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International Wood Chip Trade: Past Developments and Future Trends with Special Emphasis on Japan

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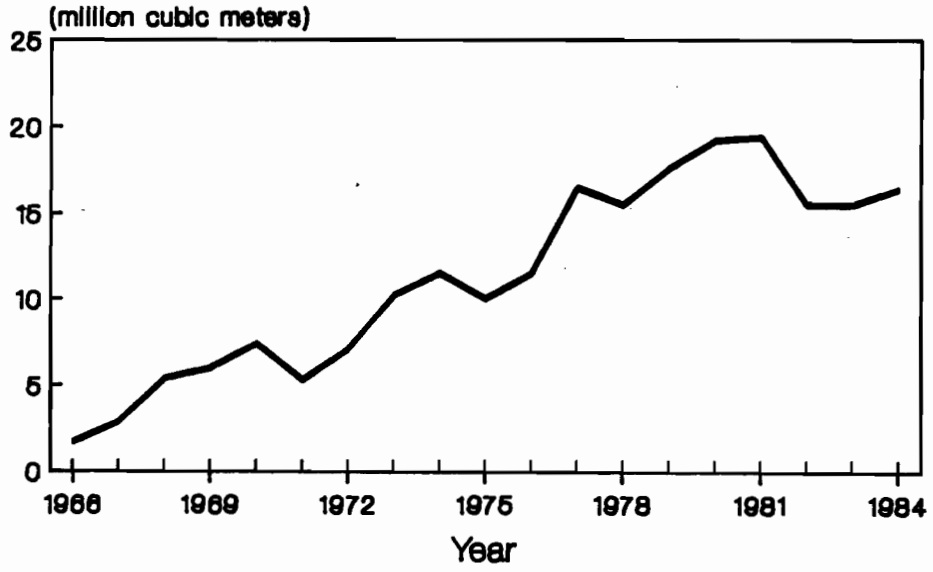
1. Introduction

Initial world trade in pulpwood had been confined to trade in pulp logs, which, for the most part, were regional flows such as between the European and Scandinavian countries. However, beginning in the early 1960s a market began to develop for pulpwood, not in the round wood form but rather in the form of wood chips. Beginning in 1965, with the introduction of specialized chip carriers by the Japanese, the international market for wood chips began to increase substantially (see Figure 1). During the period 1961-1965, before the advent of the specialized wood-chip carriers, world trade in wood-chips amounted to only 523 thousand cubic meters (FAO 1984). However, in 1966, following the introduction of chip vessels, wood chip trade had increased to 1.8 million cubic meters and by 1970 the volume traded had reached 7.4 million cubic meters. By 1980 world imports of wood chips had increased to 19.2 million cubic meters and a record-setting 1.1 billion U.S. dollars (CIF), (FAO 1984). Since 1980 these figures have declined, but it is clear that the international wood chip trade plays a very important role for both importers and exporters of forest products.

Figure 1
The Growing Role of Wood Chip Trade
World Imports 1966-1984



Source:
FAO 1984, Yearbook of Forest Products

2. International Statistics on Wood Chip Trade

The interpretation of international forest products trade statistics can often be a frustrating and challenging experience. This is especially true for wood chip statistics which are quoted in a myriad of different measurements and available from relatively few sources when compared to other commonly traded forest products.

International trade statistics for wood chips are reported both in terms of volume and weight. Volume statistics are most commonly reported in cubic meters, although cubic feet are used on occasion. In contrast to volume measurements, there are a wide variety of weight measurements used in international trade, including: short ton, long ton, metric ton, and bone dry unit (2400 lbs oven-dry weight). This makes direct comparison between different sources of data difficult as a number of conversion problems are encountered. Direct conversion between the two most commonly utilized measurements - cubic meter and metric ton - is rough at best due to differences in wood densities and percent moisture content. For example, the conversion of statistics based on metric tons to cubic meters can have an impact on the ranking of leading chip exporters such as Australia and the U.S. based entirely on the differences in the densities of export species. For the purposes of this study, statistics will be quoted on a cubic meter basis, and where needed, conversion factors will be given.

Another problem one faces when interpreting wood chip statistics is the discrepancy between the data obtained from different sources. The major sources of wood chip trade statistics are those of the Food and Agricultural Organization (FAO) and Japanese sources such as the Japanese Ministry of International Trade and Industry (MITI). Unfortunately there is a large discrepancy between these sources. Although total Japanese wood chip import statistics compare favorably between the two, the volume of wood chips supplied by individual countries differs substantially. For example, in 1982 both FAO and MITI reported total Japanese chip imports of 11.3 million cubic meters, however, FAO reported Japanese imports from the U.S.A. and Australia at 3.6 and 5.3 million cubic meters respectively, while MITI reported Japanese imports from the U.S.A. at 4.9 million cubic meters and imports from Australia at 3.6 million cubic meters. One of the reasons for this discrepancy is the differences between the volumes reported by the importing country (Japan) and those reported by exporting countries. FAO bilateral trade flow data is based on exporters' data while Japanese sources utilize import data.

Because Japan plays such a major role in international wood chip trade, particular emphasis will be placed on using data supplied by various Japanese sources in the section of this study that deals directly with Japan's imports of wood chips. However, in viewing the overall world trade in wood chips, FAO and other non-Japanese sources will be utilized.

3. International Wood Chip Trade Flows: an Overview

Initial trade in pulpwood can be characterized by small regional shipments between neighboring countries brought on by periodic raw material supply constraints and mill proximity. These early flows occurred solely between those countries which had substantially developed pulping capacities. The majority of these were confined to flows between Canada and the U.S., and flows between Scandinavian and other European countries. However, as mentioned previously, with the introduction of the Japanese specialized wood chip carriers in 1965, the scope of international wood chip trade has taken on a much more global perspective.

Due to the low weight per unit volume of wood chips, efficient shipment in traditional bulk carriers was difficult. The first chip carriers the Japanese produced were converted oil tankers with specialized chip loading equipment. In late 1964, however, the Japanese introduced a vessel designed especially for wood chips. This ship differed from traditional bulk carriers by having higher sides, a flatter hull, and specialized on-board chip handling equipment. As of 1983, the Japanese had built 69 carriers which have the capacity on average to carry 55,000 cubic meters of chips (Kato 1985). In 1983, of the total 69 carriers constructed, 43 were in operation around the globe (Japan Pulp and Paper, March 1985). Having been built initially to transport wood chips from the West Coast of North America, this network of carriers now reaches to South Africa, USSR, Australia, New Zealand, and Southeast Asia.

The impact of specialized carriers on international wood chip trade has been pronounced. No longer was trade restricted to regional flows, but raw material sources for pulp production could be developed from a global perspective.

By 1967, two years after the introduction of chip vessels, Japan had become the largest importer of wood chips in the world, overtaking the United States. Since 1967, the dominance of Japan over the international markets for wood chips has increased dramatically. By 1976, Japan accounted for 73 percent of the total world trade in wood chips (see Table 1). In recent years the raw material needs of the Japanese pulp and paper industry accounts for approximately 77 percent of the total international trade in wood chips. In fact, if one removes the inter-continental flows between the Scandinavian countries and the flows between Canada and

the U.S., Japan imports account, on average between 1979-1984, for 90 percent of total world exports of wood chips (See Table 1). Bilateral flows from the United States and Australia to Japan dominate world trade flows (see Tables 2 and 3).

Table 1. Top Importers of Woood-Chips*

(Volume 1000 cubic meters)

Importer	1976 Volume	1977 Volume	1978 Volume	1979 Volume	1980 Volume	1981 Volume	1982 Volume	1983 Volume	1984 Volume
World	11524	16530	15504	17613	19224	19380	15514	15546	16384
%	100	100	100	100	100	100	100	100	100
Japan	8434	13820	13116	15003	15936	12580	11325	11402	12100
%	73	84	85	85	83	65	73	73	74
Sweden	263	958	420	691	1191	4489	1748	1056	1273
%	2	6	3	4	6	23	11	7	8
USA	672	919	940	899	981	980	814	1087	737
%	6	6	6	5	5	5	5	7	4
Norway	242	184	233	211	248	342	264	349	563
%	2	1	2	1	1	2	2	2	3
Finland	155	130	92	98	58	206	579	776	674
%	1	1	1	1	<1	1	4	5	4
PRC	192	192	192	49	49	228	239	356	337
%	2	1	1	<1	<1	1	2	2	2
France	171	104	144	267	351	263	171	157	211
%	1	1	1	2	2	1	1	1	1

Source: FAO, Yearbook of Forest Products 1984

* Volume reported by importers.

In contrast to Japan, other traditional wood chip trade flows occur on a regional basis. Regional trade between Canada and the United States is one of the oldest and, since 1979, has accounted for approximately 5-8 percent of annual world trade. U.S. imports from Canada are most often tied to mill locality and short term-supply constraints between Canadian chip suppliers and U.S. pulp mills. In addition to inter-North American trade, regional wood chip trade between the Northern European countries has and continues to capture a significant portion of world chip trade. Similar to the Canada-U.S. trade, the flow of wood chips between Scandinavian countries has been related to locality and short-term supply constraints. According to FAO, the predominant flows in this region occur between Sweden and Norway, with Norwegian imports representing 4-7% of world trade. In contrast to the rapid increase in trade flows to Japan since 1965, the quantity ofintercontinental flows of North America and Northern Europe have remained at a fairly stable level since 1965.

Table 2. Top Five Bilateral Wood Chip Trade Flows (1979-1984).

YEAR	IMPORTER	EXPORTER	% OF TOTAL WORLD EXPORTS
1984	Japan	Australia	42.3
	Japan	USA	21.5
	Norway	Sweden	7.6
	Japan	New Zealand	4.6
	USA	Canada	4.5
1983	Japan	Australia	36.9
	Japan	USA	23.4
	USA	Canada	7.7
	Norway	Sweden	6.4
	Japan	New Zealand	3.9
1982	Japan	Australia	39.9
	Japan	USA	25.7
	USA	Canada	5.7
	Norway	Sweden	4.3
	Japan	New Zealand	3.9
1981	Japan	Australia	36.6
	Japan	USA	24.9
	USA	Canada	6.1
	Sweden	USA	5.9
	Norway	Sweden	4.5
1980	Japan	Australia	37.2
	Japan	USA	34.0
	USA	Canada	5.6
	Norway	Sweden	4.1
	Japan	USSR	3.1
1979	Japan	USA	40.3
	Japan	Australia	33.0
	USA	Canada	6.0
	Japan	USSR	3.2
	Japan	Canada	2.5

Source: FAO, Yearbook of Forest Products 1984.

In addition to inter-regional bilateral flows, another traditionally significant trade flow in wood chips occurs between the U.S. Southeast and the Scandinavian countries. The majority of this trade centers around exports from the U.S. to Sweden, although other countries such as Norway and Finland also import wood chips from the U.S. Chip exports from the U.S. South to Sweden have shown a slight but steady increase over time, with large year-to-year fluctuations. Between 1979 and 1982 the U.S. was the principal supplier responsible for more than 50 percent of total Swedish wood chip imports (FAS August 1985). Chip imports from the U.S. reached a peak of 45.7 million U.S. dollars . in 1981, then fell off sharply to 9.2 million dollars U.S. in 1982 (FAS August 1985). In 1983 and 1984 there were no imports of wood chips from the U.S., due in part to a lack of competitiveness of U.S. chips on account of the strengthening U.S. dollar. In the last couple of years shipments from the U.S. Southeast have occurred on a

shipment-by-shipment basis, due to the imposition of physiosanitary import restrictions on U.S. exports to try to curb the threat of the pinewood nematode in pine chip shipments (FAS August 1985).

Table 3. Top Exporters of Wood-Chips*

(Volume 1000 cubic meters)

Exporter	1976 Volume	1977 Volume	1978 Volume	1979 Volume	1980 Volume	1981 Volume	1982 Volume	1983 Volume	1984 Volume
World	11816	14018	13201	14931	17874	16001	14174	14175	14832
%	100	100	100	100	100	100	100	100	100
USA	5723	5273	5251	6530	6498	5147	4151	3651	3376
%	48	38	40	44	36	32	29	26	23
Australia	3457	4786	4635	4957	6594	6132	5655	5435	6576
%	29	34	35	33	37	38	40	38	44
Canada	780	1015	1231	1291	1488	14509	12549	1537	1312
%	7	7	9	9	8	9	9	11	9
Sweden	228	221	259	251	724	726	631	963	1180
%	2	2	2	2	4	5	4	7	8
New Zealand	329	498	400	350	400	487	546	650	750
%	3	4	3	2	2	3	4	5	5
Malaysia	585	715	498	228	532	562	598	598	400
%	5	5	4	2	3	4	4	4	3
USSR	226	226	226	482	547	552	425	385	200
%	2	2	2	3	3	3	3	3	1
Denmark	64	92	104	90	110	126	126	195	217
%	1	1	1	1	1	1	1	1	1
PNG	143	171	170	170	131	95	127	154	180
%	1	1	1	1	1	1	1	1	1
Norway	36	125	132	225	349	177	162	146	89
%	<1	1	1	2	2	1	1	1	1

Source: FAO, Yearbook of Forest Products 1984
* Volume reported by exporters.

Exports from the U.S. Southeast to other Northern European countries have generally been of a smaller magnitude than those to Sweden, with Finland being the second largest importer of U.S. chips followed by Norway. The source of these chips are primarily from independent sawmill producers in the U.S. South as well as from some of the integrated pulp and paper companies (PPI, August 1978). Generally these chips are deemed to be surplus of the domestic demand by pulp and paper producers in the U.S.

South. In 1976, there were reports of trial chip exports from the U.S. West Coast to Sweden via the Panama Canal (Travers 1976), however, this may have been an isolated case as recent statistics do not show recurring trade.

In concluding this section on traditional international wood chip trade flows, a number of points become obvious: first, the predominant role of Japanese imports on world trade; second, the importance of inter-continental flows in North America and Northern Europe; and finally, the development of trade between the U.S. South and Northern Europe. The role of Japan in international wood chip trade is of such importance it will be thoroughly analyzed in the next three sections.

4. The Role of Japan in World Wood Chip Trade

The rate of progress achieved by the Japanese pulp and paper industry following World War II has been remarkable. Emerging from near total destruction of the industry in World War II, the Japanese pulp and paper industry was able to achieve a production level which was equal to those established in pre-war years by 1953. From a production level of 1.4 million metric tons in 1963, the Japanese paper industry had grown to the record production level of 19.3 million metric tons by 1984 (FAO 1984). This production level places the Japanese paper industry second only to the United States in total paper output, and fourth in terms of total pulp output behind the U.S., Canada, and Sweden. When one considers that of the major pulp and paper producing countries in the world, Japan is the only one whose existence is entirely contingent upon the procurement of imported raw materials, this fact is particularly noteworthy.

As the productive capacity of the pulp and paper industry continued to expand rapidly in response to increased domestic demand for paper products, the raw material supplies needed to furnish this increase in productive capacity were greater than the domestic resource base could support.

As it became obvious that the productive capacity of the pulp and paper industry was increasing beyond a level which could be met solely through the use of domestic raw materials, Japan took a number of steps to meet its growing raw material needs:

1. The Japanese pulp industry began to introduce new techniques for utilizing small-sized hardwood logs and mill residues in the pulping process. This allowed the Japanese to make use of low-grade hardwood species which had previously only been used for firewood (Shimokowa 1978).

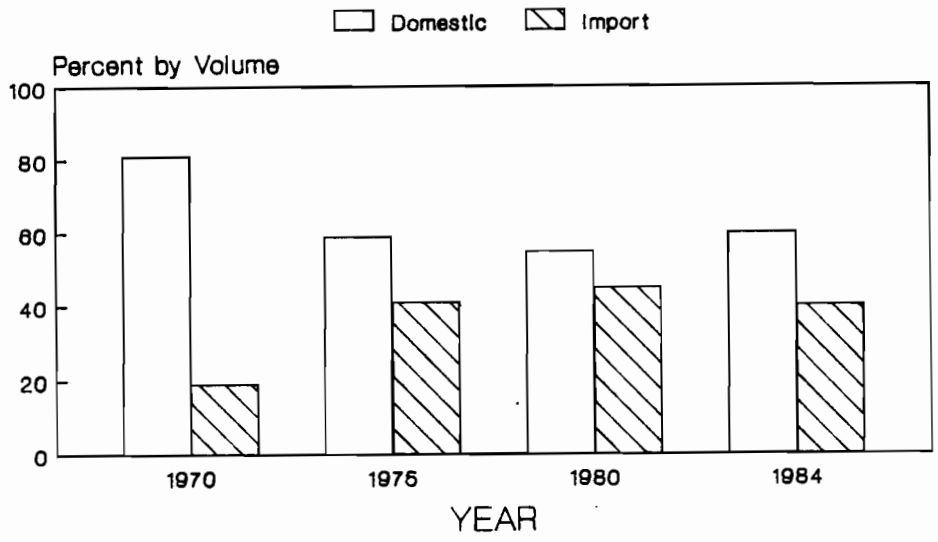
2. The Japanese began to import softwood pulp logs from the USSR in 1960.

3. As mentioned previously, the Japanese began building specialized wood chip carriers in 1963 in order to gain accessibility to overseas pulpwood sources.

In the early 1960s, the Japanese pulp industry was heavily reliant on softwood pulpwood as a furnish for their pulp mills. As domestic supplies became increasingly scarce, members of the industry began to look for new sources of low-cost softwood pulpwood. In the early 1960s, on a trip to the West Coast of North America, a member of Toyo Pulp Company observed a large volume of unutilized softwood fiber and had the idea of obtaining this sawmill by-product as a raw material source for the Japanese pulp industry (Porteous 1981). In 1963, Toyo Pulp sent two representatives to Canada and the U.S. to study the availability of obtaining fiber from sawmill residues. Based on the results of this study, a contract was set up between a group of sawmill operators in Kamloops, British Columbia, and Toyo Pulp. Soon after this contract was established, the Weyerhaeuser Company purchased the sawmills in Kamloops. Weyerhaeuser continued the contract and the first wood chips were shipped in 1965 from Coos Bay, Oregon to Kure, Japan (Porteous 1981). The introduction of chip carriers in 1965 and the subsequent development of new sources of imported raw material has allowed the Japanese pulp and paper industry to remain globally competitive in spite of its lack of a sufficient domestic raw material base.

The expansion of the Japanese pulp and paper industry required increasing reliance on sources of imported pulpwood. Figure 2 illustrates the increasing dependence of the pulp industry on imported pulpwood. In 1970, the use of domestic raw materials accounted for 81 percent of total pulpwood supply for the pulp industry. However, by 1980 the domestic supply of pulpwood represented only 55 percent of the total consumption by the pulp industry.

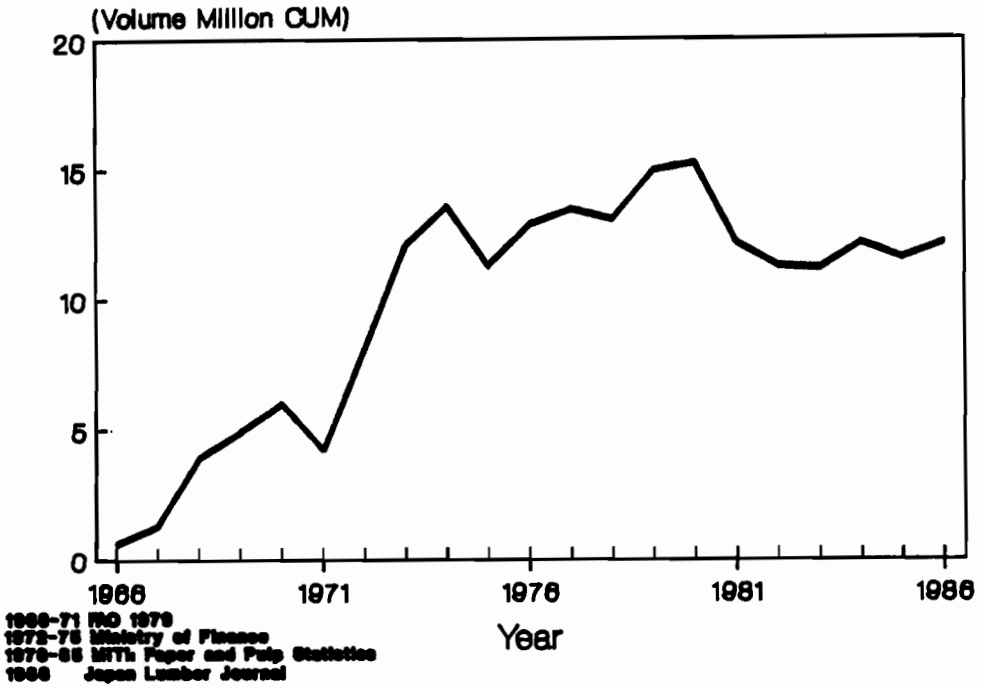
Figure 2
Japanese Wood Chip Supply*
Domestic vs. Import



Source:
Ministry of Int. Trade and Industry
*contains small percent of pulplogs.

From the beginning of pulpwood imports in 1960, the volume imported has grown dramatically. The total imported volume in 1960 was 193 thousand cubic meters, comprised entirely of pulpwood logs (JPA, 1983). Following the introduction of chip carriers in 1965, the imported volume had grown to almost 6 million cubic meters by 1970 (JPA, 1983). The rapid annual increases in import volume between 1965 and 1974 began to taper off after 1974 in response to higher fuel costs following the 1973 oil shock and a decrease in the domestic demand for paper products (see Figure 3). Even though the year-to-year changes had become smaller, by 1980 the Japanese pulp industry imported 15.3 million cubic meters of wood chips. In recent years the volume imported by Japan has been less than the level established in 1980. There are a number of reasons for this, such as higher price levels for imported raw materials, a growing raw material self-sufficiency rate, a slow-down in the GNP growth in Japan, and a drop in Japanese domestic demand for paper products. These factors will be analyzed in more detail later in this paper.

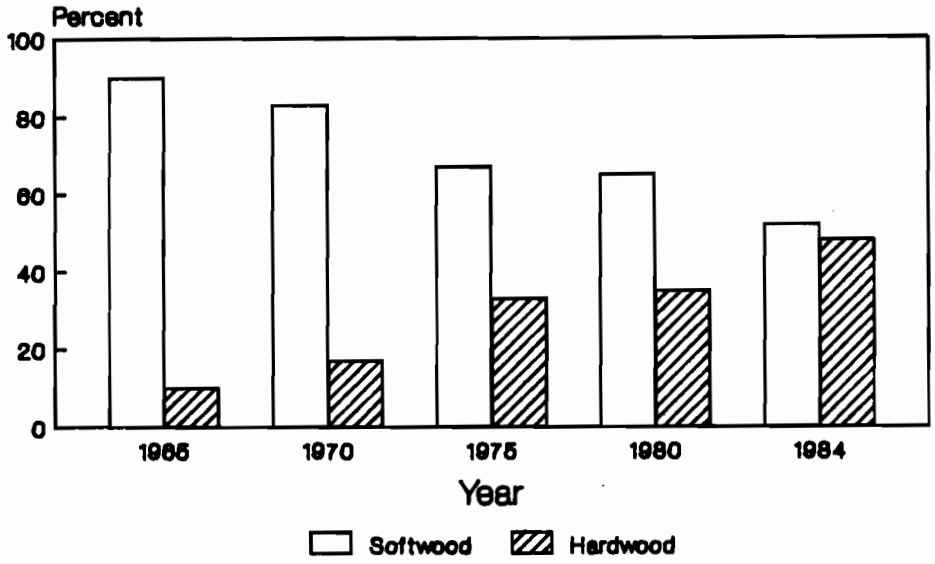
Figure 3
Japan Wood Chip Imports



In addition to the considerable change in the total volume of pulpwood imported by Japan since 1960, there have also been notable changes in the form and species of imported pulpwood. In 1960, 99.8 percent of pulp furnish was in the form of pulpwood logs. By 1974, the share of pulpwood logs in total consumption had decreased to 11 percent. In 1985, pulpwood logs represented less than one percent of Japan's pulpwood imports and only 6 percent of Japan's total pulpwood consumption (Wood Products Stockpile Corporation 1986).

Besides a change in form, the species composition of imported pulpwood has also changed since the early 1960s, as can be seen in Figure 4. The percentage of hardwood species in total pulpwood imports has increased steadily since 1965. In 1970, hardwood species represented only 17 percent of the total imported volume. By 1984, the percentage of hardwood species in the total imported furnish had grown to 49 percent. In addition, domestic pulpwood supplies have shown a similar trend, with pulpwood logs and softwood species assuming a diminishing role in total pulpwood consumption.

Figure 4
Japan Wood Chip Imports:
The Growing Role of Hardwood Imports



Source:
MITI: Paper and Pulp Statistics

As the Japanese pulp industry became increasingly dependent on imported raw materials, the procurement of these supplies became a crucial factor in the continued development of the industry. The search for wood fiber was not just limited to the West Coast of North America; the Japanese looked to other sources such as Southeast Asia, the Oceanic countries, USSR, and, more recently, South America and South Africa.

5. Major Wood Chip Suppliers in the World and to Japan

Prior to the contract between Toyo Pulp and the Weyerhaeuser Company, the only source of imported pulpwood to Japan was the USSR. However, with the introduction of the wood chip carriers in 1965, the role of imported wood chips, as well as the number of sources, began to expand

rapidly. By 1970 there were five primary suppliers to the Japanese pulp industry, including the United States, Canada, Malaysia, New Zealand, and the USSR (JPA 1983). In 1972, Australia joined the group, and in 1975-76 Indonesia and South Africa also became involved in wood chip exports to Japan (see Table 4).

Table 4. Japan Wood-Chip Imports by Country.

Volume in Thousand Cubic Meters

	COUNTRY									
YEAR	USA	Aus-tralia	Canada	USSR	New Zealand	Malay-sia	South Africa	Indo-nesia	PNG	Total
1972	5994 (74)	934 (12)	199 (2)	93 (1)	281 (3)	634 (8)	-	-	-	8076
1973	8619 (71)	2368 (20)	-	95 (1)	320 (3)	636 (5)	-	-	-	12094
1974	9240 (68)	2772 (20)	-	267 (2)	368 (3)	796 (6)	-	-	-	13580
1975	7631 (67)	2002 (18)	-	428 (4)	382 (3)	725 (6)	28		-	11340
1976	8658 (67)	2495 (19)	-	607 (5)	342 (3)	464 (4)	269 (2)	11	-	13025
1977	8467 (61)	3040 (22)	332 (2)	660 (5)	523 (4)	399 (3)	277 (2)	36	-	13823
1978	7330 (56)	2963 (23)	620 (5)	709 (5)	516 (4)	365 (3)	347 (3)	96 (1)	-	13116
1979	8408 (56)	3717 (25)	732 (5)	716 (5)	493 (3)	261 (2)	409 (3)	121 (1)	117 (1)	15003
1980	8245 (52)	4187 (26)	1192 (7)	546 (3)	570 (4)	293 (2)	552 (3)	117 (1)	180 (1)	15936
1981	5929 (47)	3455 (28)	1011 (8)	556 (4)	487 (4)	272 (2)	502 (4)	109 (1)	na	12508
1982	4930 (44)	3564 (31)	794 (7)	429 (4)	547 (5)	226 (2)	559 (5)	112 (1)	na	11325
1983	5105 (46)	3543 (32)	778 (7)	390 (3)	530 (4)	194 (2)	609 (5)	82 (1)	na	11166
1984	5110 (42)	3780 (31)	1040 (9)	420 (3)	530 (5)	230 (2)	620 (5)	110 (1)	230	12218
1985	5014 (43)	3612 (31)	1017 (10)	378 (3)	513 (4)	121 (1)	661 (6)	197 (2)	na	11582

*For conversion factors and sources refer to Appendix.
Note: Values in paranthesis represent percent of total volume imported.

The following listing will provide an overview of the traditional wood chip suppliers to Japan by geographic regions. In order to provide as current and complete a picture of Japan's imported wood suppliers as possible, statistics for this section will be drawn from a number of different sources. The data used to formulate the graphs in this section are based on the trade statistics used to derive Table 4, and may be in conflict with those values supplied by FAO.

North America

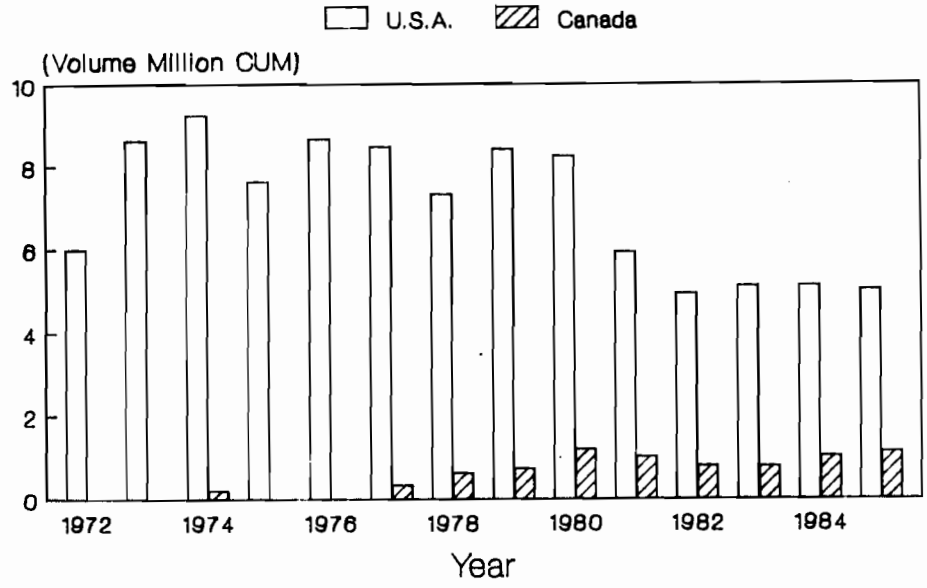
North America has consistently been the largest wood chip export region in the world. Since 1965, the United States has been the most important supplier of softwood wood chips to Japan. Canada, on the other hand, began supplying softwood wood chips to Japan with a spot shipment in 1972, followed by a resumption of export activity in 1977. Exports from North America to Japan peaked in 1980 at 12.9 million cubic meters. In 1984, the combined exports from the U.S. and Canada represented 73 percent of total Japanese chip imports and 89 percent of total Japanese softwood chip imports.

Wood chip exports from North America consist of mill residue generated from sawmill and plywood production facilities on the Canadian and U.S. West Coasts. The volume of wood chips exported is a function of two factors: the demand for mill residue by domestic pulp production facilities; and the amount of residue generated by sawmills and plywood plants. Therefore, the volume and the price of chips exported from this region are dependent upon the production level of the domestic pulp and paper industry, as well as the domestic demand for wood-based construction materials. In the U.S., the supply of wood chips to the export market is often a secondary consideration after establishing that domestic consumption needs are met. This line of reasoning is carried even further in Canada, where the government has enacted legislation which requires that companies involved in the export of wood chips obtain five-year permits which prove that what they propose to export is above the level of domestic demand.

As mentioned previously, U.S. and Canadian exports are primarily softwood. The species composition of the softwood exports include Douglas-fir, spruce, western red cedar, hemlock, and pine. In addition to softwood chips, the U.S. and Canada do export a much smaller quantity of hardwood chips. The primary hardwood species exported, in the form of wood chips, are alder and poplar. In the United States, the percent of total exports represented by hardwood species has been increasing in recent years, reaching 14 percent in 1984 (Japan Pulp and Paper, Dec. 1985). Canada, on the other hand, did not start exporting hardwood chips until 1981, and relative to the U.S., exports a much smaller volume of wood chips.

In terms of volume exported, the United States is the dominant North American wood chip exporter (see Figure 5, North American Export). United States wood chip exports to Japan reached a record level of 9.2 million cubic meters in 1974, peaked again in 1979 and 1980, and have dropped off considerably since 1980. In reference to Table 4, one can see that the role of the U.S., as a percent of total Japanese wood chip imports, has been decreasing steadily since the early 1970s. The reasons for both the drop in market share and the drop in exports since 1980 will be discussed in detail later, however, the major reason can be attributed to the Japanese move to diversify their supply sources of imported wood chips. In contrast to the U.S., Canadian exports have shown a fairly rapid increase in volume since 1977. Moreover, in terms of market share, the Canadians have increased from 2 percent in 1977 to 10 percent in 1985, while the U.S. dropped from 61 percent to 43 percent during this same period. The lifting of an export ban on pulpwood exports in 1976 has allowed the Canadians to capture some of the market share the U.S. has been losing. As the Canadian government has allowed chip exports to rise in recent years, as sawmill production has been reaching record production levels, the Japanese are hopeful that Canada can assume a more dominant role in the future supply of wood chips.

Figure 5
Japan Wood Chip Imports:
North America



See Appendix for sources.

Oceania

Following North America, the second largest wood chip exporting region in the world is the Oceanic countries of Australia, New Zealand, and Papua New Guinea. In contrast to North America, in particular the United States, the role of the Oceanic region has been growing. Australia is the dominant exporter in this region, followed by New Zealand and Papua New Guinea (see Table 4). New Zealand was the first of the Oceanic countries to enter the international market for wood chips in 1969, followed by Australia in 1971 and Papau New Guinea in 1979 (Japan Lumber Journal, March 20, 1986). But, as the statistics show, Australia has captured a large segment of the Japanese wood chip market. From 1972 to 1980 the export volume from Australian ports to Japan increased 3.3 million cubic meters. By 1985, the Australians had captured 31 percent of the total Japanese wood chip market, a gain of almost 20 percent from 1972. New Zealand, on the other hand, has shown a more gradual

increase in export volumes from 1972 to 1985. As of 1985, New Zealand exports to Japan represented 4 percent of Japan's total wood chip imports, a gain of only 1 percent from 1972 levels. Statistics on Papua New Guinea are somewhat spotty, but as a supply source Papau New Guinea represented 2 percent of Japanese imports in 1984.

In contrast to North America, chip exports from Oceania are predominantly comprised of hardwood species. Based on Japan Pulp and Paper Journal data, hardwood exports from this region represented 70 percent of total hardwood chip imports by Japan in 1984. Chip exports from Australia are made up of primarily indigenous old growth eucalyptus which are being harvested in conjunction with sawlog production (Fenton 1982). The majority of export oriented operations occur in Tasmania, New South Wales, and to a lesser extent, Western Australia. These operations are, for the most part, dedicated whole tree chipping facilities designed specifically for export purposes, in contrast with North American exports which are primarily composed of mill residue. Australia also exports softwood chips, but to a much smaller degree, representing less than 1 percent of total exports in 1984.

In contrast to Australia, whose exports are comprised almost entirely of a single species - eucalyptus - chip exports from Papua New Guinea may contain the remnants of up to 200 different species. In Papua New Guinea, the majority of chip exports are generated as by-products of Japanese paper company joint ventures designed to establish fast-growing plantation species for future use as pulpwood (JPA 1983). In most cases, areas are being cut over and the highest valued species are sawn while the rest are run through a whole-tree chipping operation and exported. As these cut-over forests can be characterized as having an abundance of species, chip exports from Papua New Guinea are often referred to as non-homogeneous "jungle wood." The whole-tree chipping operation in Madang, Papua New Guinea is one of the largest operations in the world dedicated entirely to chip exporting.

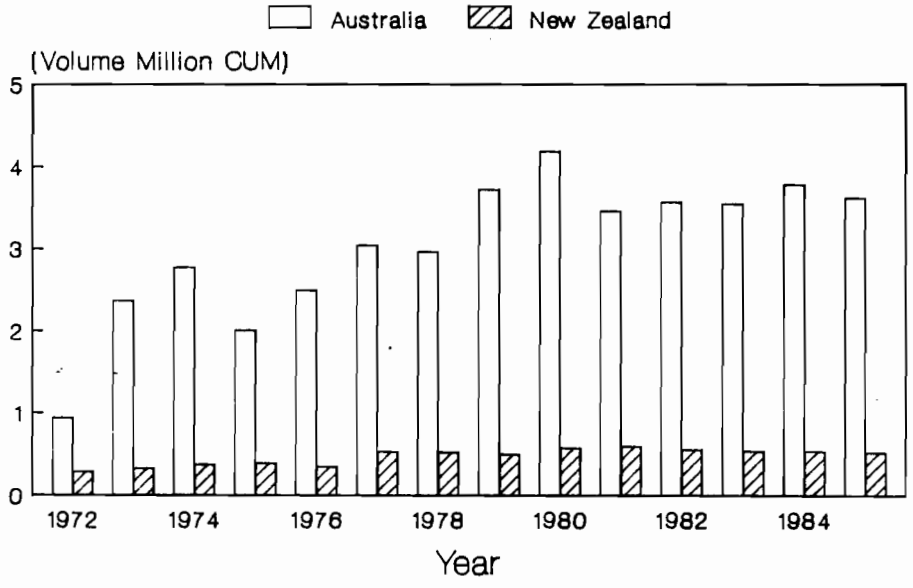
Whereas the vast majority of chip exports from Australia and Papua New Guinea are hardwood chips, New Zealand has exported more softwood chips than hardwoods. The vast majority of the softwood chip exports are composed of plantation-grown radiata pine. Softwood exports have historically capture 60-70 percent of total New Zealand exports. In terms of hardwood species, New Zealand exports have been primarily beech species. The supply of wood chips to the export market come both from mill residues and whole tree chipping operations.

Figure 6 is an illustration of the general export trends of the Oceanic countries between 1972 and 1985. As has been mentioned previously, the role of Australia in international wood chip trade has been increasing steadily. This upward trend is due in part to the move by the Japanese to diversify chip suppliers, as well as an increasing

utilization of hardwood species in the Japanese pulp furnish. In fact, in terms of market share, according to Japanese wood chip import statistics based on metric tons rather than cubic meters, Australia surpassed the United States as the largest supplier of wood chips in 1983 (Japan Lumber Journal, June 20, 1986). In contrast to the rapid rise in exports exhibited by Australia, New Zealand exports have remained at a fairly stable level. The forest products companies of New Zealand have shown a reluctance to export large volumes of wood chips. This reluctance stems from the desire of these companies to build up a domestic pulp and paper industry, rather than to export fiber in a raw form such as wood chips. The relatively small size of Papua New Guinea, as well as a lack of infrastructure, has limited chip exports to those being carried out with the aid of Japanese joint venture capital.

Figure 6

Japan Wood Chip Imports: Oceania

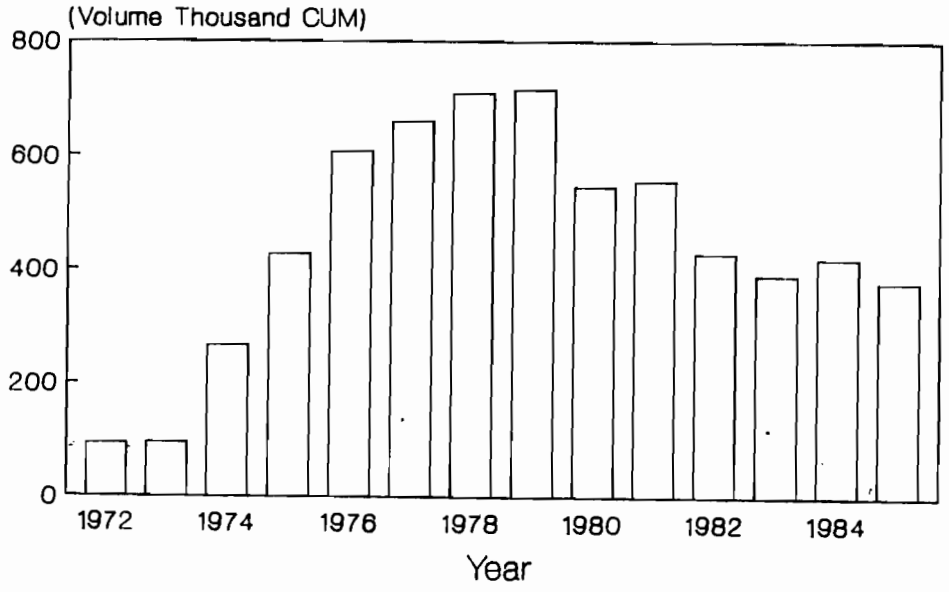


See Appendix for sources.

USSR

The Soviet Union was the first country to export pulpwood to Japan, initiating exports in the early 1960s. Since that time, the Soviet Union has remained an important source of softwood chips for the Japanese pulp and paper industry. The volume of chips exported from the Soviet Union increased rapidly from 1972 to 1979, growing in volume from 93 thousand to 716 thousand cubic meters (see Figure 7). Market share also increased during this period from 1 percent of total Japanese wood chip imports in 1972 to 5 percent in 1979. Since 1979, the volume exported to Japan has dropped off for a couple of reasons. First, a general down-turn in the Japanese chip market, and second, the expiration of the first 10-year Japanese-Soviet pulpwood supply contract.

Figure 7
Japan Wood Chip Imports
USSR



See Appendix for sources.

Soviet-Japanese chip trade is conducted on the basis of ten-year contracts. The first of these contracts was established in 1971. During the course of this contract discontent was voiced by Japanese importers over both the

quality and quantity of chips being exported from the Soviet Union. Although the total volume exported grew over this period, the volume exported was 37 percent lower than that being prescribed in the contract (Japan Pulp and Paper, December 1985). Following the expiration of the contract in 1981, wood chips were imported from the Soviet Union based on temporary agreements. The use of temporary agreements is one of the reasons for the down-turn in the volume of Soviet chip exports, as members of the Japanese pulp and paper industry showed reluctance to renew long-term supply contracts with the Soviet Union based on the problems which arose during the first contract. However, in December of 1985 a new ten-year contract was signed between the Soviet Union and Japan, and for the first time chip quality was taken into consideration (Japan Pulp and Paper, December 1985). Based on this agreement, total Japanese imports from the Soviet Union are to reach 600 thousand cubic meters annually, made up of 450 thousand cubic meters of softwood and 150 thousand cubic meters of hardwood chips (Japan Pulp and Paper, April 1986). In addition, based on this agreement, Japan has agreed to supply the Soviet Union with machinery and equipment to develop and improve the production of chips for export purposes (Japan Pulp and Paper, December 1985).

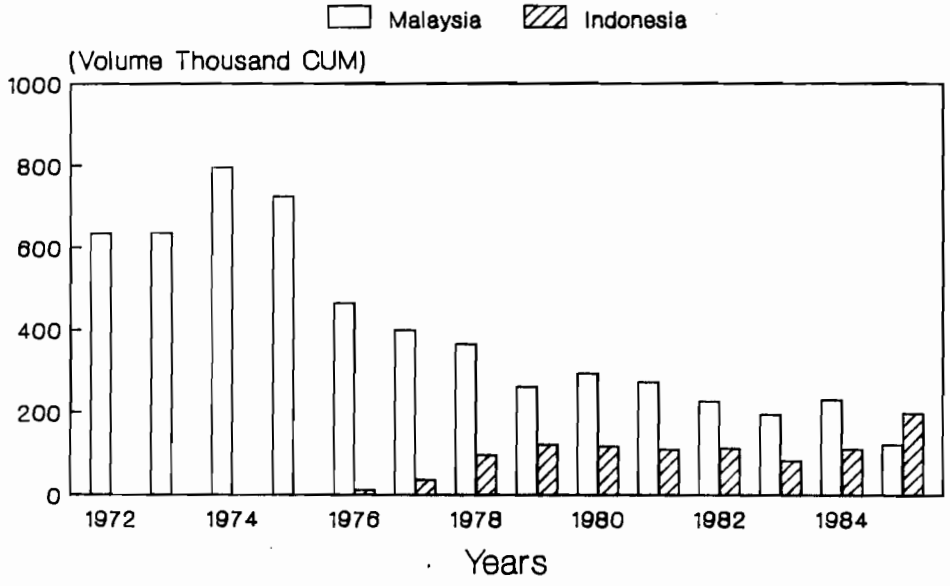
Wood chip exports from the Soviet Union have been primarily softwood species. Larch has been the primary species exported, however other softwood species such as cedar and pine have also been exported in chip form. Hardwood species represent a growing share of Soviet exports, comprising 10 percent of exports in 1980 and 25 percent in 1984 (Japan Pulp and Paper, Dec. 1985). Chip exports originate both from sawmill residue and round wood chipping facilities. In addition to wood chips, the Soviet Union continues to supply pulp logs to Japan, nevertheless, this is a relatively small percentage of total Japanese pulpwood imports.

Southeast Asia

Historically, Malaysia has been the dominant source of wood chip exports in Southeast Asia, although in recent years Indonesia has been assuming an increasing role in wood chip exports from this region (see Figure 8). Since 1972, both the volume and the market share of Malaysian wood chip exports has been declining. In 1972, chip exports from Malaysia had captured 8 percent of the Japanese chip market. By 1985, the Malaysian market share had fallen to one percent. The primary reason for the gradual drop in wood chip exports has been a decrease in the quantity of timber available for export wood chip production. Throughout the early 1970s there was a strong push to remove much of the natural indigenous hardwood species in Malaysia in order to establish single species plantations. As a result, there has been a corresponding drop in export volume. The amount

of the indigenous mangrove resource has been dwindling (Fenton 1982), and while the supply of non-productive rubber trees may represent a continuing resource base, it is unlikely to increase dramatically in the future. Future increases in wood chip exports from Malaysia will be tied to the production levels of plantations established by the Japanese, as well as the production level of plywood and sawmills. However, it has been pointed out that drastic future expansion of chip exports based on established hardwood plantations (primarily eucalyptus) species is unlikely, as these species will continue to be in short supply (Shimokawa 1978).

Figure 8
Japan Wood Chip Imports: Southeast Asia



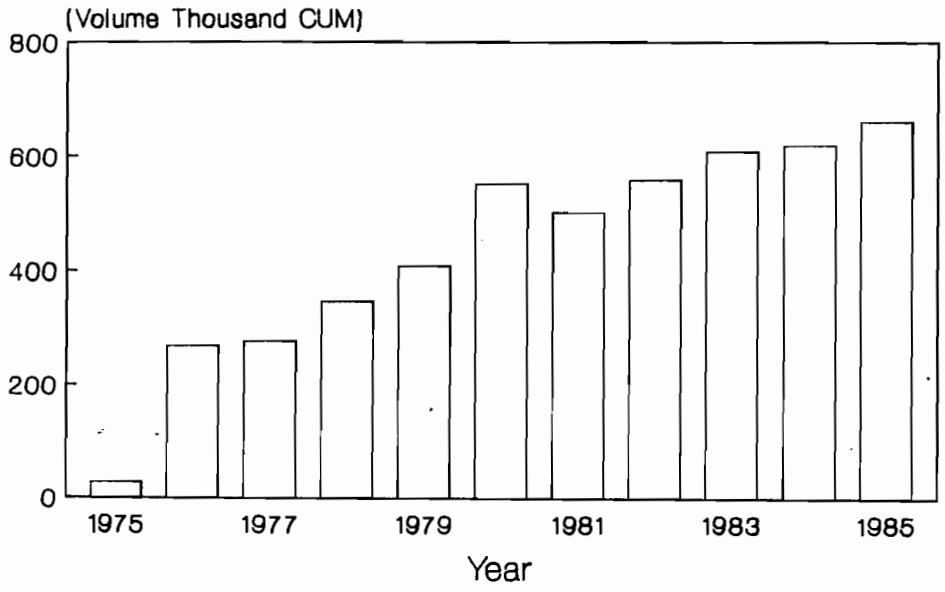
See Appendix for sources.

Wood chip exports from Indonesia began in 1976, and increased to a peak of 121 thousand cubic meters in 1979. Indonesia has maintained a relatively small share of the Japanese market for imported wood chips. However, as Fenton points out, there may be room for future expansion in the volume of wood chips exported from Indonesia, as plywood and sawmill industries replace log exports (Fenton 1982).

South Africa

Information on chip exports from South Africa are limited, however, as Figure 9 illustrates, the volume of wood chips exported from this region has increased substantially from 1975. Unlike the majority of other suppliers of wood chips to the Japanese market, South Africa has increased both its volume exported and market share following 1980. By 1985, South African exports represented 6 percent of total Japanese chip imports. South Africa exports only plantation hardwood species with the primary species including acacis spp. grown for tannins (Fenton 1982) and eucalyptus spp. grown for domestic pulp production.

Figure 9
Japan Wood Chip Imports: South Africa



See Appendix for sources.

6. Japan's Future Fiber Supply

The past section has analyzed the role of Japan in the international wood chip trade. As has been shown, the growing raw material needs of an expanding Japanese pulp and paper industry not only led to the initiation of international wood chip trade, but have, over time, become the dominant factor in dictating world wood chip trade flows. Consequently, changes in the Japanese demand for pulping raw materials have important ramifications on world chip trade. The following section will look at the current and future trends of the Japanese pulp and paper industry in relation to their impact on world wood chip trade.

The Role of "Chipshock"

In 1979, the U.S. was the predominant supply source for Japanese wood chip imports. Softwood chip exports from the U.S. West Coast accounted for 56 percent of total wood chip imports, 81 percent of softwood imports, and approximately 25 percent of the total pulpwood consumption of Japanese pulp mills. This disproportionate reliance on a single source of pulpwood supply placed the Japanese pulp industry in a tenuous position if U.S. chip production was disrupted - which, in 1979, was exactly what happened.

In the the final quarter of1979, primarily due to an increase in interest rates, the U.S. housing market went into a slump. This slump reduced the production level of U.S. plywood and sawmills, which, in turn, brought about a reduction in the output of mill residue. Moreover, during this period the demand for mill residue by domestic pulp mills remained strong. As a result, a shortage developed for wood chips both domestically and for the overseas markets. As the demand for wood chips remained high, while the supply ran short, the price of wood chips increased.

Weyerhaeuser, the largest supplier of wood chips to Japan, raised its quarterly export chip price from $55 per BDU in the fourth quarter of 1979 to $74 in the first quarter of 1980; and before the quarter was finished, raised the price to a new level of $92 per BDU. Weyerhaeuser then raised the next quarter's price to $131 per BDU - an increase in the price of export chips of 138 percent over a six month period (Hay-Roe's, August 1984). This price hike was quickly followed by other major producers in the U.S. and Canada.

This rapid hike in the price of export chips by major U.S. producers became known in the Japanese pulp and paper industry as "chipshock." Because Japanese pulp mills were so heavily dependent on U.S. sources of imported wood chips, they were ultimately forced to accept this higher price in order to keep their mills running. Due to the rapid rise of chip prices over such a short duration of time, the Japanese pulp and paper industry was not able to pass such a sharp

increase in raw material costs onto product prices (Japan Pulp and Paper, July 1980). In addition, during this period Japanese domestic demand for paper products went flat which led to overcapacity in Japanese mills. Flat domestic demand, over-capacity, and the dramatic increase in imported chip prices had a very damaging effect on the industry (Truitt 1986). The profits of Japan's pulp and paper companies dropped substantially and did not begin to show recovery until 1982 (Truitt 1986).

The impact of "chipshock" on Japan's pulp and paper industry has produced both short and long-term structural changes to the industry, which, in turn, have had a major impact on the world market for wood chips. One short-term change was the enforcement by the Ministry of International Trade and Industry (MITI) of a previously unused law which required preliminary checks of the prices, quantities, and origin of all imported wood chips (Japan Pulp and Paper, November 1982). The purpose of enforcing this trade regulation was to provide protection against further price increases brought on by competition for the scarce supply of chips.

In addition to this short term remedy to the problem of high imported wood chip prices, MITI, in conjunction with members of the Japanese pulp and paper industry, initiated a number of guidelines designed to alleviate the chances of another "chipshock" occurring in the future. These long-term future objectives of the Japanese pulp and paper industry initiated for grappling with pulpwood supply problems have, and will continue to have, a major impact on the world market for wood chips. The following is an examination of these guidelines in relation to their impact on world chip trade.

Japan's Increased Utilization of Domestic Fiber Resources

According to the MITI guidelines, the increased utilization of domestic fiber resources was to take two forms: first, expansion in the role of domestic pulpwood supplies; and second, an increase in the percentage of waste paper in the total fiber furnish. In recent years the Japanese have been very successful in carrying out the latter of these, while the former has met with marginal success. Overall, however, the increased utilization of domestic fiber resources has contributed to a general downturn in the demand for wood chip imports since 1980, while Japanese production of paper and paperboard has increased substantially (Japan Pulp and Paper, December 1985).

As the import price of overseas chips increased, the competitiveness of domestic pulpwood supplies also increased, which led to renewed interest in developing forest lands which had previously been left untouched for economic reasons. However, in retrospect, a large increase

in domestic pulpwood supplies has not been realized in recent years for a number of reasons. First, following the steep rise in import chip prices in 1979-80, the price of imported wood chips has declined to a level comparable with Japanese domestic pulpwood supply prices. Second, the ability to increase Japanese domestic pulpwood production has been hampered by the lack of large-scale forest ownership, stiff competition from other forest users, and the lack of competitiveness of industrial roundwood to be used in chip production. Although there have been increasing efforts put into exploiting potential domestic pulpwood sources, it is unlikely that the supply of domestic pulpwood will increase substantially until after 1990 (Japan Pulp and Paper, November 1982). Future increases in Japanese domestic pulpwood production will be realized in the supply of softwood chips, while hardwoods will become increasingly scarce as natural stands are converted to softwood stands (Amari 1986). Consequently, in terms of suppliers of imported wood chips, those countries who export softwood chips, such as the United States and Canada, will face increasing competition from domestic Japanese pulpwood suppliers in the future. It should be noted that any gains or losses in market share between domestic and overseas suppliers will be influenced by the relative prices and quality of wood chips being supplied. For instance, the recent downward trend in the value of the U.S. dollar relative to the yen will most likely increase the competitiveness of U.S. chip exports in the Japanese market.

Although substantial gains have not been realized in increasing domestic pulpwood supplies, there have been significant gains in the share of waste paper in the Japanese pulp furnish. Beginning in the late 1970s, there was a strong push to increase the percentage of wastepaper in the total consumption of pulp mills; following "chipshock" the push for paper recycling became even stronger. Japan's collection rate grew from 10.4 percent in 1975 to 49.1 percent in 1983 (Japan Pulp and Paper, December 1985). In turn, consumption of waste paper by pulp mills grew from 4.7 million metric tons in 1972 to 10.7 million metric tons in 1986 - an increase of 128 percent (Japan Pulp and Paper, October 1986).

Although the volume of waste paper consumed by pulp mills has increased in recent years, it is unlikely that an increase in the percentage of waste paper in the total fiber furnish of Japanese pulp mills will increase substantially in the future. Economically it is extremely difficult to increase waste paper collection rates above 50 percent, as transportation costs become prohibitive as the distance required for collection increases (Japan Pulp and Paper, November 1982). In addition, since 1985 the inclusion rate of waste papers in paper and paperboard production has reached an upper limit due to paper quality considerations, and supply has come to exceed demand.

Nevertheless, increased utilization of waste papers in the total Japanese fiber furnish is one of the major reasons for the drop in demand for imported pulpwood. This fact is particularly pronounced for suppliers of softwood chips, and, in particular, for U.S. West Coast suppliers. Over the past several years there has been a substantial change in the material structure of those products which have historically relied on imported softwood chips - newsprint and linerboard. In the last five years there has been a drop in the usage of Douglas-fir chips, the mainstay of U.S. chip exports, as the Japanese demand for kraft paper has decreased due to market penetration by plastics, and increased use of waste paper in kraft linerboard production (Kato 1985). It is suggested that marginal future increases in Japanese linerboard production will be met with increased utilization of waste paper and/or domestic Japanese softwood chip supply, rather than an increase in demand for Douglas-fir chips from the U.S. West Coast (Kato 1985). In addition, progress in de-inking technology has led to higher inclusion rates of waste paper in newsprint production, and a subsequent drop in demand for traditional softwood chip exports from the United States.

Japan's Diversification of Overseas Fiber Supply Sources

It is well documented in Japanese paper trade journals that the "chipshock" of 1979-80 served to awaken the Japanese pulp and paper industry to the necessity of diversifying its raw material supply base. One source of diversification already discussed has been the expansion of the role of domestic pulpwood supplies and the use of recycled waste papers. The second source of diversification was to enlarge the supply role of countries which are current or potential sources of wood fiber. Overall, both of these forms of diversification have been aimed at reducing the dependence of Japan's pulp and paper industry on U.S. softwood chips. The movement away from U.S. chips, along with a drop in the Japanese domestic demand for paper products, a slowdown in the GNP growth in Japan, and a strong U.S. dollar led to a reduction in U.S. chip exports to Japan of 3.2 million cubic meters between 1980 and 1985. During this same period other countries were increasing their role in the Japanese market for imported chips. But perhaps the most significant reason for a drop in U.S. market share is a loss in competitiveness of U.S. softwood chips in the Japanese market.

One factor behind the loss of competitiveness of U.S. chips - which stems from the move towards diversification - is the increasing utilization of hardwood species in the pulping process of Japanese mills. Several factors are behind the increased utilization of hardwood chips in Japanese pulp furnish. First, traditionally hardwood chips have been lower priced than softwood chips (Fenton 1982).

Second, there has been a rapid increase in the supply of hardwood chips from overseas, as indigenous hardwood forests are being replaced by plantation species such as eucalyptus or radiata pine, such as that observed in Australia and Papua New Guinea. Third, there has been, and will continue to be, a shift in paper demand in Japanese markets away from those paper products which are softwood intensive toward other paper products, such as fine writing paper and copy paper, which require a greater percentage of hardwood fiber. In addition, as a percentage of pulp furnish, U.S. softwood chips will face increasing competition from waste paper and low cost sources of imported pulp, such as Chile.

The U.S. does have one bright spot in the hardwood chip trade, and that is the export of alder chips. The Japanese consider red alder to be of good quality for bleached hardwood sulfate pulp, which places alder in competition with eucalyptus exports from Australia and South Africa. Although, it has been pointed out, in comparison to eucalyptus chip exports from Australia, the CIF cost (Japan) of alder is higher (Amari 1985). Exporting alder chips could be one way of the U.S. maintaining competitiveness in the Japanese market.

The impact of "chipshock" on the Japanese pulp and paper industry has provided the impetus to develop other supply sources, as well as technological innovations required to exploit those resources. The move away from an inordinate reliance on U.S. softwood chip resources is likely to continue in the future. Still, it would be wrong to infer that the U.S. position as one of Japan's major wood chip suppliers is likely to drop off substantially. This will not be the case; an abundance of high quality softwood export fiber, the relatively short transport distance between the U.S. and Japan, and the recent drop in the value of the dollar relative to the yen will all help to maintain the status of the U.S. as a top wood chip exporter to Japan. However, the move away from the U.S. has enabled current and emerging fiber supply sources to increase their role in the Japanese market for wood chips.

7. Current and Emerging Softwood Chip Suppliers

Japan's efforts to diversify its supply sources of wood chips will continue to have a negative impact on the future role of the U.S. as a supply source for the Japanese pulpwood market. Although JPA estimates show an increase in Japanese import volumes from the U.S. from 1984 to 1995, the U.S. market share of total imports will drop from 42 percent to 36 percent, and U.S. softwood market share will decrease from 72 percent to 61 percent over this period (see Table 5).

Table 5. Outlook for Japanese Pulpwood Imports by Area 1000 CUM

		1984		1990		1995	
Total	S	6170	(100)	9190	(100)	8130	(100)
	H	5961	(100)	8290	(100)	8420	(100)
USA	S	4421	(71.6)	6140	(66.8)	5080	(62.5)
	H	690	(11.6)	800	(9.7)	800	(9.5)
Canada	S	1046	(16.9)	1710	(18.6)	1350	(16.6)
	H			130	(1.6)	130	(1.6)
Australia	S	16	(0.3)	300	(3.3)	300	(3.7)
	H	3769	(63.2)	5200	(62.8)	5200	(61.8)
New Zealand	S	367	(6.0)	340	(3.7)	500	(6.7)
	H	172	(2.9)	200	(2.4)	230	(2.7)
USSR	S	320	(5.2)	650	(7.1)	850	(10.4)
	H	108	(1.8)	500	(6.0)	600	(7.1)
Malaysia	S						
	H	230	(3.8)	300	(3.6)	300	(3.6)
Indonesia	S						
	H	117	(2.0)	100	(1.2)	100	(1.2)
P. New Guinea	S						
	H	232	(3.9)	500	(6.0)	500	(5.9)
South Africa	H	621	(10.4)	500	(6.0)	500	(5.9)
Others	S			50	(0.5)	50	(0.6)
	H	22	(0.4)	60	(0.7)	60	(0.7)

S (Softwood) H (Hardwood)
Paranthesized are percent of total imports

Source: Japanese Paper Association 1985

Although Canada is often tied to the U.S. in the move to diversify chip sources, JPA estimates show an increase in both volume and market share of Japanese imports from Canada from 1984 to 1990. As mentioned previously, Canadian wood chip exports are tied directly to domestic sawmill and pulp production through legislation requiring export permits. It is unlikely, however, that there will be dramatic future increases in Canadian wood chip exports as this would require substantial changes in the output of sawmills and/or a reduction in the demand for pulpwood by domestic pulp producers. It is predicted that Japanese demand will remain high for Canadian SPF (spruce, pine, fir) white species chip exports used for thermal mechanical pulp processing in

newsprint production. The Japanese trend toward lighter weight newsprint will require more high quality virgin pulp and tend to limit the inclusion rate of waste paper. This will favor Canadian SPF chip exports over U.S. Douglas-fir exports, as SPF have higher wood quality characteristics for newsprint.

The softwood source of the future most often mentioned in Japanese paper trade journals is the USSR. It is clear that the Soviet Union has the resource potential to be a large supplier of pulpwood, but, as mentioned before, infrastructure and past problems with the fulfillment of contractual obligations has made the Japanese pulp and paper industry reluctant to place too much reliance on the USSR as a major supply source. The recent Soviet-Japanese agreement of 1985, however, indicates an increasing role for the Soviet Union in the future supply of wood chips to Japan. Based on the terms of this agreement it also appears that members of Japan's pulp and paper industry are willing to make a long-term commitment to the procurement of Soviet wood chips through Japanese investment in the modernization of Soviet production facilities and infrastructure designed to increase export chip production potential. JPA predictions of future pulpwood imports show an increase in Soviet market share of total pulpwood imports, softwood chip imports, and hardwood chip imports for the period 1984 to 1995 (see Table 5). Based on these predictions it appears that the Soviet Union will occupy a growing role in world wood chip trade.

In terms of softwood fiber production potential, there are a few countries that are emerging as large sources of fiber. New Zealand and Chile, and to a lesser extent Brazil, have invested heavily in establishing softwood plantations of radiata pine. These plantations are in various stages of development, with those of New Zealand being closest to harvest age. Unlike Chile and Brazil, New Zealand has been exporting wood chips since the early 1970s. Since that time, the volume of chips exported has remained at a relatively low and even level. However, it has been noted that the majority of softwood volume from New Zealand will not come on-line until at least 1995-2000 (Sutton 1985). Due to the low population level in New Zealand, which tends to limit overall domestic paper consumption, there exists the potential for large increases in the volume of softwood fiber available for export. However, it is unlikely, based on past performance patterns and future plans to expand domestic pulping capacity, that the fiber exports will be in the form of wood chips. The New Zealand forest products industry has invested heavily in developing the pulping capacity necessary to process the fiber coming from the radiata pine plantations. Therefore, future increases in softwood fiber exports will most likely be in the form of processed market pulp rather than wood chips. Because of this it is likely that wood chip export volumes will remain at the modest levels observed in the past,

unless the expansion of domestic pulp production facilities are not able to keep up with the supply of fiber coming from the plantations.

Along the same lines as New Zealand, Chile and Brazil have shown a reluctance to export chips, preferring instead to export logs, lumber, and pulp. In fact, Brazil has not yet entered the world market for wood chips and, up until May of 1985, there had been no shipment of wood chips from Chile. In May of 1985, the first shipment of 95 thousand cubic meters of wood chips was exported from Chile bound for Finland and other Scandinavian countries (Chilean Forestry News, June 1986). This initial shipment of wood chips was composed of eucalyptus rather than radiata pine chips. However, Chilean forestry officials saw this as an excellent opportunity to open new markets for Chilean wood fiber, which is increasing in importance as the supply of pulpwood from radiata pine plantations will continue to increase in the future. In November of 1986, construction began on a chip production facility in Chile, with the participation of New Zealand and Japanese capital, designed to increase the wood chip export potential of Chile. Along with the construction of a chip-producing plant, this project also includes improvements in dock facilities to increase the capacity of the dock in order to accommodate the large chip-carrying vessels (Chilean Forestry News, October 1986). These initial attempts at providing the infrastructure necessary to export wood chips on a large scale, along with a substantial future increase in softwood fiber coming from developing plantations seem to assure a growing role for Chile in the world wood chip market. In addition, the depreciation of the Chilean peso against most currencies has increased the price competitiveness of Chilean wood chips on the international market. Recent reports show an increase in Chilean wood exports from 150 thousand cubic meters in 1986 to 500 thousand cubic meters in 1987 (FAS February 1987). It is therefore likely that chip exports from Chile to Japan are not far off in the future.

8. Current and Emerging Hardwood Chip Suppliers

While future demand for hardwood chips is expected to increase relative to softwood chips, the future outlook for supply is far from optimistic for a number of reasons. First, in the past large exporters of hardwood fiber, such as Australia and Malaysia, have relied on the afforestation of indigenous hardwood species to supply the growing Japanese chip market. In the case of Malaysia, rapid afforestation rates throughout the 1970s have led to a continuous decline in the availability of timber for the production of export chips. Australia, on the other hand, has shown a rapid increase in chip exports throughout the 1970s and 80s. Again, this is primarily due to ongoing afforestation programs, which have been aimed at removing

indigenous old-growth eucalyptus stands and replacing these stands with plantation species such as radiata pine and eucalyptus. This afforestation program has allowed Australia to gain a substantial share of the total Japanese wood chip import market, and a disproportionately large share (63 percent in 1984) of Japanese hardwood chip imports. Recently, however, there has been a growing opposition in Australia from environmental groups and labor organizations to wood chip exports.

Members of labor organizations, along with members of the government, have been pushing for further downstream processing in Australia, especially in timber-rich regions such as Tasmania (Australian Forest Industries Journal, April 1985). There have been recent attempts by the Australian government to secure Japanese joint-venture capital in pulp production facilities in Tasmania in return for increases in chip exports (Australian Forest Industries Journal, April 1985). It is likely that the growing opposition to chip exports being voiced by environmental groups will have the largest impact on further increases in eucalyptus chip exports. As afforestation rates have increased over the past 10 years, stands of old-growth eucalyptus have become increasingly scarce. As this has occurred, environmental groups have increased pressures on the government to analyze the forestry practices and harvesting rates of companies involved in wood chip exporting. This pressure, along with a change in government, has led to the requirement that all future harvesting operations carried out for export chip production be subject to a full environmental impact statement (EIS) with public participation, before export wood chip licenses will be granted or renewed (Australia Forest Industries Journal, April 1985). It is suggested that this review process will have a substantial impact on the ability of Australian exporters of wood chips to increase future production. Ironically, this is occurring amid reports of Japanese wood chip requests for increases in future wood chip supplies ranging from 20-300 percent (Australian Forest Industries Journal, April 1985). Based on these recent developments, it is unlikely that Australia will be able to substantially increase future wood exports. Future increases will most likely be tied to increases in plantation output rather than old-growth eucalyptus. This will most likely favor an increasing role for softwood exports as domestic sawmilling operations increase in the future, generating increased residue output. This trend is outlined in JPA estimates, which show an increase in the volume of hardwood chip exports until 1990, followed by a leveling off of exports, and a corresponding drop in hardwood chip market share over this period.

In addition to Australia, South Africa also faces resource constraints which will tend to limit further increases in wood chip exports. South Africa's eucalyptus plantation program was established to supply pulpwood for a

growing domestic pulp and paper industry. The commitment to domestic pulp production will limit future increases in wood chip exports. In terms of volume production, Brazil's eucalyptus plantations are far ahead of all other countries. However, Brazil has made major commitments to the production of export pulp rather than wood chips. Although there were initial reports of plans for Brazilian (Anon 1981), chip exports, our research has been unable to confirm whether these shipments occurred. If the pulp mill expansion projects set for Brazil are any indication of the future, it is unlikely that Brazil will begin exporting large volumes of hardwood chips, despite its tremendous wood fiber production potential. Indications of future world shortages of hardwood chips will likely lead to an increase in demand for market hardwood pulp from Brazil. As most major suppliers of eucalyptus chips to world markets show a fairly level future supply, future growth in the demand for hardwood fiber will likely be taken up by low-cost suppliers of market pulp such as Brazil. Evidence of this trend has already been witnessed in the U.S. midwest where eucalyptus pulp from Brazil and the Iberian peninsula have been reaching mills in this region at half the cost of domestic pulp (The Northern Logger and Timber Processor, February 1986). In this case, the importation of bleached hardwood kraft pulp is leading to a reduction in the demand for domestic pulpwood. For countries such as Japan, which face fiber supply constraints, the future availability of low-cost market pulps from countries like Brazil will pose an increasing competitive threat to wood chip imports.

Future increases in eucalyptus wood chip exports to Japan, or any of the world markets for wood chips, is unlikely to occur in the future due to the inability to substantially raise the production levels of current suppliers of eucalyptus chips, as well as a commitment to domestic pulp production in those countries which are emerging as large sources of eucalyptus fiber. Traditionally eucalyptus has been a relatively low-priced species on the world market for wood chips. In recent years, however, eucalyptus chips have kept pace and even commanded a premium over high-quality softwood chip exports from North America. This trend is also exemplified in eucalyptus market pulp production, where world production levels have risen from 400,000 metric tons in 1976 to 2.4 million metric tons in 1984 (Hay-Roe's November 1985). The demand for eucalyptus fiber is increasing as papermakers are finding it to have high papermaking quality characteristics and competitive pricing. Pulp produced from eucalyptus has proven to have high bulk and absorbency characteristics for use in tissue mills, and desirable opacity and sheet formation characteristics for fine-paper production (Hay-Roe's November 1985) There are, however, a few bright spots in the future for the development of non-traditional sources of eucalyptus fiber. One of these already pointed out was

the initial shipment of eucalyptus chips from Chile to the Scandinavian countries. Another potential source is China. A recent report indicates that a contract has been signed for the Japanese import of eucalyptus chips from China beginning in July of 1987 (Japan Pulp and Paper, December 1986). The source of these Chinese exports are plantation-grown eucalyptus which are reported to be of comparable quality to those of Australia. The other sources of eucalyptus chip exports have been involved in world wood chip trade in the past. Countries such as Malaysia and Papua New Guinea have, in the past, exported lower quality wood chips such as "jungle wood" and mangrove which have been the result of afforestation efforts designed to establish plantations of eucalyptus. These plantation programs, undertaken with Japanese paper company joint-venture capital in the mid-1970s, will begin to supply growing volumes of eucalyptus fiber in the future.

9. Future Growth of non-Japanese World Wood Chip Trade

The future expansion of non-Japanese chip trade is tied to the possibility of future raw material constraints in those developed countries with substantial pulp and paper producing capacity, and those developed countries with emerging pulp and paper industries, but who lack the necessary resource base for continued future growth. Future growth in wood chip trade with developed countries is likely to hinge on the relative cost trade-off between domestic pulpwood supply, wood chip imports, and market pulp imports. However, based on recent developments in chip trade between the Scandinavian countries and Chile and the U.S. South it appears that these countries are still in the market for wood chips. In fact, there is growing evidence of increasing wood chip trade between the Iberian peninsula countries and the pulp and paper producing countries of Europe. There are reports of increased chip exports from Portugal (Anon 1981*). Additionally Spain has been increasing wood chip exports since the early 1980's. FAS reports place chip exports from Spain at 181 thousand cubic meters in 1985, an increase of 96 thousand cubic meters over 1984 levels (FAS October 1986). Spain's wood chip trading partners have traditionally been France, Norway, Sweden, and Finland. The source of wood chip exports from the Iberian peninsula have for the most part come from developing eucalyptus plantations. The continued development of the forest resource base of Spain and Portugal will most likely lead to a growing inter-European trade in wood chips, especially with the inclusion of Spain and Portugal in the EEC.

Predicting the future growth in chip trade brought about by the emerging pulp and paper industries of developing nations such as China, South Korea, and Taiwan is difficult. However, one point stands out: these countries

face serious raw material supply constraints, especially Korea and Taiwan. The ability of these countries to expand pulp production capacity in the future will depend on their ability to locate low cost sources of imported pulpwood. According to FAO statistics, China began importing wood chips as early as 1975. The volume imported has increased over the last decade, with Australia, New Zealand, Malaysia, and Papua New Guinea being the major supply sources. China has also embarked on a plantation program which may increase raw material self-sufficiency rates. Statistics on chip exports to South Korea and Taiwan are sketchy, but it appears that exports to these countries have come primarily from New Zealand, Australia, and the United States (FAS November 1985). Fenton reports that Taiwan began buying chips from New Zealand in 1981, at a price 10 percent lower than the Japanese market (Fenton 1982). These three countries certainly represent potential markets for wood chips, as the lack of domestic pulpwood resources will constrain future pulp and paper industry expansion.

Appendix

Statistical Sources and Conversion Factors for Table 4 and Figures 5-9.

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*Conversion Factors (cubic meters/metric ton): USA 2.40, Australia 1.59, Canada 2.08, New Zealand 2.35.

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