard consumption is 267 million metric tons compared with FAO's value of 260 million tons. This is not too surprising since the Canadian Working Party's estimates are also "constrained" values, similar in magnitude to those of FAO, although based upon correlations of income with consumption. Between 1985 and 1990 this study assumes that elasticities for consumption will continue to decline, as expected between 1975 and 1985, and to decline fastest where pulpwood will be in short supply. Japan is perhaps the one exception, where that country's ability to draw upon outside sources of pulpwood is expected to continue.

As mentioned in the introduction, this study foresees higher consumption levels, for that country, compared with those of FAO, because it is unlikely that synthetic papers will now exhibit the growth which then seemed probable. For Western Europe, pulpwood supplies are seen as a definite constraint, over and above its own ability to grow them, since it is buffered from the USSR by the wood deficit regions of Eastern Europe and the Western USSR and will be unable, to any significant extent, to draw on other regions for roundwood.

Further discussions of the methodology used by FAO and the CWP in arriving at their forecasts was considered unnecessary. The estimates of this study are presented in the sequence they were developed as outlined in the introduction. All of the provisos noted in the CWP and FAO studies apply to this study. The Canadian Working Party did not attempt to go beyond their consumption estimates. On the other hand, FAO's estimates were carried forward to pulp and paper output and the wood requirements implied by those production levels. It was upon these relationships of output to consumption, and capacity to consumption and output, which FAO made, that the estimates of this study are based.

Tables 21 and 24-29 inclusive begin with estimates of total paper and paperboard consumption, by region, and end with wood requirements for pulp production by grade and region. Estimates of capacity requirements for total paper and paperboard to 1990 were based upon the values up to 1975 only, of the 1973 FAO Capacity Survey, since Canadian data were lacking for 1976 and 1977.

Even so, this led to unusually high estimates for world operating ratios for 1975 and 1980 of 94 and 88 percent respectively. No attempt was made in the analysis to present specific estimates of capacity requirements for pulp and paper by grade, since capacity-output relationships by grade are a direct function of any assumed operating ratio. The production outlooks presented for pulp and paper in Tables 25 and28 could be used to derive capacity values. Operating ratios may be expected to be somewhat higher in developing countries in the near future, at least, than in the developed regions on the basis of past experience.

The forecasts of paper and paperboard production assume, on a global scale, that production will be equal to consumption. The distribution of the production on a regional basis depends of course on the competitive position of each region and involves admittedly, a high degree of speculation. The relationships of regional production and consumption which FAO arrived at, and which guided the analysis here, may no longer hold, in view of the relatively steep rise in prices which have occurred since the FAO estimates were made. Further, the capital shortage situation which was already evident when that study was made now shows signs of abating, yet with regional dislocations because of changing values of currency. What effects these changes will have on the relative trading positions of any region is difficult to judge, although, they would seem to favour the developed market economies at the expense of the developing regions, and as FAO states, the centrally planned economies might "exploit an export opportunity represented by regional supply gaps".

The estimates of pulp consumption were made on the basis of historical ratios of pulp consumption to paper production, taking into account expected changes in the use of waste paper in future paper furnishes.

Again, the arbitrary nature of the many assumptions used in arriving at these estimates is stressed.

Pulp production estimates, as with paper production estimates, involve a similar degree of subjective judgement when relating them to estimates of pulp consumption at the regional level. FAO's pulp production estimates, by region and grade were taken to indicate the relative distribution by grade and cross-checked for consistency with estimates of pulp consumption, and paper and paperboard production. One problem encountered was the difficulty of arriving at estimates for mechanical and chemical pulp which matched the trend in ratios used by FAO for the two grades to 1985. While the ratio arrived at in this study for 1990 worked out to be 3.77 for chemical to mechanical pulp, a better ratio might have been of the order of 3.50 since the FAO ratio series is 2.94 for 1973, 3.19 for 1980 and 3.38 for 1985.

Finally, pulp production was converted to wood requirement estimates using separate wood consumption values per metric ton of pulp output. The values are shown as footnotes to Table 29.

A second problem encountered in arriving at wood requirement values for some developing regions, was that FAO's method of calculating future levels of pulp production apparently applied to paper grades only, including other fibre pulps, but omitting dissolving pulp. Because dissolving pulp was included with all wood pulps in this study the wood requirement estimates are relatively somewhat higher than those given by FAO even though initially, the same value for paper and paperboard consumption may have applied.

Throughout the exercise care was taken to harmonize the graphical method of representation used to make forecasts for 1990, beyond the FAO and CWP forecasts to 1985.

In so doing it became necessary to make minor adjustments to FAO or CWP values for some regions for 1985 where obvious disparities or distortions were evident. Similarly changes were made to some 1975 values where fresh statistical data suggested that the original estimates were no longer valid.

Table 28A presents a comparative Western European outlook for pulp and paper consumption and production(with paper broken into three grades for production) to illustrate the relative importance of Scandinavia (Finland, Norway and Sweden) as a producing region within Western Europe. Section 6 deals with the U.S.-Canada situation in a North American context.

CHART 3

WORLD PAPER & PAPERBOARD CONSUMPTION ESTIMATES

Million Metric Tons

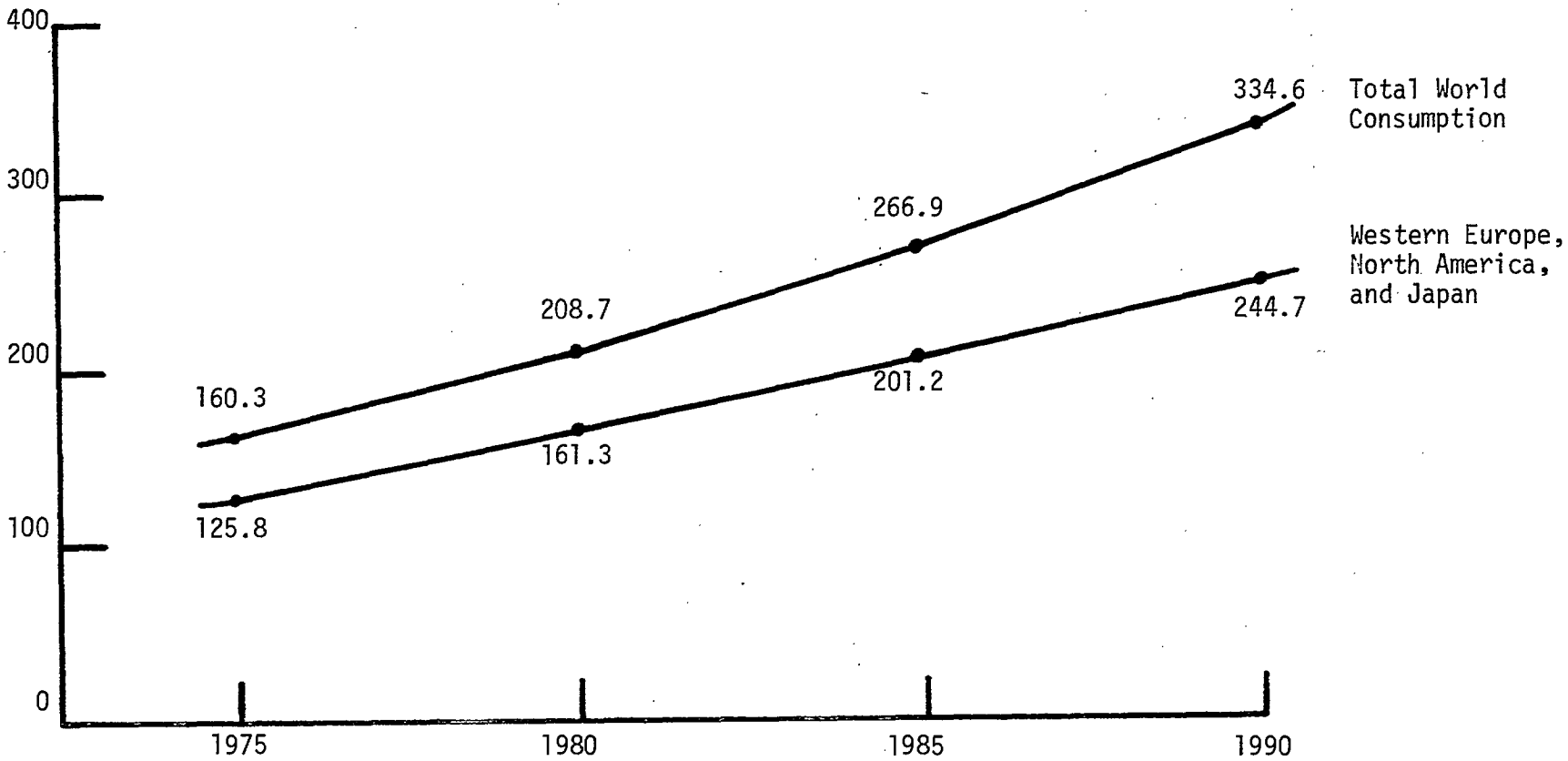

TABLE 21

A COMPARISON OF TOTAL WORLD PAPER & PAPERBOARD PRODUCTION, CONSUMPTION AND CAPACITY REQUIREMENTS

Million Metric Tons

Region	1975 Consumption Outlook	1975 Production Outlook	1975 Capacity Outlook	1980 Consumption Outlook	1980 Production Outlook	1980 Capacity Outlook
Western Europe	43.2	41.9	46.59	55.5	53.2	59.1
North America	63.0	68.7	69.89	76.3	82.1	90.6
Japan	19.6	19.2	17.95[1]	29.5	30.7	34.1
Oceania	2.9	1.7	2.16	3.8	3.0	3.8
USSR	8.4	9.0	9.80	11.1	12.5	15.6
Eastern Europe	6.5	6.1	6.18	8.7	7.9	9.7
Latin America	5.8	4.0	7.19	8.6	5.9	7.4
Asia & Far East	3.8	3.2	3.21	5.3	4.8	6.0
Middle East & Africa	2.1	1.7	2.30	3.4	2.1	2.8
China	5.0	4.8	5.65	6.5	6.5	8.1
WORLD TOTALS	160.3	160.3	170.91	208.7	208.7	237.2

Basis of estimates: See footnotes to Table 24.

[1]From 1973 FAO Capacity Survey. Estimate for Japan appears low.

Table 21 (cont.)

A COMPARISON OF TOTAL WORLD PAPER & PAPERBOARD PRODUCTION, CONSUMPTION AND CAPACITY REQUIREMENTS

Million Metric Tons

Region	1985 Consumption Outlook	1985 Production Outlook	1985 Capacity Outlook	1990 Consumption Outlook	1990 Production Outlook	1990 Capacity Outlook
Western Europe	69.8	67.5	77.6	86.0	78.9	87.7
North America	91.4	99.4	110.4	107.5	117.8	130.9
Japan	40.0	39.8	44.2	51.2	47.5	52.8
Oceania	5.3	4.2	5.2	7.2	6.2	7.8
USSR	16.3	18.2	24.3	22.8	28.9	38.5
Eastern Europe	11.6	10.4	13.9	15.6	14.3	19.1
Latin America	11.7	9.4	13.4	16.4	17.5	23.3
Asia & Far East	7.3	6.6	8.8	9.9	9.3	12.4
Middle East & Africa	4.5	2.9	3.9	5.8	4.2	5.6
China	9.0	8.5	10.6	12.2	10.0	12.5
WORLD TOTALS	266.9	266.9	312.3	334.6	334.6	390.6

TABLE 22

POPULATION AND INCOME ESTIMATES

Region	1975 Population (Millions)	G.D.P.[1] Per Capita (U.S. $)	1980 Population (Millions)	G.D.P.[1] Per Capita (U.S. $)	1985 Population (Millions)	G.D.P.[1] Per Capita (U.S. $)	1990 Population (Millions)
Western Europe	348	2122	361[2]	2539	375	3059	390
North America	240	4370	254	5085	267	5894	279
Japan	110	2181	116	3250	122	4475	127
Oceania	17	2786	19	3328	20	3934	21
USSR	225	1582	269	2065	286	2689	305
Eastern Europe	132	1245	138[2]	1595	145	2056	153
Latin America	326	494	376	598	435	725	510
Asia & Far East	1228	138	1398	176	1590	225	1810
Africa & Middle East	521	218	604	256	700	310	810
China	936	150	1033	180	1140	217	1278
World Totals	4113	686	4569	820	5080	982	5683

Source: FAO for 1975-1985.
Author's Estimate - 1990.

1. Constant 1963 prices for G.D.P. per capita values.
2. ETTS II says 544 by 1980 for all Europe. (Ref. 39).

TABLE 23

PER CAPITA CONSUMPTION - TOTAL PAPER AND PAPERBOARD

Kilograms per Capita

Region	1975	1980	1985	1990
Western Europe	124	154	186	220
North America	263	300	342	385
Japan	178	254	328	403
Oceania	171	200	265	343
USSR	33	41	57	75
Eastern Europe	49	63	80	102
Latin America	18	23	27	32
Asia & Far East	3	4	5	5
Africa & Middle East	4	6	6	7
China	5	6	8	10
World Totals	39	46	53	59

Note: These are derived values.

TABLE 24

FORWARD ESTIMATES FOR PAPER & PAPERBOARD

1975 - 1990

Consumption Outlook by Region & Grade

Million Metric Tons

Region	Newsprint				Printing & Writing				Other				Total			
	1975	1980	1985	1990	1975	1980	1985	1990	1975	1980	1985	1990	1975	1980	1985	1990
Western Europe	6.6	7.3	8.2	9.2	11.3	15.2	17.4	20.9	25.3	34.0	44.2	55.9	43.2	55.5	69.8	86.0
North America	11.0	11.9	13.6	15.5	13.1	16.6	20.5	24.6	38.9	47.8	57.3	67.4	63.0	76.3	91.4	107.5
Japan	3.0	4.2	5.6	7.4	3.1	4.5	6.5	9.1	13.5	20.8	27.9	34.7	19.6	29.5	40.0	51.2
Oceania	0.6	0.7	1.2	1.8	0.2	0.4	0.7	1.2	2.1	2.7	3.4	4.2	2.9	3.8	5.3	7.2
USSR	1.2	1.6	2.0	2.5	2.2	3.1	4.5	6.3	5.0	6.4	9.8	14.0	8.4	11.1	16.3	22.8
Eastern Europe	0.6	0.8	0.9	1.2	1.3	1.9	2.4	2.9	4.6	6.0	8.3	11.5	6.5	8.7	11.6	15.6
Latin America	1.3	1.8	2.4	3.2	1.2	1.5	2.0	2.5	3.3	5.3	7.3	10.7	5.8	8.6	11.7	16.4
Asia & Far East	0.7	1.2	1.5	1.9	1.4	1.9	2.8	3.9	1.7	2.2	3.0	4.1	3.8	5.3	7.3	9.9
Middle East & Africa	0.5	0.7	0.9	1.2	0.6	0.8	1.1	1.4	1.0	1.9	2.5	3.2	2.1	3.4	4.5	5.8
China	0.5	0.7	0.9	1.4	1.5	2.0	3.0	4.2	3.0	3.8	5.1	6.6	5.0	6.5	9.0	12.2
WORLD TOTALS	26.0	30.9	37.2	45.3	35.9	46.9	60.9	77.0	98.4	130.9	168.8	212.3	160.3	208.7	266.9	334.6

Sources: FAO for all regions except Western Europe, North America and Japan to 1985. Totals only. (Ref. 31)
CWP for Western Europe & Canada to 1985. Totals only. (Ref. 5)
USFS for U.S. Totals only. (Ref. 23)
Study estimates for Japan and for 1990 for all regions.

TABLE 25

FORWARD ESTIMATES FOR PAPER & PAPERBOARD

1975 - 1990

Production Outlook by Region & Grade

Million Metric Tons

Region	Newsprint				Printing & Writing				Other				Total			
	1975	1980	1985	1990	1975	1980	1985	1990	1975	1980	1975	1990	1975	1980	1975	1990
Western Europe	6.1	6.9	7.6	8.4	11.2	13.7	17.2	20.6	24.6	32.6	42.7	49.9	41.9	53.2	67.5	78.9
North America	12.3	15.0	17.2	20.4	12.8	15.9	19.9	23.6	43.6	51.2	62.3	73.8	68.7	82.1	99.4	117.8
Japan	2.8	4.2	5.0	6.0	3.2	5.2	7.3	8.7	13.2	21.3	27.5	32.8	19.2	30.7	39.8	47.5
Oceania	0.3	0.6	0.8	1.2	0.3	0.4	0.6	0.9	1.1	2.0	2.8	4.1	1.7	3.0	4.2	6.2
USSR	1.5	2.1	3.0	4.2	2.2	3.2	4.7	8.0	5.3	7.2	10.5	16.7	9.0	12.5	18.2	28.9
Eastern Europe	0.6	0.7	1.0	1.4	1.2	1.8	2.3	3.2	4.3	5.4	7.1	9.7	6.1	7.9	10.4	14.3
Latin America	0.5	1.0	1.7	2.7	0.7	1.1	1.6	3.5	2.8	3.8	6.1	11.3	4.0	5.9	9.4	17.5
Asia & Far East	0.7	1.1	1.5	2.1	1.1	1.6	2.4	3.4	1.4	2.1	2.7	3.8	3.2	4.8	6.6	9.3
Middle East & Africa	0.2	0.3	0.4	0.6	0.3	0.5	0.7	1.0	1.2	1.3	1.8	2.6	1.7	2.1	2.9	4.2
China	0.4	0.6	0.8	0.9	1.4	2.0	2.7	3.2	3.0	3.9	5.0	5.9	4.8	6.5	8.5	10.0
WORLD TOTALS	25.4	32.5	39.0	47.9	34.4	45.4	59.4	76.1	100.5	130.8	168.5	210.6	160.3	208.7	266.9	344.6

Source: FAO for all regions other than Western Europe, North America, and Japan to 1985. Totals only.
(Ref. 31) Author's estimates for Western Europe, North America, and Japan to 1990, and remaining regions for 1990.

TABLE 26

OUTLOOK FOR PAPER GRADE PULP CONSUMPTION

1975 - 1990

Million Metric Tons

Region	1975	1980	1985	1990
Western Europe	34.6	43.8	53.7	65.4
North America	60.6	71.1	81.9	96.2
Japan	12.3	21.5	32.0	43.0
Oceania	2.0	2.7	4.0	5.5
USSR	8.2	10.8	15.6	21.7
Eastern Europe	5.2	6.7	8.6	11.2
Latin America	3.4	4.9	6.3	8.9
Asia & Far East	2.9	4.2	6.2	8.4
Middle East & Africa	0.9	1.7	2.4	3.2
China	4.3	5.5	7.7	10.4
World Totals	134.4	172.9	218.4	273.9

Study estimates.

...65

TABLE 27

FORWARD ESTIMATES

FOR PULP PRODUCTION

1975 - 1990

Million Metric Tons

Region	1975	1980	1985	1990
Western Europe	32.7	40.0	47.3	53.7
North America	68.0	81.3	97.4	114.3
Japan	12.5	21.5	29.9	37.1
Oceania	2.0	3.2	4.4	6.3
USSR	9.4	12.6	18.3	28.9
Eastern Europe	4.8	5.9	7.5	9.7
Latin America	2.7	4.4	6.3	11.4
Asia & Far East	2.7	3.8	5.4	7.6
Middle East & Africa	1.0	1.5	2.0	2.5
China	4.1	5.4	6.7	7.7
World Totals	139.9	179.6	225.2	279.2

Study estimates.

Based on FAO ratios of paper and pulp production forecasts all pulps - paper grade and dissolving grades, including allowance for waste paper usage.

TABLE 28

FORWARD ESTIMATES

FOR PULP PRODUCTION

By Grade and Region

1975

Million Metric Tons

Region	Mechanical Wood Pulp	Chemical Wood Pulp	Other Fibre Pulp	Total Paper Grade Pulp	Dissolving Pulp	Total All Pulp
Western Europe	9.9	20.1	1.3	31.3	1.4	32.7
North America	14.4	50.4	0.9	65.7	2.3	68.0
Japan	1.9	9.6	0.4	11.9	0.6	12.5
Oceania	0.8	1.0	-	1.8	0.2	2.0
USSR	2.1	6.4	0.4	8.9	0.5	9.4
Eastern Europe	1.0	3.2	0.3	4.5	0.3	4.8
Latin America	0.7	1.4	0.6	2.7	-	2.7
Asia & Far East	0.6	0.7	1.1	2.4	0.3	2.7
Middle East & Africa	0.1	0.7	0.2	1.0	-	1.0
China	0.6	0.7	2.8	4.1	-	4.1
World Totals	32.1	94.2	8.0	134.3	5.6	139.9

...67

TABLE 28 (cont.)

FORWARD ESTIMATES

FOR PULP PRODUCTION

By Grade and Region

1980

Million Metric Tons

Region	Mechanical Wood Pulp	Chemical Wood Pulp	Other Fibre Pulp	Total Paper Grade Pulp	Dissolving Pulp	Total All Pulp
Western Europe	12.2	25.0	1.3	38.5	1.5	40.0
North America	16.5	61.1	1.0	78.6	2.7	81.3
Japan	2.7	16.3	1.8	20.8	0.7	21.5
Oceania	0.9	2.0	-	2.9	0.3	3.2
USSR	2.6	8.9	0.5	12.0	0.6	12.6
Eastern Europe	1.0	4.2	0.3	5.5	0.4	5.9
Latin America	0.9	2.6	0.8	4.3	0.1	4.4
Asia & Far East	0.9	1.2	1.3	3.4	0.4	3.8
Middle East & Africa	0.2	0.9	0.3	1.4	0.1	1.5
China	0.9	1.0	3.4	5.3	0.1	5.4
World Totals	38.8	123.2	10.7	172.7	6.9	179.6

...68

Table 28 (cont.)

FORWARD ESTIMATES

FOR PULP PRODUCTION

By Grade and Region

1985

Million Metric Tons

	Mechanical Wood Pulp	Chemical Wood Pulp	Other Fibre Pulp	Total Paper Grade Pulp	Dissolving Pulp	Total All Pulp
Western Europe	13.9	30.3	1.5	45.7	1.6	47.3
North America	18.4	74.3	1.6	94.3	3.1	97.4
Japan	3.5	21.9	3.7	29.1	0.8	29.9
Oceania	1.0	3.0	-	4.0	0.4	4.4
USSR	3.6	13.2	0.7	17.5	0.8	18.3
Eastern Europe	1.2	5.2	0.6	7.0	0.5	7.5
Latin America	1.2	4.0	0.9	6.1	0.2	6.3
Asia & Far East	1.4	2.2	1.3	4.9	0.5	5.4
Middle East & Africa	0.3	1.1	0.5	1.9	0.1	2.0
China	1.1	1.4	3.9	6.4	0.3	6.7
World Totals	45.6	156.6	14.7	216.9	8.3	225.2

TABLE 28 (cont.)

FORWARD ESTIMATES

FOR PULP PRODUCTION

1990

Million Metric Tons

Region	Mechanical Wood Pulp	Chemical Wood Pulp	Other Fibre Pulp	Total Paper Grade Pulp	Dissolving Pulp	Total All Pulp
Western Europe	16.0	34.2	1.7	51.9	1.8	53.7
North America	20.7	87.9	2.2	110.8	3.5	114.3
Japan	5.6	25.5	5.0	36.1	1.0	37.1
Oceania	1.1	4.2	0.5	5.8	0.5	6.3
USSR	8.1	18.8	1.0	27.9	1.0	28.9 [1]
Eastern Europe	1.8	6.3	1.0	9.1	0.6	9.7
Latin America	1.6	8.4	1.1	11.1	0.3	11.4
Asia & Far East	1.7	3.7	1.6	7.0	0.6	7.6
Middle East & Africa	0.4	1.2	0.7	2.3	0.2	2.5
China	1.2	1.6	4.5	7.3	0.5	7.8
World Totals	52.4	197.5	19.3	269.3	10.0	279.3

Note 1. I. Vasiliev of USSR in a recent paper notes that USSR pulp production could reach 31.2 million metric tons by 1993 (Ref. 11).

...70

TABLE 28 A

COMPARATIVE WESTERN
EUROPEAN OUTLOOK FOR PULP & PAPER
CONSUMPTION & PRODUCTION

Million Metric Tons

A. PAPER GRADE PULP ESTIMATES

	1975		1980		1985		1990	
	Consumption	Production	Consumption	Production	Consumption	Productions	Consumption	Production
Scandinavia[1]	13.2	20.1	16.8	24.3	20.6	28.7	25.1	32.7
Rest of Western Europe	21.4	11.2	27.0	14.2	33.1	17.0	40.3	19.2
Western Europe	34.6	31.3	43.8	38.5	53.7	45.7	65.4	51.9

[1]Finland, Norway & Sweden.

B. PAPER & PAPERBOARD ESTIMATES

Million Metric Tons

	1975		1980		1985		1990	
	Consumption	Production	Consumption	Production	Consumption	Production	Consumption	Production
Scandinavia[1]	2.6	13.9	4.4	17.5	5.5	25.2	6.8	27.1
Rest of Western Europe	40.6	28.0	51.1	35.7	64.3	42.3	79.2	51.8
Western Europe	43.2	41.9	55.5	53.2	69.8	67.5	86.0	78.9

[1]Finland, Norway & Sweden.

TABLE 28 A
(contd)

B.1. NEWSPRINT PRODUCTION ESTIMATES

Million Metric Tons

	1975	1980	1985	1990
Scandinavia[1]	3.9	4.5	5.1	5.8
Rest of Western Europe	2.2	2.4	2.5	2.6
Western Europe	6.1	6.9	7.6	8.4

B.2. PRODUCTION ESTIMATES FOR PRINTING & WRITING PAPERS (other than newsprint)

Million Metric Tons

	1975	1980	1985	1990
Scandinavia[1]	3.0	4.0	5.2	6.3
Rest of Western Europe	8.2	9.7	12.0	14.3
Western Europe	11.2	13.7	17.2	20.6

B.3. INDUSTRIAL PAPERS & PAPERBOARD PRODUCTION ESTIMATES

Million Metric Tons

	1975	1980	1985	1990
Scandinavia[1]	10.7	13.9	18.9	25.3
Rest of Western Europe	13.9	18.7	23.8	24.6
Western Europe	24.6	32.6	42.7	49.9

[1] Finland, Norway & Sweden.

TABLE 29

WOOD REQUIREMENTS
FOR PULP

1975

Million Cubic Metres

Region	Mechanical Wood Pulp	Chemical Wood Pulp	Dissolving Pulp	Total Wood Pulps
Western Europe	24.8	94.1	7.7	126.6
North America	36.0	235.9	12.7	284.6
Japan	4.8	33.1	3.3	41.2
Oceania	2.0	4.2	1.1	7.3
USSR	5.3	30.0	2.8	38.1
Eastern Europe	2.5	15.0	1.7	19.2
Latin America	1.8	6.6	-	8.4
Asia & Far East	1.5	3.3	1.7	6.5
Middle East & Africa	0.3	3.3	-	3.6
China	1.5	3.3	-	4.8
World Totals	80.5	428.8	31.0	540.3

Note: m^3/ton ratios used.

4.68 Chemical Wood Pulp
2.50 Mechanical Wood Pulp
5.5 Dissolving Pulp

Exception: Japan 3.45 Chemical
Oceania 4.17 Chemical

...71

TABLE 29 (cont.)

WOOD REQUIREMENTS FOR PULP

1980

Million Cubic Metres

Region	Mechanical Wood Pulp	Chemical Wood Pulp	Dissolving Pulp	Total Wood Pulps
Western Europe	30.5	114.5	8.3	153.3
North America	41.3	279.8	14.9	336.0
Japan	6.8	55.9	3.9	66.6
Oceania	2.3	8.3	1.7	12.3
USSR	6.5	40.8	3.3	50.6
Eastern Europe	2.5	19.2	2.2	23.9
Latin America	2.3	11.9	0.6	14.8
Asia and Far East	2.3	5.5	2.2	10.0
Middle East & Africa	0.5	4.1	0.6	5.2
China	2.3	4.6	0.6	7.5
WORLD TOTAL	97.3	544.6	38.3	680.2

Note: m^3/ton ratios used.
4.58 Chemical Wood Pulp except Japan 3.43 and Oceania 4,15
2.50 Mechanical Wood Pulp
5.50 Dissolving Pulp

...72

Table 29 (cont.)

WOOD REQUIREMENTS
FOR PULP

1985

Million Cubic Metres

Region	Mechanical Wood Pulp	Chemical Wood Pulp	Dissolving Pulp	Total Wood Pulps
Western Europe	34.8	137.3	8.8	180.9
North America	46.0	336.6	17.1	399.7
Japan	8.8	74.7	4.4	87.4
Oceania	2.5	12.4	2.2	17.1
USSR	9.0	59.8	4.4	73.2
Eastern Europe	3.0	23.6	2.8	29.4
Latin America	3.0	18.1	1.1	22.2
Asia & Far East	3.5	10.0	2.8	16.3
Middle East & Africa	0.8	5.0	0.6	6.4
China	2.8	6.3	1.7	10.8
World Totals	114.2	683.8	45.9	843.9

Notes: m^3/ton ratios used.
4.53 Chemical Wood Pulp except Japan 3.41 and Oceania 4.13.
2.50 Mechanical Wood Pulp.
5.50 Dissolving Pulp.

...73

TABLE 29 (cont.)

WOOD REQUIREMENTS
FOR PULP

1990

Million Cubic Metres

Region	Mechanical Wood Pulp	Chemical Wood Pulp	Dissolving Pulp	Total Wood Pulps
Western Europe	40.0	152.9	9.9	202.8
North America	51.8	392.9	19.2	463.9
Japan	14.0	86.2	5.5	105.7
Oceania	2.8	17.4	2.8	23.0
USSR	20.3	84.0	5.5	109.8
Eastern Europe	4.5	28.2	3.3	36.0
Latin America	4.0	37.5	1.7	43.2
Asia & Far East	4.3	16.5	3.3	24.1
Middle East & Africa	1.0	5.4	1.1	7.5
China	3.0	7.2	2.8	13.0
World Totals	145.7	828.2	55.1	1029.0

Chemical Wood Pulp 4.47 except Japan 3.38, Oceania 4.15, 4.47. Mechanical 2.5 and Dissolving 5.5: See Table 22 of FO:PAP/72/4. (Ref. 31)

...74

5.0 WORLD TRADE OUTLOOK FOR PULP AND PAPER

Together,pulp and paper represent the world's most important items in world trade in forest products. In 1970, world trade in forest products attained a value of 12.5 thousand million U.S. dollars, with pulp and paper accounting for $6.8 thousand million or 54 percent of the total. Between 1960 and 1970, world trade in pulp and paper more than doubled from $3.2 thousand million to $6.8 thousand million. In the same period, sawnwood, the second most important item, rose from $1.7 to $2.7 thousand million. It is significant that Canadian pulp and paper exports in the 1960's rose from $1.1 to $2.1 thousand million, at a slightly lower rate than world trade in these products. In 1970, Canadian exports represented nearly 31 percent of world trade in pulp and paper.

Western Europe and North America between them account presently for more than 90 percent, by value, of the world's pulp and paper trade. A trend towards eventual North American dominance in the trade could be developing since this region's exports, both from and into the region, rose from 41 percent of world exports in 1963 to more than 43 percent in 1967. Conversely, Western Europe's share dropped from 52 percent to 48.5 percent in the same period (Ref. 31). While some setbacks occurred in the pulp and paper trade in 1970 and 1971, the year 1972 marked a strong return to the trends of the 1960's, when the average annual rate of growth in world trade in these products exceeded 7 percent in terms of value and 6.3 percent in terms of volume.

5.1 Introduction to Trade Forecasts

Some indication of future trade prospects in pulp, paper and paperboard can be derived by calculating differences on a regional basis between the production and consumption estimates presented in section 4. The resulting regional net trade balances do not, of course, lead to estimates of the level of exports or imports of any one region.

They do, nevertheless, identify those areas which have a future potential as exporters or importers, assuming, of course, that the basis for the estimates of output and consumption are sound.

FAO's explanation is as follows:

> "A net export availability of 5.3 million tons of pulp in the North American region in 1975 could arise from a large number of combinations of imports and exports such as imports 0 and exports 5.3 million tons, ranging up to some feasible upper level such as imports 3.0 million and exports 8.3 million tons....The need for caution in appraising future trade prospects and patterns from net trade balances calculated from forecasts of production and consumption can hardly be over-estimated". (Ref. 31)

Tables 30 and 31 present this study's calculated net trade balances for paper and paperboard, by major grades and for paper-grade pulp, for the years 1975 to 1990. As noted above, the figures are indicative only of future trade potential by region and should in no way be construed as estimates of exports or imports.

Surprisingly, the 1980 net trade balances of this study compare very closely with FAO's net trade balances for 1985, suggesting rather strongly that trade developments could take place earlier than forseen by that agency.

The world trade outlook for paper and paperboard in 1985 is characterized by only two export surplus regions, North America and the USSR,compared with North America, the USSR, and Japan in 1980. North America will continue to have the largest net export potential, reaching some ten million tons in 1990, although the rate of growth in its surplus could decline between 1985 and 1990 as a result of domestic requirements outgrowing the beginnings of fibre-supply-constrained outputs.

Industrial papers would appear to have the strongest growth prospects for trade from North America, with slower growth prospects for newsprint. The region could also be a net-importer of printing and writing papers by 1990.

Prospects for USSR trade appear particularly favourable in paper and paperboard, especially between 1985 and 1990, after taking into account the counterbalancing requirements of Eastern Europe. By 1990 the net export surplus of the two regions could be of the order of 5 million tons compared with less than one million tons in 1985. By 1990 Latin America is expected to have replaced Japan as a net exporting region in paper and paperboard, although it may well remain a net importing region until 1985.

Of the net importing regions of paper and paperboard, Western Europe will continue in its role as the biggest of any region, with the possibility of net requirements climbing at the rate of one million tons per year between 1985 and 1990, reaching some 7 million tons by 1990. The other major deficit regions appear to be Japan and China with an overall requirement of some 6 million tons in 1990.

The outlook for trade in pulp (shown in Table 31) parallels the prospects for paper to 1990 with growth rates higher than those expected for paper. North American net exports could triple to almost 15 million tons, compared with less than a doubling in paper and paperboard. Again, the USSR and Latin America could emerge as major net exporters, particularly between 1985 and 1990.

The trends forseen in this analysis support the findings of FAO and others that the world's paper economy, at least to 1990, will be dominated by and concentrated in the developed regions.

TABLE 30

PAPER AND PAPERBOARD

*NET TRADE BALANCES

Million Metric Tons

	1975				1980			
	Newsprint	Printing & Writing	Other Paper & Paperboard	Total	Newsprint	Printing & Writing	Other Paper & Paperboard	Total
Western Europe	-0,5	-0.1	-0.7	-1.3	-0.4	-0.5	-1.4	-2.3
North America	+1.3	-0.3	+4,7	+5.7	+3.1	-0.7	+3.4	+5.8
Japan	-0,2	+0.1	-0.3	-0.4	-	+0.7	+0.5	+1.2
Oceania	-0.3	+0.1	-1,0	-1.2	-0.1	-	-0.7	-0.8
USSR	+0,3	-	+0.3	+0.6	+0.5	-0.1	+0.8	+1.4
Eastern Europe	-	-0.1	-0.3	-0.4	-0.1	-0.1	-0.6	-0.8
Latin America	-0,8	-0.5	-0.5	-1.8	-0.8	-0.4	-1.5	-2.7
Asia & Far East	-	-0.3	-0.3	-0.6	-0.1	-0.3	-0.1	-0.5
Middle East & Africa	-0.3	-0.3	+0.2	-0.4	-0.4	-0.3	-0.6	-1.3
China	-0.1	-0.1	-	-0.2	-0.1	-	+0.1	-
*WORLD TOTALS	-0.6	-1.5	+2.1	0.0	+1.6	-1.5	-0.1	0.0

*See Appendix II for adjusted net trade balances, where regional balances are adjusted proportionately to allow grade totals to equal zero.

TABLE 30 (cont.)

PAPER AND PAPERBOARD

*NET TRADE BALANCES

Million Metric Tons

	1985				1990			
	Newsprint	Printing & Writing	Other Paper & Paperboard	Total	Newsprint	Printing & Writing	Other Paper & Paperboard	Total
Western Europe	-0.6	-0.2	-1.5	-2.3	-0.8	-0.3	-6.0	-7.1
North America	+3.6	-0.6	+5.0	+8.0	+4.9	-1.0	+6.4	+10.3
Japan	-0.6	+0.8	-0.4	-0.2	-1.4	-0.4	-1.9	-3.7
Oceania	-0.4	-0.1	-0.6	-1.1	-0.6	-0.3	-0.1	-1.0
USSR	+1.0	+0.2	+0.7	+1.9	+1.7	+1.7	+2.7	+6.1
Eastern Europe	+0.1	-0.1	-1.2	-1.2	+0.2	+0.3	-1.8	-1.3
Latin America	-0.7	-0.4	-1.2	-2.3	-0.5	+1.0	+0.6	+1.1
Asia & Far East	-	-0.4	-0.3	-0.7	+0.2	-0.5	-0.3	-0.6
Middle East & Africa	-0.5	-0.4	-0.7	-1.6	-0.6	-0.4	-0.6	-1.6
China	-0.1	-0.3	-0.1	-0.5	-0.5	-1.0	-0.7	-2.2
*World Totals	+1.8	-1.5	-0.3	0.0	+2.6	-0.9	-1.7	0.0

*See Appendix II for adjusted net trade balances, where regional balances are adjusted proportionately to allow grade totals to equal zero.

TABLE 31

PAPER GRADE PULP NET TRADE BALANCES

Million Metric Tons

Region	1975	1980	1985	1990
Western Europe	-3.3	-5.3	-8.0	-13.5
North America	+5.1	+7.5	+12.4	+14.6
Japan	-0.4	-0.7	-2.9	-6.9
Oceania	-0.2	+0.2	-	+0.3
USSR	+0.7	+1.2	+1.9	+6.2
Eastern Europe	-0.7	-1.2	-1.6	-2.1
Latin America	-0.7	-0.6	-0.2	+2.2
Asia & Far East	-0.5	-0.8	-1.3	-1.4
Middle East & Africa	+0.1	-0.3	-0.5	-0.9
China	-0.2	-0.2	-1.3	-3.1
World Totals	-0.1	-0.2	-1.5	-4.6

Note: See Appendix IIIfor adjusted net trade balances, where regional balances have been adjusted proportionately to allow annual totals to equal zero.

...80

5.3 Possible Future Trade Patterns

Tables 32 to 36 inclusive, present what are considered to be indicative estimates of possible future trade patterns for the major exporting and importing regions for pulp and paper for 1980 and 1990. The estimates are based on past trends and on adjusted net trade balances[1] (which have their own shortcomings), for paper grade pulp and total paper and paperboard, with breakdowns for newsprint; other printing and writing paper; and industrial papers and paperboard. Unfortunately, it was not considered feasible after some considerable investigation to develop estimates of pulp trade patterns by grade. This would have required a new series of regional grade by grade pulp consumption estimates. In any event, recent trends suggest that sulphate pulp will account for more than 85 percent of Canadian woodpulp exports in the period between 1975 and 1990, with sulphite pulp the second largest at between 5 and 10 percent, and the remainder comprising dissolving grades, special alpha, and mechanical pulps.

The most outstanding outcome of the findings is that Canadian pulp exports could rise at a much faster rate than paper and paperboard exports. Whereas paper and paperboard exports could double between 1970 and 1990, all indications point to a quadrupling in pulp exports over the same period.

Table 37 presents estimates for Scandinavian pulp and paper exports to the rest of Western Europe for the period 1975 to 1990. Again, the estimates are only indicative of the relative size of exports which may take place within the region. Of some significance, in contrast to the outlook for Canada, is the dominance of paper and paperboard in estimated Scandinavian exports, in relation to expected pulp exports.

1. See Appendix II and III for adjusted net trade balances by region.

TABLE 32

Trade Patterns

TOTAL PAPER & PAPERBOARD

Million Metric Tons

1970

From \ To	U.S.	Western Europe	Japan	Latin America	Other	Total
Canada	6.0	0.9	0.1	0.6	0.5	8.1
U.S.	-	1.0	-	0.6	0.4	2.0
USSR	-	0.1	-	-	-	0.1
Japan	-	-	-	-	0.5	0.5
Latin America	-	-	-	-	-	-
Scandinavia	0.3	-	-	0.4	1.1	1.8
Total	6.3	2.0	0.1	1.6	2.5	12.5

1980

From \ To	U.S.	Western Europe	Japan	Latin America	Other	Total
Canada	7.1	1.3	0.1	1.0	1.0	10.5
U.S.	-	1.3	-	1.0	0.4	2.7
USSR	-	0.6	-	-	-	0.6
Japan	-	-	-	-	0.5	0.5
Latin America	-	-	-	-	-	-
Scandinavia	0.1	-	-	0.1	1.0	1.2
Total	7.2	3.2	0.1	2.1	2.9	15.5

1990

From \ To	U.S.	Western Europe	Japan	Latin America	Other	Total
Canada	10.0	2.8	1.7	0.8	1.9	17.2
U.S.	-	1.3	0.3	0.9	0.5	3.0
USSR	-	0.9	1.8	0.1	1.5	4.3
Japan	-	-	-	-	0.3	0.3
Latin America	-	-	-	-	1.0	1.0
Scandinavia	-	-	-	0.1	0.8	0.9
Total	10.0	5.0	3.8	1.9	6.0	26.7

Note: Excludes USSR exports to Eastern Europe as well as Scandinavian exports to Western Europe. Estimates of the latter are available from Table 37.

TABLE 33

Trade Patterns

NEWSPRINT

Million Metric Tons

1970

From \ To	U.S.	Western Europe	Japan	Latin America	Other	Total
Canada	5.7	0.6	0.1	0.6	0.5	7.5
U.S.	-	-	-	0.1	-	0.1
USSR	-	-	-	-	-	-
Japan	-	-	-	-	-	-
Latin America	-	-	-	-	-	-
Scandinavia	0.3	-	-	0.2	0.1	0.6
Total	6.0	0.6	0.1	0.9	0.6	8.2

1980

From \ To	U.S.	Western Europe	Japan	Latin America	Other	Total
Canada	6.2	1.0	0.1	1.0	1.0	9.3
U.S.	-	0.1	-	0.2	-	0.3
USSR	-	-	-	-	-	-
Japan	-	-	-	-	-	-
Latin America	-	-	-	-	-	-
Scandinavia	0.1	-	-	-	0.2	0.2
Total	6.3	1.1	0.1	1.2	1.2	9.8

1990

From \ To	U.S.	Western Europe	Japan	Latin America	Other	Total
Canada	7.5	1.3	0.9	0.6	1.9	12.2
U.S.	-	-	-	0.1	-	0.1
USSR	-	0.2	0.8	0.1	0.2	1.3
Japan	-	-	-	-	-	-
Latin America	-	-	-	-	-	-
Scandinavia	-	-	-	-	0.1	0.1
Total	7.5	1.5	1.7	0.8	2.2	13.7

Note: Excludes USSR exports to Eastern Europe as well as Scandinavian exports to Western Europe which are presented in Table 37.

TABLE 34

Trade Patterns

PRINTING & WRITING
Million Metric Tons

1970

From \ To	U.S.	Western Europe	Japan	Latin America	Other	Total
Canada	0.2	-	-	-	-	0.2
U.S.	-	-	-	-	-	-
USSR	-	-	-	-	-	-
Japan	-	-	-	-	0.2	0.2
Latin America	-	-	-	-	-	-
Scandinavia	-	-	-	0.1	0.5	0.6
Total	0.2	-	-	0.1	0.7	1.0

1980

From \ To	U.S.	Western Europe	Japan	Latin America	Other	Total
Canada	0.3	-	-	-	-	0.3
U.S.	-	-	-	0.1	-	0.1
USSR	-	0.3	-	-	-	0.3
Japan	-	-	-	-	0.2	0.2
Latin America	-	-	-	-	-	-
Scandinavia	-	-	-	-	0.5	0.5
Total	0.3	0.3	-	0.1	0.7	1.4

1990

From \ To	U.S.	Western Europe	Japan	Latin America	Other	Total
Canada	0.3	-	-	-	-	0.3
U.S.	-	-	-	-	-	-
USSR	-	0.2	0.4	-	1.0	1.6
Japan	-	-	-	-	0.1	0.1
Latin America	-	-	-	-	0.2	0.2
Scandinavia	-	-	-	-	0.2	0.2
Total	0.3	0.2	0.4	-	1.5	2.4

Note: Tables exclude USSR exports to Eastern Europe and Scandinavia exports to Western Europe which are presented in Table 37.

TABLE 35

Trade Patterns

INDUSTRIAL PAPER & PAPERBOARD

Million Metric Tons

1970

From \ To	U.S.	Western Europe	Japan	Latin America	Other	Total
Canada	0.1	0.3	-	-	-	0.4
U.S.	-	1.0	-	0.5	0.4	1.9
USSR	-	0.1	-	-	-	0.1
Japan	-	-	-	-	0.3	0.3
Latin America	-	-	-	-	-	-
Scandinavia	-	-	-	0.1	0.5	0.6
Total	0.1	1.4	-	0.6	1.2	3.3

1980

From \ To	U.S.	Western Europe	Japan	Latin America	Other	Total
Canada	0.6	0.3	-	-	-	0.9
U.S.	-	1.2	-	0.7	0.4	2.3
USSR	-	0.3	-	-	-	0.3
Japan	-	-	-	-	0.3	0.3
Latin America	-	-	-	-	-	-
Scandinavia	-	-	-	0.1	0.5	0.6
Total	0.6	1.8	-	0.8	1.2	4.4

1990

From \ To	U.S.	Western Europe	Japan	Latin America	Other	Total
Canada	2.2	1.5	0.8	0.2	-	4.7
U.S.	-	1.3	0.3	0.8	0.5	2.9
USSR	-	0.5	0.6	-	0.3	1.4
Japan	-	-	-	-	0.2	0.2
Latin America	-	0.8	-	-	-	0.8
Scandinavia	-	-	-	0.1	0.5	0.6
Total	2.2	4.1	1.7	1.1	1.5	10.6

Note: Tables exclude USSR exports to Eastern Europe and Scandinavian exports to Western Europe which are presented in Table 37.

TABLE 36

Trade Patterns

PAPER GRADE PULP

Million Metric Tons

1970

From \ To	U.S.	Western Europe	Japan	China	Other	Total
Canada	3.0	1.2	0.5	-	0.4	5.1
U.S.	-	1.4	0.4	-	1.0	2.8
USSR	-	0.1	-	-	-	0.1
Japan	-	-	-	-	-	-
Latin America	-	-	-	-	-	-
Scandinavia	0.1	-	-	0.1	0.5	0.7
Total	3.1	2.7	0.9	0.1	1.9	8.7

1980

From \ To	U.S.	Western Europe	Japan	China	Other	Total
Canada	5.7	3.0	1.2	0.2	0.5	10.6
U.S.	-	1.5	0.5	0.1	0.5	2.6
USSR	-	0.3	0.1	-	-	0.4
Japan	-	-	-	-	0.4	0.4
Latin America	-	-	-	-	-	-
Scandinavia	-	-	-	-	0.3	0.3
Total	5.7	4.8	1.8	0.3	1.7	14.3

1990

From \ To	U.S.	Western Europe	Japan	China	Other	Total
Canada	9.6	6.0	3.0	1.5	2.1	22.2
U.S.	-	1.0	0.5	0.2	0.3	2.0
USSR	0.2	1.4	2.4	-	0.4	4.4
Japan	-	-	-	-	-	-
Latin America	0.5	0.5	0.5	0.2	0.5	2.2
Scandinavia	-	-	-	-	-	-
Total	10.3	8.9	6.4	1.9	3.3	30.8

Note: Excludes USSR exports to Eastern Europe and Scandinavian exports to Western Europe which are presented in Table 37.

TABLE 37

SCANDINAVIAN EXPORT ESTIMATES TO THE REST OF WESTERN EUROPE

Million Metric Tons

	1975	1980	1985	1990
1. NEWSPRINT				
Production	3.9	4.5	5.1	5.8
Consumption	.6	.7	.9	1.2
Balance	3.3	3.8	4.2	4.6
Less Exports Outside Region[1]	.5	.2	.2	.1
Export to Rest of W. Europe	2.8	3.6	4.0	4.5
2. OTHER PRINTING AND WRITING				
Production	3.0	4.0	5.2	6.3
Consumption	.6	.8	1.1	1.4
Balance	2.4	3.2	4.1	4.9
Less Exports Outside Region[1]	.5	.5	.3	.2
Exports to Rest of W. Europe	1.9	2.7	3.8	4.7
3. INDUSTRIAL PAPERS				
Production	10.7	13.9	18.9	25.3
Consumption	3.6	5.4	7.6	8.8
Balance	7.1	8.5	11.3	16.5
Less Exports Outside Region[1]	.6	.6	.6	.6
Exports to Rest of W. Europe	6.5	7.9	10.7	15.9
4. PAPER GRADE PULP				
Production	20.1	24.3	28.7	32.7
Consumption	13.2	16.8	20.6	25.1
Balance	6.9	7.5	8.1	7.6
Less Exports Outside Region[1]	.5	.3	.1	-
Exports to Rest of W. Europe	6.4	7.2	8.0	7.6

Note: See Tables 33 to 36 for estimates of exports from Scandinavia to regions outside Western Europe.

6.0 CANADA'S POSITION IN A WORLD PULP AND PAPER PERSPECTIVE

In a world perspective, Canada appears to be in a favourable position to benefit substantially from growing world demands for pulp and paper. Not only does Canada possess large resources of long fibred species, which command the highest prices when converted to pulp, paper, and paperboard, but these resources are strategically placed between the huge United States, European, and Japanese markets. Canada, in addition, has the technical know-how in both logging and pulping to make the most of these advantages and continue in her role as the world's leading exporter of pulp and paper products.

6.1 Canadian Outlook

Examined more closely, the situation may not be as encouraging. Taking forest resources first, it is clear from Section 2, Table 3 that Canada's forests are relatively slow-growing because of their northern latitude. Rates of growth in the United States are more than double the rates for Canada. Second, the most favourable plant locations, close to the best resources, power sources, water, manpower centres, and deep-sea shipping have already been developed. Third, with already high labour costs, the development of inland sites will be costly since movement of industry to those locations implies high transportation costs for products moving to markets and for materials moving to those plants. Fourth, natural forests, which are marginal in character, are more difficult to develop than man-made forests and require large expenditures for road building. Fifth, recent escalations in delivered prices of pulpwood could affect Canada's overseas competitive position. Sixth, difficulties are being experienced in attracting workers to remote areas. Seventh, the ageing newsprint sector in Eastern Canada requires costly revitalization.

Eighth, there is growing concern in investment circles, both in Canada and abroad, and in the private sector, over recent direct public sector involvement in the pulp and paper industry.

Ninth, paper and paperboard items which are presently protected by tariffs, could face poor growth prospects, and tenth, foreign control of a substantial part of the Canadian industry acts to the detriment of the industry, especially during periods of overcapacity.

Viewed from this essentially domestic perspective, the outlook is less encouraging, more especially in view of the difficulties experienced in launching new capacity in Newfoundland, Manitoba, and British Columbia, alluded to in item eight. These problems attracted Federal attention and gave rise to a series of studies, including this appraisal.

On the international level, the opportunities for the development of new viable pulp and paper capacity are, on balance, less attractive than they are in Canada, with the possible exception of the U.S. South. More particularly is this so for export capacity. In the market economies of the U.S., Japan, and Europe, there is still room for considerable expansion, particularly in the U.S., but less so in Japan and Europe where raw material constraints will limit growth of capacity unless outside supply sources are developed.

In the developing countries, there is likely to be a continuation of policies of self-sufficiency and import substitution both within countries and within regions, as a means of achieving savings in foreign exhange. Financing of new projects in pulp and paper will likely come from bilateral arrangements or, to a lesser extent, from regional development banks in cooperation with multi-national companies. Those countries with large forest resources, or with a proven potential for developing large plantations of fast growing species will obviously attract new industry and will be first to develop. Yet there will be administrative constraints and difficulties, some of a social character, which will affect operations and trade. To date the record has not been good for mills based on mixed tropical hardwoods. New opportunities would be created by a technological break-through which altered the economies of scale in favour of smaller mill sizes. Low labour costs could be used to greater advantage in establishing new plantations.

Total domestic pulpwood requirements in the developing countries of Latin America, Asia, the Middle East, and Africa in 1990 are expected to be 72 million cubic metres compared with over 640 million cubic metres in the market economies of North America, Western Europe, Japan, and Oceania. Thus, the relative size of development in those countries could also be small, but this will depend upon the successes achieved by Western Europe, and more especially Japan, in making either trade or development arrangements for pulpwood, pulp, or paper with those countries. This analysis has suggested that fuelwood requirements in developing countries

could rise to such an extent as to create a large wood fibre deficit in those regions by 1990. This is by no means certain, however, as the situation could change if capital and alternative sources of fuel became more freely available to developing regions.

Western Europe and Japan can be expected to focus greater attention on Canada as a source of pulp and paper supplies in the future. Of the two markets, Western Europe will remain the larger market, since Japan will look more to the USSR for supplies, and to developing its own "in-transit" mills in the Pacific region. This is especially true for wood pulp. For paper and paperboard, Western Europe's dependence on Canada will be substantial compared with that of Japan, with the emphasis on newsprint, paperboard, and sack kraft. Canadian exports of paper and paperboard to Western Europe by 1990 could rise to nearly three million tons from their 1970 level of one million tons. Similarly, exports of pulp could climb to over six million tons from a level of 1.2 million tons in 1970.

The United States will continue to be Canada's largest market for pulp and paper in the 1975-1990 period and the rate of development of the U.S. industry will have a direct bearing on the nature and extent of Canadian pulp and paper development and trade. If the U.S. achieves the production levels predicted by the recent Forest Service Study (Ref. 32) then the Canadian industry and its exports will not reach the levels forseen in this analysis. However, the Forest Service Study notes that higher relative prices for pulp and paper tend to result in

higher levels of Canadian imports by the U.S.[1] For woodpulp, the U.S. report forsees no increase in imports to 1990 and beyond from Canada if prices remain at 1970 levels; a rise from 1970 levels of 3.0 million metric tons to 6.7 million metric tons by 1990 if relative prices increase by 0.5 percent per year; and a rise to 6.3 million tons by 1990 if relative prices rise by ten percent above the 1970 average. Similarly, for paper and board, the U.S. report expects imports of 7.2 million tons; 11.3 million tons and 10.4 million tons respecively under the above price assumptions. The arguments are largely academic since many investigators have found that paper and paperboard demand is relatively insensitive to price changes. Already actual pulp and paper prices have risen significantly since 1970 and relative prices are advancing more rapidly than the U.S. study anticipated. The Canadian price index for paper-grade sulphite pulp for export in October, 1973 was 132.8 compared with 100 for 1970. Sulphate pulp was 134.2 and newsprint, although not reflecting the price increases announced that month, was 109.6. Taking into account the rate of inflation, relative prices for pulp were some 17 percent higher in October 1973 than in 1970. Increases in pulp and paper prices since 1970 marked the end of a decline, which took place throughout the 1960's, of some 15 percent in real prices on the international market.

Ref. 23

[1]Although imports (of paper and board) have increased somewhat in the last few years, it appears unlikely that Canada could significantly increase recent levels of shipments to the United States unless prices rise enough to cover the higher costs of utilizing timber in the undeveloped northern parts of the Canadian provinces. Thus, it was assumed that at 1970 relative prices imports of paper and board would remain at about the 1972 level. With higher prices, Canada could provide much larger volumes of paper and board, with actual imports depending in part on U.S. demand.

Among the factors which will favour the development of Canadian pulp and paper capacity at a faster rate than U.S. capacity will be the availablilty of larger tracts of forest land in Canada as compared with the U.S., to support large mills, since economy of scale considerations will continue to be important in North America. Other advantages in Canada's favour are an abundance of energy supplies, a high level of technical know-how and already firmly established links between the Canadian and U.S. forest industries. Environmental considerations could also direct new North American capacity into the more remote areas of Canada where public pressures would not be as strong. Lastly, the demand for pulp and paper of the quality, strength, and sizes of the Canadian product is unlikely to diminish in the U.S. and elsewhere.

In Section 3, World Fibre Demands, it was noted that U.S. paper and paperboard consumption estimates had been adopted by this study. Consumption is expected to grow in the U.S. by 70 percent in the fifteen year period from 1975 to 1990. This study forsees a rise in production during the same period of 67 percent. In Canada, while consumption will rise by some 79 percent, output could increase by 91 percent. For newsprint, output in the U.S. is estimated to rise by sixty percent from its relatively small base while demand will grow by some 40 percent in the 1975-1990 period. Canada's share of the U.S. market (total consumption) could fall from a level of about 65 percent to 53 percent. At the same time Canada's share of U.S. woodpulp and paper markets (excluding newsprint) could more than double to levels of 13 percent and four percent respectively.

One of the most outstanding changes forseen in this analysis is the growing importance which overseas markets will assume as an outlet for Canadian pulp and paper exports. By 1990 overseas markets could account for 57 and 44 percent of total Canadian pulp and paper exports respectively, compared with 1975 proportions of 27 and 17 percent. Thus the corresponding decline in the proportion of exports going to the U.S. would be from 83 to 56 percent for paper and paperboard and from 73 to 43 percent for woodpulp. This is not to suggest that exports to the U.S. will decline. Rather, they will increase but at a relatively slow pace while overseas markets will take on a new significance and account for most of the growth in exports.

Tables 38 to 41, which follow, present an objective outlook of the North American region separated into expected Canadian and U.S. developments in pulp and paper to 1990. For Canada, the outlook is favourable, if looked at in terms of the expected rates of growth in output and exports. However, the substantial rise forseen in woodpulp output and exports may not be in line with present ideas on resource upgrading and efforts to increase the intensity of manufacturing in Canada. By 1990 roundwood requirements for pulping and wood products in Canada could amount to 275 million m^3 with approximate equal inputs of roundwood into each sector, after allowing for an estimated 46 million m^3 of residue transfers from the wood products sector into pulping.

Table 7 suggests the Canadian forest potential is only 217 million m^3 of industrial wood. However, better inventory information, especially for hardwoods, and more intensive use of the forest could cause the potential to exceed 300 million m^3. Nevertheless, by 1990 the Canadian forest will be under pressure and it is difficult to forsee much expansion of forest based industry after that date. This has obvious bearings on the rate of forest industry development, which Canada might choose to pursue in the 1975-1990 period.

Table 42 summarizes Canadian exports for 1970 and estimates for 1980 and 1990, and their percentage relationships with total world exports on a regional rather than country basis. The figures are derived from Tables 32 to 37 and include Scandinavian exports to Western Europe and other markets but exclude exports from Russia to Eastern European countries. The indicated trend is for an increasing Canadian share of world trade in pulp and industrial papers, offset by a decreasing Canadian share in the printing and writing and newsprint grades.

6.2 Tables of Canadian Export Outlook

CHART 4

CANADIAN PULP AND PAPER PROSPECTS

Million Metric Tons

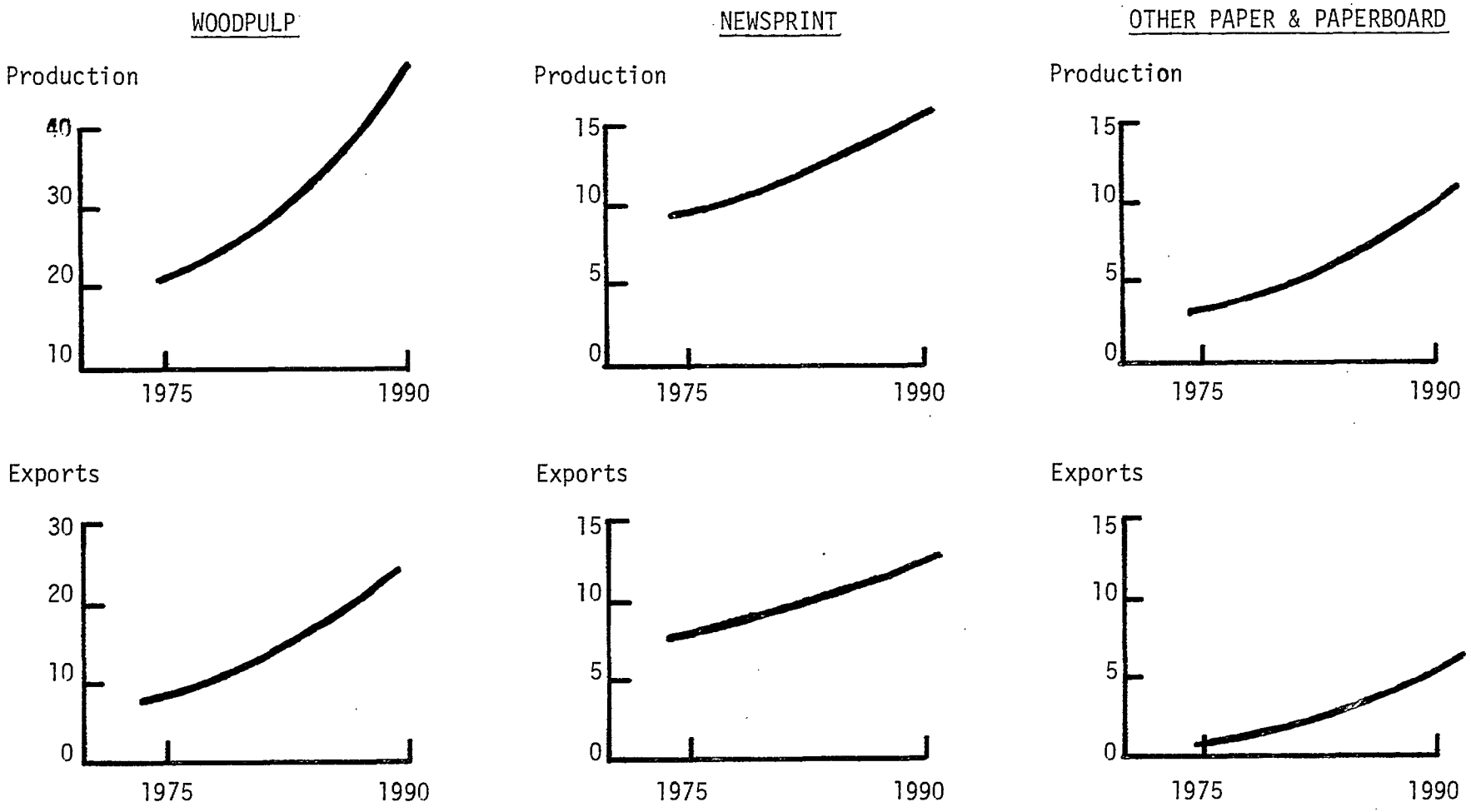

TABLE 38

NORTH AMERICAN PAPER AND PAPERBOARD OUTLOOK

1975 - 1990

Million Metric Tons

Year	United States			Canada			North America		
	Consumption	Production	Capacity	Consumption	Production	Capacity	Consumption	Production	Capacity
1975	58.8	55.8	56.9	4.2	12.9	13.0	63.0	68.7	69.9
1980	71.0	66.3	73.7	5.3	15.8	16.9	76.3	82.1	90.6
1985	85.0	79.8	88.7	6.4	19.6	21.7	91.4	99.4	110.4
1990	100.0	93.2	103.6	7.5	24.6	27.3	107.5	117.8	130.9

Sources: Canadian Working Party Estimates "Consumption Projections for Paper 1970 - 1985" Ottawa 1972.
USDA Forest Resource Report No. 20 Washington 1973.
FAO - 1973 Capacity Survey and Advisory Committee, Rome 1972 and 1973.

Notes: USDA FRR No. 20 forecasts are similar to this study's estimates of consumption, though somewhat higher for production - 67.5 for 1980 and 96.4 for 1990.
Canadian Working Party estimates of US Consumption were also moderately higher at 60.8, 73.6 and 87.6 for 1975, 1980 and 1985 respectively.

TABLE 39

NORTH AMERICAN NEWSPRINT PROSPECTS

1975 - 1990

Million Metric Tons

	Production	Exports	Imports	Consumption	Extra North American Surplus for Export
1975					
Canada	9.0	8.2	-	0.8	+1.3
United States	3.3	-	6.9	10.2	-
North America	12.3	8.2 #	6.9	11.0	+1.3
1980					
Canada	11.3	9.3	-	1.0	+3.1
United States	3.7	-	6.2	10.9	-
North America	15.0	9.3	6.2	11.9	+3.1[1]
1985					
Canada	12.7	10.6	-	1.1	+3.6
United States	4.5	-	7.0	12.5	-
North America	17.2	10.6	7.0	13.6	+3.6
1990					
Canada	15.1	12.2	-	1.3	+4.9
United States	5.3	-	7.3	14.2	-
North America	20.4	12.2	7.3	15.5	+4.9[1]

Note: See Appendix III for Adjusted Net Trade Balances for 1980 and 1990. Indicated level of exports from North America could be lower; 2.9 million m^3 in 1980 and 4.3 in 1990, suggesting Canadian exports to the U.S. of 9.1 and 11.6 million m^3 respectively, with correspondingly lower levels of production from those shown in Table 38.

TABLE 40

NORTH AMERICAN PULP[1] PROSPECTS

1975 - 1990

Million Metric Tons

	Production	Exports	Imports	Consumption	Extra North American Surplus for Trade
1975					
Canada	20.1	7.5	-	12.6	+ 2.0
United States	47.9	3.1	5.5	50.3	+ 3.1
North America	68.0	10.6	5.5	62.9	+ 5.1
1980					
Canada	26.0	10.6	-	15.5	+ 4.9
United States[2]	55.3	2.6	5.7	58.3	+ 2.6
North America	81.3	13.2	5.7	73.8	+ 7.5
1985					
Canada	34.5	15.5	-	19.0	+10.1
United States	62.9	2.3	5.4	65.8	+ 2.3
North America	97.4	17.8	5.4	84.8	+12.4
1990					
Canada	46.1	22.2	-	23.9	+12.6
United States[2]	68.2	2.0	9.6	75.8	+ 2.0
North America	114.3	24.2	9.6	99.7	+14.6

Notes: [1]Values shown are for total pulp. Woodpulp alone excluding other fibre pulps is some 2 percent below total pulp consumption values for North America in 1990. Paper grade pulp is some 3.5 percent lower than total pulp consumption for North America in 1990. Estimated trade surpluses are similar for paper grade pulp and total pulp, and marginally lower for woodpulp.

[2]USFS estimates of production are 57.9 and 75.3 million metric tons in 1980 and 1990 respectively, and consumption estimates are 58,3 and 75.8 million metric tons for the same years.

TABLE 41

CANADIAN PULP AND PAPER OUTLOOK

1975 - 1990

Million Metric Tons

Year	Newsprint Exports	Other Paper and Paperboard Exports	Total Paper and Paperboard Exports	Domestic Consumption Paper and Paperboard	Paper and Paperboard Output	Pulp Exports	Pulp Production
1975	8.2	0.5	8.7	4.2	12.9	7.5	20.1
1980	9.3	1.2	10.5	5.3	15.8	10.6	26.0
1985	10.6	2.6	13.2	6.4	19.6	15.5	34.5
1990	12.2	5.0	17.2	7.5	24.6	22.2	46.1

TABLE 42

CANADIAN AND WORLD TRADE[1]

Million Metric Tons

	1970	1980	1990
Total Paper and Paperboard			
Canadian Exports to:			
United States	6.0	7.1	10.0
Western Europe	.9	1.3	2.8
Japan	.1	.1	1.7
Other	1.1	2.0	2.7
Total Canadian Exports	8.1	10.5	17.2
Total World Exports [2]	18.0	31.0	52.7
Canadian as a % of World	45.	33.9	32.6
Newsprint			
Canadian Exports to:			
United States	5.7	6.2	7.5
Western Europe	.6	1.0	1.3
Japan	.1	.1	.9
Other	1.1	2.0	2.5
Total Canadian Exports	7.5	9.3	12.2
Total World Exports [2]	9.8	13.6	18.3
Canadian as a % of World	76.5	68.4	66.7
Other Printing and Writing			
Canadian Exports to:			
United States	.2	.3	.3
Western Europe	-	-	-
Japan	-	-	-
Other	-	-	-
Total Canadian Exports	.2	.3	.3
Total World Exports [2]	1.7	4.6	7.3
Canadian as a % of World	11.8	6.5	4.1
Industrial Papers			
Canadian Exports to:			
United States	.1	.6	2.2
Western Europe	.3	.3	1.5
Japan	-	-	.8
Other	-	-	.2
Total Canadian Exports	.4	.9	4.7
Total World Exports [2]	6.5	12.9	27.1
Canadian as a % of World	6.2	7.0	17.3
Paper Grade Pulp			
Canadian Exports to:			
United States	3.0	5.7	9.6
Western Europe	1.2	3.0	6.0
Japan	.5	1.2	3.0
Other	.4	.7	3.6
Total Canadian Exports	5.1	10.6	22.2
Total World Exports [2]	14.2	21.8	38.4
Canadian as a % of World	35.9	48.6	57.8

Note: 1. This table is derived from Tables 32 to 37 of Section 5.
2. Excludes USSR exports to Eastern Europe.

REFERENCES

1. Can. Gov't. 1969 — Projection of World Demand for Wood-Fibre Products to the Year 2000, Draft copy of study by J. L. Keays, D.O.E., Vancouver, 1969.

2. Can. Gov't. 1970 — Canada, Dept. of Fisheries and Forestry, Canada's Consumption of Forest Products, Glenn H. Manning, Forest Economics Research Institute Information Report, E-X-8, Ottawa, May 1970.

3. Can. Gov't. 1971 — Environment Canada, Forest Resources and Utilization in Canada to the Year 2000, Glenn H. Manning and H. Rae Grinnell, Canadian Forestry Service, Pub. No. 1304, Ottawa, 1971

4. Can. Gov't. 1972 — Statistics Canada, Pulp and Paper Mills, 1970, Ottawa, August 1972.

5. Can. Gov't. 1972 — Industry, Trade & Commerce Dept., Consumption Projections for Paper 1970-1985, Working Party on Demand Projections, Interdepartmental Committee for Review of the Canadian Pulp and Paper Industry, Ottawa, September 1972.

6. Can. Gov't. 1973 — Interim Copy, Canada's Reserve Timber Supply, F.L.C. Reed and Associates Ltd., Ottawa, March 1973.

7. COFI 1972 — Council of Forest Industries of B.C., Canada's Forest Resource and Forest Products Potentials, Washington D.C., June 5, 1972.

8. CPPA 1972 — Import of Developments in the European Common Market on the Canadian Pulp and Paper Industry, Canadian Pulp and Paper Association, Montreal, October 1972.

9. CPPA 1973 — Reference Tables 1973, Canadian Pulp and Paper Association, Montreal, September 1973.

10. CPPA 1973 — Newsprint Data, Canadian Pulp and Paper Association, Montreal, November 1973.

11. EEC Timber Committee 1973 — 31st Session of EEC Timber Committee, The Structural and Geographic Changes in Forest Utilization in the USSR, I. V. Vasiliev, Geneva, October 1973.

.../2

12. McKillop. WLM 1967 — Hilgardia Vol. 38(1), Supply and Demand for Forest Products - An Econometric Study, California Agricultural Experiment Station, University of California, March 1967.

13. National Forestry Conference 1966 — Fibre - Demand for Canada's Wood Fibre in 1975 and 2000 Haviland, W.E., I. B. Chenoweth and E. T. Owens, Montebelo, Quebec, February 1966.

14. OECD 1970 — Paper and Board Consumption Patterns and Development Trends in the OECD Countries 1950-1967, Arne Sundelin, Paris, 1970.

15. Resources for the Future Inc. 1967 — U.S. Timber Resources in a World Economy, John A. Zivnuska, The Johns Hopkins Press, Baltimore, Maryland, 1967.

16. RCCEP 1957 — Royal Commission on Canada's Economic Prospects, The Outlook for the Canadian Forest Industries, John Davis, A. L. Best, P. E. Lachance, S. L, Pringle, J. M. Smith and D. A. Wilson, Ottawa, March 1957.

17. 7th World Forestry Congress 1972 — Will Wood Products Be Cheap or Expensive, John A. Zivnuska, Buenos Aires, Argentina, October 1972.

18. 7th World Forestry Congress 1972 — What Will 2000 Bring in Changed Patterns of Production, Trade and Consumption, Andras Madas (Hungary), Buenos Aires, Argentina, October 1972.

19. 7th World Forestry Congress 1972 — Main Trends in Forest Utilization and Forest Management in the USSR, G. I. Vorobiov (State Committee for USSR Ministers - Moscow), Buenos Aires, Argentina, October 1972.

20. T. S. Streyffert 1968 — World Plywood, Published by Almquist & Wiksells Boktryckeri A.B. Uppsala, 1968.

21. The Tuolumme Corp. 1972 — The Production and Consumption of Forest Products in Mainland China: Future Requirements and Trade Prospects, S. D. Richardson, Belvedere - Tiburon, California, U.S.A. August 1972.

22. USDA 1967 — Forest Service, Forest Resource Report No. 18, Use of Regression Equations for Projecting Trends in Demand for Paper and Board, Dwight Hair, Washington, December 1967.

23. USDA 1973 — Forest Service, Forest Resource Report No. 20, The Outlook for Timber in the United States, Washington, October 1973.

24. FAO 1965 — Advisory Committee on Pulp and Paper, Pulp and Paper Trends in the USSR and Eastern Europe, 6th Session, Document No. 12, Rome, 1965.

.../3

25. FAO 1971 — Advisory Committee on Pulp and Paper, End-Use Projections, Based on a report by Business Intelligence Services Ltd., FO:PAP/DST/71/1.5, Rome, March 25 1971.

26. FAO 1971 — Advisory Committee on Pulp and Paper, Development of a Forecasting Model for the Pulp and Paper Industry (with emphasis on the supply function), Lars Wohlin for FAO's Second Consultation on World Pulp and Paper Demand, Supply and Trade, Rome, 11-13 May 1971.

27. FAO 1971 — Advisory Committee on Pulp and Paper, Critical Evaluation of Projection Techniques for Paper and Paperboard Consumption, William McKillop for FAO's Second Consultation on World Pulp and Paper Demand, Supply and Trade, FO/PAP/DST/71/1.2, March 24 1971.

28. FAO 1971 — Advisory Committee on Pulp and Paper, State of Knowledge of Resource Potential, Secretariat Paper, FO:PAP/DST/71/3.4, Rome, May 10 1971.

29. FAO 1972 — Advisory Committee on Pulp and Paper, Annex 3, The Outlook for Pulpwood Demand and Supply to 1985, FO:PAP/72 Report, Rome, October 1972.

30. FAO 1972 — Advisory Committee on Pulp and Paper, Outlook for Pulp and Paper Consumption, Production and Trade to 1985, Secretariat Paper, FO:PAP/DST/71/1.1, Revised, Rome, March 1972.

31. FAO 1972 — Advisory Committee on Pulp and Paper, Document No. 4, Outlook for Pulp and Paper Consumption, Production and Trade to 1985, Secretariat Paper, FO:PAP/72/4, Rome, April 14 1972.

32. FAO 1973 — Advisory Committee on Pulp and Paper, World Pulp and Paper Capacities 1972-1977, Country Data, FO:PAP/73/3.1, Rome, April 1973.

33. FAO 1973 — Advisory Committee on Pulp and Paper, World Pulp and Paper Capacities 1972 to 1977 - FAO Survey 1973, Secretariat Paper, FO:PAP/73/3/Rev., Rome, June 1973.

34. FAO 1973 — Advisory Committee on Pulp and Paper, A Preliminary Appraisal of the World's Temperate Hardwoods and Their Pulpwood Potential, Secretariat Paper, FO:PAP/73/4, Rome, 1973.

35. FAO 1973 — Advisory Committee on Pulp and Paper, Estimated Number of Yearly Paper Machine Start-Ups in Western Europe Less Scandinavia Until 1985, Secretariat Paper, FO:PAP/73/Info. 4, Rome, May 1973.

.../4

36. FAO 1973 — Advisory Committee on Pulp and Paper, Outlook for Chemical Paper Grade Market Pulp, Secretariat Paper, FO:PAP/uw/5/Rev. 2, Rome, July 1973.

37. FAO 1965 — Pulp and Paper Development in Africa and the Near East, Appraisal of the Region's Fibrous Raw Material Supply, Economic Availability and Technical Suitability, Rome, 1965.

38. FAO 1966 — World Forest Inventory, 1963, Rome, 1966.

39. FAO/ECE 1969 — European Timber Trends and Prospects, 1950-1980, An Interim Review, Vols. I and II, Geneva, July 1969.

40. FAO 1969 — Indicative World Plan for Agricultural Development, Main Conclusions and Policy Implications of Provisional Indicative World Plan Vol. III, Fifteenth Session, Rome, November 8-27 1969.

41. FAO 1970 — Committee on Wood Based Panel Products, A Reappraisal of the Outlook for the Future, Secretariat Paper, FAO:WWP/70/33, Rome, September 1970.

42. FAO 1971 — Paper for the American Paper Institute, Pulp and Raw Materials Group, International Fibre Sources - Getting More Mileage, Borje K. Steenberg, A.D.G. Forestry Dept., FAO, New York, March 15 1971.

43. FAO 1972 — Yearbook of Forest Products, 1970, Rome, 1972.

44. FAO 1973 — Unasylva, Special Issue No. 104, Seventh World Forestry Congress, Rome, 1973.

45. FAO 1973 — Timber Bulletin for Europe, January - December 1972, Rome, 1973.

46. FAO 1973 — World Pulp and Paper Capacities 1972 to 1977, FAO Survey 1973, Secretariat Paper, FO:PAP/73/3/Rev., Rome, June 1973.

Appendix I

LIST OF COUNTRIES INCLUDED IN EACH REGION

Western Europe

Austria
Belgium - Luxembourg
Denmark
Eire
Federal Republic of Germany
Finland
France
Greece
Iceland
Italy
Malta
Netherlands
Norway
Portugal
Spain
Sweden
Switzerland
United Kingdom

North America

Canada
U.S.A.

Japan

Oceania

Australia
Fiji
French Polynesia
New Calendonia
New Zealand

U.S.S.R.

Eastern Europe

Bulgaria
Czechoslavakia
East Germany
Hungary
Poland
Romania
Yugoslavia

Mainland China

Africa

Algeria
Angola
Cameroon
Cape Verde Islands
Central African Republic
Chad
Congo Brazzaville
Congo, Democratic Republic of the
Dahomey
Ethiopia
French Somalia
Gabon
Gambia
Ghana
Guinea
Ivory Coast
Kenya
Libya
Madagascar
Malawi
Mali
Mauritania
Mauritius
Morocco
Mozambique
Niger
Nigeria
Portugese Guinea
Réunion
Republic of South Africa
Swaziland
Lesotho
Botswana

...2

Africa (contd.)

Ruanda
Senegal
Sene
Sierra Leone
Somalia
Southern Rhodesia
Sudan
Tanzania
Togo
Tunisia
Uganda
United Arab Republic
Upper Volta
Zambia

Asia and Far East

Afghanistan
Brunei
Burma
Cambodia
Ceylon
Malaysia
Hong Kong
India
Indonesia
Laos
Macao
Mongolia
North Korea
North Vietnam
Pakistan
Papua and New Guinea
Philippines
Republic of Korea
Republic of Vietnam
Ryuku Islands
Taiwan
Thailand
Timor

Latin America

Argentina
Barbados
Bolivia
Brazil
British Honduras
Chile
Columbia
Costa Rica
Cuba
Dominican Republic
Ecuador
El Salvador
French Guiana
Guadeloupe
Guatemala
Guyana
Haiti
Honduras
Jamaica
Martinique
Mexico
Nicaragua
Panama
Paraguay
Peru
Surinam
Trinidad and Tobago
Uruguay
Venezuela

Middle East

Cyprus
Iran
Iraq
Israel
Jordan
Lebanon
Syria
Turkey

Appendix II

PAPER & PAPERBOARD
Adjusted Net Trade
Balances

1980 & 1990
Million Metric Tons

Region	Newsprint	Printing & Writing	Other Paper & Paperboard	Total	Newsprint	Printing & Writing	Other Paper & Paperboard	Total
Western Europe	-0.6	-0.3	-1.4	-2.3	-1.0	-0.2	-5.8	-7.0
North America	+2.9	-0.5	+3.4	+5.8	+4.3	-0.9	+6.4	+9.8
Japan	-0.2	+0.9	+0.5	+1.2	-1.6	-0.3	-1.7	-3.6
Oceania	-0.2	+0.1	-0.7	-0.8	-0.8	-0.2	+ .1	-0.9
USSR	+0.3	+0.3	+0.8	+1.4	+1.3	+1.7	+2.8	+5.8
Eastern Europe	-0.2	-	-0.6	-0.8	-	+0.4	-1.6	-1.2
Latin America	-0.9	-0.4	-1.4	-2.7	-0.7	+1.1	+ .8	+1.2
Asia & Far East	-0.3	-0.1	-0.1	-0.5	-	-0.4	- .1	-0.5
Middle East & Africa	-0.5	-0.2	-0.6	-1.3	-0.8	-0.3	- .4	-1.5
China	-0.3	+0.2	+0.1	-	-0.7	-0.9	- .5	-2.1
World Totals	0	0	0	0	0	0	0	0

Appendix III

ADJUSTED NET TRADE
BALANCES
PAPER GRADE PULP

Million Metric Tons

Region	1975	1980	1985	1990
Western Europe	-3.2	-5.2	-7.7	-12.5
North America	+5.1	+7.6	+12.9	+16.1
Japan	-0.4	-0.7	-2.7	-6.3
Oceania	-0.2	+0.2	+0.1	+0.3
USSR	+0.7	+1.2	+2.0	+6.8
Eastern Europe	-0.7	-1.2	-1.5	-1.9
Latin America	-0.7	-0.6	-0.2	+2.4
Asia & Far East	-0.5	-0.8	-1.2	-1.3
Middle East & Africa	+0.1	-0.3	-0.5	-0.8
China	-0.2	-0.2	-1.2	-2.8
WORLD	0	0	0	0

U.S. FIBRE DEMANDS

U.S. Roundwood Production
Domestic Consumption and Trade[1]
(Roundwood Equivalent)

Million Cubic Metres

1950 - 1990

Item	1950	1960	1970	1980	1990
Log Exports	-	-	11	20	20
Lumber - Domestic Output	169	146	153	150	144
Imports	14	17	28	42	51
Exports	3	3	6	6	6
Apparent Consumption	180	157	173	187	190
Plywood & Veneers					
Domestic Output	9	20	31	45	54
Imports	-	3	5	5	5
Exports	-	-	-	-	-
Apparent Consumption	11	23	36	50	59
Paper & Board[2]					
Domestic Output	43	74	108	144	184
Imports	26	29	37	54	57
Exports	-	9	20	28	25
Apparent Consumption	69	94	125	170	221
Miscellaneous Product Consumption	23	14	11	14	11
All Products Consumption	283	289	345	421	481
Fuelwood Consumption	66	37	14	14	14
Total Consumption (RWE)	349	326	359	435	495
Total Fibre Demands or Total Consumption plus Exports	349	326	370	455	515
Less Imports, on U.S. Domestic Fibre Demands/Output	309	277	300	354	402

Source: US Forest Service Report No. 20. OTUS, 1973, Table 30.

Notes: 1. Values may not add due to rounding. Values are rough, having been converted directly from billions of cubic feet to millions of cubic metres at 35.31 cu ft./m^3(r). Projection chosen assumes rising relative prices for the various products.

2. Includes particle board and fibreboard.

Appendix V

ESTIMATES OF PANEL PRODUCTS CONSUMPTION

1970 and 1980

Region	Plywood & Veneer		Fibreboard		Particleboard		All Panel Products	
	1970	1980	1970	1980	1970	1980	1970	1980
	Million m^3		Million M Tons		Million M Tons		Million M Tons	
Europe (all)	4.8	6.8	2.8	3.6	6.6	13.0	12.6	21.1
North America	19.2	28.0	2.8	3.8	2.1	6.5	17.6	28.8
Japan	4.2	7.1	0.5	1.2	0.3	1.4	3.6	7.3
Pacific Area	0.2	0.5	0.2	0.5	0.2	0.5	0.5	1.3
USSR	2.2	5.6	0.8	2.0	1.1	3.4	3.4	9.1
Latin America	0.8	2.3	0.3	0.9	0.2	0.8	1.0	3.2
Asia (Excl. Japan)	1.0	2.5	0.4	0.9	0.1	0.5	1.2	2.6
Africa	0.3	0.7	0.2	0.4	0.1	0.4	0.5	1.3
	32.7	53.5	8.0	13.3	10.7	26.5	40.4	74.7

Source: FAO-F01 WPP/70/3.3 (Ref. 41)

Appendix VI

TRADE FLOWS
1965 & 1970
(Approximate)

1. Total Paper & Paperboard — Thousands of Metric Tons

From \ To	Scandinavia	Other Western Europe	Eastern Europe	Canada	U.S.A.	Japan	Oceania	USSR	Latin America	Asia & Far East	Middle East & Africa	China	Total
Scandinavia	-	5,530 (3,809)	140 (96)	3 (-)	350 (310)	3 (-)	124 (70)	418 (185)	385 (242)	135 (135)	500 (295)	48 (16)	7,636 (5,158)
Other W. Europe	78 (35)	- (-)	245 (53)	3 (-)	11 (2)	4 (2)	42 (18)	45 (-)	78 (13)	38 (26)	305 (133)	5 (1)	854 (283)
Eastern Europe	3 (-)	152 (44)	- (-)	2 (-)	1 (-)	- (-)	- (-)	- (-)	2 (-)	- (-)	25 (22)	- (-)	185 (66)
Canada	- (-)	926 (607)	1 (-)	- (-)	5,971 (5,665)	96 (-)	180 (135)	- (-)	595 (306)	240 (87)	106 (65)	- (-)	8,115 (6,865)
United States	15 (4)	1,071 (590)	31 (-)	209 (134)	- (-)	10 (14)	49 (44)	- (-)	640 (443)	183 (141)	226 (136)	- (-)	2,434 (1,506)
Japan	- (-)	3 (4)	2 (-)	1 (-)	4 (1)	- (-)	25 (11)	3 (2)	- (1)	399 (178)	66 (24)	24 (28)	527 (249)
Oceania	- (-)	- (-)	- (-)	- (-)	5 (-)	2 (-)	- (-)	- (-)	- (-)	83 (-)	20 (-)	10 (-)	120 (-)
USSR	7 (-)	64 (5)	22 (7)	4 (-)	- (-)	3 (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	100 (12)
Total	103 (39)	7,746 (5,059)	441 (156)	222 (134)	6,342 (5,978)	118 (16)	420 (278)	466 (187)	1,700 (1,005)	1,078 (567)	1,248 (675)	87 (45)	19,971# (14,139)

Source: 1970 World Trade Annual
(1965 World Trade Annual)

Trade Flows
1965 & 1970
(Approximate)
Thousands of Metric Tons

2. Newsprint

From \ To	Scandinavia	Other Western Europe	Eastern Europe	Canada	U.S.A.	Japan	Oceania	USSR	Latin America	Asia & Far East	Middle East & Africa	China	Total
Scandinavia	- (-)	1,649 (1,145)	1 (16)	- (-)	282 (244)	- (-)	26 (-)	79 (38)	185 (170)	59 (61)	69 (50)	- (3)	2,350 (1,727)
Other W. Europe	- (-)	- (-)	1 (6)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	1 (-)	17 (10)	- (-)	19 (16)
Eastern Europe	- (-)	16 (6)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	3 15	- (-)	19 (21)
Canada	- (-)	555 (400)	1 (-)	- (-)	5,660 (5,559)	90 (-)	164 (129)	- (-)	,556 (291)	231 (84)	83 (59)	- (-)	7,340 (6,522)
United States	- (-)	12 (4)	- (-)	1 (1)	- (-)	- (12)	3 (4)	- (-)	71 (46)	35 (19)	6 (3)	- (-)	128 (89)
Japan	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	32 (7)	- (-)	- (-)	32 (7)
Oceania	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	5 (10)	- (-)	- (-)	5 (10)
USSR	- (-)	4 (5)	- (7)	- (-)	- (-)	3 (-)	- (-)	- (-)	- (-)	- (7)	- (-)	- (-)	7 (19)
Total	- (-)	2,236 (1,560)	3 (29)	1 (1)	5,942 (5,803)	93 (12)	193 (133)	79 (38)	812 (507)	363 (181)	178 (144)	- (3)	9,900 (8,411)

Source: 1970 World Trade Annual
(1965 World Trade Annual)

TRADE FLOWS
1965 & 1970
(Approximate)

3. Other Printing & Writing Papers — Thousands of Metric Tons

From \ To	Scandinavia	Other Western Europe	Eastern Europe	Canada	U.S.A.	Japan	Oceania	USSR	Latin America	Asia & Far East	Middle East & Africa	China	Total
Scandinavia	-	738	49	-	26	-	72	172	99	14	94	-	1,264
	(-)	(457)	(6)	(-)	(6)	(-)	(45)	(45)	(57)	(36)	(90)	(-)	(742)
Other W. Europe	5	-	56	-	2	-	20	34	22	12	120	-	271
	(25)	(-)	(2)	(-)	(-)	(-)	(16)	(-)	(9)	(15)	(68)	(-)	(135)
Eastern Europe	-	23	-	-	-	-	-	-	1	5	11	-	40
	(-)	(12)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(4)	(-)	(16)
Canada	-	24	-	-	247	1	6	-	9	1	12	-	300
	(-)	(23)	(-)	(-)	(77)	(-)	(4)	(-)	(7)	(-)	(5)	(-)	(116)
United States	2	40	1	38	-	1	7	-	38	9	4	-	140
	(1)	(13)	(-)	(12)	(-)	(-)	(2)	(-)	(17)	(2)	(3)	(-)	(50)
Japan	-	1	-	1	3	-	16	-	2	128	38	1	190
	(-)	(4)	(-)	(-)	(1)	(-)	(9)	(1)	(1)	(69)	(22)	(3)	(110)
Oceania	-	(-)	-	-	-	-	-	-	-	9	6	-	15
	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(10)	(-)	(-)	(10)
Totals	7	826	106	39	278	2	121	206	171	178	285	1	2,220
	(26)	(509)	(8)	(12)	(84)	(-)	(76)	(46)	(91)	(132)	(192)	(3)	(1,179)

Source: 1970 World Trade Annual
(1965 World Trade Annual)

TRADE FLOWS
1965 & 1970
(Approximate)
Thousands of Metric Tons

4. Other Paper & Paperboard

From \ To	Scandinavia	Other Western Europe	Eastern Europe	Canada	U.S.A.	Japan	Oceania	USSR	Latin America	Asia & Far East	Middle East & Africa	China	Total
Scandinavia	- (-)	3,143 (2,207)	90 (74)	3 (-)	42 (60)	3 (-)	26 (25)	167 (102)	101 (15)	62 (38)	337 (155)	48 (13)	4,022 (2,689)
Other W. Europe	78 (10)	- (-)	188 (45)	3 (-)	9 (2)	4 (2)	22 (2)	11 (-)	56 (4)	25 (11)	168 (55)	5 (1)	569 (132)
Eastern Europe	3 (-)	105 (26)	- (-)	2 (-)	1 (-)	- (-)	- (-)	- (-)	1 (-)	5 (-)	9 (3)	- (-)	126 (29)
Canada	- (-)	346 (184)	2 (-)	- (-)	64 (29)	5 (-)	10 (2)	- (-)	30 (8)	7 (3)	11 (1)	- (-)	475 (227)
United States	13 (3)	1,019 (573)	30 (-)	170 (121)	- (-)	9 (2)	39 (38)	- (-)	531 (380)	139 (120)	216 (130)	- (-)	2,166 (1,367)
Japan	- (-)	2 (-)	- (-)	- (-)	1 (-)	- (-)	9 (2)	3 (1)	- (-)	239 (102)	28 (2)	23 (25)	305 (32)
Oceania	- (-)	- (-)	- (-)	- (-)	5 (-)	2 (-)	- (-)	- (-)	- (-)	69 (-)	14 (-)	10 (-)	100 (-)
USSR	7 (-)	60 (-)	22 (-)	4 (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	93 (-)
Total	101 (13)	4,675 (2,990)	332 (119)	182 (121)	122 (91)	23 (4)	106 (69)	181 (103)	719 (407)	546 (274)	783 (346)	86 (39)	7,856 (4,576)

Source: 1970 World Trade Annual
(1965 World Trade Annual)

TRADE FLOWS
1965 & 1970
(Approximate)

5. Total Wood Pulp — Thousands of Metric Tons

From \ To	Scandinavia	Other Western Europe	Eastern Europe	Canada	U.S.A.	Japan	Oceania	USSR	Latin America	Asia & Far East	Middle East & Africa	China	Total
Scandinavia	-	5,787	257	-	65	28	74	174	91	16	128	50	6,670
	(-)	(5,387)	(230)	(-)	(288)	(23)	(117)	(175)	(171)	(56)	(104)	(83)	(6,634)
Other W. Europe	12	-	6	-	1	1	-	2	4	1	23	-	50
	(-)	(-)	(9)	(-)	(4)	(-)	(-)	(-)	(7)	(-)	(-)	(-)	(20)
Eastern Europe	-	35	-	-	-	-	-	-	-	-	4	-	39
	(-)	(37)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(37)
Canada	2	1,247	35	-	3,009	473	71	29	79	82	35	-	5,062
	(1)	(474)	(2)	(-)	(2,556)	(185)	(62)	(-)	(178)	(27)	(10)	(-)	(3,495)
United States	-	1,407	78	60	-	357	94	65	373	285	89	-	2,808
	(-)	(587)	(2)	(70)	(-)	(262)	(25)	(13)	(170)	(130)	(7)	(-)	(1,266)
Japan	-	-	-	-	-	-	-	-	-	11	-	-	11
	(-)	(-)	(-)	(-)	(-)	(-)	(5)	(-)	(-)	(2)	(-)	(-)	(7)
Oceania	-	-	-	-	-	2	-	-	-	11	-	-	13
	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
USSR	-	86	5	-	-	20	-	-	-	-	-	-	111
	(-)	(110)	(3)	(-)	(-)	(1)	(-)	(-)	(-)	(-)	(-)	(-)	(114)
Total	14	8,562	381	60	3,075	881	239	270	547	406	279	50	14,764
	(1)	(6,595)	(246)	(70)	(2,848)	(471)	(209)	(188)	(526)	(215)	(121)	(83)	(11,573)

Source: 1970 World Trade Annual
(1965 World Trade Annual)

Trade Flows
1965 & 1970
(Approximate)

6. Mechanical Wood Pulp — Thousands of Metric Tons

From \ To	Scandinavia	Other Western Europe	Eastern Europe	Canada	U.S.A.	Japan	Oceania	USSR	Latin America	Asia & Far East	Middle East & Africa	China	Total
Scandinavia	- (-)	1,017 (1,326)	2 (-)	- (-)	- (-)	- (-)	10 (10)	- (-)	10 (10)	10 (8)	22 (11)	- (-)	1,071 (1,365)
Other W. Europe	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)
Eastern Europe	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)
Canada	- (-)	68 (-)	- (-)	- (-)	163 (170)	3 (1)	4 (-)	- (-)	20 (117)	5 (-)	2 (-)	- (-)	265 (288)
United States	- (-)	1 (-)	- (-)	3 (-)	- (-)	- (-)	- (-)	- (-)	- (-)	3 (-)	4 (-)	- (-)	11 (-)
Japan	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	1 (-)	- (-)	- (-)	1 (-)
Oceania	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	2 (-)	- (-)	- (-)	2 (-)
USSR	- (-)	5 (4)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	5 (4)
Total	- (-)	1,091 (1,330)	2 (-)	3 (-)	163 (170)	3 (1)	14 (10)	- (-)	30 (127)	21 (8)	28 (11)	- (-)	1,355 (1,657)

Source: 1970 World Trade Annual
(1965 World Trade Annual)

Trade Flows
1965 & 1970
(Approximate)
Thousands of Metric Tons

7. Chemical Wood Pulp Dissolving

From \ To	Scandinavia	Other Western Europe	Eastern Europe	Canada	U.S.A.	Japan	Oceania	USSR	Latin America	Asia & Far East	Middle East & Africa	China	Total
Scandinavia	- (-)	334 (433)	60 (110)	- (-)	- (-)	- (5)	- (-)	95 (107)	11 (13)	- (-)	14 (16)	3 (5)	517 (689)
Other W. Europe	- (-)	- (-)	- (-)	- (-)	- (1)	- (-)	- (-)	- (-)	1 (7)	- (-)	- (-)	- (-)	1 (8)
Eastern Europe	- (-)	25 (24)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	25 (24)
Canada	- (-)	34 (38)	3 (1)	- (-)	194 (267)	28 (34)	1 (1)	26 (-)	- (2)	11 (6)	5 (-)	- (-)	302 (349)
United States	- (-)	328 (223)	34 (2)	10 (12)	- (-)	164 (139)	8 (6)	65 (13)	94 (50)	69 (38)	17 (2)	- (-)	789 (485)
Japan	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)
Oceania	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)
USSR	- (-)	6 (-)	- (-)	- (-)	- (-)	3 (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	9 (-)
Total	- (-)	727 (718)	97 (113)	10 (12)	194 (268)	195 (178)	9 (7)	186 (120)	106 (72)	80 (44)	36 (18)	3 (5)	1,643 (1,555)

Source: 1970 World Trade Annual
(1965 World Trade Annual)

Trade Flows
1965 & 1970
(Approximate)

8. Sulphate Wood Pulp — Thousands of Metric Tons

From	Scandinavia	Other Western Europe	Eastern Europe	Canada	U.S.A.	Japan	Oceania	USSR	Latin America	Asia & Far East	Middle East & Africa	China	Total
Scandinavia	- (-)	2,986 (2,012)	145 (75)	- (3)	55 (226)	23 (14)	41 (65)	40 (42)	49 (120)	6 (6)	60 (47)	21 (40)	3,426 (2,650)
Other W. Europe	12 (-)	- (-)	- (-)	- (-)	1 (-)	- (-)	- (-)	- (-)	- (-)	- (-)	16 (-)	- (-)	29 (-)
Eastern Europe	- (-)	3 (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	3 (-)	- (-)	6 (-)
Canada	1 (1)	1,048 (281)	11 (-)	- (-)	2,198 (1,527)	440 (133)	62 (45)	- (-)	47 (37)	64 (18)	21 (7)	- (-)	3,892 (2,049)
United States	- (-)	931 (314)	40 (-)	40 (22)	- (-)	144 (71)	54 (3)	- (-)	218 (95)	165 (54)	59 (4)	- (-)	1,651 (563)
Japan	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (1)	- (-)	- (-)	10 (2)	- (-)	- (-)	10 (3)
Oceania	- (-)	- (-)	- (-)	- (-)	- (-)	2 (-)	- (-)	- (-)	- (-)	9 (4)	- (-)	- (-)	11 (4)
USSR	- (-)	21 (33)	5 (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	26 (33)
Total	13 (1)	4,989 (2,640)	201 (75)	40 (25)	2,254 (1,753)	609 (218)	157 (114)	40 (42)	314 (252)	254 (84)	159 (58)	21 (40)	9,051 (5,302)

Source: 1970 World Trade Annual
(1965 World Trade Annual)

Trade Flows
1965 & 1970
(Approximate)
Thousands of Metric Tons

9. Sulphite Wood Pulp

From \ To	Scandinavia	Other Western Europe	Eastern Europe	Canada	U.S.A.	Japan	Oceania	USSR	Latin America	Asia & Far East	Middle East & Africa	China	Total
Scandinavia	-	1,393	48	-	10	5	23	39	21	-	30	26	1,595
	(-)	(1,583)	(35)	(-)	(62)	(4)	(42)	(26)	(28)	(42)	(30)	(38)	(1,890)
Other W. Europe	-	-	4	-	-	1	-	2	3	1	5	-	16
	(-)	(-)	(9)	(-)	(3)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(12)
Eastern Europe	-	7	-	-	-	-	-	-	-	-	1	-	8
	(-)	(13)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(13)
Canada	1	97	21	-	454	2	4	3	12	2	7	-	603
	(-)	(155)	(1)	(-)	(592)	(17)	(16)	(-)	(22)	(3)	(3)	(-)	(809)
United States	-	147	4	7	-	49	32	-	61	48	9	-	357
	(-)	(50)	(-)	(36)	(-)	(52)	(16)	(-)	(25)	(38)	(1)	(-)	(218)
Japan	-	-	-	-	-	-	-	-	-	-	-	-	-
	(-)	(-)	(-)	(-)	(-)	(-)	(4)	(-)	(-)	(-)	(-)	(-)	(4)
Oceania	-	-	-	-	-	-	-	-	-	-	-	-	-
	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
USSR	-	54	-	-	-	17	-	-	-	-	-	-	71
	(-)	(73)	(3)	(-)	(-)	(1)	(-)	(-)	(-)	(-)	(-)	(-)	(77)
Total	1	1,698	77	7	464	74	59	44	97	5	52	26	2,650
	(-)	(1,874)	(48)	(36)	(657)	(74)	(78)	(26)	(75)	(83)	(34)	(38)	(3,023)

Source: 1970 World Trade Annual
(1965 World Trade Annual)

Trade Flows
1965 & 1970
(Approximate)
Thousands of Metric Tons

10. Semichemical Wood Pulp

From	Scandinavia	Other Western Europe	Eastern Europe	Canada	U.S.A.	Japan	Oceania	USSR	Latin America	Asia & Far East	Middle East & Africa	China	Total
Scandinavia	- (-)	57 (33)	2 (10)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	2 (-)	- (-)	61 (43)
Other W. Europe	- (-)	- (-)	2 (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	2 (-)	- (-)	4 (-)
Eastern Europe	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)
Canada	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)
United States	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)
Japan	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)
Oceania	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)
USSR	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)
Total	- (-)	57 (33)	4 (10)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	- (-)	4 (-)	- (-)	65 (43)

Source: 1970 World Trade Annual
(1965 World Trade Annual)

World Trade Flows

Notes

1. All Figures are in M metric tons and are taken from World Trade Annuals, Volume III, 1965 and 1970, prepared by the statistical office of the United Nations.

2. Figures are only accurate to the extent of the cooperation provided by exporting and importing countries; it appears that major suppliers and purchasers have provided the information.

3. Most of the trade figures are taken from the export side of the statistics, which relies on inputs from export countries and are often quite different in amount from the compiled import statistics, which are based on inputs from import countries. In the case of Russia and Eastern Europe, exports were not completely available from the export side so the information was obtained from the import side.

4. All trade is external to the region indicated, i.e., trade within Western Europe is excluded from the figures indicated.

5. Paper and paperboard statistics exclude SITC 641.6 Fibreboard of Wood (treated as a panel product).

6. In the category of other paper and board, kraft paper and paperboard constitute slightly less than 50% of the total exported by Scandinavia and slightly less than 75% of the total exported by the United States, the two major supplying regions.

Appendix VII

LIST OF CAVEATS

The following caveats associated with this study include key assumptions, problems and difficulties many of which have been discussed in some detail in the text.

1. Energy crisis.
2. World inflation.
3. Relative pulp and paper prices.
4. Tariff reductions.
5. Production constrained outlook may not hold in longer term.
6. Synthetic paper situation.
7. Data deficiencies in all areas.
8. Population forecasts.
9. Controls on multi-national companies.
10. Investment outlook.
11. Lumber demands.
12. Degree of integration achieved.
13. World fuelwood situation.
14. Resource upgrading policies.
15. Rates of waste paper utilization.
16. New technology.
17. Provincial forest regulations and stumpage policies.
18. Environmental considerations.

Appendix VIII

PULP, PAPER & PAPERBOARD TRADE

FAO - Tentative Selected Country Estimates

Million Metric Tons
1969 - 1980

1. Total Paper & Paperboard	IMPORTS 1969	1975	1980	EXPORTS 1969	1975	1980
North America						
Canada	.2	.2	.2	7.9	9.7	11.6
U.S.	6.5	7.4	8.9	2.3	3.1	3.8
Western Europe						
Belgium	.6	.9	1.1	.3	.5	.7
France	1.0	1.4	1.7	.3	.6	.9
Germany Fed. Rep.	2.8	3.8	4.8	.5	.7	.9
Italy	.4	.5	.7	.3	.4	.6
Netherlands	.7	1.1	1.4	.6	.7	.8
United Kingdom	.2	.3	.4	-	.1	.1
Finland	-	-	-	3.4	5.3	NE
Norway	.1	.1	.1	1.0	1.2	1.5
Sweden	.1	.2	.3	2.7	4.2	5.3
Austria	.1	.1	.2	.5	.8	.8
Switzerland	.2	.3	.4	-	-	.1
Eastern Europe						
Hungary	.1	.3	.3	-	-	-
Poland	.2	.2	.3	-	-	-
Yugoslavia	.1	.1	NE	.1	.1	NE
Asia & Far East						
India	.2	.1	.1	-	.1	.1
Turkey	.1	.1	.2	-	-	-
Japan	.2	.4	.8	.4	.8	1.1
Oceania						
Australia	.5	.3	.3	-	.1	.1
New Zealand	-	-	.1	.1	.4	.4
Latin America						
Argentina	.3	.2	.2	-	-	-
Chile	-	-	-	.1	.1	.2

PULP, PAPER & PAPERBOARD TRADE

FAO - Tentative Selected Country Estimates

Million Metric Tons
1969 - 1980

2. Total Woodpulp For Making Paper & Paperboard	IMPORTS 1969	1975	1980	EXPORTS 1969	1975	1980
North America						
Canada	-	-	-	4.9	7.2	10.2
U.S.	3.4	4.3	5.2	1.2	1.8	2.2
Western Europe						
Belgium	.3	.4	.5	.1	.1	.1
France	1.1	1.5	1.7	.1	.1	.1
Germany Fed. Rep.	1.3	1.9	2.3	.1	.1	.1
Italy	1.3	2.1	3.4	-	-	-
Netherlands	.6	.8	1.0	-	-	-
United Kingdom	.2	.2	.3	-	-	-
Finland	NE	NE	NE	2.0	1.4	NE
Norway	.2	.1	.2	.8	1.1	1.2
Sweden	-	-	.1	3.4	4.5	5.2
Austria	.1	.2	.2	.1	-	-
Switzerland	.2	.2	.3	-	-	-
Eastern Europe						
Hungary	.1	.1	.2	-	-	-
Poland	.1	.1	.2	-	-	-
Yugoslavia	.1	.1	NE	-	-	NE
Asia & Far East						
India	NE	NE	NE	NE	NE	NE
Turkey	-	-	.1	-	-	-
Japan	.7	1.5	2.5	-	-	.1
Oceania						
Australia	.3	.3	.3	-	-	.1
New Zealand	-	-	-	.3	.3	.4
Latin America						
Argentina	.2	.1	.2	-	-	-
Chila	-	-	-	.1	.4	.3