WORLD MARKET PULP DEMAND WITH SPECIAL INTERESTS TO EUCALYPTUS

1986

Woodbridge, Reed and Associates
Vancouver, BC

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SUMMARY

The evolution and development of fibre alternatives is ongoing, having accelerated rapidly in the past decade, as paper and board manufacturers continue to seek raw materials which must:

- be economically competitive
- be available on a regular basis
- be of consistent quality
- make the paper maker feel comfortable in his requirements for
  - efficient and profitable production with existing equipment
  - satisfying the needs of his customers
- have acceptable economics/quality balance to give paper makers
  - better quality/same cost
  - same quality/lower cost

Paper makers have a wide range of products to consider in preparing their products' furnish. They have been able to benefit from the numerous developments in the market pulp industry. These have enabled them to upgrade their product standards and also lower their raw material costs.

Increasing quantities of both market softwood and hardwood chemical and also hi-yield pulp must be produced to supply the world's growing consumption of paper and board. Alberta has the resources to participate in sharing in this opportunity, as long as the Province applies a similar dedication to its long term development of its forest resources as it did for energy.

Eucalyptus pulp, which came onto the scene in the early seventies, is an outstanding example of a rapid innovation of both production and marketing in an established resource industry. In a short period of time it has become a major participant in the world's pulp and paper industry, benefiting both the producers and their customers.

Successful and long-term profitability in Alberta will depend on the Province's strategy and planning, together with the private sector, of the requirements necessary to achieve economic competitiveness.

This means that it is important to give priority to:

- continuing recent efforts to ensure that the softwood and hardwood forest base is perceived by customers to be viable and sustained (considerable progress has already been made)

- establishing market pulp mills in the lowest cost quartile of world pulp producers

- ensuring Alberta pulp have a strong and dedicated internationally oriented marketing plant to combat competition and meet customer requirements.

TABLE OF CONTENTS

INTRODUCTION

The forests of Alberta offer one of the few opportunities in North America for growth in the pulp and paper industry. The potential has been the subject of several studies and seminars. Among these was the 1985 Woodbridge, Reed and Associates' (WRA) study "Utilization of Hardwood in Northern Alberta.

In order to quantify these opportunities the Government of Alberta Department of Forestry is engaged in an intensive study of the incremental wood supply available for development. As background for this evaluation the Department of Forestry has engaged Woodbridge, Reed and Associates to provide an overview of the international position of market pulps and specifically the newer eucalyptus grades.

This study will focus on the marketing and technical perspective in the following sections:

1. Outlook for World Paper and Board demand to 2000

2. Trends in Fibre Usage in Paper and Board Products

3. Outlook for Market Pulp Demand

4. Supply and Demand for Market Pulp

5. Marketing Aspects of Eucalyptus BKP
   - Supply - current and projected
   - marketing and pricing

6. Technical Position of Eucalyptus BKP
   versus
   - softwood BKP
   - other hardwood BKP
   - secondary fibre
   - fillers

7. Implications for Alberta's Forest Resources

OUTLOOK FOR THE GROWTH OF PAPER AND BOARD DEMAND TO 2000

World paper and board consumption is closely linked to real GNP cycles and the trend has been inexorably upwards. There is still significant latent demand to be satisfied, in addition to maintaining the supply of over 190 million tonnes/year of established consumption.

A review of the changes since 1960 (Table 1) illustrates the

1. notable slowdown in the annual rate of growth since the mid-1970's (but still growing, nevertheless)

2. maturity of demand in most of the developed world countries

3. emerging rate of growth in the developing countries.

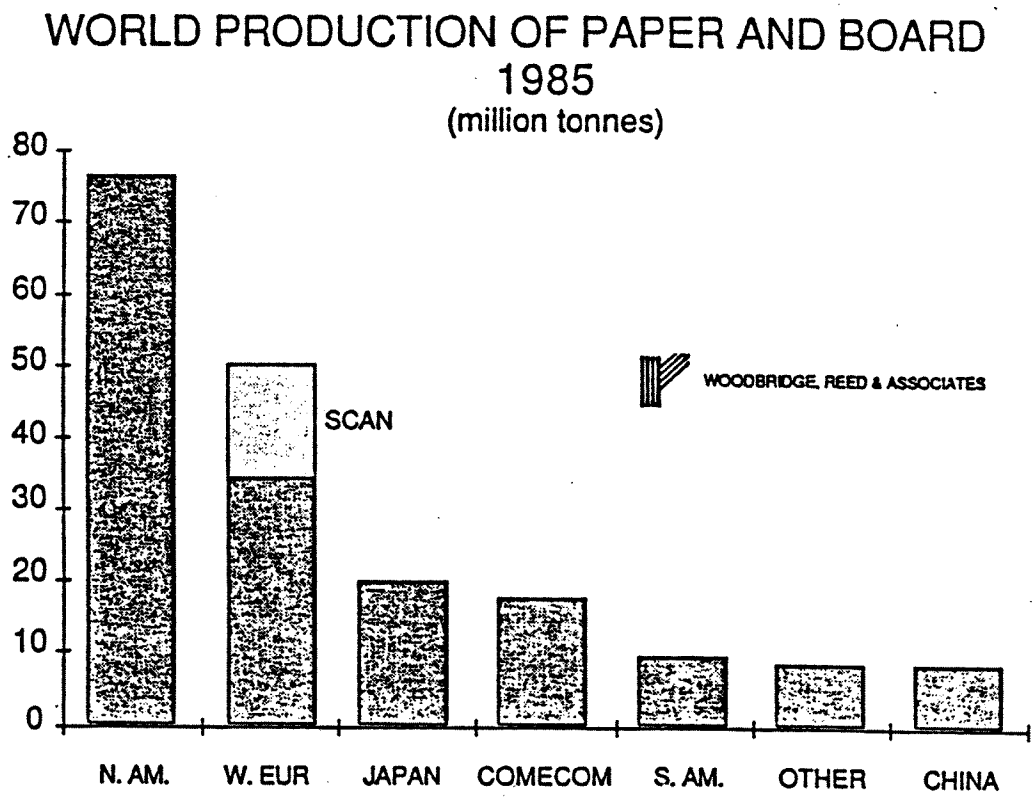
Table 1. World Production of Paper and Board 1960-1985 (million tonnes)

	North America	Western Europe	Japan	Rest of World	Total
1960	39.4	19.6	4.5	11.1	74.6
1970	59.5	30.7	12.9	26.2	129.3
Annual per cent increase (1960-69)	4.0	4.7	11.1	9.0	5.6
1980	68.9	43.8	18.1	40.2	171.0
Annual per cent increase (1970-79)	1.5	3.6	3.4	4.4	2.9
1983	72.1	44.3	18.3	42.9	177.3
Annual per cent increase (1980-82)	1.5	0.4	0.4	2.2	1.2
1984	76.6	48.6	19.4	45.3	189.9
Annual per cent increase	6.2	9.7	6.0	5.6	7.1
1985	75.5	49.0	20.5	46.0	191.0 (e)
Annual per cent increase	(1.4)	0.8	5.7	1.5	0.5

The current level of production, in total tonnages, of major regions is illustrated in the Figure 1.

The imbalance in demand between the developed world which in 1985 accounted for 76 per cent of total paper and board consumption with less than 30 per cent of the world's population, is apparent. Annual consumption of paper and board in North America (+250 kg./capita), Europe and Japan (120-200 kg./capita range) contrasts with the consumption of underdeveloped regions of 2-10 kg./capita.

Figure 1



REGIONAL TONNAGES

There are several different forecasts of total paper and board demand in the next 20 years, with the major ones being shown in Table 2. The variations can be debated at length. For the purpose of this study, we submit that if predictions which are the more optimistic are achieved then the demand for raw material fibre will even greater than we indicate.

All forecasters agree that the dramatic growth in demand until the mid-1970's of 100 per cent in 15 years, will not reoccur in the next 15 years.

Table 2. Forecasts of Paper and Paperboard Demand

	1985(e)	1985	1987	1990	1995	2000
WRA (1986	191.0	-	198.0	207.0	-	238.0
Jaakko Poyry (1982)	191.0	201.0	-	235.0	276.0	-
Jaakko Poyry (1985)	191.0	-	197.0	210.4	232.8	255.3
DRI (1986) (consumption)	191.0	-	197.1	224.8	254.2	296.5
FAO (1977) (medium projection)	191.0	215.0	-	259.0	-	-
FAO* (current)	191.0	-	-	220.0	255.0	-

*FAO current study will not be officially published until the fall of 1986. The data shown is based solely on verbal reports on the draft.

WRA's assumptions which result in relatively conservative growth rates, are:

1. GNP growth in the period will not parallel 1945-1985.

2. Population growth in the majority of OECD countries will be 0.5-0.7 per cent/year, and in Europe will be relatively stagnant.

3. Population growth of above 2 per cent per year in developing countries will not result in corresponding increases in per capita paper and board demand. In fact, for the balance of this century debt and lack of funds will continue to inhibit paper consumption.

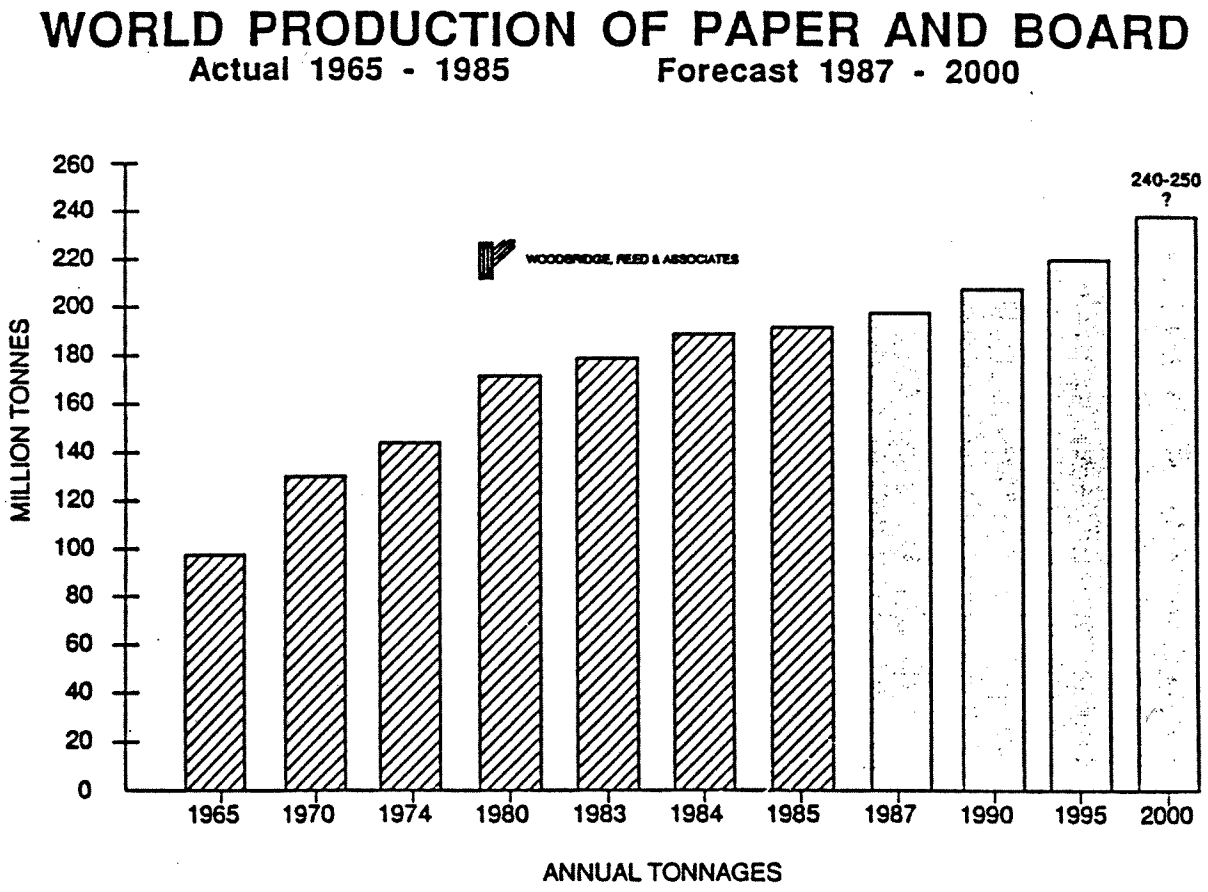
4. No sharp impact from electronic media is foreseen, but persistent intrusion into communications will inhibit consumption growth in some paper grades.

5. Miscellaneous plastic products will erode the rate of growth of cellulose packaging.

6. There will be ongoing economies in the units of paper and board output by means of both sheet area and strength e.g., lower basis weights, and there will be more combination packaging with non-cellulose products.

But in spite of lower growth rates, the increases in paper and board demand will still be significant. An annual increase of only 1.0 per cent (WRP forecasts 1.7-1.8 per cent) will, require 2 million tonnes of incremental production of paper and board, or the equivalent of 20-30 new world scale paper machines.

These result in the growth shown in Figure 2.



The annual growth rate of different grades of paper and board will vary, making forecasts in terms of total tonnage volume imprecise, except in terms of trends. Consumption vis a vis weight will decline because of the emphasis being placed on increasing surface area and lowering basis weight. This strengthens the competitive position of the most effective producers.

Trends in paper production will include:

a) greater utilization of fillers
b) improvement in the surface characteristics of the sheet
c) development of new grades to accompany changes in printing technology
d) improved supercalendered grades for "throw away" advertising, and
e) new business paper grades, specifically for reproduction.

In December 1985 at an OECD meeting in Paris it was concluded that the new electronic information technologies would have no significant impact on the paper industry. However, it would be dangerous to accept this comfortable view entirely, and well informed minority opinions warned that a) some grades would suffer b) some producers would not be flexible enough to survive and c) increase in the hi-tech communication might well be accelerated. However, it is more likely that developments in the electronics industry will result in positive demand aspects for business papers, outweighing losses in other sectors.

The structure of the paper and board manufacturing industry will continue to concentrate into larger and faster machines. There is intense competition within the different sectors, with over capacity problems in several. In spite of lessons in the past, a current example is the evidence from the European Paper Institute that an expansion spree of wood containing publication paper capacity will result (in European countries) in 1990 capacity being at least twice as high as forecast requirements.

As a result, product qualities are raised to increasingly higher standards to gain market share.

TRENDS IN FIBRE USAGE IN PAPER AND BOARD PRODUCTION

The Dominance of Northern Softwoods

The pulp and paper industry developed in the northern countries where there was a preponderance of high quality long-fibred softwoods and large industrialized populations existed to consume the products. In terms of both location and quality the fibre resources were relatively fixed. This meant the paper and board producers were bound by the parameters set by diet-driven, or production oriented pulp suppliers.

Papermaking processes, paper grades and equipment were developed specifically for these fibres, taking advantage of the resource strengths and accommodating the weaknesses. Today the market is changing. Paper and board producers must increasingly develop end products to meet new or changing market requirements, and adjust the fibre supply to meet these. With the development of silviculture technology and management, it is now possible to tailor the fibre-mix to the product rather than the other way around. Progressive pulp producers realize they have no choice but to do this.

Until the mid 1900's the abundance of northern softwood pulp eliminated any pressure on paper makers to improve their processes in order to use lower cost, lower strength materials. After 1950, this changed with the rapid expansion of the pulp and paper industry and fears that fibre supplies were running out. The paper and board producers began to seek alternate and more economical sources of fibre.

The Emergence of Radiata Pine and Hardwoods

The utilization of fast growing southern U.S. pine increased along with hardwoods. Birch, aspen and maple were the most successful with high yield and thin fibres. The denser hardwoods such as gums, oaks and eucalyptus were of less interest until the late sixties. Only in the early 1970's did large quantities of commercial eucalyptus came onto the scene.

The "newer" fibres were initially dismissed as inferior by most of the established pulp sellers and even many paper makers played down the prospects for the emerging fibre grades.

Of the radiata and southern pine fibres, it was said that these thick walled fibres would be suitable for linerboard and packaging papers. Tropical hardwood growth was not going to be practical, and the resultant fibres would not impart any real benefits. The same attitude prevails at this time about CTMP hi-yield pulp!

Economics and technical advances in papermaking soon changed established attitudes.

Paper makers historically relied on the intrinsic strength of the long slender softwood fibres to carry the sheet across long open paper machine draws and through the faster running printing presses. Machinery

manufacturers reduced this dependency by shortening or eliminating the open draws. In addition chemical suppliers developed better additives for the wet end of the paper machine to improve drainage, bonding and fines retention.

The shift away from northern softwood dominance in paper furnishes was paralleled by a shift in the grade of long fibre being used. The so-called inferior pulps from the U.S. South were gaining in importance. Northern softwood and hardwood pulps still led in price and perceived quality but were often being replaced by southern pine especially in grades requiring higher bulk.

Until the late seventies, Scandinavia and North America dominated the pulp and paper industry especially the market pulp sector, (to the extent that "world" inventories were those quoted for Norscan!). In the past 10 years "non-Norscan" producers have become an integral part of international trade of pulp and paper, and published production and inventory data includes virtually all sources. The leaders of this group has been the new plantation eucalyptus in Southern America and Iberia (Portugal and Spain).

Paper makers were pleasantly surprised to discover that the inclusion of hardwood pulp not only decreased furnish costs but increased certain paper qualities. The result was that hardwood pulp furnish content steadily increased, reaching a level of 60 per cent of most grades of woodfree printing paper. Previously the hardwood component accounted for only 40 per cent and in some cases was as low as 30 per cent.

An example of the papermakers flexibility and reaction to economic factors was the "chip shock" in 1979-80. Japan was purchasing a significant percentage of fibre needs from the west coast of North America in the form of softwood chips. Within a period of 6 months the U.S. suppliers more than doubled the price of chips. The Japanese industry reacted by producing fine papers without softwood pulp. Soon the fine papers industry was producing top quality paper form 100 per cent hardwood pulp. Brazil moved into this position for the domestic paper production as soon as eucalyptus became available.

In North America paper makers still use from 30 to 40 per cent softwood BKP in most grades. The reason is not due to inability to use higher amounts of hardwood but because much of the industry is integrated and tied to fibre supplies. In spite of this, Brazil is exporting almost 200,000 tonnes/year of eucalyptus to North America because U.S. paper makers value the fibre for its intrinsic advantages.

In Europe the trend is toward both higher hardwood usage and higher filler content. Europe uses up to 28 per cent filler in uncoated fine paper's more than any other region.

Mechanical Pulps

Mechanical Pulps are produced by physically separating the fibres in a grinder or refiner. They have been traditionally distinguished by short

stiff fibres and fibre fragments, high shive content, high opacity and low brightness. Yields are normally 88-95 per cent.

Until the 1960's the technologies for producing mechanical pulps remained fairly static. Stone groundwood was the only mechanical pulp in use and newsprint was the major end user.

Since the 1960's, mechanical pulp technology has undergone a revolution. Equipment was developed so that mechanical pulp can be produced from chips rather than from more costly logs. Development of the new refiner mechanical pulping (RMP) process was initially slow because of limitations in equipment and operating experience.

Nonuniform pulp quality limited the amount that could be used in newsprint. However RMP development set the stage for development of the thermomechanical (TMP) pulping process. TMP is satisfactory for low valued commodity papers such as newsprint and groundwood specialties but has some restrictions for use in higher valued grades.

When thermomechanical (TMP) pulp was first used in newsprint, it was limited to 25-30 per cent of the furnish because of severe quality problems. Now, after only 10 years of development, new mills rarely consider using chemical pulp in the furnish, even in the U.S. South.

Throughout the world wherever electrical power is economically available for mechanical pulping, CTMP is gaining acceptance for other paper end uses, tissue, toweling, duplex board, and increasingly in printing and writing.

Historically mechanical pulping has been restricted to softwoods in order to achieve adequate strength and brightness and has therefore been primarily in northern softwoods regions. There are now indications that good quality mechanical pulp can be produced form the northern aspen and birch hardwoods and experiments are being conducted with eucalyptus.

Mechanical pulps have properties that are unique and superior to those of other pulps. Process techniques and knowledge are evolving rapidly and CTMP with peroxide bleaching has strengths equal to those of hardwood BKP and brightness up to 82-84. It is now starting to compete with chemical pulps in a variety of paper products where mechanical pulps were virtually nonexistent 15 years ago.

When these characteristics are better defined demand for high yield pulps will increase and high yield pulps will be marketed not only as a substitute for other grades such as hardwood and secondary fibre, but also on an inherent benefit basis.

Fillers

In addition to fibres, paper furnish also includes clay, sizing, titanium and other non-fibrous materials. The amount used depends on the grade being produced and sheet strength.

These products are generally much less expensive than cellulose. In countries which a) have indigenous mineral resources and b) have to import pulp, the trend has been to increase the output of coated papers for printing papers. In some instances in Europe the filler content is as high as 28 per cent of the basis weight. Generally, fillers now comprise up to 10 per cent of other paper and board furnishes.

Secondary Fibre

Use of secondary fibre, especially for packaging grades, has been pushed to new levels (45-50%) in Japan and some European countries. Technological improvements in the deinking process has raised consumption in some printing and writing grades.

The growth rate is not expected to continue to the same extent because in most countries which lack indigenous fibre, recovery rates appear to have reached their economically feasible levels.

OUTLOOK FOR MARKET PULP

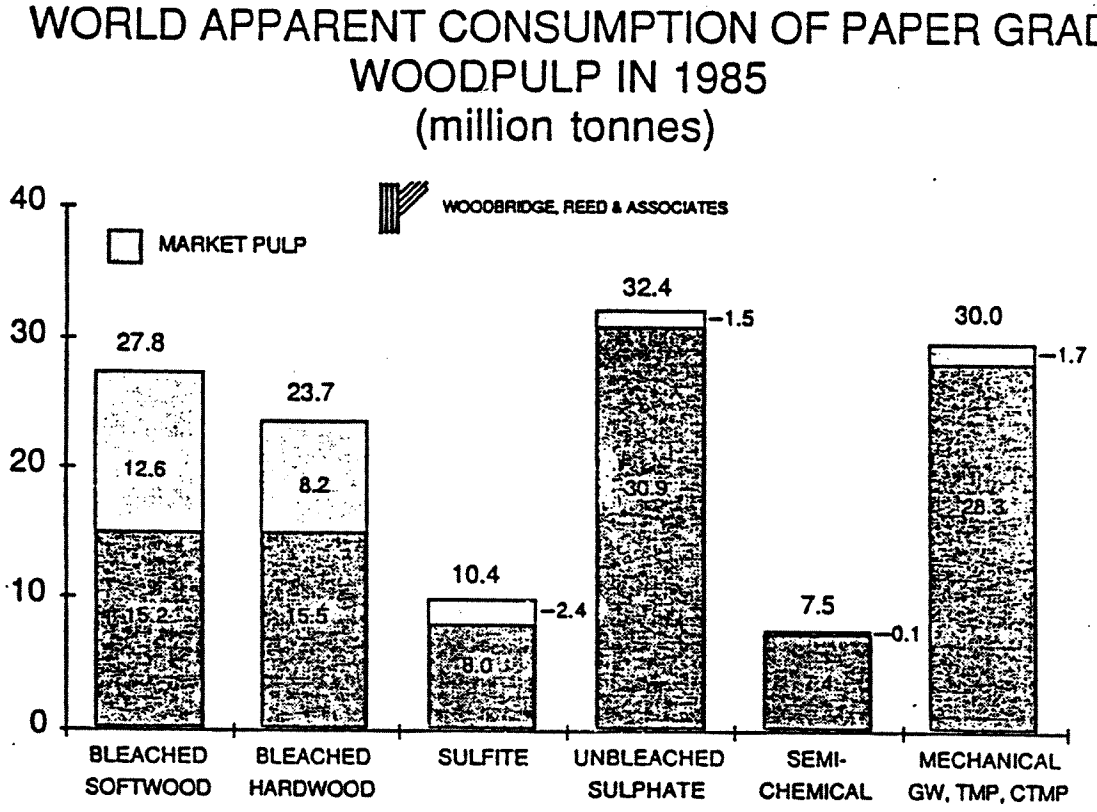
The supply of raw material to support world paper and board production is broken down into the following major divisions:

- Integrated-Affiliated-Non-integrated-Market
- Paper grades and dissolving (hi-alpha)
- Chemical and mechanical
- Bleached and unbleached
- Softwood and hardwood
- Secondary and non-wood

Integrated-Affiliated-Non-integrated-Market

Annual world consumption of all paper grade pulp is now over 130 million tpy as shown in Figure 3.

Figure 3



Source: DRI

The characteristics of the pulp classifications are as follows:

"Integrated" - manufactured on site and passed to the paper machine in slushed form.

"Affiliated" - (usually dried, but can be in wet-lap or slushed form) - in-house transactions of "captive" pulp.

As mergers increase, the amount of captive pulp is increasing. For statistical purposes the industry considers that export sales (offshore in North America) are all "market", even if shipped to an affiliate.

"Market" - sold in competition with other suppliers, where there is no control of the buying/selling decision by one party over the other except by negotiation.

Annual demand for market pulp is now in the order of 28 million tonnes, or 20 per cent of all manufactured pulp (Figure 3). Historically, the annual proportion of market pulp has bene between 18-22 per cent.

Market pulp is;

a) Produced and sold on a global basis, the most international of all forest products.

b) Manufactured world wide by more than 200 individual producers. In the early 1970's there were fewer than ten countries exporting over 100,000 tpy - today there are over 20.

c) Faced with ongoing currency fluctuations which impact in various ways compared to the relative stability which existed until 1975, when pricing was universally in U.S.$.

d) Priced solely in accordance with the laws of supply and demand.

e) Available in an increasing range of varieties to fulfill specialty requirements.

f) For the most part, a commodity raw material.

Paper Grades and Dissolving/Hi-Alpha

Paper Grades

There are five basic grades of virgin paper grade fibre:

- softwood kraft (bleached, semi-bleached, unbleached
- hardwood kraft
- sulphite (bleached and unbleached)
- semi-chemical
- mechanical

Dissolving (Hi-Alpha)

These pulps are manufactured primarily from softwoods by the sulphite method, but on occasion a) the kraft process and b) hardwood furnish is used.

Very little of the dissolving production is sold to the paper and board industry, however some competes with paper grades when it a) is used for diaper manufacture and b) is substituted for paper pulp if the selling price is competitive.

Chemical and Mechanical Pulp

Chemical

Approximately 70 per cent of manufactured paper pulp is chemical, with the remaining 30 per cent mechanical.

Chemical pulp is produced by dissolving most of the lignin contaminant in wood with chemicals. The pulp can then be bleached to brightnesses of 85-92 in a multistage bleach plant. Pulp yields based on wood range from 35-48 per cent for softwood, and 50-60 per cent for hardwood. The prime chemical pulping process is kraft.

Sulphite pulp, which preceded the now dominant kraft process, is now used primarily in integrated facilities. There is still some (declining) market use, but the grade is coming under increasing pressure from hardwoods and "sawdust" softwood pulp.

Mechanical

Until the 1960's mechanical pulp production was mainly integrated and used for newsprint. It amounted to just under 30 per cent of total world fibre consumption.

Since 1980, market mechanical pulp production has increased in both Scandinavia and Canada. Most of the new mills use the new bleached CTMP process, which has several advantages over previous pulps.

New production techniques have increased pulp strengths at higher freenesses, so that softwood CTMP can compete favourably with most hardwood BKP in printing papers. This market will grow in the future, after marketing has been developed to gain paper makers' confidence in quality and consistency of supply.

Bleached and Unbleached

Market BKP supplies approximately 43 per cent of all bleached pulp requirements, primarily because of the specialty requirements in printing and writing papers, and also the number of non-integrated independents in the tissue and diaper sectors.

During the 1950's approximately 70 per cent of market pulp was unbleached. By 1980 this had dropped to 15 per cent and by 1990 unbleached pulps will likely comprise only 5 per cent of the market. Major reasons for this dramatic decline are a) the increase in secondary fibre quality and usage and b) the trend to higher valued paper and paperboard. Unbleached paper grades are the most vulnerable during downturns losing both in price and sales and the end-products are liable to substitution (e.g., plastic packaging vs. linerboard and such multiwall sacks as grocery bags). For a market pulp, the least desirable grade is unbleached.

Softwood and Hardwood

This classification refers to the two families of trees used for pulp, "coniferous" and "deciduous". An alternate classification is long fibre and short fibre. Long fibred pulps from species such as pine, fir and spruce are well established in paper grades for strength. The short fibred pulps from species such as aspen, birch and eucalyptus have been used where formation, opacity, printability and bulk are important. Most grades of paper require both strength and printability and paper makers usually blend the different types of pulp according to their needs.

The traditional distinctions of pulp characteristics are becoming blurred and are frequently interchangable. In fact, in general terms, only 10-15 per cent of market pulp is purchased to fill a "niche", irrespective of price. The balance is considered to be substitutable if there is a price incentive.

The relative position of short and long fibred pulps has changed dramatically in the past few years. Due to technological advances in paper machine design and papermaking, the requirement for high pulp strength is becoming relatively less important. In North American and Europe this has resulted in a shift from a blend of 50/50 softwood/hardwood to 40/60. Japan and Brazil, on the other hand, have moved toward 100 per cent hardwood utilization in as many grades as possible.

Secondary and Non-Wood Fibres

Secondary

Improved methods of recovery of secondary fibre in recent years have resulted in the maximum possible use of this fibre source in most countries. Even the relatively "fibre rich" countries (North American and Scandinavia) are stepping up their collection and use of waste paper (U.S. is now 28 per cent of fibre use, versus 22 per cent in 1970). In contrast, the Japanese industry believes that the technical limit of waste re-use is about 55 per cent. WRA believes that Japan has probably reached the economical limit at 48 per cent.

Economic collection of waste is a) dependent on high population concentration and b) labour intensive. Inevitably there is a reduction in quality each time the fibre is recycled. The industry has introduced technological methods to salvage fibre (deinking) and improved sorting to

reduce contaminants such as plastics. By far the largest volume of secondary fibre is used in packaging products, although in the U.S. some mills produce newsprint using 100 per cent deinked fibres.

The term "secondary fibre" also represents a wide spectrum of higher quality material such as roll ends, clippings from converting plants, etc. which in tight markets approach the price of virgin BKP.

Recycled fibre can only be used in grades equal to or below the origin of the fibre. Therefore, although utilization will be maximized for economic reasons, more virgin pulp has to be produced.

Non-Wood

A variety of other fibres, such as straw, cotton linters, bagasse, bamboo and esparto, are used for papermaking. These grades are more prevalent in developing countries lacking adequate wood resources. A small amount of esparto and hemp pulp is traded for specialty grades, e.g., cigarette papers and filters.

Manmade fibres are used in a number of products such as non wovens and textiles. Some of these are cellulose based such as rayon or contain cellulose derivatives such as the superabsorbents used in diapers. There is also growing interest in cellulose fibres with non-cellulose chemicals grafted on to them for specialty products. The volume of these products is small relative to wood pulp.

The description of the various types of paper making raw materials high-lights the fact of vigorous competition for the papermakers furnish.

Softwood and hardwood BKP will remain the cornerstones of the industry. But their automatic supremacy, especially that of Northern Softwood, is no longer assured.

SUPPLY AND DEMAND FOR MARKET PULP

This section concentrates on the source and destination of softwood, hardwood and mechanical paper pulp grades which are of interest to Alberta.

As shown in section 2, there is a competitive clash between all grades of market pulp under certain economic conditions (e.g., hardwood vs sulphite, hardwood vs softwood, Northern softwood vs. Southern softwood).

An outline of the production and movement of all paper grade pulps is useful to set the scene for Section 5 which gives more specific details about eucalyptus.

Supply

Some historical data (Table 3) is included to illustrate the change and development of supply sources. Statistics have been readily and accurately available for the traditional Norscan suppliers (Canada, U.S.A., Sweden, Finland and Norway) who, until the mid-1970's, group dominated (85%) the World's market pulp supply. Until recently details about other countries have been limited, but estimates have been made based on the available data.

In 1974, shipments of chemical grade market pulp from all sources was 19.4 million tonnes, of which 77 per cent originated from Norscan countries. By 1985 the total had risen to 24.7 million tonnes, with the Norscan share falling to just below 66 per cent as shown in Figure 4.

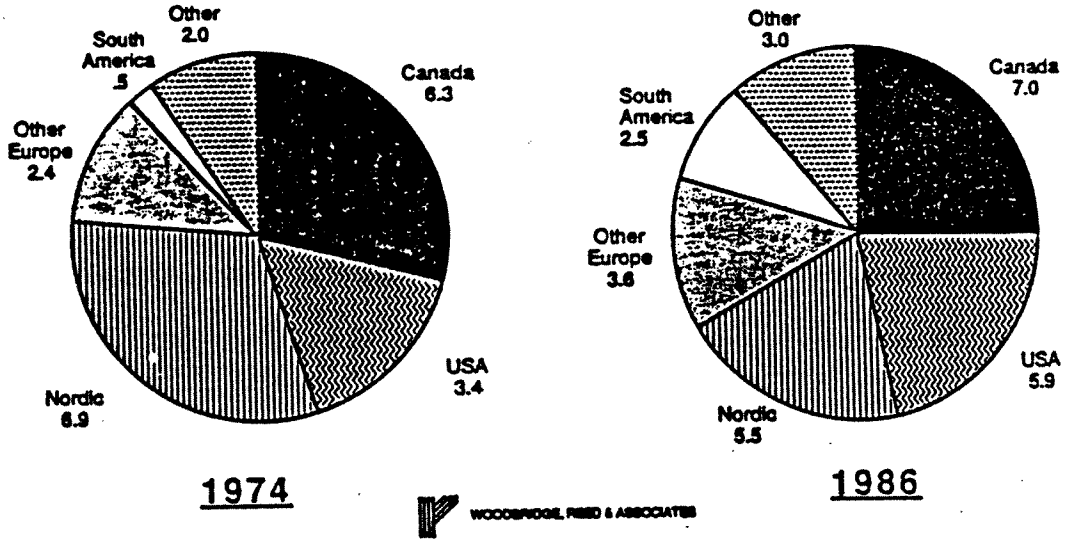
Table 3. World Paper Grade Market Pulp Shipments 1974-1985 (million metric tonnes)

	Bleached & Unbleached Sulphite	Bleached Softwood	Sulphate Hardwood	Unbleached Sulphate	Total
1974	4.0	8.8	4.5	2.1	19.4
1980	2.8	11.4	6.6	1.8	22.6
1983	2.5	11.9	7.9	1.5	23.8
1984	2.5	12.3	8.2	1.6	24.6
1985	2.4	12.6	8.2	1.5	24.7
Change 1974/1985	(40%)	47%	91%	(22%)	30%

Source: Various

Figure 4

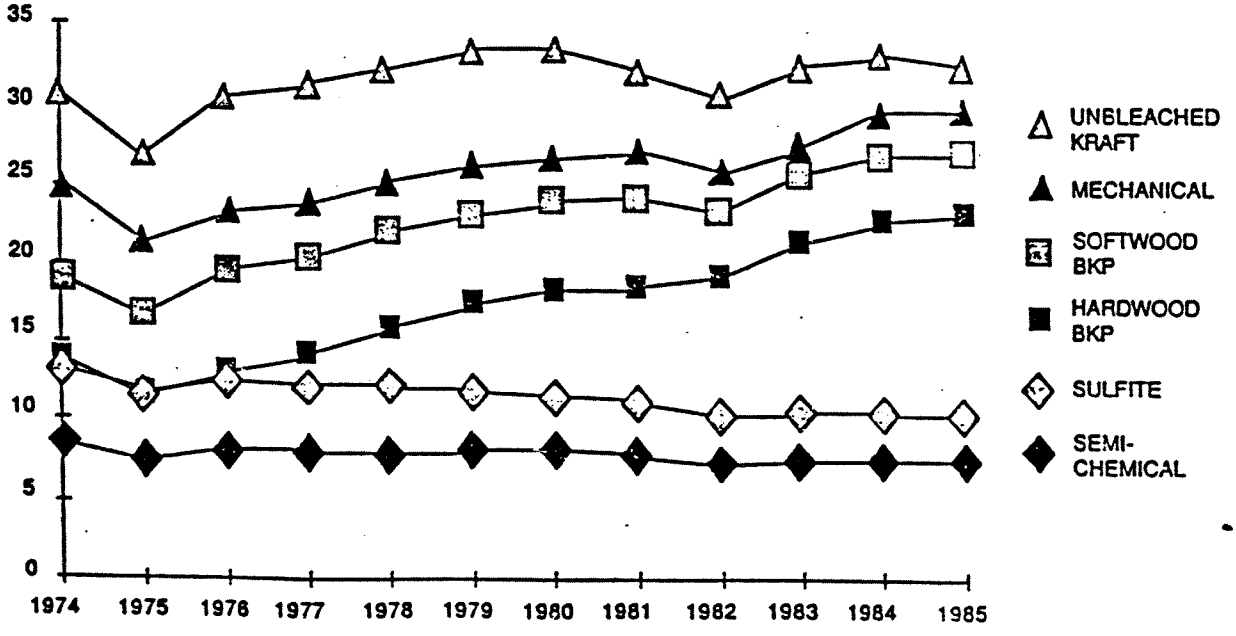
WORLD PAPER GRADE MARKET
BLEACHED KRAFT PULP CAPACITIES
1974 vs 1986
(Million Tonnes)



The decline in the importance of sulphite and unbleached grades in contrast to the growth of bleached kraft, particularly hardwood, is apparent from Figure 5 which illustrates total paper consumption.

Figure 5

WORLD WOODPULP APPARENT CONSUMPTION
1970-1985
(million tonnes)



Softwood and Hardwood Market Bleached Kraft Pulp

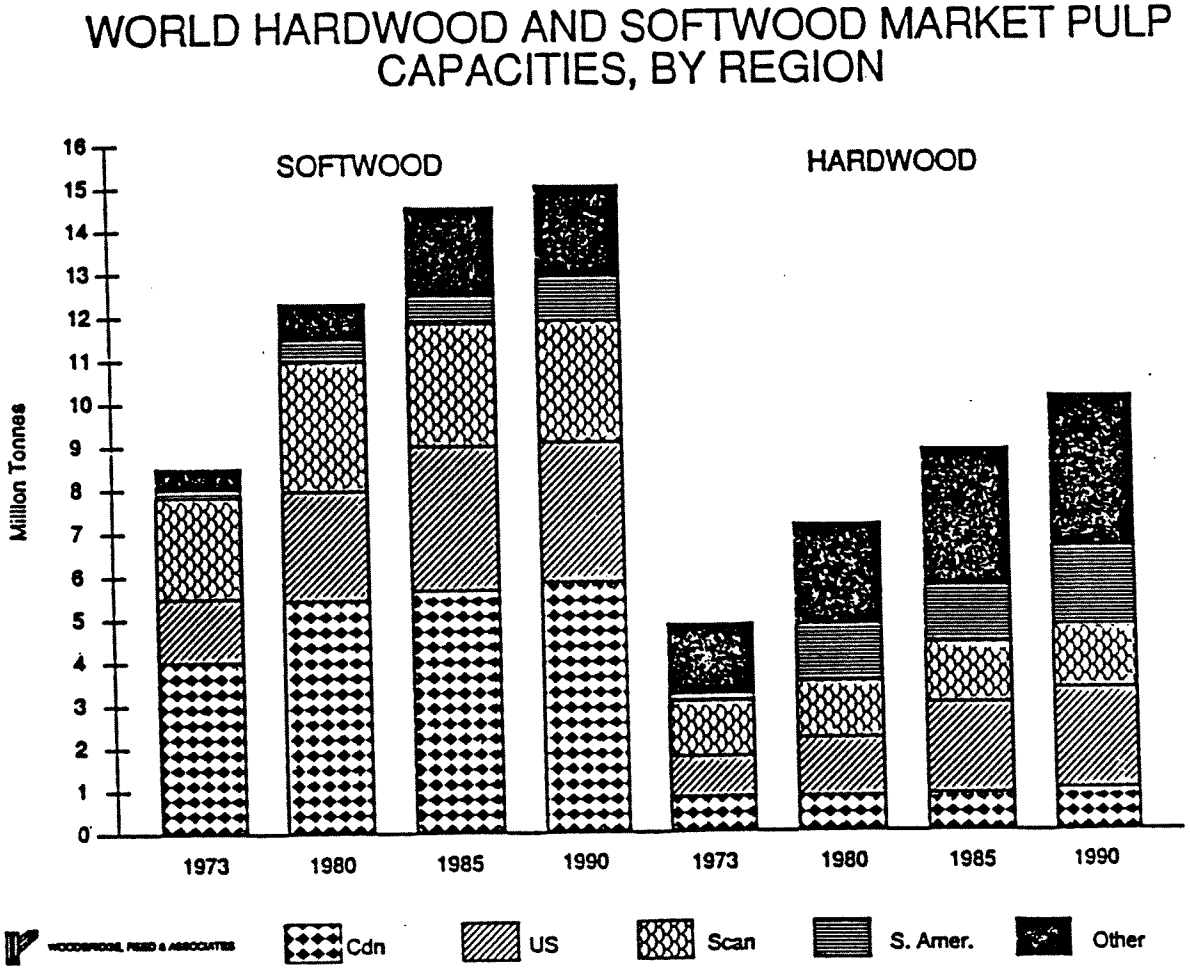
Figure 5 (and Figure 3 page 10) illustrates the importance of both softwood and hardwood market pulp to the world's paper and board industry.

Bleached kraft is required especially by the many independent paper makers of printing and writing grades, in varying blends, to make the vast array of products for a multitude of end uses.

It is estimated that there are over 250 individual producers of bleached kraft pulp. They range from those who occasionally sell marginal quantities in excess of their own integrated requirements to dedicated market pulp mills with capacities in excess of 1000 tpd.

BKP capacity trends over the past ten years and onwards to 1990 are shown in Figure 6. The growth of hardwood capacity in South America, Portugal and "other regions" is heavily concentrated to eucalyptus, and will be covered in section 5.

Figure 6



The 1986 capacities of softwood and hardwood, by producing country, illustrate the international scope of market pulp supply.

Table 4. Market Bleached Kraft Pulp Capacity - 1986 (000 ADMT)

Country	Softwood	Hardwood	Total
Canada	5.9	0.9	6.7
USA	3.6	2.0	5.6
Sweden	2.2	0.6	2.8
Finland	0.6	0.9	1.5
Norway	0.3	-	0.3
Total Norscan	12.5	4.4	16.9
Austria	0.2	-	0.2
Belgium/France	0.2	0.7	0.9
Portugal	-	1.3	1.3
Spain	0.1	0.2	0.3
Other W. Europe	-	0.1	0.1
Total Europe	0.5	2.3	2.8
Argentina	0.2	-	0.2
Brazil	0.1	1.5	1.6
Chile	0.2	-	0.2
Total S. America	0.5	1.5	2.0
Japan	0.2	0.7	1.0
Austrailia/New Zealand	0.2	-	0.2
Taiwan/S. Korea	0.1	0.2	0.3
Other	-	0.1	0.1
Total Pacific Rim	0.6	1.0	1.6
Comecom	0.4	1.0	1.4
WORLD TOTAL	14.5	10.2	24.7

Source: DRI, API, CPPA, WRA

Shipments

1985 shipments by the major supply countries were as follows:

Table 5. Shipments by Major Supply Countries, 1985 (million tonnes)

	Softwood	Hardwood
Canada	4.9	0.7
USA	3.1	1.7
Sweden	1.8	0.6
Finland	0.5	0.8
Norway	0.2	-
Brazil	0.1	1.4
Chile/Argentina	0.6	-
New Zealand	0.1	-
Austria	0.2	-
Portugal	-	0.8
Spain	-	0.3
Other Europe	0.5	0.5
Japan	0.1	0.4
Other	0.5	1.0

Source: Various

Demand/Consumption

1985 deliveries of market BKP highlight the concentration of consumption in North America, Europe and Japan, but there are few countries not receiving same BKP.

An exact balance between shipments and apparent consumption is impossible to achieve because of a) consumer inventory changes and b) variable methods of reporting (estimates have been made if national statistics are incomplete).

Details of shipments to major market areas from the Norscan/S. America group are shown in Table 6. More details of eucalyptus, including Iberia, are shown in Section 5.

Table 6. Shipment to Major Market Areas from Norscan/S. America, 1985

To	From							
	Softwood				Hardwood			
	Canada	U.S.	Nordic	S. America	Canada	U.S.	Nordic	S. America
Canada	530	110	5	-	140	-	-	1
U.S.	1,560	1,480	30	-	300	770	30	220
Nordic	-	-	390	-	-	-	260	-
W. Europe	1,470	860	1,850	240	140	340	850	230
Japan	600	280	50	-	120	200	50	170
China	260	4	27	*	-	6	11	*
Other	510	390	160	30	30	370	160	180

*included with others
Source: Various

Since Europe is the prime user of market pulp, imports as recorded by local statistics for 1984 and 1985 are listed in Table 7.

Table 7. European Market Pulp Imports

	Softwood		Hardwood	
	1984	1985	1984	1985
Germany	1,450	1,500	850	880
France	900	890	420	440
Italy	720	750	360	420
U.K.	540	500	610	540
Japan	880	960	470	530

Source: National Statistics

EUCALYPTUS PULP - MARKETING

Eucalyptus Pulp

The steadily increasing internationally available volumes of market eucalyptus pulp since 1974, illustrates the potential of concentrated forest management and species selection to meet end use needs.

Over 600 varieties of Eucalyptus are grown world wide, ranging from forest giants in Tasmania to scrub trees in tropical countries. They differ vastly in fibre characteristics, the majority being unsuitable for commercial development.

Under strong pressure to utilize indiginous forests, several countries, specifically Brazil, undertook major research projects to find a suitable commercial and economic fibre base. They also sought to upgrade marginal land for use as forest plantations instead of leaving it unproductive.

Hybrid development, the establishment of tree farms and the identification of fertilizers, harvesting cycles and logging techniques are some of the research projects which were followed through, and are being continued.

Commercially, results have been spectacular. They are proof of the value of using science to develop natural resources.

The increased availability of eucalyptus has:

a) delighted paper makers by providing a bright, good quality hardwood pulp which provides valuable benefits to their products at reasonable cost.

b) provided a new fibre option for paper and board furnish

c) contributed to the continuity of raw material fibre supply to support growth of paper and board consumption

d) alarmed traditional pulp suppliers who have seen their market share eroded.

Established producers of market pulp have been reluctant, almost ostrich-like, in accepting eucalyptus as a major market participant. They are increasingly nervous about its rewarding period of growth.

WRA does not believe that Eucalyptus development and expansion should be viewed as a "cloud over the market" by efficient softwood and mechanical pulp producers. Eucalyptus will certainly impact on high cost producers, but the other grades of pulp will still be required either exclusively or in blends, for paper and board manufacture.

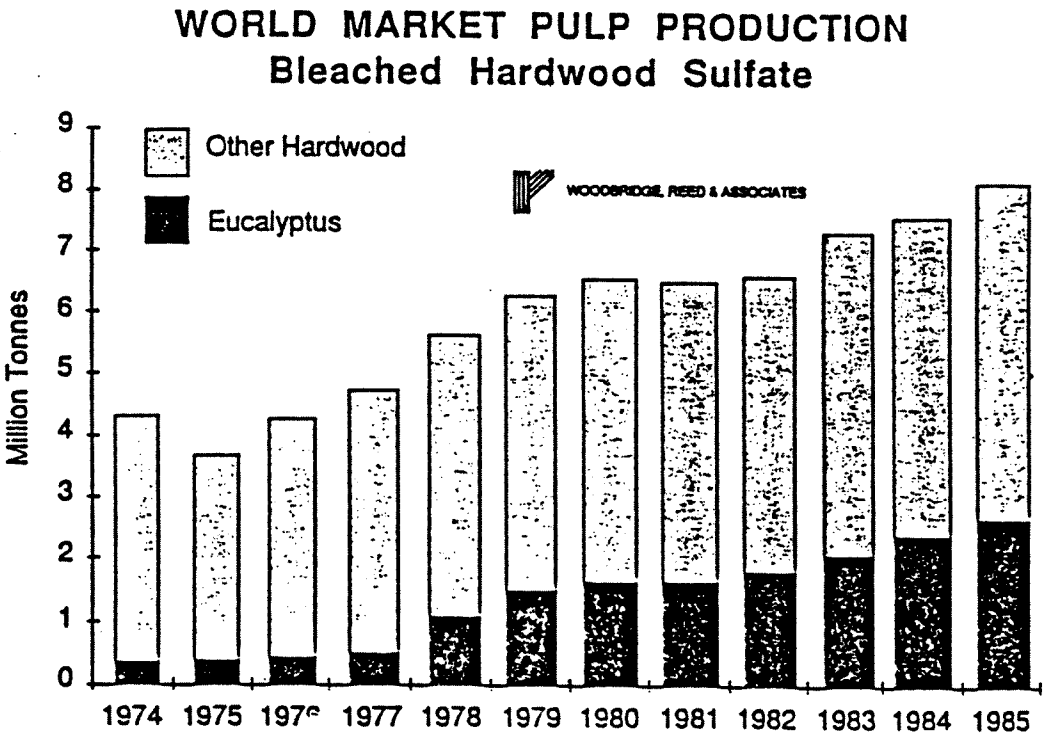
It is imperative that all pulp producers clearly recognize the various participants in the cellulose raw material industry, and plan their strategy accordingly.

The end user looks for a top quality/low cost product. The paper maker must meet this expectation. He will seek the fibre source which can supply the best balance of lowest cost/highest quality raw material.

Supply

Since 1974, the growth in world hardwood pulp production has been driven by the new Eucalyptus mills, details of which are shown in Figure 7.

Figure 7



Source: Various

In the future, other tropical regions are expected actively to pursue the development of plantations and production e.g., Indonesia, Ghana. Growth could be achieved in Australia and New Zealand, in addition to their established coniferous resources.

The fundamental economic rationale for eucalyptus is that the rapid growth translates to low-cost forestry because of the relatively small area necessary to supply a large scale pulp facility.

For instance, pulp production of 500,000 tone/yr. can be supplied from only a 50,000 hectare of forest, or even less growing at 60-80 m^3/ha/yr. Land capital investment is reduced, due to the short rotation of time of 7-12 years.

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[1]Papertree November 1985

By comparison, a northern Spruce-Pine-Fir forest grows about 1.75 m^3 per hectare per year and at 5 m^3 per tonne of pulp, it would require 1.43 million hectares to supply a softwood mill of similar size.[1]

As a result, eucalyptus capacity expansion can be rapidly prepared. Several of Brazil's pulp export companies have planted new forests for a new pulp line in the next 5-10 years.

The structure of today's supply, and the proposed expansion to 1990 is as follows (Table 8):

Table 8. Present and Future Supply of Eucalyptus

Country	Producer	Start-up	Present Capacity	Planned Expansion Date	Planned Expansion in Capacity
Brazil	Aracruz	1978	475	1989	525
	Cenibra	1977	340		
	Riocell	1972	195	1990-91	250
	Suzano			1992	340
	Others		200	1986-89	70 (net)
Portugal	Caima	1930/62	120		
	Celbi	1967-83	200		
	Portucel (2 mills)	1957-83	400	1988	120
	Soporcel	1984	260		
Spain	Ceasa	1972	110		
	Erce (3 mills)	1963-67	460		
	Siace	1949-84	50		
Morocco	Celluma	1957	100		
S. Africa	Sappi, Mondi	1985	250		

Source: Various

Demand

Distribution of eucalyptus pulps is becoming widespread, even to countries which have indigenous hardwood pulp production. Worldwide, papermakers are showing an increasing interest in eucalyptus.

Europe is the major target, but of note is the steady growth of projected supply to the U.S.A., with small quantities also being shipped to Canada.

Buyers have been interested in the high quality of the product, its inherent characteristics, the economics of substitution for sulphite and other hardwoods, and to some extent, replacement for softwood.

In balanced market conditions, hardwoods are priced $30-$40 tonne below northern bleached kraft. During the recent depressed conditions, hardwoods (including some eucalyptus) have sold at a greater differential, up to $80. But it is of significance that some eucalyptus producers who discounted their pulps against birch in order to gain a market acceptance have been successful in the recent upturn in prices (Spring 1986) to match the previous grade leaders, Scandinavian birch @ $30 off softwood. A strike in South America helped to balance supply and demand.

The demand pattern for 1985 (Table 9) was:

a) by main destination region and supply source
b) when available, by input details of the major consuming countries.

Table 9. Eucalyptus Market Pulp 000 metric tonnes, Source of Shipments at Destination, by Major Regions.

		Brazil	Portugal	Spain
Domestic use	1984	395	160	n/a
	1985	420	140	190
U.S.A.	1984	135	30 (e)	-
	1985	200	30 (e)	-
Europe	1984	390	500	300 (e)
	1985	299	620	340
Japan	1984	175	-	-
	1985	170	5 (e)	-
Other	1984	215	50 (e)	-
	1985	180	100 (e)	5 (e)
Total				

Source: WRA, various

Details, about Moroccan and South African destinations are not available. Morocco exports are known to be primarily directed to Europe and South Africa to Europe and the Pacific Rim.

Market hardwood pulp imports by major consuming countries are shown in Table 10.

Table 10. Market Pulp Hardwood Imports, 1985 (000 metric tones/year)

Country	Domestic	Hardwood Imports	Total	of which Eucalyptus Brazil	Iberia	Other
U.S.A.[1]	830	550	1,380	210	20	-
Japan[1]	70	530	600	170[2]	-	-
Germany	-	820	820	90	225	6
France	250	430	680	54	55	12
Italy	-	420	420	30	100	25
U.K.	-	540	540	50	240	15
Other	-	-	-	100	200 (e)	10

[1]Significant quantities of domestic hardwood production are used by integrated mills (U.S. 8 million'tpy, Japan 3.2 million tpy).

[2]85 per cent from joint venture mill (Cenibra).

Source: WRA

In summary, there is significant opportunity for high quality hardwood pulp in world markets. Aspen from Alberta should be part of that supply.

EUCALYPTUS BKP TECHNICAL ADVANTAGES

The rapid growth in eucalyptus market BKP is due to

- availability
- pricing strategy
- technical characteristics

It was mentioned earlier that paper makers are very flexible in their choice of pulps with price being a major criteria for many producers. If the price is right, generally there is always a market. Eucalyptus producers used this fact to get their foot in the door. Once paper makers had a chance to use the pulp they realized that it has characteristics that make it unique and in some respects superior to other types of pulps. Eucalyptus is now the highest priced hardwood pulp in the market! If the traditional price setter is to regain market share it will have to do it through price reductions.

The paper and paperboard industry is diverse and generalizations must be made with some caution. What can be considered an advantage for one product is often a disadvantage for another. The following comparisons of eucalyptus BKP to other furnish components should be considered with this in mind.

Eucalyptus vs Softwood BKP

Softwood BKP is used to produce sheet strength and hardwood BKP for print quality. If the major criteria for a paper or board is strength then the choice is softwood. Examples are kraft linerboard, and sack paper.

Apart from packaging and sanitary products, the major end-use quality criteria for paper is printability. Strength must be sufficient to get the paper over the paper machine and through the printing press or converter. Determinents of printability are formation, smoothness, opacity and brightness. Formation is a function of fibre length. The shorter the fibre the better the formation will be. All hardwood pulps give better formation than softwood pulps. This basic reason is shown in Table 11.

Smoothness is a function of fibre diameter and wall thickness. The smaller the fibre diameter the smoother the surface and better the printability. Opacity is a function of total specific surface available to reflect light. This is related to the number of fibres per unit weight of pulp and fibre diameter. Hardwood pulps because they are shorter and smaller in diameter have higher paper opacity than softwood pulps. Brightness is determined mainly by the pulping and bleaching process, with both softwood and hardwood pulps being about equal.

Table 11. Comparison of Fibre Length and Diameter

	Fibre Length mm	Fibre Width microns
Softwoods		
Western Hemlock	3.5	28
Spruce	32.	24
Pine	3.4	28
Cedar	3.5	28
Hardwoods		
Poplar	1.1	10
Birch	1.9	20
Beech	1.2	16
Eucalyptus	1.0	16

In general the properties of all hardwood pulps are distinct from those of softwood pulps and can be considered as a specific group when comparing them to softwood pulps. To the paper maker, the distinction between the various hardwoods also becomes important.

Eucalyptus vs Other Hardwood BKP

Dillner of Billerud[1] has grouped hardwood BKP into classifications according to their morphological properties as follows:

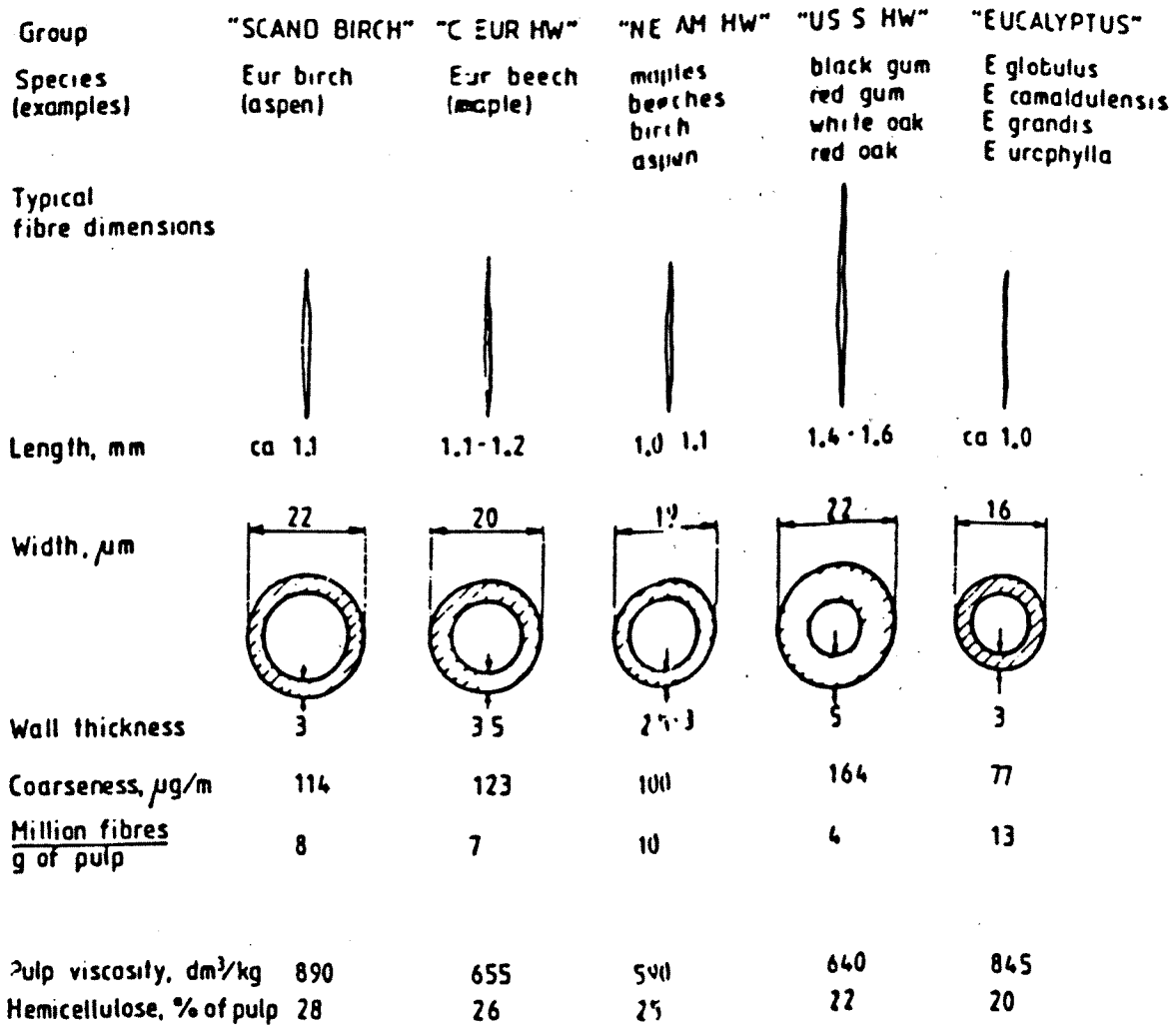
- Scandinavian birch, the traditional hardwood pulp from the Nordic countries.
- Central European hardwoods, pulps from various hardwoods with beech and dominant species.
- N.E. American hardwoods, pulps from a more complex mixture of species such as maple, birch, beech and aspen.
- U.S. Southern hardwoods, pulps predominantly made form numerous species of oak and gums.
- Eualyptus, pulps from Portugal, Spain, Northwest Africa and Brazil. These pulps are all based on eucalyptus plantation wood of similar kinds but different species in the various countries.

Note that aspen is included in the N.E. U.S. group of hardwoods.

The physical characteristics of these groups are depicted in Figure 8.

[1]Symposium Proceeding on New Pulps for Paper Industry, PPI, Brussels, May 1979.

Figure 8



Morpological characteristics of the hardwood groups

Source: Dillner

There is considerable variation between the hardwood groups. While fibre length varies by up to 60 per cent this is of lesser importance in assessing hardwood pulps. The more important parameters are fibre diameter, fibre wall thickness to fibre diameter.

Comparing the Scandinavian birch to Southern U.S. hardwoods:

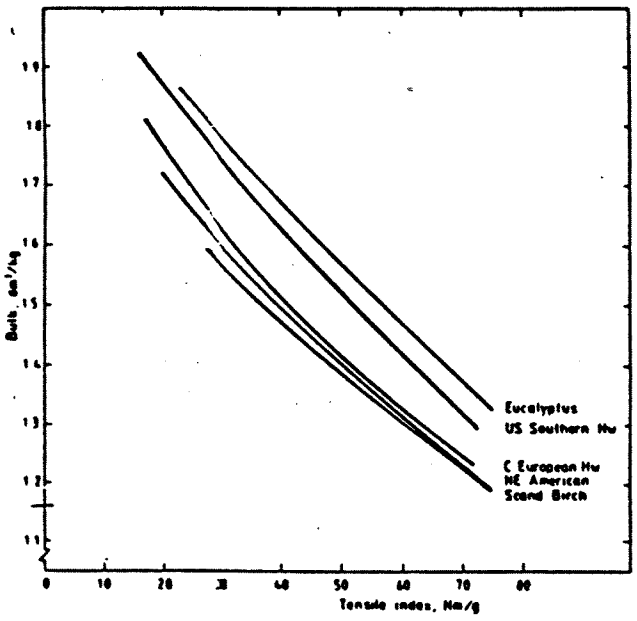
- both have the same fibre diameter
- the fibre wall thickness of the Southern U.S. species is almost double that of the birch.

Until recently paper makers ranked the birch group number one and the Southern U.S. hardwood group a distant last in desirability. The major drawback of the Southern U.S. species is the thick fibre walls. In papermaking the birch fibres will collapse giving a smoother surface. For a given weight of paper there are twice as many birch fibres as Southern U.S. fibres resulting in a less porous structure and more uniform formation.

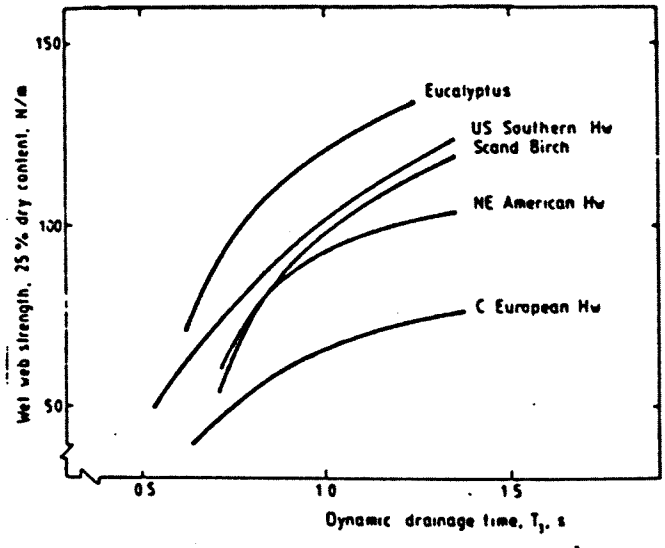
Eucalyptus pulps are unique. They have a higher ratio of fibre wall thickness to diameter than birch which results in lower fibre collapse but because of their small diameters they give good formation and surface smoothness. The number of fibres per gram is the highest of any of the hardwoods.

A high bulk is desired in most fine papers, especially if stiffness if important. In beating, however, the bulk decreases at the same time as the strength is developed. It can be seen in Figure 9 that the eucalyptus and the U.S. Southern hardwoods combine these two properties in a more favourable manner than the other pulps. The morphological explanation is that the eucalyptus and U.S. gum/oak fibres do not collapse to the same extent as the others, so that a more open sheet is formed. As shown in Figure 10, the same pulps were also shown to give good dewatering properties.

A higher bulk with good smoothness makes the paper more compressible, giving a better printability, especially for coated papers.

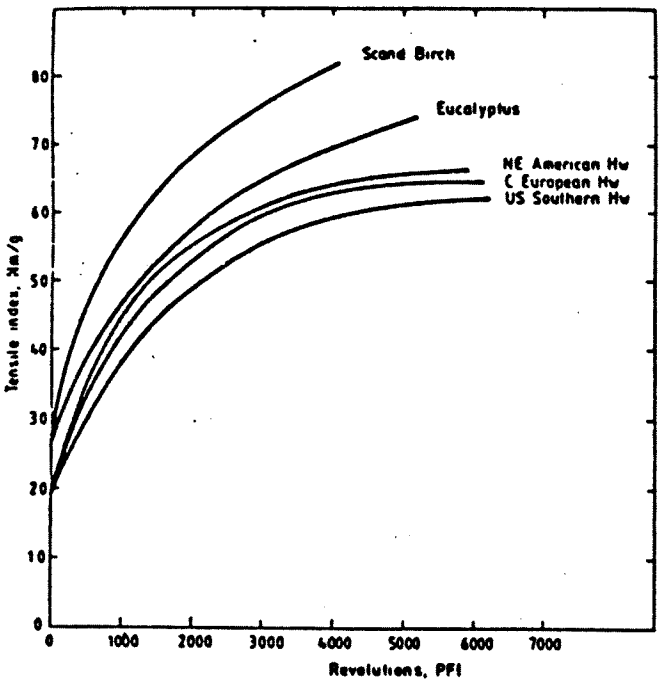


Bulk-tensile relationships. When comparing at a certain strength the eucalypt and US Southern hardwood pulps are much bulkier than the other pulp types

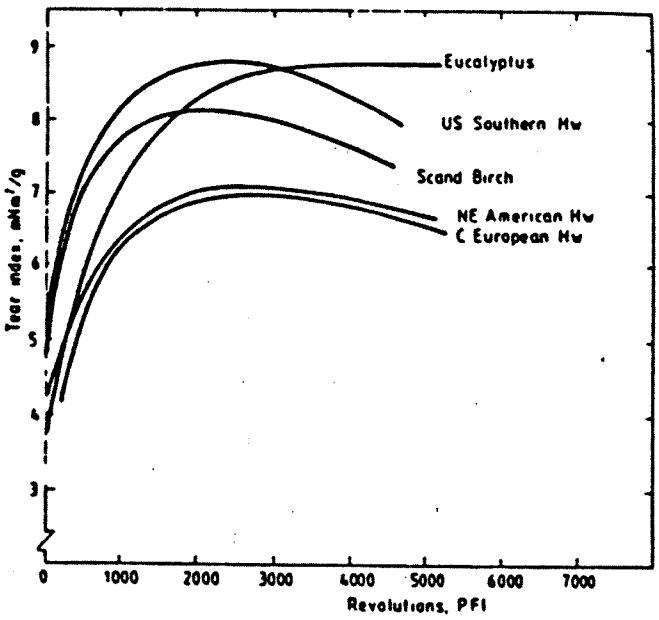


Wet web strength vs dynamic drainage time. Here the order of the pulps are altered compared to figure 5 due to very rapid drainage of the eucalypt and US Southern Hw pulps.

The physical properties of aspen are in between those of eucalyptus and birch. However the pulping properties are closer to those of birch. In the development of tensile and tear strength aspen (N.E. U.S. hardwood) is inferior to birch and eucalyptus as shown in Figures 11 and 12.



Strength development during beating of the hardwood pulps



Tear strength development during beating of the hardwood pulps

In general the following relationships hold for the major classes of commercial hardwood pulps:

- Birch pulps are easily beaten and give good wet and dry strength development but poor bulk and opacity.

- Central European and N.E. American hardwood pulps are comparatively moderate in strength but show good bulk and opacity.

- U.S. Southern hardwood pulps are resistent to beating and have moderate strength except for high tear. They have high bulk but poor opacity.

- Eucalyptus pulps combine most of the important qualities in a remarkably favourable manner. They have good wet and dry strengths provided that the pulps are not degraded in the pulping process and at the same time they have very high bulk and opacity.

In the market place eucalyptus BKP will probably command the best price with birch second and aspen close behind birch. In the future eucalyptus producers will probably be the least and Southern U.S. the most affected by market swings.

Eucalyptus vs Secondary Fibre

Secondary fibre refers to pulp from reclaimed paper or paperboard. It varies in quality from high quality in printed woodfree papers commonly referred to as pulp substitutes to mixed waste from all sources. Fibres from recycled paper have gone through the papermaking process at least once and have been beaten, collapsed and treated with chemicals. they typically have lower strength than virgin fibres and produce a denser sheet.

In grades which require a high bulk, such as paperboard and toweling, a blend of either eucalyptus or Southern hardwood BKP and secondary fibre is advantageous. The more collapsable species such as birch and aspen would be less desirable. The newer CTMP grades with their high bulk and yield would be the best type of fibre to blend with secondary fibre.

The choice between CTMP and BKP will probably depend on selling price and availability. CTMP should be slightly less expensive than the hardwood pulps but may not be as plentiful.

Eucalyptus vs Fillers

Fillers are used to increase printability and decrease furnish costs. They are either applied to the surface of the sheet as in coated papers or mixed in the furnish for uncoated papers. Fillers are only used in printing papers where they give high opacity, brightness, smoothness and lower porosity. Fillers, typically clay or calcium carbonate, do not bond well to fibres. The result is that increasing filler content decreases strength, stiffness and bulk. Eucalyptus pulps are preferred in filled papers where bulk and stiffness are important. Where opacity is important, less filler is required to reach a desired level when eucalyptus pulp is used.

IMPLICATIONS FOR ALBERTA'S FOREST RESOURCE

Eucalyptus BKP has achieved a major role in the world's paper and board furnishes. It has become established and has provided economic and quality benefits to paper makers.

These pulps have helped to show the value of hardwood pulps to paper makers. WRA believes that the increasing acceptance of eucalyptus and hardwoods in general is a positive feature for aspen resources. Paper and board technical and process technology has shown that it is capable of adopting fibres for economic reasons and at the same time maintaining or enhancing quality.

We believe that paper and board demand will increase as indicated in Chapter 1 and that more aspen will be needed as an additional source of hardwood fibre, providing it is economically viable for Alberta and its customers. There is no doubt that competition between aspen and eucalyptus producers will be very strong during periods of market pulp supply over capacity. But as has been shown, this is the environment in which the world's pulp and paper industry operates and participants must be prepared to meet the challenges.

With the largest hardwood resources in Canada, most of which is aspen, there is the opportunity for Alberta to participate in the growth of paper demand. In 1975, four Canadian mills shipped 350,000 tonnes of market hardwood. Today there are eleven mills which shipped 860,000 tonnes in 1985.

This does not mean a demise in the prospects for the high quality of Alberta's softwood pulps, but suggests that evidence is clear that the increasing share of hardwood consumption should be noted and used to advantage.

The Province can achieve this goal with the abilities of the public and private sectors being combined to ensure that Alberta's name ranks high as a meaningful and long term supplier of fibre to the international pulp and paper industry.